



Perspectives from FSF Scholars
May 18, 2026
Vol. 21, No. 24

**Using Communications Technology to Enhance Safety:
The Freight Rail Market's Proactive Approach**

by

Joseph V. Kennedy *

I. Introduction and Summary

Although technology is creating the potential to increase automation and safety in many markets, its implementation is often slowed by regulations from a previous era. Regulators, who are often more comfortable with the certainty of old technology than the promise of the new, may give less emphasis to productivity and innovation than they deserve. This is especially true for safety issues.

The uncertainty of innovation is often seen as compromising public safety. Yet increasingly innovation, especially investments in communications technology, will become an important source of better safety, even as it promotes other goals such as profits and efficiency. Regulators should worry less about specific rules for improving safety and concentrate instead on systemic regulatory reform that emphasizes a long-term approach utilizing technology to continually improve safety.

This is certainly true with regard to the freight railroad industry where railroads have been leaders in implementing continuous safety improvements. They have voluntarily implemented a number of technologies including hotboxes, which measure the temperature of each wheel and bearing on a passing train. Like any communications network, recent rail safety initiatives concentrate on collecting data, analyzing it, and acting on the results far quicker and more

accurately than could humans. Although accidents still occur, almost all safety statistics show long-term, significant improvement.

Freight railroads operate under a self-governed framework led by the Association of American Railroads (AAR). The model allows stakeholders to set high standards, share safety data, certify suppliers, and update rules faster than government can. The AAR uses a variety of practices to maintain minimum standards among its members. These include interchange agreements between members, peer-reviewed standards, audits, real-time data systems, and standing committees.

The railroads' efforts have led to several exciting present and future technologies, each of which is discussed below. These include wheel temperature detection systems, wheel impact load detectors, acoustic bearing detectors, truck hunting detectors, and machine vision systems. These efforts are paying off in the form of significant and prolonged declines in the number and cost of accidents. Recent data reaffirms the long-term trends toward greater safety. Not only is safety improving within freight railways; data show that railroads enjoy a healthy lead in safety over their main competition, the trucking market.

The freight railways attribute this to continual private investment, advanced safety technologies, and constant workforce training. Using freight rail as an example, this paper will review some of the main principles regulators should follow to transform the old tradeoff between profits and safety into a symbiotic relationship.

II. The Strong Relationship Between Innovation and Safety

Ironically, federal regulations often prevent companies from increasing automation, in part because regulators often give less emphasis to productivity and innovation than they deserve. Yet intelligent regulatory reform can remove barriers to innovation and significantly increase economic growth. It can also help achieve social goals such as safety and environmental quality.¹

Regulatory reform should be driven by several key principles. One of the most important is to welcome technology. Automation technology, especially networks that collect, process, and act on increased volumes of information, offers significant benefits to society in the form of lower costs, greater safety, reduced fuel use and emissions, and faster delivery times. Regulators should assume that much greater automation is not only inevitable due to technological improvements, but it is also desirable.

Regulators should also allow for different futures. Rather than favoring a particular technology or business model, regulators should focus on key topline goals regarding safety, the environment, labor, and other values, and work with companies to find the best strategies for accomplishing them. They should be agnostic on the specific practices for achieving social goals, which will change over time with technology and market forces. Because companies are often

¹ Joseph V. Kennedy, "Regulatory Reform General Principles: Some Examples From the Telecommunications Sector," *Perspectives from FSF Scholars*, Free State Foundation, January 28, 2026, <https://freestatefoundation.org/wp-content/uploads/2026/02/Regulatory-Reform-General-Principles-Some-Examples-From-the-Telecommunications-Sector-012826.pdf>.

better at discovering improved technology and management practices, agencies should harvest their knowledge to determine the best goals to work toward.

The regulatory challenge is much greater in markets experiencing a rapid pace of innovation. But so are the possible rewards. This can be seen by comparing goals across a range of innovation and safety characteristics. In industries with little innovation and few safety risks, the challenge of balancing both is minimal. In these cases, agencies should generally refrain from implementing rules and let markets determine firm behavior. The most promising industries occur when innovation is rapid but safety concerns are minor. Here the need for regulation is relatively low because there are few concerns about safety, thus the benefits of innovation can be enjoyed without worry. Regulators can let firms innovate as much as possible.

The opposite is true when safety risks are high but innovation is low. An example is road barriers at railroad crossings that prevent cars from crossing a track when a train is coming. Here safety concerns are strong, but the technology to address it is still fairly simple. Since there is little innovation occurring, the cost of overregulation is relatively low. Finally, we have cases where both innovation and safety concerns are high. In these cases, regulators must carefully balance the benefits of innovation with safety risk. Mismanagement in either direction has a significant cost. Here, the regulator needs to work with companies to find innovative ways to increase safety over time. The goal is to agree on strong safety standards, giving firms a lot of discretion in how to achieve them.

The link between innovation and economic growth is strong. Measures that slow innovation impose a cost on society. This link is especially strong for the freight rail market. A recent report finds that long-run growth depends on sustained reductions in per-unit transportation costs.² Compared to other freight methods, rail is uniquely positioned to deliver national-scale cost reductions through automation efficiency. A follow-on report looks at the accumulation of regulation within the rail freight network.³ It finds that a modest increase in regulatory burden produces higher shipping costs and a sharp decline in freight rail movement within a year. Higher rail costs reduce the total movement of goods, raising costs on other sectors of the economy. The losses compound over time as productivity growth slows.

Although not always thought of as being motivated by high safety concerns, railroad companies are tightly focused on increasing safety, if only because of the potentially high costs per incident. Railways have been a leading partner with government regulators in these efforts, often seeking to go further than regulators require. The Federal Railroad Administration (FRA) has recognized these efforts:

Rail transportation of hazardous materials in the United States is recognized to be the safest land-based method of moving large quantities of chemicals over

² Bentley Coffey, Patrick A. McLaughlin, and Pietro F. Peretto, “Transportation, Innovation, and Growth,” Economics Working Paper 26107, Hoover Institution, March 17, 2026, <https://www.hoover.org/research/transportation-innovation-and-growth>.

³ Bentley Coffey, Patrick A. McLaughlin, and Pietro F. Peretto, “Regulation and the Cost of Moving Goods,” Economics Working Paper 26108, Hoover Institution, March 20, 2026, <https://www.hoover.org/research/regulation-and-cost-moving-goods>.

long distances. Recent statistics show that the rail industry's safety performance, as a whole, is improving. In particular, the vast majority of hazardous materials shipped by rail tank car every year arrive safely and without incident, and railroads generally have an outstanding record in moving shipments of hazardous materials safely⁴

The FRA also notes that: “[i]t is the nature of government regulations that acceptable designs will not generally include the latest and most efficient technologies.”⁵ Freight rail companies have tried to correct this. Their efforts have also been recognized in the press. A recent article explains the FRA’s dependence on the private sector for information:

The new rail regulations will be ineffective because railroad employees know more about safety and how to improve it than legislators and regulatory officials do, and because railroad managers already have strong financial incentives to apply that expertise to operate as safely as possible. Private sector firms must educate regulators about their technology and explain the steps that should be taken to ensure the technology is safe, not vice-versa.⁶

The difference is how railways approach safety. A recent article argues that sustained improvements in safety require a transition to safety management systems (SMS), which are structured organization-wide approaches to managing safety risk used to proactively identify hazards, assess risks, and implement corrective actions.⁷ The FRA requires Class 1 railroads to implement a risk reduction program grounded in SMS principles, including tracking safety performance, analyzing operational risks, and instituting preventive measures.⁸ These systems represent a shift from reactive compliance with rules to continuous, proactive safety improvement through institutional accountability, system-wide surveillance, and ongoing evaluation.

III. Railways Have a Strong Safety Record

The freight rail market faces a fairly unique challenge. Although many of the railcars and rails are proprietary, much of the central system of rail, signals, and sensors is owned in common. Individual companies therefore face the temptation to save money by using laxer safety standards. The cost of doing so would be spread among all members. However, if every company adopts lax standards, the overall result will be a degradation of safety standards. To

⁴ U.S. Department of Transportation, Federal Railroad Administration, “Hazardous Materials Transportation,” March 8, 2023, <https://railroads.dot.gov/research-development/program-areas/hazmat-transportation/hazardous-materials-transportation>.

⁵ Ibid.

⁶ Clifford Winston, “The Legal System Isn’t Helping After Norfolk Southern’s Derailment,” *Barrons*, March 10, 2023, <https://www.barrons.com/articles/legal-liability-lawsuit-mediation-norfolk-southern-train-derailment-334d432e>.

⁷ Roslyn Layton, “Your Life Versus Their Jobs: The Political Economy of Transport Safety Automation,” February 14, 2026, <https://doi.org/10.1111/ecaf.70027>.

⁸ U.S. Department of Transportation, Federal Railroad Administration, “Final Rule: Risk Reduction Program,” *Federal Register*, Vol. 85, No. 32, February 18, 2020, <https://www.govinfo.gov/content/pkg/FR-2020-02-18/pdf/2020-00425.pdf>.

prevent this the AAR puts out a Manual of Standards and Recommended Practices and offers training and testing facilities to ensure that companies are following the standards.

These efforts are paying off in the form of significant and prolonged declines in the number and cost of accidents. The most recent data reaffirms the long-term trends toward greater safety. Not only is safety improving within freight railways, data show that railroads enjoy a healthy lead in safety over their main competition, the trucking market. The railways attribute this progress to sustained private investment of \$23 billion per year, advanced safety technologies, and rigorous workforce training.”⁹

In 2025 data released by the FRA, safety continued to improve across nearly every measured category, marking the safest year on record. The overall train accident rate fell 14 percent year over year, reaching its lowest level ever.¹⁰ Derailments (down 13.6 percent), and both equipment- and track-caused accidents (down 12.1 and 7.7 percent respectively) fell to their lowest levels on record. Human factor-related accidents declined 19.7 percent year over year. Class 1 railroads achieved their lowest rate of employee injury ever. This trend is not just a temporary accomplishment. The following statistics have shown long-term declines since 2005; train accident rates (40%), derailments (46%), mainline accidents (37%), and employee injury rates (54%).

IV. Automation Will Continue

Automation in safety and other fields often results in fears about job loss. For instance, Congress is currently considering the Railway Safety Act of 2026 (H.R. 7748). One provision of the bill would require that almost all freight trains operate with a two-man crew instead of one.¹¹ Yet the FRA has admitted that there is no evidence that two-person crews are safer. In fact, one-person crews are common in Europe and for U.S. passenger trains. The main fear is a loss of jobs.

Similar fears apply to inspections. Railroads have petitioned the FRA for a waiver of visual inspection frequency requirements. The railways argue that autonomous track measurement systems, including sensors that continuously collect real-time data, detect and analyze data much faster than periodic manual inspections. The FRA has resisted providing these waivers and recently proposed that waiver applications should demonstrate that their proposed changes would not eliminate jobs.¹²

⁹ American Journal of Transportation, “FRA Data Confirm Freight Rail Achieved Record Safety Performance in 2025,” March 4, 2026, <https://www.ajot.com/news/fra-data-confirm-freight-rail-achieved-record-safety-performance-in-2025>.

¹⁰ Ibid.

¹¹ Joseph V. Kennedy, “Mandated Crew Sizes Don’t Make Trains Safer,” *Perspectives from FSF Scholars*, Free State Foundation, April 9, 2026, <https://freestatefoundation.org/wp-content/uploads/2026/04/Mandated-Crew-Sizes-Dont-Make-Trains-Safer-040926.pdf>.

¹² U.S. Department of Transportation, Federal Railroad Administration, “Notice of Proposed Rulemaking: Federal Railroad Administration’s Procedures for Waivers and Safety-Related Proceedings,” Docket No. FRA-2024-0033, October 29, 2024, <https://www.federalregister.gov/documents/2024/10/29/2024-24586/federal-railroad-administrations-procedures-for-waivers-and-safety-related-proceedings>.

Automation affects jobs in two ways. The first is that over time automation raises the productivity of current workers, justifying higher pay. In fact, any improvement in incomes ultimately depends on increases in efficiency and innovation, including automation. However, this process can take time. In other cases, job losses are directly due to automation. A key question therefore becomes the extent to which industries are willing to delay the benefits of automation in order to preserve jobs.

Giving companies the ability to adjust labor requirements in response to new safety investments has two major benefits. First, the elimination of redundant labor allows the company to redirect capital towards emerging safety technologies. Second, the reduction in regulatory rigidity encourages firms to experiment with new safety-enhancing systems.

The automated safety systems that railroads have implemented do things that human inspectors cannot. They constantly monitor wheel and bearing temperature while trains are moving. They also check load weights, track condition, and speed. Manual systems cannot collect this much data. The automated systems also use sophisticated algorithms to quickly examine the data, spotting causal relationships that humans cannot see. Finally, automated systems can often act quickly and without human intervention to prevent accidents. Using railways as an example, current safety systems do not replace workers: they increase safety in ways that workers cannot. Automated programs that are deeply rooted into the culture of the private sector have a much stronger impact on safety than manual inspections. Stunting their growth in order to preserve jobs in the short-term makes little sense.

The safety/jobs debate is not new. In retrospect, it often looks kind of silly. For instance, safety concerns rose when elevator operators were phased out.¹³ The same explanation explains why New Jersey is still the only state that does not let motorists pump their own gas.¹⁴ But perhaps the best example is when the economist Milton Friedman visited a foreign construction site and observed road builders moving earth with shovels instead of machinery. When asked why machines were not used, his host answered that they needed to keep employment high. Friedman responded, “then instead of shovels, why don’t you give them spoons and create even more jobs?”¹⁵

V. Freight Rail’s Institutional Devotion to Safety

Freight railroads operate under a self-governed framework led by the Association of American Railroads (AAR). The model allows stakeholders to set high standards, share safety data, certify suppliers, and update rules faster than government can.¹⁶ The AAR uses a variety of practices to maintain high standards among its members. These include interchange agreements between members, peer-reviewed standards, audits, real-time data systems, and standing committees. The

¹³ Philip S. Naudus, “When Operator-less Elevators Faced Public Skepticism,” *Medium*, October 13, 2022, <https://medium.com/lessons-from-history/when-operator-less-elevators-faced-public-skepticism-16cb59760e9a>.

¹⁴ Laura Kiniry, “It’s Illegal to Pump Your Own Gas in New Jersey. But Why?” *Popular Science*, April 9, 2026, <https://www.popsoci.com/environment/why-cant-pump-gas-new-jersey/>.

¹⁵ Robert D. Atkinson, “Spoons or Tractors?” Innovation Files, Information Technology and Innovation Foundation, October 22, 2021, <https://itif.org/publications/2021/10/22/spoons-or-tractors/>.

¹⁶ Center for Industry Self-Regulation, “The American Railroad Industry: A Proven Blueprint in Self-Regulation,” August 7, 2025, <https://staging.industryselfregulation.org/media-resource/test/casestudies/railroad>.

railways argue that regulations governing track inspection, freight car and locomotive safety standards, brake system safety, and signal system safety lag behind current technology, partly because federal regulations prioritize manual or visual inspections.¹⁷

Freight railways are organized in a way that facilitates focus on safety issues, helping to ensure that the cost of accidents continues to fall. A large part of this effort is the involvement of subsidiary bodies that have an institutional emphasis on continual improvement. Railinc is a wholly owned subsidiary of the AAR. It works as the AAR's nerve center, serving as its principal source of data and software. Railinc tracks more than 300 million transactions daily. One of its most important tools is the AskRail app, which provides emergency personnel with real-time information on railcars carrying hazardous materials. In addition to safety initiatives, Railinc also supports asset management, financial transactions, and electronic data interchange.¹⁸

MxV Rail is another wholly owned subsidiary of the AAR. It is the world's leading rail research, testing, and technology organization.¹⁹ It leads the AAR's Strategic Research Initiative Program and helps conduct research on training, consultation, and testing standards. This program leads a number of important efforts, including developing a clear understanding of the root causes behind accidents, evaluating promising technologies, and implementing validated solutions. It works with over 250 rail experts. Its current emphasis is on wayside detection systems, track performance under heavy loads, implementation of advanced rail materials, geotechnical risk management tools, and automated inspection and predictive analytics. Separate internal groups such as the Security and Emergency Response Training Center and the Mechanical Inspection Department help enforce safety standards across railroads.

Freight railroads describe what they do as integrating predictive analytics, automation, AI, and advanced inspection systems to enhance safety, efficiency, and sustainability. They invest billions of dollars into deploying infrastructure and developing innovative tools. In many cases this complements the workforce by increasing worker safety and providing better information to each employee.

Freight railways are already using artificial intelligence to improve safety and efficiency.²⁰ Some of the key benefits of AI are preventing problems, enabling predictive maintenance, and improving fuel performance. The effort uses a combination of technologies including trackside sensors, drones, and digital twins to collect data for predictive maintenance and energy management systems to analyze. Thousands of sensors across the rail network collect billions of data points daily, automatically generating alerts for urgent issues. Advanced computing programs, machine learning, and AI analyze this data to identify patterns and predict repairs days or months ahead of trouble.

¹⁷ Ibid.

¹⁸ Association of American Railroads, "Railinc: Freight Rail's Digital Nerve Center," <https://www.aar.org/issue/railinc/>.

¹⁹ Association of American Railroads, "MxV Rail: Advancing Safety in Rail Transportation," <https://www.aar.org/issue/mxv-rail/>.

²⁰ Association of American Railroads, "How Freight Railroads Use AI for Safety & Efficiency," <https://www.aar.org/issue/how-freight-railroads-use-ai-for-safety-efficiency/>.

The AAR website points out that an advanced algorithm can analyze track alignment of more than 1,500 curves in a track within a few hours, whereas a team of four people would take 10 months. Similarly, machine visioning allows 40,000 images per second as a train goes by. Even experienced inspectors could never collect or analyze that much information.

Trackside sensors capture large amounts of data as trains pass by, including wheel profiles, wheel impact loads, acoustic signatures of bearings, and the temperature of bearings and wheels. Meanwhile, AI learns what the early stages of wheel failure look like and flags potential problems before they happen. Another example: Drone imagery helps inspectors get a closer look at cracks or erosion on bridges as well as track surveys for water accumulation or storm damage.

VI. The Components of Tomorrow's Safety Programs

The rail market's continual focus on using technology to improve safety has resulted in a steady progression of new systems for collecting, analyzing, and acting on new data. Below are some of the recent technologies that either are or will soon be integrated into railroad systems.²¹

Wheel Temperature Detection Systems are located adjacent to the rails or along the track at regular intervals. Sensors measure bearing and wheel temperatures as a train passes. They compare temperature patterns across the entire train to spot abnormalities such as internal damage or insufficient brake contact. If a problem is detected, the system sends an automated radio message to alert the train crew. The algorithms look at more than 35 million readings each day.

Wheel Impact Load Detectors are built into the track. Sensors installed on sections of the rail measure the forces being exerted by the wheels of a railcar. They measure how hard each wheel hits the rail as the train passes over. The system can measure whether a wheel has a flat spot, is slightly out of round, or has surface damage.

Acoustic Bearing Detectors are installed along the side of the track near where the wheels and axles pass by. They use specialized microphones to listen to sounds coming from wheel bearings as the train passes by. Bearings normally make a consistent sound when they are in good condition. However, in cases of internal component damage, they can produce high-frequency noises that humans cannot hear. The system uses software to spot early warning signs of bearing problems.

Truck Hunting Detectors use a mix of sensors built into the track to monitor how the frame that holds the wheels, axels, and suspension behaves as the train moves. The system measures abnormal outward strain against each rail that is produced when car wheels begin moving in a side-to-side action that can cause premature wear.

Machine Vision Systems use precisely aimed, high frame-rate cameras to capture thousands of images of the sides, bottom, tops, and focused angles of railcars passing by. Inspections

²¹ Association of American Railroads, "How Freight Rail Wayside Detectors Work," <https://www.aar.org/wayside-detectors/>.

performed when components are in use can yield better results because signs of failure are more visible. The images are processed by algorithms to identify emerging mechanical or safety issues.

VII. Conclusion

Railroad companies are focused on safety, not only because they care about preserving life and property, but also because they recognize the link between fewer accidents and higher profits. Separate rail companies have dealt with the collective action problems by creating strong institutional features such as Railinc, MxV, training programs, and verifiable standards. The result has been joint efforts to increase automatic monitoring systems that improve public safety.

This progress will continue under AI. Automation will increase, along with improved safety and performance. Unfortunately, the Federal Railroad Administration has politicized some of these advancements by preventing rail companies from cutting redundant labor. The result is higher costs, delayed innovation, and reduced safety. Whether mandating two-person crews or denying waivers that might lead to job losses, the FRA is delaying rather than encouraging safety systems.

* Joseph V. Kennedy is Director of Policy Studies and Senior Fellow of the Free State Foundation, an independent, nonpartisan free market-oriented think tank located in Potomac, Maryland. The views expressed in this *Perspectives* do not necessarily reflect the views of others on the staff of the Free State Foundation or those affiliated with it.

Further Readings:

[Joseph V. Kennedy, "Mandated Crew Sizes Don't Make Trains Safer," *Perspectives from FSF Scholars*, Vol. 21, No. 16, April 9, 2026.](#)

[Joseph V. Kennedy, "Why is Vance Supporting Overregulation of Rail Service?" *Free State Foundation Blog*, March 26, 2026.](#)

[Randolph J. May, "The Proposed Railway Safety Act is Highly Problematic," *Free State Foundation Blog*, March 10, 2026.](#)

[Joseph V. Kennedy, "Regulatory Reform General Principles: Some Examples From the Telecommunication Sector," *Perspectives from FSF Scholars*, Vol. 21, No. 4, January 28, 2026.](#)