# Freight Rail Technology

**Key Takeaway:** Technology is central to freight rail operations, enabling optimized efficiency, enhanced safety and improved customer service. Through real-time tracking, data analytics, and predictive maintenance, technology has driven significant advancements in the industry, making it safer, more efficient, and better equipped to meet the demands of a rapidly changing world.

Freight rail *is* technology.

From the first locomotive that helped build our nation nearly two hundred years ago to the artificial intelligence integrated into today's modern operations, America's freight railroads continue to innovate to solve current transportation challenges while anticipating those of tomorrow.

Integrated teams of data scientists, developers, and engineers drive freight rail's continuous transformation by developing and implementing advanced technologies across freight rail's networks. Smart sensors monitor infrastructure, tools like drones empower employees, sophisticated software provides customer insights, and fuel management systems reduce emissions.

Sustained infrastructure investment and advancements in inspection practices have significantly decreased accidents, with the Class I mainline train accident rate down 42% since 2000. This technological amalgamation positions freight rail at the forefront of America's transportation needs, ensuring adaptability and resilience to meet evolving customer needs today and tomorrow.

## Safeguarding Communities

The freight rail industry extends its safety commitment beyond tracks, integrating technology to enhance community safety. Initiatives include training tens of thousands of first responders each year and developing the AskRail app, which provides hazmat information to responders.

To help keep the public safe near tracks, railroads have worked with federal regulators and private technology companies to improve safety around railroad tracks and rights of way, including through the Waze app and smart crossing signals. Thanks to efforts like these, collisions and incidents involving pedestrians, vehicles and trains have declined in recent years.

## Empowering Employees

The rail industry is one of America's safest workplaces, with lower employee injury rates than most other industries. Advanced training centers with simulators and virtual reality enable employees to practice real-life skills in a safe, rigorous and controlled environment, while like remote control locomotives and high-definition cameras allow employees to perform their jobs effectively from a distance where possible, keeping them out of harm's way.

## Keeping Infrastructure & Equipment Safe

Wheel Profile Detectors (WPDs) use lasers and optical scanning to measure moving train wheel profiles, helping identify wheels that may need removal. Hot bearing detectors and wheel impact load detectors placed along the right-of-way identify overheating bearings and wheels heavily pounding on tracks, allowing railroads to promptly address issues and reduce broken rails and failures. Ultrasound technology and Automated Track Inspection (ATI) systems with lasers and cameras on locomotives, along with track inspection vehicles, enhance overall safety by proactively detecting flaws in tracks and ties.

## Reducing Emissions

With freight demand expected to surge by 30% by 2040, railroads are intensifying efforts to combat climate change through strategic investments and technology adoption. As the most fuel-efficient land freight option — three to four times more efficient than trucks — railroads continue their commitment to emission reduction.

Innovative technologies like locomotive fuel management and anti-idling systems contribute to improved fuel efficiency, with modern locomotives showing up to a 14% enhancement. Railroads also focus on minimizing emissions and community impact in rail yards through streamlined processes and operational adjustments.

## Meeting Customer Needs

Over 630 North American freight railroads ensure safe and sustainable transportation through advanced software, mobile apps, and tools that optimize efficiency and communication. Like air traffic control systems, dispatching software analyzes system-wide train schedules, speed restrictions, and crew schedules, reevaluating train management plans every two minutes. This allows dispatchers to respond in near real-time to changing conditions, including delays, weather events and unplanned maintenance work.

Specialized tools, including APIs integrated into customer platforms, provide detailed insights, from the precise location of products on the rail network to information about rail car availability and ordering.

## Moving Forward

Founded in 1985, MxV Rail, an AAR subsidiary, leads the way in rail research and testing, bolstering safety and efficiency for freight railroads worldwide. Situated in cutting-edge facilities and expansive test tracks in Pueblo, Colorado, the MxV Rail team drives innovation, ensuring railroads stay ahead. The Security and Emergency Response Training Center (SERTC), launched by MxV Rail, has trained over 50,000 hazmat emergency responders since its inception. In April 2021, MxV Rail unveiled plans for a specialized engineering and laboratory facility in Pueblo, cementing its dedication to industry leadership, research, testing, and community development through a partnership with PEDCO.

**Highlighted Project:** The Strategic Research Initiative (SRI), backed by MxV Rail, spans the entire research spectrum, from fundamental scientific exploration to real-world implementation. With 24 initiatives across three key areas—infrastructure systems, mechanical systems, and operations systems—the program drives forward innovation

## Running High Tech Operations

Railinc, established in 1999 as a subsidiary of AAR, provides essential IT, network operations, financial services, and real-time data for North America's railroads. Born from AAR's IT division, Railinc's products assist railroads, equipment owners, and logistics providers in boosting productivity, achieving efficiencies, and ensuring safe asset movement. Based in Cary, N.C., the company collects extensive railroad data, leveraging it to offer critical insights for safety and efficiency enhancements. The Asset Health Strategic Initiative (AHSI), a joint endeavor with the AAR Safety and Operations Management Committee, aims to provide a holistic view of rolling stock health, prioritizing safety and operational excellence.

**Project Highlight:** Launched by the Class Is and rail-car owners, the Asset Health Strategic Initiative (AHSI) is a multi-year, multi-phase effort that the AAR Safety and Operations Management Committee oversees with Railinc. The goal is to provide a view of the health of rolling stock available to all stakeholders, particularly to the railroads on which the cars and locomotives are operating.