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ASSOCIATION OF AMERICAN RAILROADS

BUILDING A SAFER FUTURE

Examining Freight Rail's Comprehensive Safety Framework

Executive Summary

At the heart of railroad operations is an unwavering commitment to safety. The well-being of employees, customers and the communities served is paramount. Railroads demonstrate this commitment through decisive and meaningful actions, concentrating on practical steps designed to make the biggest improvements in rail safety, including:

- Rigorous compliance with all applicable laws and regulations, often voluntarily exceeding legal requirements.
- Sustained private investment in infrastructure, equipment and safety technologies — averaging more than $23 billion per year — fuels innovations that safeguard railroad operations.
- Comprehensive training programs for employees to instill a safety-first culture.
- Ongoing improvement of operating and maintenance practices to reduce safety risks.
- Comprehensive accident mitigation and response strategies, including specialized training for first responders, to ensure swift, safe and effective action in emergencies.

Today, railroads are the safest way to move goods and people over land – and they are working to get even safer. Federal Railroad Administration (FRA) data reflect significant advancements in safety over time, marking a positive trend that merits recognition.

Railroad Accident & Injury Rate Changes 2000-2023

Total Train Accident	**-27%**
Collisions	**-62%**
Derailment	**-30%**
Track-caused	**-50%**
Equipment-caused	**-31%**
Human factors-caused	**-18%**
Class I Mainline Accidents	**-42%**
Employee Injuries	**-50%**
Grade Crossings	**-25%**
Hazmat Incidents	**-75%**

Source: FRA, AAR

It is important to acknowledge that most rail derailments are relatively minor and primarily occur in rail yards at low speeds, resulting in minimal, if any, impact on local communities. However, on the rare occasions when a serious accident occurs, the effects on a community can be significant. That's why railroads strive to reduce the frequency and severity of all accidents through daily, tangible safety initiatives.

Recognizing that safety is a collective responsibility, railroads actively partner with employees, customers, policymakers and communities to achieve the ultimate goal: a future free of rail accidents.

This collaborative approach underscores the industry's dedication to elevating safety standards and ensuring railroads remain a cornerstone of American prosperity.

Introduction

In a typical year, U.S. freight railroads haul 1.4 billion tons of essential raw materials and finished goods across an expansive network spanning nearly 140,000 miles. This 24/7 operation involves 1.6 million rail cars and thousands of locomotives navigating diverse terrains and weather conditions to keep the nation moving.

Railroads carry the goods that are integral to our economy and quality of life, from the grain and food that sustain us to the materials like steel, lumber, and cement that underpin our construction industry; and the furniture, electronics and appliances that furnish our homes.

Consider the efficiency of rail transport: a single train can carry the equivalent load of several hundred trucks. Without freight railroads, our highways would be overwhelmed with an additional 80 million trucks, exacerbating congestion and environmental impact. Rail's superior efficiency – being, on average, three to four times more fuel efficient than trucks – significantly lowers greenhouse gas emissions by up to 75%.

Since railroads are vital in moving the extensive array of products essential to modern life, prioritizing safety isn't an option; it's an imperative. Safety is essential to operational excellence and is fundamentally the right thing to do.

Rail Safety Trends

The journey towards achieving zero accidents and injuries in the rail industry is complex and does not always follow a straight or predictable path. However, the trends over the past two decades are encouraging and underscore rail's status as the safest way to move goods over land.

Data from the FRA highlight significant safety improvements across the rail industry. The overall train accident rate in 2023 decreased 27% from 2000; the employee injury rate fell 50%; and the grade crossing collision rate dropped 25%. Notably, railroads today boast lower employee injury rates than most other major industries, including trucking, airlines, agriculture, mining, manufacturing, construction and even grocery stores.

When it comes to transporting hazardous materials over land, railroads offer an unparalleled safety record. Since 2000, the rail hazmat accident rate has plummeted by 75%. Today, more than 99.99% of rail hazmat shipments reach their destination without a release caused by a train accident, highlighting the safety of rail for even the most sensitive cargo.

The industry's success is deeply rooted in its workforce and safety milestones stem from consistent investment in privately rail owned infrastructure, integration of advanced safety technologies, and updates to operating and maintenance practices based on ongoing learnings. This multi-faceted approach not only protects its workforce and the public, but it also reinforces the industry's commitment to maintaining its status as a leader in transportation safety.

A Professional & Highly Dedicated Workforce

The U.S. freight rail network, renowned as the world's premier freight rail system, owes it success to the dedicated, highly skilled railroaders who manage its daily operations. These individuals, from train operators and track maintenance workers to car and locomotive repair personnel, perform myriad critical tasks. Railroad management and front-line employees are united in their conviction that a safe, efficient railroad is vital to the nation's prosperity.

Rail employees, especially those who operate trains, undergo extensive training. Becoming a freight rail engineer typically demands years of experience as a conductor, a position that itself requires specialized training spanning several months.

A trainee learns virtually before venturing onto the tracks.

This training combines intensive classroom instruction with practical, real-world experience and ongoing exams. On-the-job training is provided to ensure that train crews possess the requisite expertise for safe train operations within their designated territories.

Railroads supplement this foundational training with continuing education programs to sustain and enhance the knowledge, skill and competencies essential for these roles.

Safety rules are critical for defining permissible or prohibited actions. However, company culture plays a pivotal role in fostering problem-solving skills and encouraging innovation and behavioral changes.

REMEMBER THIS

While rules aim for compliance, culture has the transformative power to achieve tangible safety improvements.

Railroads work diligently to instill a high level of safety awareness in all aspects of operations. Adopting technologies such as remote-controlled locomotives and drones improves employee performance and creates a safer work environment.

By empowering people and actively pursuing innovative solutions, railroads are paving the way for future safety gains.

Addressing the Leading Causes of Train Accidents

The rail industry's unwavering commitment to safety focuses on addressing the primary causes of accidents: infrastructure or track defects, equipment malfunctions and human error. Railroads proactively identify and implement measures to mitigate these risks and reduce the likelihood of future accidents.

Track

With close to 140,000 miles of track crisscrossing the country, railroads employ a combination of visual monitoring and automated track inspection technology to prevent things such as wear and tear, defects or weather-related impacts from causing accidents.

Technologies such as ground-penetrating radar help detect underground problems like excessive moisture that could destabilize track, while specialized rail cars with advanced instruments identify track defects invisible to the human eye.

This approach allows railroads to develop a plan for timely maintenance and repair to ensure safe and effective operations.

Equipment

To keep equipment like rail cars and locomotives and their component pieces in top condition, railroads invest heavily in the upkeep of their rolling stock and leverage technology to monitor the condition of railcars and locomotives in real-time. A crucial benefit of these advanced technologies is the ability to monitor rail equipment while it is in-use, providing railroaders with a more accurate picture of the equipment's health while it is being subject to real-world operating forces. This approach enables the workforce to proactively identify and fix mechanical issues, thereby enhancing the safety and reliability of rail operations.

DID YOU KNOW?

Most derailments are minor incidents that occur in rail yards, away from mainline tracks.

Any time even a single rail car wheel leaves the rail, except when caused by a collision, railroads are legally required to report that data to the FRA as a derailment if the reporting threshold is met.

Most derailments occur in rail yards, where cars are added to and removed from trains, not on mainline tracks running across the country. These rail yard derailments have an average train speed of five MPH and typically result in few – if any – injuries and minimal property damage or impact on local communities.

Human Error

Despite the high level of professionalism and skill among rail employees, human error remains a significant factor in rail accidents, accounting for approximately 43% of incidents in 2023.

To address these types of accidents, railroads maintain rigorous training programs and continually explore technological innovations to assist employees in minimizing risks.

For example, the industry's Positive Train Control (PTC) systems represent a critical step in eliminating the risk for some of the most serious human-error accidents. Further innovation in this space could prove to be a game changer for rail safety.

A significant subset of human-caused accidents in the railroad industry occurs at grade crossings — locations where train tracks intersect with roads or paths commonly used by vehicles and pedestrians.

Today, approximately 95% of rail-related fatalities are trespassers or grade crossing users. Railroads, in collaboration with local communities and safety organizations, have made significant strides in reducing these incidents through public safety campaigns, improved warning devices and hundreds of millions of dollars spent by railroads every year on grade crossing maintenance.

While challenges still persist in this area, the consistent efforts to enhance grade crossing safety have resulted in a 25% decrease in the grade crossing collision rate since 2000.

DEEPER DIVE

PTC is a set of technologies designed to prevent serious accidents caused by human error, like train-to-train collisions and derailments due to excessive speed.

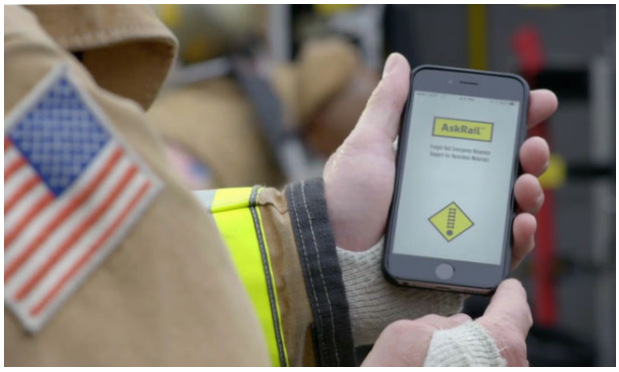
PTC monitors precise train location, direction and speed; alerts train operators to speed limits, track conditions and movement authority limits; and automatically stops the train if needed. With detailed geo-mapping, advanced communications systems and upgraded locomotive hardware, PTC enhances safety today and paves the way for future improvements across the rail network.

Strengthening Community & First Responder Preparedness

Empowering First Responders With Training & Technology

In 2023 alone, freight railroads trained 35,500 first responders in local communities across the nation and 1,800 first responders at the Security and Emergency Response Training Center, the industry's leading hazmat response training facility. This program has been enhanced with advanced scenario planning and training tools to better prepare responders for real-world challenges.

To further bolster first responder capabilities, the industry, in collaboration with the International Association of Fire Chiefs, developed the AskRail app. This free tool gives first responders instant access to crucial hazmat information, enabling safer and more informed emergency responses.



A firefighter holds the free AskRail app.

Partnerships with national call centers like CHEMTREC and CANUTEC and local Emergency Communication Centers have expanded AskRail access, equipping more than 2.3 million first responders with crucial information and improving safety and preparedness across the nation.

Active Engagement & Support For Communities

Railroads actively engage with communities, government entities, and first responders to improve safety and reduce the impact of rail operations. Efforts include maintaining and enhancing grade crossings, implementing grade separations, improving warning systems and advancing public safety initiatives. Since 2005, these initiatives have led to a 10% decrease in the number of public crossings and a 40% increase in the number of crossing with gates.

Collaboration with state and local governments is key to planning and funding projects that separate grades and close crossings, with the states playing the primary role in prioritizing these projects.

Significant support comes from legislative and regulatory funding, notably the recent surface transportation reauthorization which provided $245 million to enhance warning devices and more than $600 million annually in grants through 2025 for crossing elimination. The FRA already has allocated $570 million to enhance safety at approximately 400 crossings in 32 states.

Railroads also work with local authorities to adapt to community growth, seeking ways to minimize interactions with rail operations while preserving the flow of goods along the rail network. These efforts include developing alternative routes to redirect traffic away from grade crossings, thereby enhancing safety for all. Educational partnerships, such as with Operation Lifesaver, extend these safety efforts by raising public awareness about the importance of rail safety.

Elevating Safety Through Investment & Innovation

Investing in Safety

The commitment to enhancing safety within America's freight railroads is evident in the substantial investments made from 1980 to 2022, totaling over $780 billion.

This translates to more than $23 billion annually – or roughly $65 million every day – spent to maintain and upgrade tracks, bridges, grade crossings, and other essential infrastructure and equipment. A significant portion of these investments targets safety improvements directly, underlining the rail industry's prioritization of operational safety.

Unlike trucks, barges and airlines, America's freight railroads — almost all of which are not government-subsidized — operate almost exclusively on infrastructure they own, build, maintain and pay for themselves. The American Society of Civil Engineers cited sustained private investment by freight railroads as its primary reason for rating the rail network as the best infrastructure in America.

Using Technology to Identify & Address Defects

Identifying potential problems before they can cause an accident is key to advancing rail safety. Research, data, and years of experience have proven that a layered approach that combines manual inspections in concert with technology and automated inspections is a sound path to improved safety performance. Noteworthy technological initiatives include:

- **Brake System Innovations:** The rail industry, with the support of labor, is advocating for technology that makes it easier and more efficient to identify and repair issues with brakes.
- **Trackside Detectors:** Railroads have voluntarily deployed and continue to expand the national network of more than 15,000 various trackside detectors to identify equipment defects that cannot be seen by the naked eye or on stationary trains.
- **Automated Track Inspections (ATI):** Complementing manual inspections, ATI technologies enable more precise identification of track defects, a leading cause of train derailments, by evaluating each foot of track under the same force exerted by a loaded train.

These inspection technologies improve operational safety and contribute to a data collection effort on the performance, usage, maintenance and health of the 1.6 million car fleet.

Collecting and analyzing data throughout the entirety of the nation's rail network allows railroads to track the health of rail equipment, find patterns that can predict when repairs are needed, manage their equipment and infrastructure and create new standards designed to make America's safe rail network even safer.

Staying on the Cutting Edge of Technology

There is widespread public support for adapting advanced technologies in transportation because they have been proven to deliver tangible safety gains. As technology evolves, so does the rail industry's approach to improving safety, reducing environmental impact and enhancing its competitive edge in today's fast-paced environment.

While rail technology is pervasive, the industry is entering an exciting new era of innovation. Advanced algorithms and data analysis software will enable railroads to harness the massive amounts of data being collected nationwide and enhance safety, reliability and service to customers.

Next-generation automation technology will continue to reduce the leading causes of accidents, improving safety and efficiency. Promising advances include:

- **Artificial Intelligence (AI):** AI is increasingly being used to analyze the vast amounts of data generated by the industry's growing network of detectors and inspection technologies. The goal: identify potential problems and maintenance needs *before* accidents occur.

- **On-Board Sensors for Real-Time Monitoring:** Railroads are testing GPS-equipped on-board sensors to monitor the real-time status, location, and condition of individual rail cars to improve equipment tracking and proactive safety efforts. Similarly, imaging systems monitor track across the rail network, allowing workers to remotely analyze conditions and proactively address safety issues.

- **Electro-Magnetic Field Imaging (EMFI):** EMFI is currently being tested at the industry's lead research facility – MxV Rail – and could revolutionize rail surface defect detection, helping employees determine when scheduled maintenance is needed to keep rail infrastructure in top-notch condition.

Machine visioning can take 1,000 images per rail car at speeds up to 70 mph, identifying defects early for maintenance.

Geometry cars transmit hundreds of millions of bytes of data to technology teams to analyze and develop track maintenance schedules that prioritize conditions that need immediate attention.

Policymakers Play an Important Role

Policymakers play a crucial role in the safety and efficiency of the rail industry, a responsibility that involves balancing stringent oversight while encouraging continued innovation.

The FRA sets and enforces regulations that govern rail operations, covering aspects such as track and equipment inspections, employee certifications, operating speeds and signals. FRA safety inspectors (and in some states, state inspectors) also evaluate rail facilities and operating practices.

These regulations are essential for maintaining high safety standards across the industry, and the evolution of rail safety also depends on the ability to adopt new technologies and practices.

Railroads strictly adhere to FRA regulations. For decades the industry has set and continued to strengthen the AAR standards that govern North American operations. Recognizing the efficacy of these standards, FRA has incorporated the industry's own standards into the regulations and requires railroad compliance with them as a part of their requirements on mechanical specifications.

Additionally, railroads voluntarily take steps that go beyond the baseline established by the FRA, such as adopting more rigorous track and mechanical standards, conducting more frequent inspections, and petitioning the Department of Transportation (DOT) to strengthen its regulations on numerous occasions such as calling for tougher tank car standards.

DID YOU KNOW?

Promoting Technological Innovation

Since its initial pilot program approval, ATI has proven its ability to revolutionize track maintenance, yet the FRA has stalled further adoption by letting test programs expire and denying the expansion of waivers, despite clear evidence of its effectiveness.

Similarly, the Brake Health Effectiveness (BHE) program, which improves brake inspection efficiency, has seen resistance in its expansion efforts, despite support from rail labor.

These examples underscore a critical issue: the FRA's regulatory approach should encourage the adoption of safety-enhancing technologies.

To promote a safer rail network, it is imperative for regulators to work with the rail industry to address and eliminate barriers that hinder the adoption and expansion of both new and existing technologies. Instead, they should adopt a regulatory environment that not only accommodates but also promotes the integration of these innovations.

By developing regulations that value innovation and adaptability, policymakers can ensure that the rail industry remains a safe, efficient and vital component of America's infrastructure and economy, now and in the future.

Freight railroads encourage policymakers to adopt a regulatory framework that:

- Prioritizes modal equity in the development, testing and deployment of new technologies.
- Uses performance-based regulations to encourage investment in cost-effective, innovative solutions that enhance safety and efficiency.
- Bases regulations on solid data, sound science and a clear need.
- Encourages innovation and avoids "locking in" existing technologies and processes.
- Ensures transparency and engages in meaningful dialogues with industry stakeholders and the public.
- Assesses the benefits of regulations against their costs, considering the overall regulatory burden.
- Uses guidance documents to clarify ambiguous regulations, without overstepping their intended purpose.
- Encourages waivers and pilot programs that allow for the demonstration of new safety technologies and practices and pave the wave for industry adoption when proven to successfully enhance safety.