United States Department of Transportation
Federal Railroad Administration
May 2008

National Rail Safety Action Plan
Final Report
2005-2008

History & Background

This report details the Federal Railroad Administration's (FRA) achievements in successfully completing all of the original elements of the *National Rail Safety Action Plan* (*Action Plan*). While the specific provisions of the *Action Plan* are complete, FRA's work is not. This agency will continue with ongoing implementation of many of the individual safety efforts and will extend and enhance many other projects started under the *Action Plan.* In addition, the FRA is pursuing a wide range of other initiatives to improve freight and passenger rail safety, and continues to perform safety compliance and enforcement oversight.

On May 16, 2005, FRA launched the *Action Plan*, an ambitious effort to address the most critical safety issues confronting the nation's rail system following several major freight and passenger train accidents in 2004 and 2005 (notably those at Macdona, Texas; Graniteville, South Carolina; and Glendale, California). The *Action Plan* established a comprehensive set of objectives and an aggressive schedule to bring about the desired safety improvements.

The *Action Plan's* broad goals included:

- Targeting the most frequent, highest-risk causes of train accidents;
- Focusing FRA oversight and inspection resources more precisely; and
- Accelerating research efforts that have the potential to mitigate the largest risks.

Action Plan projects and initiatives generally correspond to one of several areas of focus such as: reducing human factor-caused train accidents; addressing the challenges posed by fatigue to railroad operating employees; assuring track safety; enhancing hazardous materials safety and emergency response preparedness; targeting FRA inspections and enforcement resources on areas warranting the most attention; and advancing highway-rail grade crossing safety.

The *Action Plan* has contributed to the significant improvement in rail safety across a broad range of statistical measurements, including a 23.3 percent reduction in the number of train accidents over the past three years.

The success of the *Action Plan* is the result of many factors, including: dedicated and aggressive implementation by FRA staff; support by railroads of the FRA safety initiatives; independent actions taken by railroads, labor unions, and rail employees to operate more safely; and the assistance of researchers and other industry stakeholders in the development and deployment of new, safer technology.

Looking Forward: FRA's Risk Reduction Strategy

FRA believes that an important opportunity now exists to implement changes that could significantly reduce the future occurrence of railroad accidents. The key to bringing about additional, substantive improvements in rail safety is emblemized by a risk reduction program. Risk-reduction strategies protect and preserve the best elements of current FRA oversight and compliance methods, while creating an environment that values and encourages honesty and

openness. By utilizing both the traditional regulatory standards and risk based approaches, the railroad industry should be able to more fully transition to a culture of safety with the full and lasting support of both labor and management.

This effort will be an FRA-led industry-wide initiative to develop innovative methods, processes, and technologies to identify and correct individual and systemic contributing factors using "upstream" predictive data.

The essential ingredients of the risk reduction approach include:

- Developing knowledge of precursors to actual accidents;
- Confidential reporting;
- Effective problem analysis; and
- Corrective actions.

Since 2005, the railroad industry has hired over 40,000 new employees, with another 40,000 expected to be hired in the next three years. Such a massive influx of new employees brings a need for fresh ideas to improve safety. In addition, with statistics showing historic levels of safety it indicates that current safety systems have more or less reached the limits of their effectiveness. A new approach is needed to improve rail safety even further.

Existing regulations, safety rules, regulatory compliance, rules compliance, and employee disciplinary policies are integral elements of the current rail safety regime. However, the fault or blame-oriented nature of this system tends to engender fear of punishment or reprisal among workers, instead of active and constructive engagement. The expectation of a punitive response to any attempt to point out a safety failure or shortcoming, suppresses the very type of honest and open dialogue that allows the sharing of information needed to prevent an accident. The current practice of withholding information actually increases the likelihood that an accident will occur.

Initially, the FRA Risk Reduction Program will be composed of a set of pilot projects targeting specific risk categories in limited studies. Voluntary risk reduction projects will target operations, equipment or systems that pose potential risks to operational and personnel safety. Some examples include confidential close call reporting systems, peer-to-peer accident prevention, and fatigue risk management programs. In addition, the strategic use of technology, such as the Track Quality Index or wayside monitors and sensors, to proactively identify and predict where problems may arise can be of significant benefit to reducing risk through preventative maintenance or by directing capital investments.

FRA will work with railroad, labor, and other interested organizations that volunteer to conduct pilot projects and will oversee project implementation and evaluation to determine the effectiveness of countermeasures and corrective actions taken. FRA will then disseminate information about successful pilot projects to encourage more wide-scale, or even nationwide, adoption of effective risk reduction solutions.

FRA intends to announce more specific details about this new rail safety approach later this year.

National Rail Safety Action Plan Milestones

May 2005	FRA launches the National Rail Safety Action Plan
	FRA T-18 automated track geometry inspection vehicle begins service
	FRA issues Safety Advisory on Highway-Rail Grade Crossing Safety
July 2005	With FRA encouragement, CSX Transportation and CHEMTREC (a resource center for emergency responders) begin pilot project to have the railroad share information on an accelerated basis about hazmat train accidents
October 2005	FRA field tests the Automated Optical Track Joint Bar Inspection System
November 2005	FRA funds a pilot project with BNSF Railway to monitor the position of hand-operated track switches in non-signaled, or dark, territory
March 2006	FRA National Inspection Plan (NIP) is fully implemented for each of the agency's five rail safety disciplines
April 2006	With FRA assistance, the Louisiana Department of Transportation and Development approves a state highway-rail grade crossing safety action plan
October 2006	FRA issues proposed rule on human factor-caused train accidents
November 2006	FRA issues summary report on validation of a fatigue measurement model for use in train crew scheduling
December 2006	With FRA encouragement, Railinc Corporation and CHEMTREC begin a pilot project to provide information to emergency responders more quickly regarding hazmat shipments on short line and regional railroads
January 2007	FRA joins Union Pacific Railroad, Dow Chemical Company and Union Tank Car on the Next Generation Rail Tank Car (NGRTC) cooperative research project to improve hazmat tank car safety
	FRA announces the first Positive Train Control (PTC) system approved under revised federal regulations for use in regular freight service
February 2007	FRA Confidential Close Call and Reporting System (C^3RS) pilot project begins on the Union Pacific Railroad
April 2007	FRA T-19 and T-20 automated track geometry inspection vehicles begin service
July 2007	FRA completes research on material testing for Dynamic Fracture Toughness in support of strengthening the structural integrity of rail hazmat tank cars
August 2007	FRA completes research on Dynamic Forces in Train Accidents in support of strengthening the structural integrity of rail hazmat tank cars

February 2008	FRA issues final rule on human factor-caused train accidents
April 2008	FRA adds the Canadian Pacific Railway to the Confidential Close Call and Reporting System (C^3RS) pilot project
	FRA and PHMSA[1] issue proposed rule to strengthen rail hazmat tank cars
May 2008	FRA issues National Rail Safety Action Plan Final Report

Additional FRA Rail Safety Actions

During the past three years, FRA took many additional steps to improve both freight and passenger rail safety that were not specifically part of the *Action Plan*, but nonetheless supported and advanced the agency's safety program. The following is an incomplete list of some of those additional activities:

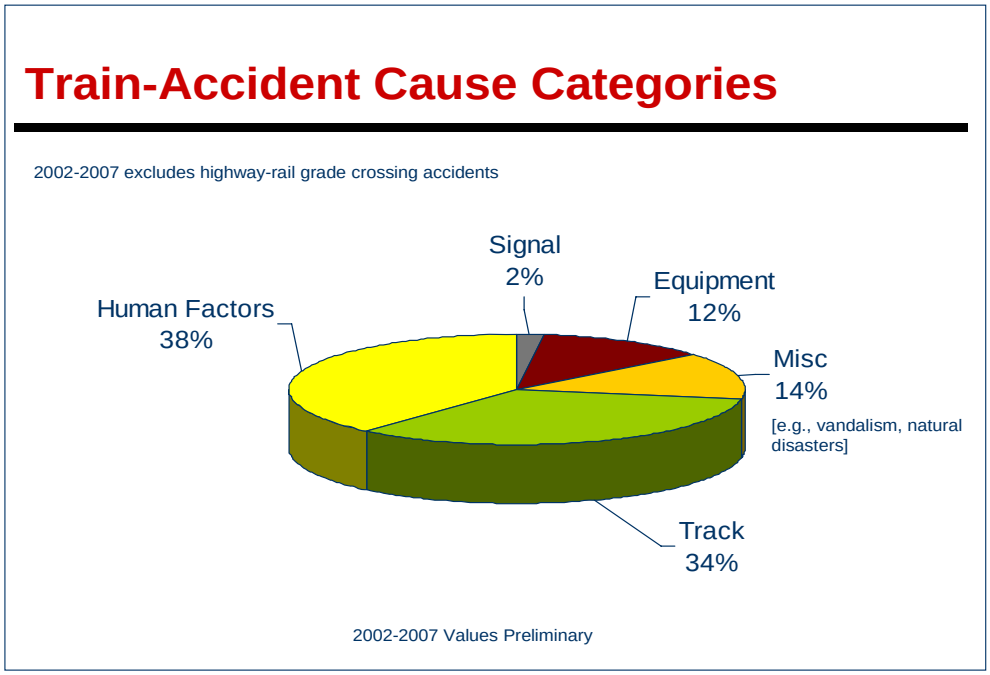
June 2005	FRA issues a final rule requiring more crashworthy locomotive event recorders to better preserve and prevent loss of data used in train accident investigations
October 2005	FRA issues Emergency Order No. 24 in response to an increasing number of train accidents caused by hand-operated, main track switches being left in the wrong position in non-signaled (dark) territory
November 2005	FRA issues proposed rule to improve how railroads conduct safety inspections of track joints connected by continuous welded rail (CWR)
March 2006	FRA conducts a full-scale passenger train crash to test new Crash Energy Management (CEM) technology and designs to better protect passengers and train crews
May 2006	FRA and PHMSA hold first of three public meetings to review design and operational factors that affect rail hazmat tank car safety
	FRA unveils the Passenger Rail Vehicle Emergency Evacuation Simulator ("Rollover Rig") to train emergency responders and test new safety components
August 2006	FRA issues a proposed rule to strengthen and add more safety features to passenger train emergency systems
	FRA holds the first of five public meetings to discuss issues on private highway-rail grade crossing safety
	FRA issues a report on the business benefits of electronically controlled pneumatic (ECP) train brake technology

[1] *Pipeline and Hazardous Materials Safety Administration*

October 2006	FRA issues final rule to improve how railroads conduct safety inspections of track joints connected by continuous welded rail (CWR)
December 2006	FRA and PHMSA issue a proposed rule to require railroads to analyze and select the safest and most secure route for hazmat shipments
February 2007	U.S. DOT submits to Congress an FRA reauthorization legislative proposal that seeks to strengthen rail employee Hours of Service provisions and establish a risk-reduction approach to further improve rail safety, among other items
August 2007	FRA issues a proposed rule to strengthen the collision and corner posts of passenger rail cars to better protect passengers and train crews
September 2007	FRA issues a proposed rule designed to encourage railroads and rail car owners to invest in and deploy electronically controlled pneumatic (ECP) brake technology
	FRA issues a Safety Advisory on Railroad Bridge Safety to re-emphasize important aspects of the agency's policy recommending that railroads implement effective bridge inspection and maintenance programs
October 2007	Under an FRA waiver, the Norfolk Southern Railway operates the first train in revenue service fully-equipped with electronically controlled pneumatic (ECP) brake technology
November 2007	FRA issues a Collision Hazard Analysis Guidebook for passenger rail operators to identify, analyze and develop risk-reduction strategies
January 2008	Under an FRA waiver, the BNSF Railway operates the second train in revenue service fully-equipped with electronically controlled pneumatic (ECP) brake technology
	FRA issues final rule to strengthen and add more safety features to passenger train emergency systems
February 2008	FRA issues a Guide for Managing Gap Safety for passenger rail operators to help minimize incidents arising from the gap between the edge of a station platform and the threshold of passenger train door
March 2008	FRA issues a rail trespasser demographic study conducted to better understand the number one cause of rail-related fatalities
April 2008	FRA and PHMSA issue interim final rule requiring railroads to analyze and select the safest and most secure route for hazmat shipments
May 2008	FRA to issue final report on safety at private highway-rail crossings

Causes of Train Accidents

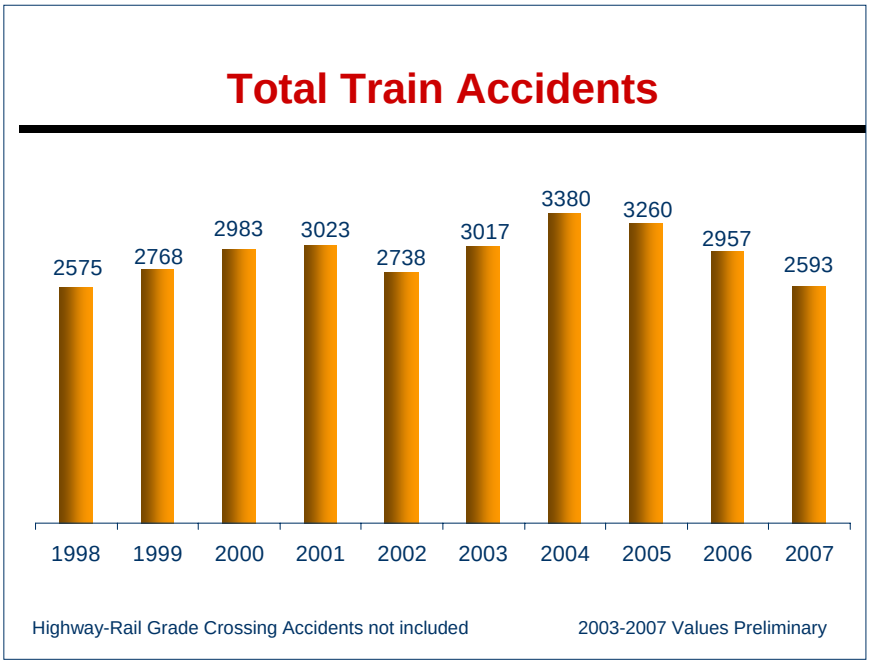
Train accidents are generally attributable to one of several main cause categories: human factors, track, equipment, signal and train control systems, and miscellaneous causes. Two categories of accidents– those caused by human factors and those caused by defective track– comprise more than 70 percent of all reportable train accidents. Consequently, FRA focused most heavily on these areas to bring about improvements in the overall rate of train accidents. In recent years, the most serious train accidents that resulted in the release of hazardous materials, or that harmed rail passengers, were the result of human factor or track causes.

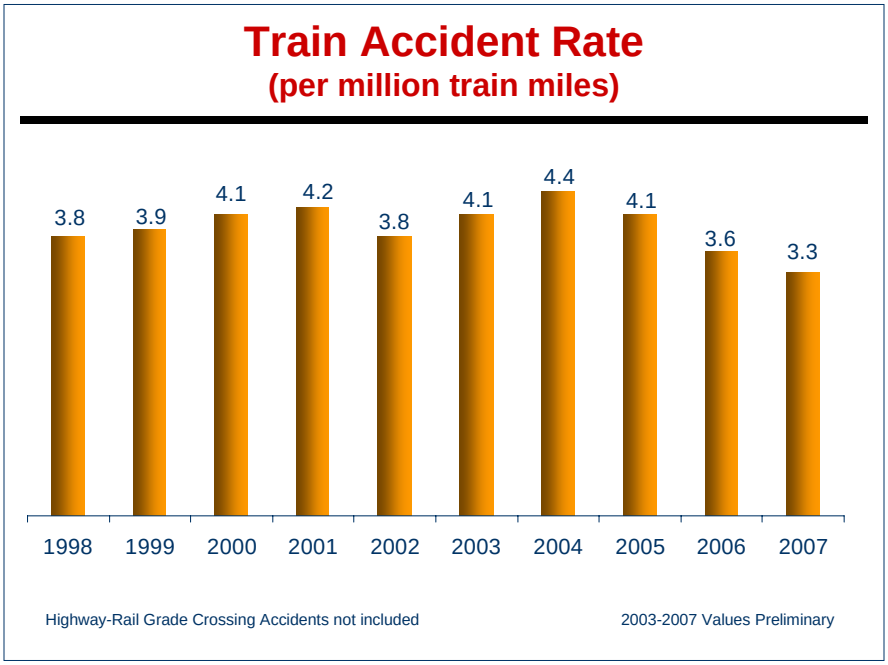


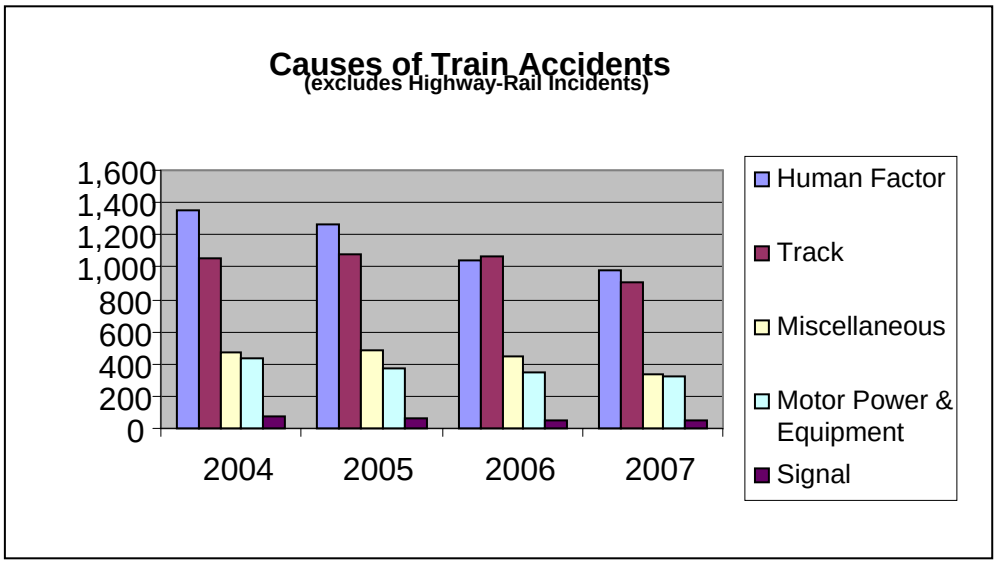
Action Plan Contributes to Improvement in Rail Safety

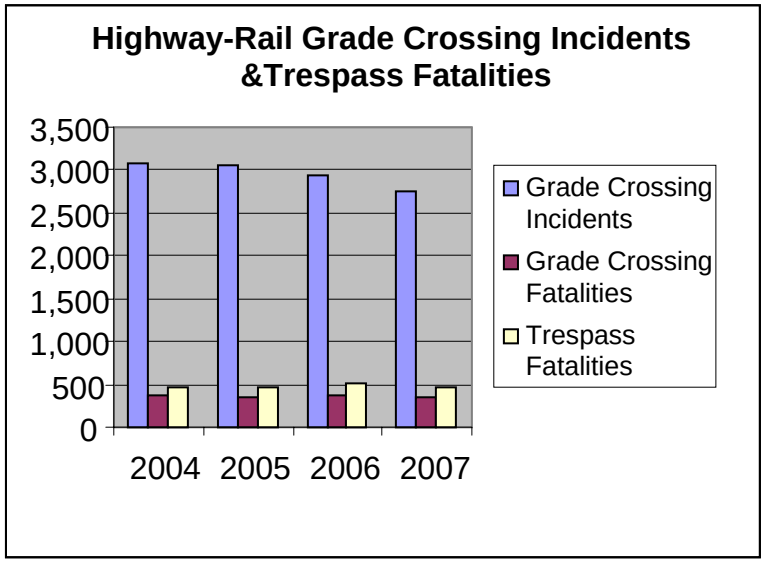
Rail safety has improved significantly since 2004 for a wide range of reasons, including, in part, FRA's focused and aggressive implementation of the *Action Plan*. A comparison of full year safety statistics for the period 2004 to 2007 reveals that railroads had nearly 800 fewer train accidents nationwide, or a 23.3 percent reduction. And, the train accident rate per one million train-miles is at a 10-year low despite significant increases in the volume of rail traffic.

The data also reveal that from 2004 to 2007 train accidents caused by human error— the leading cause of all train accidents, declined 27.2 percent. Train accidents due to track causes decreased 13.8 percent, and those caused by equipment failure and signal problems fell by 26.4 percent and 35.7 percent, respectively. In addition, the number of highway-rail grade crossing collisions declined by 10.9 percent, grade crossing fatalities decreased by 8.9 percent, and trespass fatalities, the number one cause of all rail-related deaths, showed little movement increasing by 0.4 percent.


Total Train Accidents
2575
2768
2983
3023
2738
3017
3380
3260
2957
2593
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Highway-Rail Grade Crossing Accidents not included
2003-2007 Values Preliminary


Train Accident Rate
(per million train miles)
3.8
3.9
4.1
4.2
3.8
4.1
4.4
4.1
3.6
3.3
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Highway-Rail Grade Crossing Accidents not included
2003-2007 Values Preliminary


Causes of Train Accidents
(excludes Highway-Rail Incidents)
1,600
1,400
1,200
1,000
800
600
400
200
0
2004
2005
2006
2007
Human Factor
Track
Miscellaneous
Motor Power & Equipment
Signal


Highway-Rail Grade Crossing Incidents &Trespass Fatalities
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2004
2005
2006
2007
Grade Crossing Incidents
Grade Crossing Fatalities
Trespass Fatalities

Reducing Human Factor Accidents

ACTION ITEM: Issue a federal rule addressing the top causes of human factor-caused train accidents

STATUS: COMPLETED ✓

In February 2008, FRA issued a final rule to reduce common mistakes that result in nearly half of all human factor-caused train accidents. It places greater accountability on both railroad management and employees for complying with basic operating rules. By emphasizing compliance with fundamental operating rules and providing FRA a more direct means of promoting compliance, safety will be improved. Only when management, labor and employees are fully engaged can a 'Culture of Safety' take hold.

FRA Administrator Joseph H. Boardman speaks to a group of new hires at a railroad employee training facility.

FRA analyses of train accident data reveal that a small number of particular kinds of human errors account for an inordinate and disproportionate number of human factor-caused accidents. The eight (8) human factor causes that are the central focus of this final rule involve noncompliance with long-established, core railroad operating rules and practices that are essential to ensuring safe railroad operations and include:

- Improperly lined track switches (switch left in incorrect position);
- Failure to latch and or lock a track switch;
- Lack of point protection (i.e. shoving or moving rail cars without a person in front of the move to monitor conditions ahead);
- Shoving rail cars with point protection but failing to properly control the movement;
- Failure to determine the track ahead is clear before beginning a shoving movement;
- Leaving rail cars in a place that fouls or obstructs train movements on an adjacent track;
- Operating over a track switch previously run through (i.e. damaged or broken); and
- Failure to apply or remove a derail (a precautionary safety device).

In each of these cases, compliance can be objectively and conclusively determined. Taken together, they account for approximately 48 percent of all human factor caused accidents. Documented cases of non-compliance may now result in a violation of federal rail safety regulations. Currently, these types of mistakes are subject to internal railroad standard operating procedures and addressed through employee disciplinary procedures or other corrective actions.

In addition, the new rule defines three distinct levels of responsibility and accountability including: railroad managers for putting in place programs designed to test employees for

proficiency in abiding by applicable operating rules; supervisors for properly administering such operational tests; and employees for complying with the rules. Employees have a "right of challenge" should they be instructed to take actions that, in good faith, they believe would violate the rules.

In October 2005 FRA issued Emergency Order No. 24, in response to an increasing number of train accidents caused by hand-operated, main track switches in non-signaled territory being left in the wrong position. The Emergency Order required special handling, instruction and testing of railroad operating rules pertaining to these switches. The final rule supersedes Emergency Order No. 24.

ACTION ITEM: Establish a "close call" pilot project to analyze and learn from incidents or events that could have caused or resulted in a train accident but did not

STATUS: COMPLETED ✓

While FRA already receives reports from railroads about a wide range of accidents and incidents, obtaining "close call" data, similar to that used in the aviation sector, enables analyses that help identify and determine new or potentially unknown risks, and to develop specific solutions and countermeasures to prevent accidents from occurring. Examples of "close calls" could be as minor as employees lifting objects in such a way that place them at risk for minor injuries, or more serious events, such as a train operating in non-signaled dark territory proceeding beyond its track authority, or a train crew member's failure to properly test an air brake before leaving a yard, which could lead to a runaway train.

In February 2007, FRA announced that Union Pacific Railroad (UP) employees at the nation's largest rail yard in North Platte, Nebraska could voluntarily and anonymously report without fear of sanction or penalty from their employer or the federal government, "close call" incidents (also known as "near misses") that *could have* resulted in an accident, but did not. The Confidential Close Call and Reporting Pilot Project (C^3RS) was made possible through an agreement between the railroad, the Brotherhood of Locomotive Engineers and Trainmen (BLET) and the United Transportation Union (UTU), allowing employees to anonymously report such incidents or events to the U.S. Department of Transportation's Bureau of Transportation Statistics. "Close call" reports will be collected for five years, providing researchers sufficient data to conduct thorough analyses. During the interim, an expert review team will evaluate reports as they are received in order to make safety recommendations for those that require immediate attention.

In April 2008, the Canadian Pacific Railway became the second railroad to join this pilot project allowing its Wisconsin-based employees to make confidential reports of "close calls." FRA plans to extend the C^3RS project to two other railroads, including at least one commuter rail operator.

Addressing Fatigue

ACTION ITEM:	Accelerate research on railroad crew work histories and validate a fatigue model for use in improving crew scheduling
STATUS:	COMPLETED ✓

Fatigue has long been considered a fact of life for many railroad operating employees, given the long and often unpredictable work hours and fluctuating schedules. Existing knowledge of the industry's work patterns and the developing science of fatigue mitigation, combined with National Transportation Safety Board investigation findings that employee fatigue was a major factor contributing of some train accidents, persuaded FRA that fatigue plays a role in one out of every four human factor-caused accidents.

In October 2006, FRA completed research which provides a strong scientific rationale for evaluating rail employee work schedules to address worker fatigue. It was determined that a fatigue model can accurately and reliably predict an increased risk of human error that could contribute to the occurrence of a train accident. A model for detecting the point at which the risk of fatigue becomes hazardous will aid the rail industry and labor organizations in improving crew scheduling practices and fatigue management plans. A similar approach is currently utilized by the Department of Defense.

Researchers analyzed the 30-day work schedule histories of locomotive crews preceding approximately 1,400 train accidents and found a strong statistical correlation between the crew's estimated level of alertness and the likelihood that they would be involved in an accident caused by human factors. In fact, the relationship was found to be so strong that the level of fatigue associated with some work schedules was found to be equivalent to being awake for 21 hours following an 8-hour sleep period the previous night. At this level, train accidents consistent with fatigue, such as failing to stop for red signals, are more likely to occur.

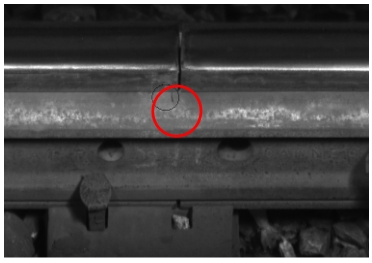
Concurrently with the fatigue-model research, FRA is conducting random sample work/rest surveys of employees crucial to railroad operations. To date, surveys have been completed and published for signalmen, dispatchers and maintenance of way workers, and a survey of train and engine employees will take place in 2008. FRA plans to analyze this data with the validated fatigue model to produce the first comprehensive picture of fatigue in the US railroad industry.

In addition, FRA used the fatigue research as a basis of its legislative proposal to replace railroad hours of service laws, first enacted in 1907, with comprehensive, scientifically based regulations. The laws, which set the maximum on-duty or minimum off-duty hours for train crews, dispatchers, and signal maintainers would be set by the FRA (working with the Railroad Safety Advisory Committee), much like hours of services standards are set by regulation for airline pilots and truck drivers.

Improving Track Safety

ACTION ITEM: Demonstrate vehicle-mounted photo imaging technology to detect cracks in joint bars that can lead to derailments

STATUS: COMPLETED ✓



A hairline fracture (above) that can be detected by the FRA Automated Optical Track Joint Bar Inspection System (below).

Track has consistently been the second leading cause of train accidents accounting for about one-third of all train accidents from 2001 to 2006. Broken joint bars, for example, are a leading cause, but the kinds of cracks in those bars that foreshadow a derailment-causing break are very hard to spot with the naked eye. Similarly, broken rails account for some of the most serious accidents, but the internal flaws that lead to many of those breaks can be detected only by specialized equipment. To address these challenges, FRA is developing an automated high-resolution video joint bar inspection system that can be deployed on a hi-rail vehicle that will detect visual cracks in joint bars at operating speed without having to stop.

In October 2005, a prototype system that inspects joint bars on both sides of each rail was successfully demonstrated. Testing showed that the high-resolution video system detected visual cracks that were missed by the traditional visual inspections. During the summer of 2006, the system was enhanced with new features to improve the reliability of joint bar detection and to add capabilities to include the global positioning system coordinates for each joint to facilitate future inspection and identification. Additionally, software was developed to scan the images automatically, detect the cracked joint bar, and then send a message to the operator with an image of the broken joint bar. Further enhancements were made to the system to improve joint detection reliability, and were tested at participating railroads during the spring of 2007.

In 2008, FRA intends to make yet more technical and functional enhancements to increase the speed at which the test equipment host vehicle may operate, and develop a rugged, simple, and robust defect detection system.

ACTION ITEM: Deploy two additional automated track geometry inspection vehicles

STATUS: COMPLETED ✓

Each railroad has the primary responsibility to ensure its own track meets or exceeds the standards prescribed in the FRA track safety regulations and to perform regular track inspections. The role of the FRA is to strategically monitor track conditions to determine whether a railroad is complying with federal safety standards.

In May 2005, FRA added the T-18 to its fleet of automated track inspection vehicles that measure weaknesses in the track structure such as bad crossties or poor connections between the rail and crosstie that could cause the rails to dangerously widen. In April 2007, FRA began operating its two newest automated track inspection vehicles, known as the T-19 and the T-20, equipped with state-of-the-art technology that helps prevent train derailments by detecting subtle track flaws that are difficult to identify during regular inspections.

The addition of two new vehicles brings the FRA fleet to five, which once fully integrated into the federal track inspection program, will allow FRA to inspect nearly 100,000 track-miles each year, tripling current capability. The additions are also allowing FRA to optimize track inspection resources by focusing on high-volume rail lines that carry the largest quantities of hazardous materials and the most passenger trains, as well as improving our ability to respond more quickly to inspect routes where safety is suspected or deemed to be substandard.

The new vehicles use several technologies to measure track geometry flaws such as whether two rails are level, if the width between the rails is acceptable, and if the shape of each rail meets federal standards so to avoid derailments. The measurements are recorded in real-time and at operating speed. Problem areas are identified by global positioning system location and shared immediately with the railroad so appropriate corrective actions can be taken in a timely manner.

The FRA T-19 track geometry inspection vehicle (left) and the interior of the T-20 vehicle (right).

Improving Hazardous Materials Safety and Emergency Response Capability

ACTION ITEM: Identify technology to improve safety in non-signaled (dark) track territory

STATUS: COMPLETED ✓

As part of the federal response to the January 2005 Graniteville, SC train derailment involving the release of hazardous materials, FRA partnered with the BNSF Railway in a $1 million Switch Point Monitoring System pilot project in November 2005. The main objective of the project was to develop a low-cost system that electronically monitors, detects, and reports a misaligned switch on mainline track located in dark, or non-signaled, track territory.

The project entailed installation of wireless communication devices connected to switch circuit controls at 49 switches along a 174-mile section of BNSF track between Tulsa and Avard, Oklahoma. Train dispatchers at the railroad's central operations center in Fort Worth, Texas, monitor information from the devices to identify when the hand-operated switches are set in the wrong position, or if their position is unknown by a loss of communication. If a switch is misaligned or its position is unknown, the dispatcher directs the crew of any potentially affected nearby train to stop until they or other railroad personnel in the field check the switch position and confirm it is safe to proceed. To date, there have been no unsafe failures of the system.

One of a variety of hand-operated track switches in use on the Nation's rail network.

The pilot project was considered a success prompting BNSF to develop technology that allows dispatchers to monitor and control the operation of switches by remote means. The railroad has since installed switch position monitoring technology elsewhere and plans to expand it use across its rail network.

ACTION ITEM: Ensure emergency responders have access to key information about hazardous materials transported by rail

STATUS: COMPLETED ✓

Emergency responders need access to a wide variety of information regarding hazardous materials transported by rail. The Association of American Railroads (AAR) offers hazardous materials incident response training and the American Chemistry Council has a program that familiarizes local emergency responders with railroad equipment and hazmat product characteristics. In addition, PHMSA publishes the *Federal Emergency Response Guidebook* (the 2008 edition is available online for the first time) and distributes federal grants to States to train emergency personnel.

In March 2005, with FRA encouragement, the AAR amended its Recommended Operating Practices for Transportation of Hazardous Materials (Circular No. OT-55-G) to expressly provide that local emergency responders, upon written request, will be provided with a ranked listing of the top 25 hazardous materials transported by rail through the community they protect, allowing them to plan, and focus training for incidents they are most likely to encounter.

In July 2005, again with FRA encouragement, CSX Transportation and CHEMTREC (the chemical industry's 24-hour resource center for emergency responders) began a pilot project called the Network Operations Workstations, or NOW. It allows CHEMTREC immediate access to CSX consist data for a specific train, including the type of hazardous materials (if any) being carried, and its exact position within the train.

In December 2006, another pilot project began to evaluate the use of Railinc Corporation's Freightscope™, a program that provides equipment search capabilities for hazmat shipments. The system was installed at CHEMTREC, and it has the potential to provide information about hazmat shipments on short line and regional railroads more quickly thereby reducing potential delays in emergency response. The Department of Homeland Security's (DHS) Transportation Security Administration (TSA) has agreed to continue funding the project with an expansion to include the major Class 1 railroads. In addition, CSX extended its participation by expanding access to their computer system to several state centralized emergency management facilities.

U.S. DOT Secretary Mary E. Peters watches a demonstration of an emergency responder training course involving a hazmat train derailment.

While the work of the *Action Plan* related to the CSX NOW and Freightscope™ pilot projects continue, they have been incorporated into a national system-wide project to improve communications with the emergency response community regardless of mode of transport.

In addition, in March 2008, PHMSA held a meeting of stakeholders to define a scope of work for an upcoming project involving electronic shipping papers for shipments of hazardous materials. FRA supports this effort that is part of the Transportation Research Board (TRB) Hazardous Materials Cooperative Research Panel program.

The PHMSA electronic shipping paper initiative is intended to define the regulatory guidelines necessary to amend the current federal Hazardous Materials Regulations pertaining to shipping paper requirements to allow the electronic transfer of hazard communication in lieu of paper documentation. PHMSA is evaluating the potential for the electronic communication of hazard information to improve safety and increase efficiencies in the transport system by:

- Improving the accuracy of hazard communication by having the party most familiar with the product create the data file that is utilized throughout the transport chain;
- Facilitating the flow of hazard information to emergency responders prior to arrival on a hazmat incident scene;
- Increasing the amount of information available to emergency responders prior to their arrival on a hazmat incident scene; and
- Creating a standard communication vehicle for multimodal shipments, therefore reducing the need to redraft documents at ports, rail yards, and other locations.

ACTION ITEM: Accelerate research into hazardous materials rail tank car structural integrity to prevent release of hazardous materials

STATUS: COMPLETED ✓

FRA is seeking to strengthen the structural integrity of tank cars used to transport the highest-risk commodities to reduce the probability that a derailment or collision will result in a potentially catastrophic release of toxic or poison inhalation hazard (TIH or PIH) commodities. Toward this end, FRA has undertaken applied research to evaluate alternative methods for enhancing blunting of loads and increasing the energy absorption capability of tank cars while maintaining tank integrity.

FRA has conducted and completed research to: model dynamic forces acting on hazmat tank cars in accidents and assessing the subsequent damage and to test the fracture behavior of different types of hazmat tank car steel. Originally scheduled to be finished in 2008, FRA provided an additional $400,000 to push the completion date forward to 2007.

A third research effort to rank the risk of hazmat tank cars for their vulnerability to catastrophic failure was overtaken by the new FRA/PHMSA proposed rule for hazmat tank car safety that calls for the complete replacement of the tank car fleet that carries the most dangerous hazardous materials with newer, stronger, and more crashworthy designs.

In January 2007, FRA executed a formal Memorandum of Cooperation with Union Pacific Railroad, Dow Chemical Company, and the Union Tank Car manufacturing company to share and exchange research data and findings to aid development of new federal design standards for safer hazardous materials tank cars. The goal of the Next Generation Rail Tank Car (NGRTC) project partnership is to leverage resources in order to move beyond incremental design changes, and instead utilize and apply the latest knowledge and technology in pursuit of shared objectives.

Making rail tank cars that carry the most dangerous hazardous materials stronger and better able to survive accidents intact is a major focus of the FRA Action Plan.

A head-end shield developed for use in a crash impact test for the Next Generation Rail Tank Car project.

As part of the NGRTC project, FRA conducted three full-scale dynamic side impact tests of conventional pressurized tank cars that carry chlorine in April and July of 2007. Using the results of the tests, FRA evaluated alternative strategies for significantly enhancing the impact performance of a TIH or PIH tank car. A design has been developed that is capable of maintaining the integrity of a laden tank car while absorbing 4.5 times the energy compared to a conventional tank car in a similar scenario. Additionally, the design would render the car's head shield capable of absorbing 8.5 times the energy that a conventional tank car could sustain.

In March 2008, FRA/PHMSA issued a proposed rule to improve tank car integrity under the most commonly identified derailment and collision scenarios, in order to significantly enhance public safety in very low probability, but high-consequence, incidents. The proposed performance-based standard would increase by 500 percent on average the amount of energy the hazmat tank car must absorb during a train accident before a catastrophic failure will occur. This can be achieved with innovative designs, materials, and technologies available today and in combination with operating speed restrictions.

The consequences of a catastrophic release of lethal hazmat commodities would also be mitigated through proposed operating speed restrictions for tank cars transporting poison inhalation hazard (PIH) materials to a maximum of 50 mph; a measure effectively already in place today through voluntary actions adopted by the rail industry for the majority of PIH shipments. In non-signaled (dark) territory a 30 mph speed restriction would be put in place, based on FRA's finding that a disproportionate number of incidents resulting in loss of PIH material occurred in non-signaled territory. In lieu of the speed restriction, railroads would be permitted to implement alternative safety measures, such as switch position monitoring systems, track integrity circuits, enhanced operational safeguards, or positive train control technology. As tank cars meeting the enhanced performance standard enter the fleet, this 30 mph restriction will be phased out.

One of a series of crash impact tests performed in the development of the FRA / PHMSA proposed rule to strengthen rail hazmat tank cars.

The proposed rule also would requires that PIH tank cars have a shell puncture-resistance system capable of withstanding a side impact at 25 mph to ensure that in most instances, a tank car would not be breached if involved in a derailment or other similar type of accident. To address

the high forces associated with direct impacts in train-to-train collisions, the tank-head puncture-resistance system would be required to survive an impact at 30 mph. Additionally, because of concerns that have been raised about the ability of PIH tank cars manufactured prior to 1989 with non-normalized steel to resist the propagation of fractures that can lead to catastrophic failure, such tank cars will be phased out of PIH service no later than five years after the effective date of the rule. This portion of the tank car fleet represents the oldest cars and those that are the most cost and safety efficient for early replacement. FRA/PHMSA intends to issue a final rule as quickly as possible.

In April 2008, FRA issued an Interim Final Rule (IFR) to ensure that railroads use routes with the fewest overall safety and security risks to transport security-sensitive hazardous materials. In order to prevent a catastrophic release of ultra-hazardous material shipments (i.e. PIH, more than 5,000 pounds in a single carload of Division 1.1, 1.2, or 1.3 explosive, and certain high-level radioactive material) in proximity to populated areas, events or venues with large numbers of people in attendance, populated buildings, landmarks or environmentally significant areas rail carriers would: (1) compile data on specified shipments of hazardous materials and routes currently used; (2) analyze safety and security risks along routes where those materials are transported; (3) assess alternative routing options and (4) make routing decisions based on those assessments. In collecting the relevant data, each carrier will seek input from state and local officials regarding security risks.

In addition to the routes normally and regularly used for hazardous materials movements, the IFR requires rail carriers to analyze and assess the safety and security of all available alternative routes over which they have authority to operate. Each risk analysis will be based upon 27 specific risk factors. Railroads will also have to consider the use of interchange agreements with other carriers when determining practicable alternative routes and the potential economic effect of using an alternative route. To guard against sabotage the IFR requires pre-trip inspections of placarded rail cars to include an inspection for signs of tampering with the rail car, including its seals and closures, and an inspection for anything suspicious.

If during the course of a routine review or audit of a railroad's hazmat security plan, FRA determines that a railroad's risk analysis was incomplete or inaccurate, and that an alternative route poses the least safety and security risks based on the information available, the agency may require the use of the alternate route until such time as any deficiencies identified are corrected by the railroad. FRA will consult with the Transportation Security Administration and the Surface Transportation Board before ordering the use of an alternate route. In a Notice of Proposed Rulemaking published concurrently with the IFR, the FRA is proposing procedures for rail carriers to appeal such a decision by the FRA to require the use of an alternative route.

Strengthening FRA's Safety Compliance Program

ACTION ITEM: Make better use of accident/incident and inspection data to maximize the effectiveness of FRA safety inspections

STATUS: COMPLETED ✓

The National Inspection Plan (NIP) is a strategic resource allocation program that uses predictive indicators to assist FRA in conducting inspection and enforcement activities within a given geography or on a particular railroad. In essence, it makes use of existing inspection and accident data in such a way to identify potential safety "hot spots" so they can be corrected before a serious accident occurs. The NIP was fully implemented for all five FRA rail safety disciplines in March 2006.

During the first year FRA utilized the NIP, FRA regional offices and field inspectors learned how to interpret and use the highly detailed data and information. During the second year, field personnel proactively learned how to make adjustments where needed and better manage resources to achieve the targets in the plan. As a result, there has been a greater willingness and ability to break with past inspections patterns and to focus more effort on railroads with the most potential safety problems as revealed by the NIP outputs. The workforce has since improved upon the planning phase of the NIP by implementing a mid-year review process. FRA has observed a net reduction in both the number and rate of accidents and expects additional safety gain once the NIP becomes fully institutionalized and FRA further refines its application to real-world experience.

The FRA National Inspection Plan directs safety inspectors to potential "hot spots."

In the enforcement arena, in December 2006 FRA announced that the civil penalty guideline amounts assessed against railroads for violating federal rail safety regulations would double for most violations. FRA evaluated each of the more than 2,000 regulations using a five-point severity scale. The measure takes into consideration the likelihood that a rail accident or graver consequences will occur as a result of failing to comply with a particular section of the regulations. The more severe the potential outcome of violating a rule, the higher the fine. In September 2007, pursuant to the Federal Civil Penalties Inflation Adjustment Act, FRA published a final rule raising the ordinary maximum civil penalty per violation from $11,000 to $16,000. As a result, the original proposal has become obsolete as the range of penalties was based on an $11,000 ordinary maximum. FRA is far along in drafting a revised proposal for line-by-line changes in the penalty schedules, which it intends to publish in 2008.

Fostering Innovative Solutions to Improve Highway-Rail Grade Crossing Safety

ACTION ITEM:	Strengthen partnerships and emphasize shared responsibilities concerning safety at highway-rail grade crossings
STATUS:	COMPLETED ✓

Deaths due to highway-rail grade crossing collisions are the second largest cause of railroad fatalities (trespassing is the leading cause). While the number and frequency of grade crossing incidents and deaths has declined substantially and steadily since the 1970s, the growth in rail and motor vehicle traffic continues to present challenges.

In May 2005, FRA issued Safety Advisory 2005-03 describing the roles of the Federal and state governments and of the railroads in addressing safety at highway-rail grade crossings. It also noted railroads' responsibilities to: properly report any accident involving grade crossing signal failure; maintain accurate records on credible reports of grade crossing warning system malfunctions; preserve data from all locomotive mounted recording devices following grade crossing collisions; and fully cooperate and assist local law enforcement authorities with investigations of such events. We also explained our willingness assistance to local law enforcement authorities in conducting investigations of train-vehicle collisions where information or expertise within FRA's control is required to complete the investigation.

Safety at highway-rail grade crossings is a shared responsibility among motorists, railroads, law enforcement agencies, judges, traffic safety organizations and federal, state, and local governments.

ACTION ITEM: Assist States in Improving Highway-Rail Grade Crossing Safety

STATUS: COMPLETED ✓

In March 2005, FRA began working with the state of Louisiana in developing a state-wide highway-rail crossing safety action plan. Louisiana has the unfortunate distinction of consistently ranking among the top five states nationally with the highest number of grade crossing collisions and fatalities. The state's action plan focuses on reducing vehicle-train collisions at grade crossings where multiple incidents have occurred. The State of Louisiana approved its action plan in April 2006.

In June 2006, in part as a result of efforts to create this action plan, the Louisiana Department of Transportation and Development announced an agreement with Kansas City Southern Railway to make safety improvements at 300 public grade crossings. Over a five-year period, more than $16 million will be invested to upgrade warning devices, replace cross buck signage, and close redundant crossings.

FRA is now working with Texas to develop a similar, State-specific action plan, which is expected to be completed by the end of May 2008. The Illinois Commerce Commission has begun to work on an action plan for the state of Illinois and is expected to complete the plan by the end of 2008.

In February 2008 FRA released two publications that provide additional information for use by roadway authorities to improve safety at highway-rail grade crossings. The *Compilation of Pedestrian Safety Devices in Use at Grade Crossings* provides an overview of existing warning devices designed to provide warning to pedestrians at grade crossings. This information will enable public authorities to look at a variety of warning devices so that the best option may be employed. *Guidance on the Use of Traffic Channelization Devices at Highway-Rail Grade Crossings* encourages the use of channelization devices at crossings that are equipped with flashing lights and gates to improve driver compliance. The addition of traffic channelization devices may improve driver compliance by as much as 80 percent.

FRA supports use of channelization devices to deter motorists from driving around lowered gates at highway-rail grade crossings.

To further improve grade crossing safety, FRA developed and distributed 3,000 copies of an educational video directed toward migrant farm workers to provide information on how they can work safely along railroad property. And, FRA continued to fulfill the elements of a separate U.S. Secretary of Transportation's *Highway-Rail Grade Crossing Safety and Trespass Prevention Action Plan* issued in 2004 to establish responsibility for safety at private grade crossings. Private crossings are owned by private property owners primarily to allow roadway access over railroad tracks to residential, commercial, or agricultural areas not meant for general public use. Each year, about 400 accidents, and 30 to 40 fatalities, occur at the approximately 94,000 private crossings. During 2006 and 2007, FRA held a series of five public meetings across the country (CA, LA, MN, NC, and NY) to stimulate discussion and solicit input about how best to increase safety at the nation's largely unregulated private highway-rail grade crossings. FRA sought comments on topics such as determining when a private crossing has a public purpose and whether the State or Federal government should assume a greater role in setting safety standards. FRA's a final report on safety at private highway-rail grade crossings is targeted for release in May 2008.

FRA held five public meetings on safety at private grade crossings.

In addition, in March 2008, FRA released a report entitled *Rail-Trespasser Fatalities: Developing Demographic Profiles* to help in the fight against the number one cause of rail-related fatalities. This report utilized information provided by medical examiners and coroners over a three year period in order to obtain demographic information that can be used by states and local authorities to develop targeted materials aimed at demographic groups most likely to be involved in fatal trespass incidents.

Other Ongoing FRA Rail Safety Initiatives

FRA continues to vigorously pursue numerous other safety initiatives above and beyond the elements of the *Action Plan*. These other activities include advancing the development and deployment of safety technology such as Positive Train Control (PTC) and electronically controlled pneumatic (ECP) brake systems, and enhancing passenger rail safety. FRA has submitted to Congress a comprehensive legislative proposal that seeks to reauthorize FRA for four years and strengthen the federal rail safety program.

Positive Train Control (PTC)

In 2005, FRA revised federal signal and train control regulations to facilitate and enable development and deployment of PTC technology. In January 2007, FRA announced approval of the first PTC system intended for general use by the freight railroads capable of automatically enforcing maximum authorized train speeds and the limits of movement authorities in order to prevent certain accidents, including train collisions and over-speed derailments. This is a major achievement that marks the beginning of a new era of rail safety.

The approved PTC system is the BNSF Railway's Electronic Train Management System (ETMS), an overlay technology that augments and supplements existing train control methods. ETMS employs both digital communications and a global positioning system to monitor train location and speed within track authority limits. The ETMS system includes an in-cab electronic display screen that will first warn of a problem and then automatically engage the train's air brake system if a locomotive engineer fails to act in accordance with operating instructions and limitations. The FRA action allows BNSF to implement ETMS on 35 specific freight lines in 17 states, and requires appropriate employee training before it can be initiated.

It is expected that the railroad industry will increasingly embrace and adopt PTC technology as other railroads— among them, Union Pacific Railroad, Norfolk Southern Railway, CSX Transportation, the Alaska Railroad, Metra in Chicago, and the Ohio Central Railroad System— are each making significant strides themselves to develop their own PTC systems. In addition to its safety benefits, in some cases PTC can also increase the capacity of high-density rail lines, improving overall efficiency.

Electronically Controlled Pneumatic (ECP) Brakes

In August 2006, FRA released a report on the business benefits of electronically controlled pneumatic (ECP) brake systems that have the capability to significantly improve train control significantly, reduce derailments, and shorten stopping distances. ECP brakes are to trains what anti-lock brakes are to automobiles—they provide better control. ECP brakes apply uniformly and virtually instantaneously on every rail car throughout a train and not sequentially from one car to the next as is done with conventional air brake systems.

The full train brake application, and an ability to gradually apply and release the brakes, provides for vastly improved train control and enhances safety. FRA believes ECP brake systems are the

most significant development in railroad brake technology since the 1870s. ECP brake technology can help avert train derailments caused by sudden emergency brake applications, prevent runaway trains caused by loss of brake air pressure, and shorten train stopping distances up to 60 percent under certain circumstances. ECP brake systems also are capable of performing continual electronic self-diagnostic 'health checks' of the brakes to identify maintenance needs.

At the time the benefit report was issued, FRA announced its intention to propose revisions to the federal rail safety regulations in 2007 to facilitate use of ECP brakes. In March 2007, FRA approved a joint request by BNSF Railway and Norfolk Southern Railway (NS) to install ECP brakes on trains to demonstrate the safety and efficacy of the technology in revenue service. In October 2007, NS began operating its first ECP-equipped train under the FRA waiver from a coal mine to a utility in southwestern Pennsylvania outside the Pittsburgh area. And, in January 2008, the first waiver approved BNSF train with ECP brakes starting operating a run from Wyoming's Powder River Basin coal fields to a utility near Birmingham, Alabama. In March 2008, the Union Pacific Railroad submitted its own waiver request to allow it to operate using ECP brakes over a specific intermodal route.

FRA issued its proposed rule for ECP brakes in September 2007. The proposal would allow trains equipped with ECP brakes to safely travel up to 3,500 miles--more than double the distance currently allowed by federal regulations. To ensure safety, the proposal includes several conditions such as requirements that the railroad clearly define a process for rectifying brake problems discovered en route; ensuring that ECP inspections are only performed by qualified mechanical inspectors; and providing appropriate training to crew members.

In addition, ECP brakes support the U.S. Department of Transportation's *National Strategy to Reduce Congestion on America's Transportation Network*. Better brakes mean longer trains can move more freight faster and safer to help reduce congestion on America's rail system.

Passenger Rail Safety Initiatives

While many of the major components of the *National Rail Safety Action Plan* focused on improving the safety of freight railroad operations, FRA continues to advance numerous initiatives designed to bring about additional improvements to the safety of passenger rail operations. In order to build upon the already exceptional safety record of intercity and commuter rail services, FRA is sponsoring cutting-edge research on rail car design and leading efforts to implement best practices on all carriers.

In March 2006 FRA successfully conducted the final in a series of full-scale passenger train collisions at the one of the world's premiere rail testing facilities located in Pueblo, Colorado. In order to test new Crash Energy Management (CEM) technology, a passenger train was equipped with crush zones which absorb the force of a crash to better protect passenger seating areas and operators' spaces. The crush zones have stronger end frames that act as bumpers to distribute crash forces throughout an entire train so passengers feel less of the impact. Other devices tested include newly designed couplers, which join two cars together and are built to retract and absorb

energy to keep trains upright on the tracks during a crash. New passenger seats and chairs designed with special padding and crushable edges also were tested.

The Passenger Rail Vehicle Emergency Evacuation Simulator or "Rollover Rig."

In May 2006, FRA unveiled the Passenger Rail Vehicle Emergency Evacuation Simulator, or "Rollover Rig," which can rotate a full-sized commuter rail car up to 180 degrees, to simulate passenger train derailment scenarios. It provides researchers the ability to test new passenger rail evacuation strategies and safety components such as emergency lighting, doors, and windows and gives first responders a unique training tool.

In August 2007, FRA published a proposed rule to enhance structural strength requirements for the front end of cab cars and multiple-unit locomotives. These proposed enhancements include the addition of "energy deformation" requirements specified in revised industry standards for front end collision posts and corner posts for this equipment. In April 2008 FRA conducted a dynamic impact test of a cab cars end frame (i.e., collision and corner posts) to help show alternative testing method which can be used to assess whether new rail car designs comply with the proposed standards.

Crash impact tests to strengthen collision and corner posts are part of ongoing FRA research to improve passenger rail safety.

In February 2008, FRA published a final rule establishing new passenger rail safety standards to improve the evacuation of passengers from trains in emergency situations by enhancing requirements for emergency window exits and providing additional ways for emergency responders to access passenger cars. The final rule also mandates public address systems on all existing passenger cars by January 1, 2012, and requires new passenger cars to have intercom systems to enable passengers to quickly communicate in emergency situations with the train crew. In addition, FRA is currently developing a proposed rule focusing on passenger car emergency signage, low location exit path marking, and emergency lighting.

Finally, in February 2007, FRA held the first meeting of its Railroad Safety Advisory Committee (RSAC) General Passenger Safety Task Force. The first task for this group was to review passenger safety at stations with high-level platforms where there are gaps between passenger car doorways and the platform. In February 2008, the RSAC approved a "Gap Safety Management Guide" which has been issued to interested parties.

Proposed FRA Rail Safety Legislation

As mentioned briefly before, in February 2007, the U.S. DOT submitted to Congress the *Federal Railroad Safety Accountability and Improvement Act* (H.R. 1516 and S. 918) to reauthorize the FRA for four years and to strengthen its safety program. The proposed bill's major provisions include: granting FRA authority to regulate railroad worker hours of service; providing greater emphasis by FRA and railroads to establish risk reduction programs; and improving highway-rail grade crossing safety.

The current statutory provisions-- first enacted in 1907- that govern the hours of service of railroad train crews, dispatchers, and signal maintainers are antiquated and inadequate to address present realities. FRA has proposed to revise and update those hours of service laws with comprehensive, scientifically based regulations that make use of a century worth of learning on sleep-wake cycles and fatigue-induced performance. Under the proposal, the maximum on-duty or minimum off-duty hours would be established by FRA, much like hours of service standards are set for airline pilots by the Federal Aviation Administration and for truck drivers by the Federal Motor Carrier Safety Administration. If given the authority, the FRA Railroad Safety Advisory Committee, comprised of railroad management, labor representatives and other key stakeholders, will review the issue and develop recommendations on new hours of service limits based on current, sound science before any changes are made.

Other provisions in the FRA proposal include requiring states and railroads to update the National Crossing Inventory on a regular basis to ensure current information is available for hazard analysis in determining where federal highway safety improvement funding is directed. In addition, the bill seeks to encourage the creation and deployment of new, cost-effective technology at the Nation's approximately 80,000 public highway-rail grade crossings that still lack active warning devices.

Furthermore, the proposed legislation would expand the authority of the FRA to disqualify any individual in the railroad industry as unfit for safety-sensitive service for violation of federal regulations related to transporting hazardous materials, among other items.

Finally, to achieve meaningful and lasting safety improvements, the FRA proposal also will supplement traditional safety efforts with a pilot program to establish safety risk reduction programs. FRA is placing greater emphasis on developing methods to systematically evaluate safety risks in order to hold railroads more accountable for improving the safety of their own operations, including risk management strategies and implementing plans to eliminate or minimize the opportunity for workers to make errors that can result in accidents.

Some provisions very similar to those in the Department's bill have been incorporated into both the House and Senate versions of a rail safety bill.

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