Middlesex Corporation Employee Fatality on Housatonic Railroad Company-Operated Line

Great Barrington, Massachusetts
August 4, 2023

Abstract: This report discusses the August 4, 2023, fatal roadway maintenance worker accident in Great Barrington, Massachusetts. A Middlesex Corporation tie drilling machine operator was making a northbound reverse movement along the Berkshire (rail) Line when the roadway maintenance machine struck and killed another Middlesex employee operating a leaf blower on the same track. Middlesex Corporation was contracted to perform track improvements by the Massachusetts Department of Transportation, the owner of the Berkshire Line. The Housatonic Railroad Company (HRRC) operates freight railroad services on the line and had provided a roadway-worker-in-charge to oversee safety for the track improvement work.

Safety issues identified in this report include the unsafe operation of the tie drilling machine; the need for roadway maintenance machines to be equipped with new technologies such as collision warning and avoidance systems to further advance on-track safety and eliminate human error; the uncoordinated and inadequate communication between HRRC and Middlesex that failed to identify repeated unsafe actions of HRRC and Middlesex employees; and the Federal Railroad Administration's lack of annual evaluations to assess which railroads have inadequate safety performance and, therefore, are required to establish risk reduction programs.

New recommendations are made to the Federal Railroad Administration, all Class I railroads, the American Short Line and Regional Railroad Association, the National Railroad Construction and Maintenance Association, the Housatonic Railroad Company, and Middlesex Corporation. One recommendation to the Federal Railroad Administration is reiterated and classified, and one recommendation to the Federal Railroad Administration is classified.

Contents

Figures

Tables

Acronyms and Abbreviations

Abbreviation	Name
2008 RSIA	Rail Safety Improvement Act of 2008
ASLRRA	American Short Line and Regional Railroad Association
CFR	*Code of Federal Regulations*
FRA	Federal Railroad Administration
GPS	Global Positioning System
HRRC	Housatonic Railroad Company
MassDOT	Massachusetts Department of Transportation
MP	milepost
NRC	National Railroad Construction and Maintenance Association
NTSB	National Transportation Safety Board
RMM	roadway maintenance machine
RRP	risk reduction program
RSAC	Railroad Safety Advisory Committee
RWIC	roadway worker-in-charge
STOP	stop, think, observe, plan

Executive Summary

What Happened

On August 4, 2023, about 10:05 a.m., the operator of a roadway maintenance machine (RMM) struck and killed a Middlesex Corporation employee performing track work on the Berkshire Line in Great Barrington, Massachusetts. The RMM involved in the accident was a tie drilling machine, which is commonly referred to as a driller. About an hour before the accident, the driller experienced a mechanical issue that required the driller operator to remove the driller from the work location for repairs. The driller operator was part of a four-member work group of Middlesex employees; one of those employees accompanied him when he departed the job location on the driller, while the other two employees remained working (on foot) at the job location. After repairs had been made to the driller, the driller operator traveled about 1.4 miles in reverse along the Berkshire Line back to the job location to resume work. While conducting this reverse movement, the driller operator did not see that his two fellow Middlesex employees, who had remained working at the job location, were on the same track as the RMM; subsequently, the driller struck and killed one of the employees.

What We Found

Maintaining constant visibility of the track ahead of RMM movements is necessary to ensure the path of travel is clear and the operator can stop short of any obstructions or people. We found that the driller operator had sufficient sight distance to see the employees on the tracks and most likely could have stopped the driller before striking his fellow employee, but he did not actively observe the driller's path of travel or monitor the RMM's rearview mirror as he approached the work site.

We found that, because the driller was not equipped with safety devices (other than a wide-angle mirror) to aid the operator's lookout for hazards, the lapse in the driller operator's attention and/or judgment resulted in severe consequences. Although there is a lack of evidence to determine with certainty why the driller operator did not actively observe the driller's path of travel, we found that, had the driller been equipped with a collision avoidance system capable of detecting people on the ground and automatically stopping its movement before a collision, the RMM would have stopped before the collision occurred. We also identified that people detection systems on RMMs with moveable extensions can alert operators to take preventive action when people enter the RMM's work zone.

We found that communication between the Housatonic Railroad Company (HRRC) roadway worker-in-charge (RWIC) and Middlesex supervisors was insufficient, because the RWIC was not aware of all the work being conducted on the day of the accident, resulting in an inadequate on-track safety briefing and the absence of a second, FRA-mandated RWIC engaged in supervising work, coordinating on-track RMM movements, or properly locking switches used for RMM movements when unmonitored. Had the need for a second RWIC been identified and provided, the work group would likely have had a job briefing tailored to their tasks, qualified supervision overseeing their work, and proper communication around the driller's movements.

HRRC oversaw all railroad operations on the Berkshire Line and was experienced in railroad operations and safety oversight, but HRRC did not consistently ensure safety oversight was properly planned and implemented. Had HRRC implemented an effective safety management system prior to the accident, it would have increased the likelihood of HRRC identifying and correcting the supervision and communication deficiencies that contributed to the accident.

Lastly, we found that, if the Federal Railroad Administration does not perform annual analyses of short line railroads' safety performance, it will continue to miss opportunities to require risk reduction programs for those railroads that demonstrate inadequate safety performance.

We determined that the probable cause of the Great Barrington, Massachusetts, roadway maintenance worker fatality was the Middlesex Corporation driller operator's failure to actively observe that the driller's path of travel was clear. Contributing to the accident was the Housatonic Railroad Company roadway worker-in-charge's (RWIC) lack of awareness of daily tasking, which prevented him from conducting an adequate job briefing for all tasks being performed, the RWIC's lack of awareness of on-track roadway maintenance machine movements without his knowledge or authorization, the absence of a required second RWIC, and no communications between the RWIC and the second work group about their work activities prior to the accident, which resulted in his lack of awareness that a second work group or work site existed.

What We Recommended

As a result of this investigation, the NTSB issued six new recommendations. We recommended that the FRA require all on-track RMMs to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision. (This recommendation superseded a 2023 safety recommendation to require that RMMs be equipped with backup cameras.) We also recommended that the FRA require all on-track RMMs with movable extensions to be equipped with a 360° people detection system that alerts operators when people are within an unsafe proximity.

We similarly recommended that all Class I railroads, the Housatonic Railroad Company, and Middlesex Corporation require all on-track RMMs, including leased or contracted RMMs, to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision. We also recommended that Class I railroads require that all on-track RMMs with movable extensions, including leased or contracted RMMs, be equipped with a 360° people detection system that alerts operators when people are within an unsafe proximity.

We also recommended that the American Short Line and Regional Railroad Association and the National Railroad Construction and Maintenance Association inform their members of the safety benefits of equipping RMMs with collision avoidance systems and, when RMMs have movable extensions, a people detection system that alerts operators of nearby workers. We further recommended that these associations urge their members to inform their employees of the circumstances of this accident, the importance of thorough job briefings with railroad contractors, and the requirement to communicate on-track activities and movements with the RWIC.

In addition, we reiterated a 2012 recommendation to the FRA to require that safety management systems be incorporated into railroads' risk reduction programs.

1 Factual Information

1.1 The Accident

On August 4, 2023, about 10:05 a.m., a tie drilling roadway maintenance machine (RMM) being operated in reverse by a Middlesex Corporation employee struck and killed another Middlesex employee performing maintenance-of-way work on the Berkshire Line in Great Barrington, Massachusetts.[1] The RMM involved in the accident is commonly referred to as a driller. At the time of the accident, the driller operator (accompanied by another Middlesex employee) was conducting a reverse movement along the Berkshire Line to resume work after having relocated the driller to a separate location for repair about an hour before the accident. While conducting the reverse movement, the driller operator did not see that two fellow Middlesex employees were working in the driller's path of travel; subsequently, the driller struck and killed one of the employees. (See figure 1.) There were no other injuries. The temperature at the time and location of the accident was 66°F with no precipitation. Visibility was clear and unobstructed at the accident location.

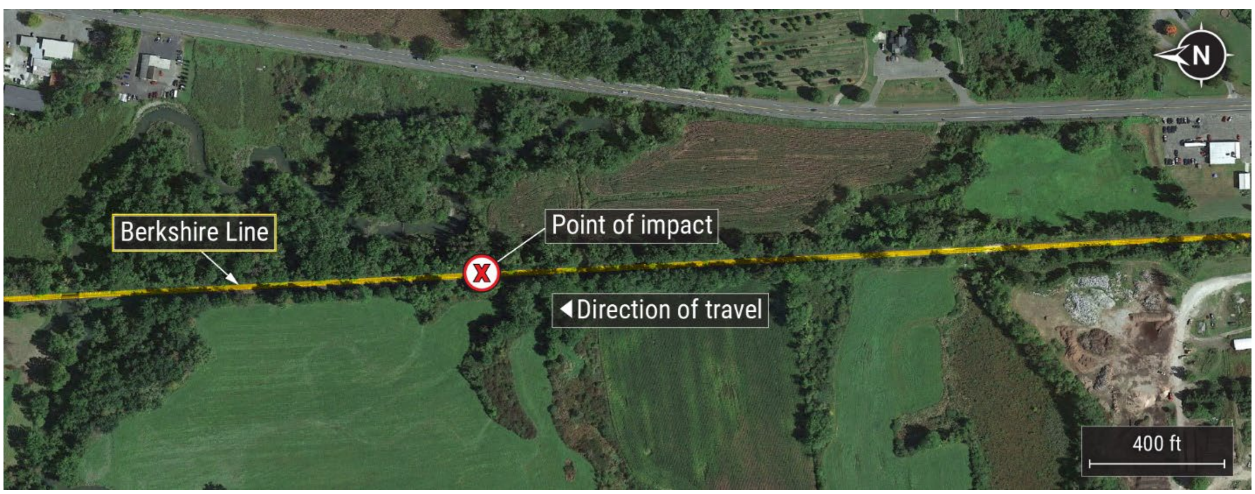

Figure 1. Overhead view of the accident site. (Background image courtesy of Google Earth.)

[1] (a) Visit ntsb.gov to find additional information in the public docket for this NTSB accident investigation (case number RRD23FR015). Use the CAROL Query to search safety recommendations and investigations. (b) A *tie drilling RMM* is a specialized tool designed specifically to drill holes into railroad ties from a standing position, typically used for applications like installing anchors or fastening rails to the ties.

The work group directly involved in the accident included four Middlesex contract workers (all hired by Middlesex in 2023) tasked with installing lag screws on the Berkshire Line.[2] (The Berkshire Line is owned by the Massachusetts Department of Transportation [MassDOT] and operated by the Housatonic Railroad Company [HRRC].) Work group 2 first cleaned ballast and other debris from holes in railroad tie plates; then used the driller to pre-drill holes into the wood crossties through the holes in the tie plates; and, finally, used another RMM—a lagger—to install the lag screws into the pre-drilled holes.[3]

All Middlesex employees reported to a Middlesex foreman, and the foreman reported to a company superintendent. On the day of the accident, a Middlesex quality control manager was acting as the superintendent; he is referred to as the Middlesex superintendent throughout this report. Additionally, Middlesex had a site safety manager present on the day of the accident, as required by its contract with MassDOT. An HRRC roadway worker-in-charge (RWIC) was responsible for on-track safety.[4] Table 1 provides a list of the individuals involved in the accident.

[2] (a) *Lag screws* (also called screw spikes or coach screws) are coarsely threaded steel fasteners used to secure tie plates to crossties. (b) The four-member work group described is hereafter referred to as "work group 2." Throughout this report, reference will be made to two different work groups designated as work group 1 and work group 2. Work group 2 is the team directly involved in the accident, while work group 1 refers to the crew tasked with performing work at another location (bridge worksite).

[3] (a) *Tie plates* are metal plates located between rails and crossties. They provide a smooth bearing surface for the rail and distribute the loads applied by trains to crossties. Tie plates are fastened to crossties with track spikes or lag screws. (b) A *lagger*, also called a screw spiker, is an RMM used to install lag screws into crossties.

[4] *RWIC* is defined in Title 49 *Code of Federal Regulations (CFR)* Part 214.7 as "a roadway worker who is qualified under 214.353 to establish on-track safety for roadway work groups and lone workers qualified under 214.347 to establish on-track safety for themselves." During interviews, employees commonly referred to the RWIC as the employee in charge, flagger, or flagman.

Table 1. List of employees.

Personnel Identifying Titles	Employer	Duties at Time of Accident
Employee 1	Middlesex	Employee who was fatally struck in the accident. Employee 1 acted as the work group lagger operator but was on the ground operating a leaf blower at the time of the accident.
Driller operator	Middlesex	Employee who was operating the drilling machine that struck employee 1. The lead employee of the work group, which also includes employees 1, 2, and 3.
Employee 2	Middlesex	Employee who was working on the ground with employee 1 at the time of the accident and was removing ballast from tie plate holes with a screwdriver just before the event.
Employee 3	Middlesex	Employee who was riding on the driller with the driller operator at the time of the accident.
Foreman	Middlesex	Direct supervisory authority over employees 1, 2, 3, and the driller operator.
Superintendent	Middlesex	Acting as both superintendent and quality control manager. The foreman's supervisor.
Site safety manager	Middlesex	Required, by contract, for the supervision and enforcement of Middlesex on-site safety practices.
RWIC	HRRC	Responsible for establishing on-track safety of the Middlesex employees performing work on the day of the accident, including authorizing all RMM movements.

The day before the accident, HRRC established working limits on the Berkshire Line from milepost (MP) 50 to MP 59, which includes the accident site.[5] These working limits remained in place at the time of the accident and prohibited trains and other equipment (vehicles) from entering the area without the permission of the RWIC.

On the day of the accident, about 4:30 a.m., HRRC and Middlesex employees gathered at a staging area near Lanes—at MP 57.3 on the Berkshire Line—to receive an on-track safety job briefing for the day's work.[6] The job briefing was led by the HRRC RWIC. In his interview with the National Transportation Safety Board (NTSB), the RWIC said his job briefing included the working limits and safety topics related to bridge work but did not include any discussion about lagging procedures, because he was unaware this work was to be performed on the day of the accident. He also said that

[5] *Working limits* means a segment of track upon which movement authority for trains and other equipment is held by an RWIC. Exclusive track occupancy is a method of establishing working limits on a controlled track in which a train dispatcher or control operator withholds movement authority for trains and other equipment. See 49 *CFR* 214.319 and 214.321.

[6] *Lanes* is a single main track switch and a set out track. Middlesex used this track to store RMMs and used the area adjacent to the track for conducting morning job briefings and as a staging area for material and equipment.

his job briefing did not include discussion of the different RMMs that would be used that day. The RWIC told investigators that he asked a Middlesex foreman about the planned work the day before, but he did not ask any Middlesex supervisors—those with the actual knowledge of the day's planned events—what work was scheduled for the day of the accident. Other employees present for the job briefing described it as typical of those provided by HRRC RWICs.

After the RWIC completed the job briefing and disengaged from the rest of the meeting, the Middlesex site safety manager and superintendent briefed the Middlesex employees about safety and the two different work tasks for the day: the bridge project and the work installing lag screws.[7]

After the morning briefings, the Middlesex foreman separated the employees into two different work groups, with each group tasked to perform duties at two separate locations. Work group 1 included about 15 to 20 Middlesex employees assigned to perform bridge work about 6 miles south of Lanes; the RWIC spent his workday at the bridge with work group 1. Work group 2 was a four-person team of Middlesex employees assigned to perform lagging and drilling work about 1 mile north of Lanes, which required using two on-track RMMs and a rail cart. Figure 2 illustrates the relative locations of Lanes and the two work locations.

[7] These briefings are referred to by Middlesex as daily huddles and are included in Middlesex's operating rules.

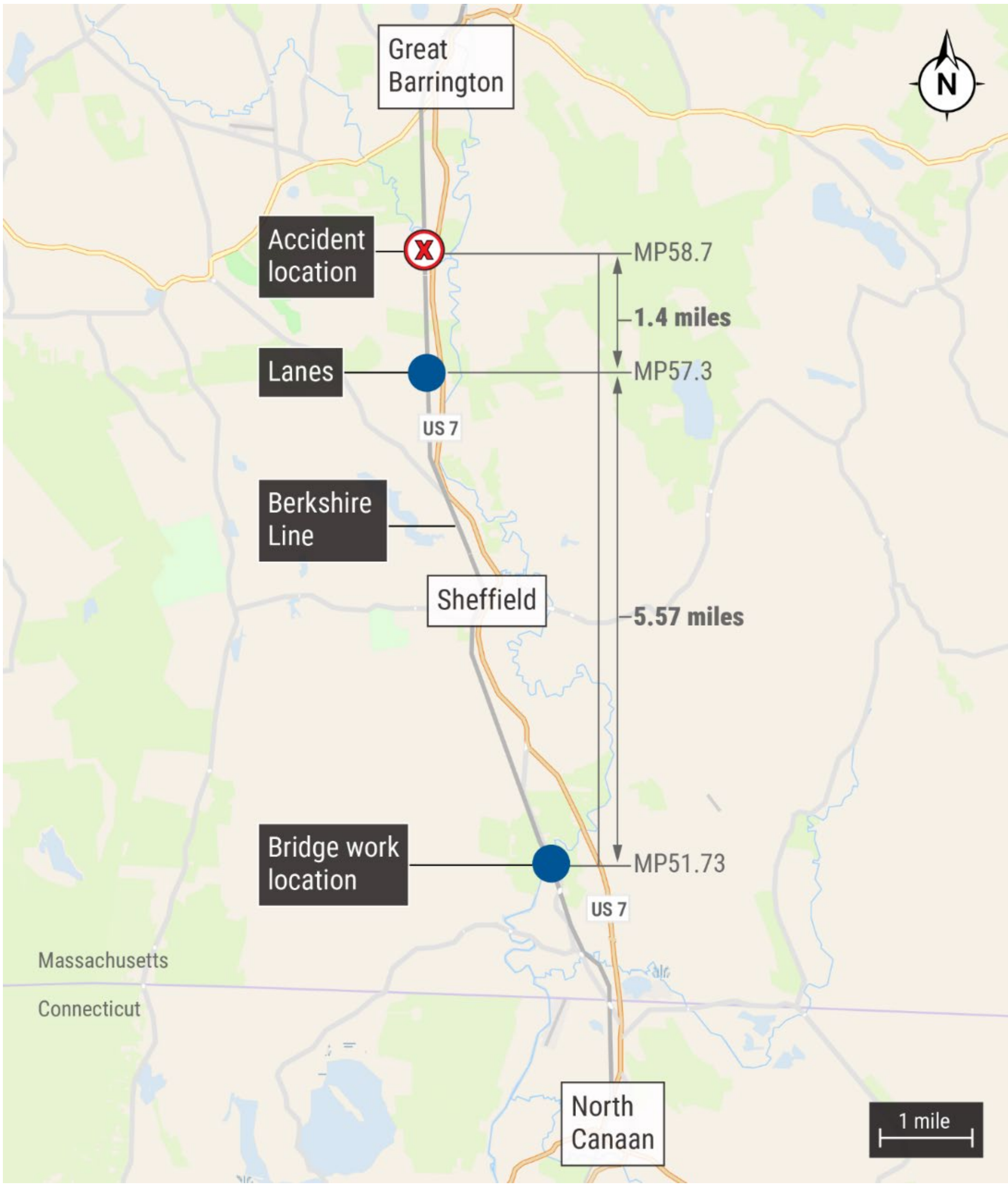

Figure 2. Map of the Berkshire Line and important locations related to the accident.

Work group 2 was also tasked with preparing other RMMs at Lanes for use in the future. This work involved moving the RMMs on and off the Berkshire Line from the track and out of Lanes multiple times to get the RMMs aligned in the proper order for future work. The RWIC was responsible for overseeing and authorizing RMM movements on and off the track; however, during his interview, the RWIC said he was not aware that RMMs were traveling north to perform drilling or lagging work, and he believed that the members of work group 2 were only aligning equipment to work at the bridge.

Moving RMMs on and off the track requires the activation of switches only by authorized personnel. Since Middlesex employees were not qualified in HRRC's operating rules and did not have the authority to operate switches, the RWIC was the only employee authorized to manage the switch at Lanes; likewise, per regulation, the RWIC was required to lock the switch when he was unable to monitor its use.[8] The RWIC unlocked the switch and left it both unlocked and unsupervised, which allowed for Middlesex employees to operate the switch and position RMMs on the main track without authorization or guidance.

According to the RWIC, about 7:00 a.m., employees finished shifting their equipment out of Lanes for work at the bridge, although he could not specify which on-track RMMs went to that worksite. The RWIC then left Lanes without locking the switch and drove south to the bridge located between MP 51 and 52 to meet work group 1. The RWIC told the NTSB during his interview that he was not paying attention to which specific RMMs were on the main track. The RWIC and Middlesex employees told the NTSB during interviews that the switch was routinely left unlocked throughout the day for the duration of the Middlesex project.

When the RWIC left to join work group 1, the four employees of work group 2 were still at Lanes moving various RMMs to access the driller and lagger they needed for their assignment and to prepare other RMMs for future work. About 8:20 a.m., work group 2 completed their preparations and arranged the two RMMs on the main track for the day's work. The lagger was positioned on the track to the north of the driller, and both RMMs were facing south. A rail cart was connected to the driller using a tow bar at the rear (north) end. Work group 2 then departed north, in reverse, to travel to their work location. Figure 3 shows the driller that was involved in the accident. At the time of the accident, the operator was in the driver (left) seat and moving the driller in reverse.

[8] 49 *CFR* Part 218, Section 103, *Hand-operated switches, including crossover switches*.

Figure 3. Tie drilling machine MS097 reenactment photograph.

Shortly after 9:00 a.m., the driller developed a mechanical problem and could not continue operating until the problem was addressed. A mechanic that could address the issue was working at Lanes, so employee 3 and the driller operator uncoupled the rail cart and relocated the driller back to Lanes for repairs. During this time, employees 1 and 2 continued to work cleaning holes in tie plates south of the lagger with hand tools and a handheld, gas-powered leaf blower. They also distributed lag screws, manually moving the rail cart to transport the material.

After the Middlesex mechanic completed the required repairs at Lanes—about 10:00 a.m.—the driller operator and employee 3 departed Lanes on the driller, making a reverse movement north to the work location. Although required by HRRC's On-Track Safety Program and federal regulations in 49 *Code of Federal Regulations* (*CFR*) Part 214 to coordinate all on-track movements with the RWIC, the driller operator stated in his interview with the NTSB that he did not contact the RWIC or employees 1 and 2 before this movement.

About 10:03 a.m., a security camera mounted on a nearby commercial building captured video of the driller about 2,400 feet from the location of the accident traveling north in reverse on the tracks. Based on the video, the NTSB determined the driller was traveling about 13 mph. In the video, the driller operator and employee 3 are looking toward the front of the driller (not in the direction of travel) and slightly down.

Employee 2 told the NTSB during a postaccident interview that he saw the driller approaching in the distance as it returned to the worksite. As the driller approached, employee 2 was using a screwdriver to remove ballast from tie plate holes. He said employee 1 was nearby (slightly north of him and between the rails) using the leaf blower to help clear the tie plate holes. Employee 2 said that the driller did not slow down as it approached and that when the RMM was about 20 to 30 feet away, he jumped out of the way and yelled to alert employee 1. Employee 2 said that he saw employee 1 turn to face the driller just as he was struck.

Employee 3 was riding in the right seat of the driller. When interviewed by the NTSB, employee 3 said the driller was moving about 15 mph in reverse before the accident and that he was looking toward the front of the driller and to his left (not in the direction of travel) during the movement. He said he saw employee 2 beside the driller as they passed him. He then heard yelling and turned his head to see employee 1 about 15 feet behind the driller. Employee 3 said he yelled to the driller operator to stop, and that the driller operator applied the brakes as the driller struck employee 1. Employee 3 also mentioned that employee 1 never wore hearing protection.

During his postaccident interview, the driller operator told the NTSB that, as he approached the accident location in reverse, he scanned his mirrors and looked over his shoulder to watch his route along the rail. He said that he saw the lagger in the same location it had been in when he left the location for repairs, and he saw employee 2 from about 300 feet away. The driller operator also said that he saw employee 2 clear the tracks as he passed him, but he did not see employee 1. He said he heard employee 2 yelling as he continued moving the driller past employee 2's position. The driller operator said he then turned his head to look back, saw employee 1, and applied the foot brake as the driller struck employee 1. He said the driller also struck the rail cart before coming to a stop. Figure 4 shows the rail cart that was struck by the driller and, in the inset, tools and nylon bags of material that were on the cart when it was struck.

Figure 4. The rail cart struck by the driller.

Employee 1 fell to the ground between the rails when he was struck by the driller. The driller passed over the employee and struck the rail cart. When the driller came to a stop, employee 1 was in front (south) of it. (See figure 5.) The work group immediately called 911, contacted supervisors, and assisted emergency responders with accessing the accident location. First responders transported employee 1 by helicopter to Baystate Medical Center, where he was later pronounced dead.

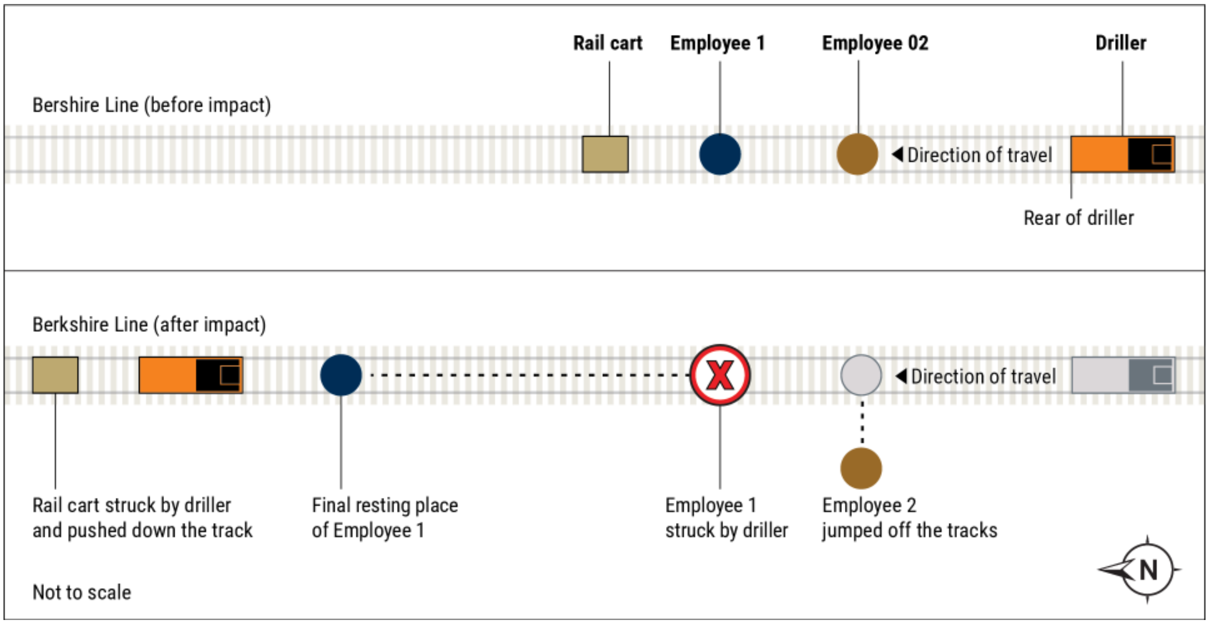

Figure 5. Diagram of the accident sequence.

Table 2 provides a timeline of events based on information gained from employee interviews and security camera footage.

Table 2. Timeline of events preceding the accident.

Time	Description	Source
4:30 a.m.	HRRC RWIC begins the job briefing at Lanes near MP 57.3.	Estimated from interview testimony
7:00 a.m.	RWIC departs Lanes and travels south in his vehicle to the bridge work location near MP 51.7.	Estimated from interview testimony
8:20 a.m.	Work group 2 departs north on the main track from the siding at Lanes.	Estimated from interview testimony and security camera footage
8:30 a.m.	Work group 2 arrives at their lagging work location near MP 58.8.	Estimated from interview testimony and security camera footage
9:18 a.m.	The driller is recorded by the security camera traveling south toward Lanes for repairs.	Security camera footage
10:04 a.m.	After the driller is repaired, the driller is recorded by the security camera traveling north about 13 mph.	Security camera footage
10:05 a.m.	Accident occurs at MP 58.7 on the Berkshire Line.	Estimated from security camera footage and phone records of the 911 call

1.2 Track Information

The Berkshire Line extends from Danbury, Connecticut (MP 0.0), to Pittsfield, Massachusetts (MP 86.22). MassDOT owns the 36.3 miles of line in Massachusetts between MP 50.00 and MP 86.3; HRRC owns the Connecticut portion of the line. The line is a single main track with passing sidings and a timetable direction of north to south. At the time of the accident, the main track through the accident location had a maximum authorized speed of 25 mph, established by a temporary speed restriction.

The NTSB's examination of the track infrastructure at the accident location did not reveal any unusual conditions or defects.

1.3 Equipment Information

The tie drilling machine was manufactured by Nordco, Inc. as an M-3 screw spiker and later modified to function as a driller. It weighs about 14,000 pounds and measures about 16 feet 9 inches long, 8 feet 2 inches wide, and 10 feet 6 inches tall. It is equipped to travel and work in either direction on railroad tracks. The driller was leased by Middlesex from Railway Equipment Leasing and Maintenance, Inc. The lease agreement between Middlesex and Railway Equipment Leasing and Maintenance, Inc., required Middlesex to maintain the driller in operating condition in compliance with all applicable laws and regulations. Regulations in 49 *CFR* Part 243 denote that the training of RMM operators is the responsibility of each operator's employer; in this case, it was Middlesex.

Movement of the driller, including braking, is controlled by foot pedals on the left side of the RMM. The driller's seats are fixed-position, forward-facing, and do not pivot. The visibility behind the driller is unobstructed, and the driller is equipped with wide-angle mirrors for rearward visibility when facing forward (although wide-angle mirrors distort the images they reflect and objects seen in wide-angle mirrors are closer than they appear). (See figures 6 and 7.)

The driller was not equipped with rearview cameras and monitors or any other technologies, such as a collision avoidance system that could have assisted the operator in detecting employees in the driller's path or that could have automatically stopped the RMM before a collision.[9]

[9] Collision avoidance systems are designed to prevent accidents from occurring by warning operators of an imminent incident or actively intervening to prevent an accident. Cameras and collision avoidance systems are not required by federal regulations and are discussed further in sections 1.8 and 2.3.

Figure 6. Rear view of the tie driller RMM. (Courtesy of the FRA).

Figure 7. The field of view in the driller's rearview wide-angle mirror from the driller operator's seat. (Courtesy of the FRA.)

1.4 Operational Factors

1.4.1 Involved Organizations

This accident involved three separate organizations: MassDOT, HRRC, and Middlesex. At the time of the accident, MassDOT owned about 285 miles of active railroad lines in the state of Massachusetts including the portion of the Berkshire Line where this accident occurred. Although MassDOT is a railroad track owner, it does not perform railroad operations or maintenance but has operating agreements with railroads like HRRC that perform these functions. MassDOT purchased the Massachusetts portion of the Berkshire Line from HRRC in February 2015. In a 2014 submission to the Surface Transportation Board, MassDOT explained that the intended Berkshire Line purchase was part of a multistep process leading to the establishment of a new railroad passenger service route (79 *Federal Register* 64883).

HRRC is a Class III railroad (commonly referred to as a "short line" railroad) that owns and operates freight railroads in Massachusetts, Connecticut, and New York.[10] HRRC was established in 1984, originally operating passenger excursion trains, and has been operating freight service since 1989. HRRC has an exclusive freight railroad operating easement on the MassDOT-owned portion of the Berkshire Line and manages all railroad operations of the line, including the portion it owns in Connecticut and that MassDOT owns in Massachusetts. As a Class III railroad, HRRC is regulated by the FRA and is subject to federal requirements covering training and safe operations.

MassDOT awarded a contract to Middlesex on June 8, 2022, to complete track upgrades between MP 50 and MP 59 on the Berkshire Line.[11] Middlesex is a heavy civil construction contractor headquartered in Littleton, Massachusetts. MassDOT's project manager told the NTSB that Middlesex had "full responsibility for on-the-job safety," with the exception that HRRC was required to provide RWICs for Middlesex's work. The MassDOT contract required Middlesex to coordinate its work and its employees' on-track safety protections with HRRC.

MassDOT has several agreements with HRRC regarding the Berkshire Line, including an operating agreement. The operating agreement required HRRC to perform track maintenance until MassDOT began passenger service on the line, which had not yet occurred. These agreements require HRRC to comply with FRA railroad safety regulations, give HRRC an exclusive freight railroad easement, and outline the parties' responsibilities regarding track maintenance and track improvement projects. The agreements establish MassDOT's intent to rehabilitate the line, including MassDOT directly contracting with third parties like Middlesex to perform these improvements.

Regarding MassDOT contracts for track improvements on the Berkshire Line, the HRRC superintendent told investigators that HRRC did not see the pre-bid specifications for those contracts, MassDOT did not solicit input from HRRC when selecting a contractor, and MassDOT did not provide a copy of their track

[10] The Surface Transportation Board categorizes rail carriers into three classes by operating revenues. In 2023, Class III carriers were those with an annual operating revenue of less than $47.3 million. See 49 *CFR* Part 1201.

[11] More information regarding the Berkshire Line Track Phase III contract is available here: https://www.commbuys.com/bso/external/bidDetail.sdo?docId=BD-22-1030-0T100-0T100-72216.

improvement contracts with HRRC. Notably, the HRRC superintendent told investigators that, before the accident, he had never seen the contract between MassDOT and Middlesex.

Figure 8 depicts the contractual relationship between the three main parties involved in the Great Barrington track improvement work taking place at the time of the accident.

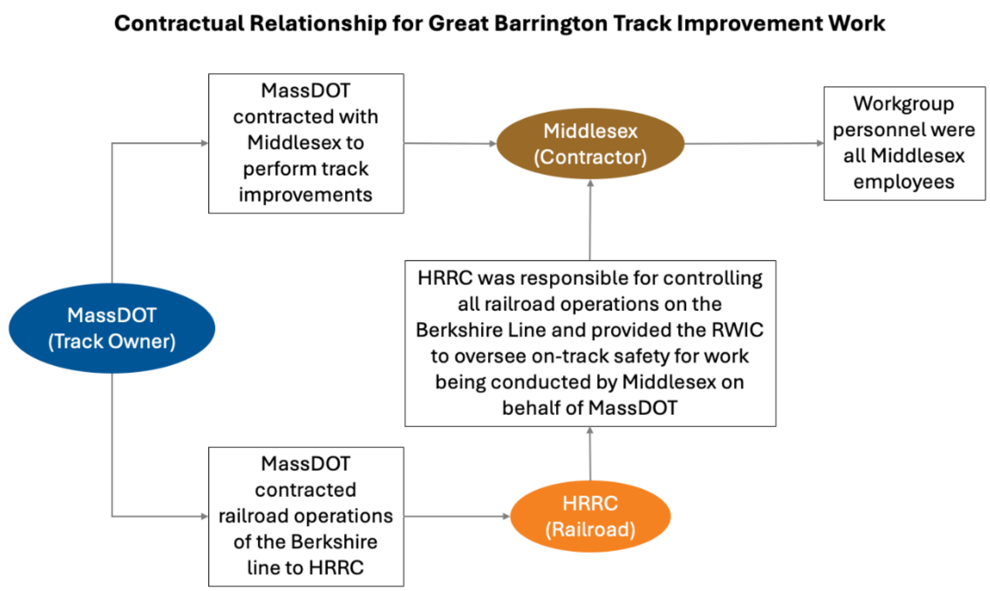

Figure 8. Diagram of the contractual relationship between the organizations.

1.4.2 Safety Records

1.4.2.1 HRRC

Three years earlier, on October 14, 2020, an HRRC employee was fatally injured when struck by an RMM near North Canaan, Connecticut (NTSB 2022). This accident was included in data reviewed by the FRA during a two-phase analysis of short line railroads conducted in 2023. The purpose of the two-phase analysis was to identify those short line railroads with inadequate safety performance, which would then be required by regulation to establish a risk reduction program (RRP). The first phase of this analysis reviewed safety data from 2020 to 2022. On October 21, 2024, the FRA notified HRRC that their analysis led to a determination of inadequate safety performance for the railroad and instructed HRRC to establish an RRP.

1.4.2.2 Middlesex

Middlesex rules require that employees report all accidents, incidents, or near misses to management within 24 hours.[12] Middlesex supervisors routinely reviewed accident and near miss reports and used them to inform future safety messaging and policy reviews. The NTSB reviewed Middlesex near miss records for the 4 months preceding the accident. These records detailed six near misses, one of which occurred on May 25, 2023, and involved a work group using RMMs on the Berkshire Line without receiving authorization from the RWIC. The near miss record noted that the incident was caused by poor communication and a misunderstanding of the day's on-track safety.[13]

1.5 Operator/Personnel Information

The four employees in work group 2 were hired by Middlesex in 2023. The driller operator had a total of 5 months' experience with Middlesex. The other three employees, including employee 1, had fewer than 60 days of experience with Middlesex before the accident. All four employees received FRA required Roadway Worker Protection training, and the driller operator was qualified by Middlesex as an RMM operator, and more specifically, as an operator of the driller.

On the day of the accident, work group 2 performed their duties as directed by a Middlesex foreman, superintendent, and site safety manager. These three employees were present at the morning job briefing but were not at the accident location, each having gone to the bridge work location after the job briefing. The foreman had 12 years of railroad work experience and had worked for Middlesex for about 1 year. The superintendent had about 6 years of experience working on railroad projects with Middlesex. The site safety manager worked for Middlesex for about 7 years and told the NTSB during an interview that he worked on two major railroad projects during that time.

An HRRC employee acted as the RWIC on the day of the accident. The RWIC had about 30 years of railroad work experience in train operations, dispatching, and track maintenance, including about 12 years with HRRC. HRRC most recently qualified him as an RWIC on January 9, 2023. The RWIC's supervisor, the HRRC trainmaster,

[12] Middlesex defines *near miss* as "incidents where, given a slight shift in time or distance, injury, ill-health, or damage easily could have occurred, but did not in that instance."

[13] The other five near miss reports described incidents involving RMM mechanical failures, improper planning, and procedural failures attributed to insufficient training and carelessness/complacency.

said in his interview that Middlesex provided an advance work schedule, but also that plans often changed day to day. As part of his job description, the HRRC RWIC was responsible for initiating daily conversations with Middlesex supervisors to discuss any changes to the daily tasking before the RWIC's on-track safety job briefing.

1.5.1 Cell Phone Use

Middlesex rules prohibit the use of cell phones when on railroad tracks. In a postaccident written statement, employee 3 (the Middlesex employee that traveled with the driller operator back to Lanes for RMM maintenance) noted he was on his phone during the reverse movement that struck employee 1. When interviewed by the NTSB, he denied using his phone during this time.

The NTSB obtained records of cell phone use from the carriers for the driller operator and employees 1, 2, and 3. Traditional voice calls, regular text messages, and data usage are recorded separately in phone carrier records. Records showed that none of these four employees were using native calling or texting applications immediately before the accident.[14] Records of cell phone data use do not differentiate between automatic background data activity, such as loading incoming email messages or software updates, from user-initiated data activity such as internet browsing or scrolling on social media. Employee 3’s data usage was not obtained, but the records for the driller operator’s cell phone indicated about 53 megabytes of data usage over about a 42-minute period that starts about 17 minutes before the accident.

[14] (a) Regular text messages are text messages sent/received via mobile carriers using Short Message Service protocol or Multimedia Messaging Service, and do not include any text messages sent/received via software applications, which use mobile data via the internet. (b) *Native calling or texting applications* refers to the apps that are built specifically for a particular mobile operating system and come pre-installed or downloaded from official app stores.

1.5.2 Fatigue and Toxicology

1.5.2.1 Employee 1

The Massachusetts State Police Forensic Sciences Crime Laboratory performed toxicology testing of employee 1's blood. No tested-for substances were detected.[15] Employee 1 also underwent FRA postaccident toxicological blood testing; no substances were detected.[16]

At the NTSB's request, the FAA Forensic Sciences Laboratory performed postmortem toxicological testing of employee 1's tissue specimens.[17] No impairing substances were detected other than those administered to the employee during postaccident medical care.

1.5.2.2 Driller Operator

The driller operator underwent FRA postaccident toxicological testing. No tested-for substances were detected in urine collected at 7:38 p.m. on the accident date.[18] Blood collected at 7:35 p.m. on the accident date tested negative for ethanol.

The four members of the accident crew worked a six-day work week, with their shift beginning at 4:30 a.m. each workday. A typical work week involved 8 to 10 hours per day. Some variability in actual work hours per day were noted in the work records reviewed by NTSB investigators. The driller operator worked 41 hours in 4 days (Monday through Thursday) and was about 5.5 hours into his Friday shift when the

[15] According to the laboratory report, the Massachusetts State Police Forensic Sciences Crime Laboratory tested for ethanol, methanol, isopropanol, and acetone; screened for amphetamine, benzodiazepines, buprenorphine, cocaine, fentanyl, methamphetamine, opiates, and cannabinoids; and tested for organic bases and neutrals.

[16] The FRA toxicology report listed tested-for substances in heart blood as amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, MDMA/MDA, methadone, opiates/opioids, phencyclidine, tramadol, sedating antihistamines (brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, and pheniramine), and ethanol.

[17] The FAA Forensic Sciences laboratory has the capability to test for about 1,000 substances including toxins, prescription and over-the-counter medications, and illicit drugs.

[18] The FRA toxicology report listed tested-for substances in urine as amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, MDMA/MDA, methadone, opiates/opioids, phencyclidine, tramadol, and sedating antihistamines (brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, and pheniramine).

accident occurred. He did not work on Saturday or Sunday before the accident (July 29 and 30), and he worked 40 hours over 4 days the week before the accident.

The driller operator told NTSB investigators that he usually woke up at 2:30 a.m. on each workday and departed his residence at 3:00 a.m. for a 1-hour, 10-minute commute to work. He also said that his return commute from work to his residence took about 1 hour. The driller operator reported that he did not have any disturbances with his work commute times or his home life activities that affected his sleep.

1.6 Tests and Research

1.6.1 Driller Evaluation

The NTSB's examination of the driller after the accident indicated the machine was in overall good mechanical condition. The NTSB tested the driller's braking capability at a location with a similar grade to that of the accident location. For speeds ranging from 13 to 17 mph, the driller stopped in less than 100 feet using the service brake and the emergency brake. The driller's brakes applied and released as expected.

Although required by 49 *CFR* 214.509, its 360° intermittent warning light was visible from behind but was not visible from directly in front of the driller.[19]

1.6.2 Sight Distance Observation

The NTSB performed sight distance observations at the scene using the equipment involved in the accident to determine the visibility of personnel on the ground from the driller seats. The driller was equipped with two seats—the driller operator was seated in the left seat while employee 3 occupied the other seat. The lagger and rail cart were positioned on the tracks about where they were positioned at the time of the accident. The lagger's work lights and 360° warning light were illuminated as they had been at the time of the accident. Two investigators stood on the ground at the point of impact wearing personal protective equipment similar to what the members of work group 2 had worn, including yellow high-visibility vests

[19] This regulation requires that an RMM warning light be visible from 360° to aid workers in seeing RMMs. The driller's 360° light was visible from the front of the RMM from a distance, but it was not visible near the RMM, because it was obscured by the RMM's roof line.

and red hard hats. Investigators moved the driller toward the point of impact to recreate the circumstances of the accident.

The NTSB noted the following:

- The investigator could first see the stationary lagger from either of the two seats in the driller when the driller was about 4,900 feet from the point of impact.
- Investigators on the ground at the point of impact could first see the driller when it was about 4,300 feet away.
- The investigator in the driller could first see the investigators on the ground from either of the two driller seats when the driller was about 1,300 feet away.

Figure 9 is an overhead representation of the results of the sight distance evaluation.

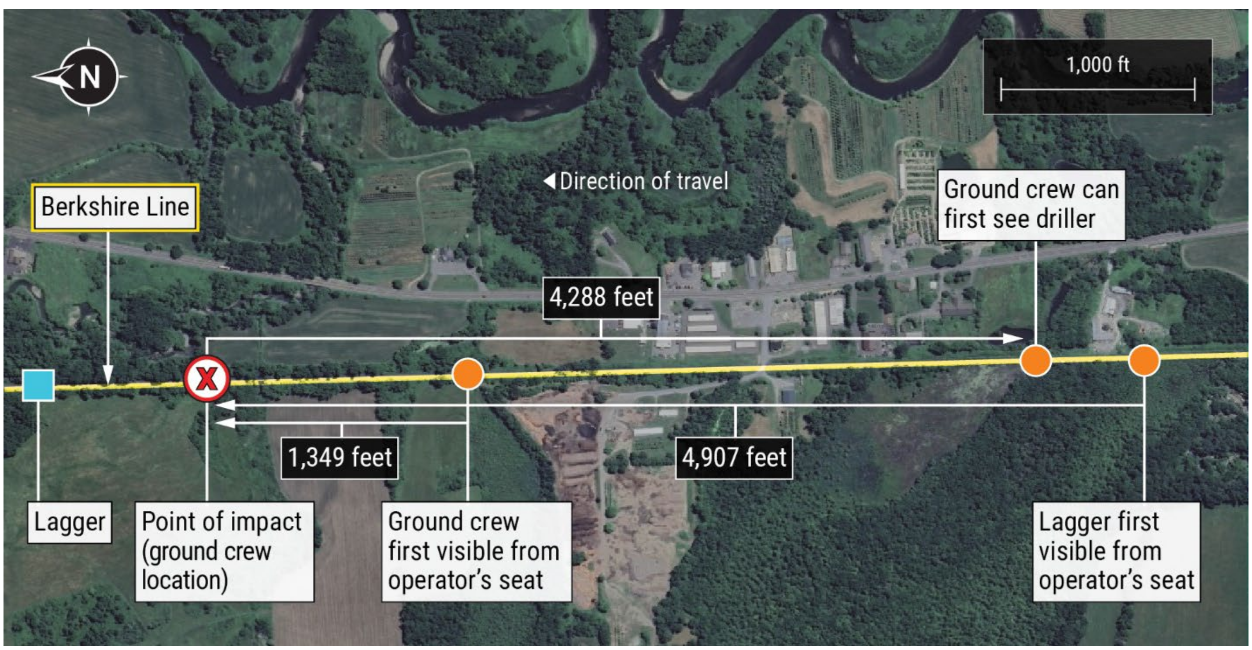

Figure 9. Sight distance observation results. (Background image courtesy of Google Maps.)

1.7 Policies and Procedures

1.7.1 MassDOT

MassDOT owns some railroad lines within the state, such as the Berkshire Line, and provides funding for railroad improvement projects on those lines. While MassDOT does not directly operate a railroad or perform railroad maintenance, they contract this work with third parties. MassDOT's internal policies and procedures do not require them to actively monitor these contractors' compliance with FRA regulations, nor are these contracts analyzed through a safety management system to identify potential hazards or safety issues.

1.7.2 HRRC

HRRC is the only railroad that operates on the Berkshire Line. HRRC uses Northeast Operating Rules Advisory Committee operating rules, creates timetables, and has on-track safety rules and other programs in place to comply with federal regulations that control activities on the line.

HRRC's on-track safety manual defines a roadway work group as "two or more workers organized to work together on a common task" and requires a qualified RWIC to be assigned to each roadway work group. HRRC was responsible for providing on-track safety oversight of the Berkshire Line project work groups. HRRC's rules also mirror federal regulations that require job briefings performed by RWICs to include the nature and characteristics of the work to be performed and that follow-up briefings be performed whenever working conditions or on-track safety change.

In response to the training, qualification, and oversight requirements in 49 *CFR* Part 243, the American Short Line and Regional Railroad Association (ASLRRA) developed a model program to help participating short line railroads and railroad contractors meet FRA compliance requirements.[20] In submissions to the FRA before the accident, HRRC stated that it uses this ASLRRA model program. As required by federal regulation, 49 *CFR* Parts 217 and 243, HRRC conducts operational testing to evaluate compliance with rules and federal regulations, including those related to on-track safety.

[20] ASLRRA is a trade association representing North American short line and regional railroads.

1.7.3 Middlesex

When performing railroad work, contractors like Middlesex must comply with the rules of the railroads upon which they are working.

On October 5, 2022, Middlesex submitted a Health and Safety Plan to MassDOT, as required by the Berkshire Line Track Improvement Phase III contract provisions. Middlesex's internal periodic oversight is documented in the following four observational programs:

1. Stop, think, observe, plan (STOP) cards
2. Daily huddles
3. Near miss reports
4. Site inspection reports

Middlesex's STOP card program is an employee observation program to identify unsafe actions and working conditions. STOP cards could be completed via a company mobile application by any employee, craft or management, to document observations of safe or unsafe behaviors or conditions at work sites. Middlesex superintendents and managers are required to complete at least one STOP card for every 40 work hours performed. Once completed, STOP cards are submitted to the safety supervisor for assessment and are reviewed by project teams at least weekly. If a STOP card notes an imminent danger, it must be immediately addressed by the project team and site safety manager. The NTSB noted Middlesex employees entered 134 STOP card observations on the project between April 1, 2024, and the day of the accident.

In daily huddles, foremen and employees review the daily work to be performed, identify hazards, and discuss safe work procedures for the tasks ahead. Daily huddles are performed at the beginning of each shift, and all employees are required to participate. Daily huddles also may include safety issues identified through the STOP card program or by other means.

Middlesex also issues company radios to employees to facilitate coordination of work activities. On the day of the accident, the driller operator and employee 1 were each provided with a Middlesex radio. The RWIC, who had an HRRC radio to coordinate with the train dispatcher and other HRRC employees, was also provided a Middlesex radio, because Middlesex did not have access to the radio channels used by HRRC. Radio communications at the time of the accident were not recorded and, therefore, could not be reviewed by investigators.

1.8 Regulatory Requirements

FRA regulations concerning on-track maintenance activities and the training, qualification, and oversight of roadway workers applies to both railroads like HRRC and maintenance-of-way contractors such as Middlesex. FRA regulations do not restrict a railroad or railroad contractor from adopting and enforcing additional or more stringent requirements than those required by regulation. FRA regulations do not require RMMs to be equipped with backup cameras or collision avoidance systems.

1.9 Postaccident Actions

1.9.1 FRA

As a result of this accident, the FRA inspected Middlesex's training and oversight programs for compliance with the regulations in 49 *CFR* 243.205. In this review, the FRA noted that Middlesex's programs were incomplete and not in compliance with the requirements. (See section 1.9.3 for actions taken by Middlesex in response.)

The FRA also issued Safety Advisory 2023–06 on September 29, 2023. The advisory emphasized the importance of rules and procedures regarding the safety of roadway workers who operate or work near RMMs. In addition, the advisory recommended that railroads and contractors review and update their rules regarding the safety of roadway workers who operate and work near RMMs, communicate those rule changes to their employees, monitor their employees' compliance with their existing and updated rules, and conduct additional safety briefings to raise workers' awareness of the hazards associated with operating and working around RMMs.[21]

1.9.2 MassDOT

Following the accident, MassDOT added requirements to standard contracts for contractors to provide proof of compliance along with the training and qualification requirements for roadway workers specified in 49 *CFR* Parts 214 and 243 (impairment and training regulations). MassDOT also added requirements for rail contractors and subcontractors to provide copies of FRA acknowledgment letters

[21] In addition to Safety Advisory 2023-06, the FRA issued a separate safety advisory after similar accidents in Roanoke Rapids, North Carolina, and McNeil, Arkansas, that references Safety Advisory 2023-06 and discusses many of the same topics. For further information, see Safety Advisory 2024-01.

documenting compliance with 49 *CFR* Parts 219 and 243 before MassDOT authorizes a contractor access to MassDOT-owned railroad property.

MassDOT revised their standard contracts for rail work to add minimum experience requirements for contractually required supervisory positions and reserve the right to stop work when a contractor fails to have a safety supervisor on site.

MassDOT implemented changes to its railroad contractor prequalification requirements. In addition to a previous requirement to meet Massachusetts Bay Transportation Authority prequalification requirements, rail contractors must now demonstrate at least 5 years of experience as a prime contractor performing railroad trackwork to qualify for contracts with MassDOT.

1.9.3 Middlesex

After this accident, Middlesex undertook an internal review of safety policies, procedures, and programs. Middlesex has since taken the following actions:

- Conducted a companywide stand down on August 7, 2023, focused on backing (reverse moves) safety, worker protection, and working around equipment.
- Contracted with a third party to review, revise, and update the company’s 49 *CFR* Part 243 training program.
- Revised the company policy regarding reverse movements to clarify it applies to rail operations.
- Created a job hazard analysis for the reversing of rail equipment, working around rail equipment, and drilling and lagging operations.
- Retrained all Berkshire Line project personnel on roadway worker protection via in-person, instructor-led training provided by a third party.
- Began a re-evaluation of all operators on the safe operation of RMMs.
- Added supervisory personnel with railroad experience to the Berkshire Line project.
- Began recording communications performed through company-provided radios to improve accident investigations.
- Installed backup cameras on all rented RMMs.

2 Analysis

2.1 Introduction

On August 4, 2023, an RMM (a tie drilling machine) struck and killed a Middlesex employee who was performing maintenance-of-way work on the Berkshire Line in Great Barrington, Massachusetts.

The analysis will discuss the following safety issues:

- The unsafe operation of the driller. (Section 2.2)
- The need for RMMs to be equipped with new technologies such as collision warning and avoidance systems to further advance on-track safety and eliminate human error. (Section 2.3)
- The uncoordinated and inadequate communication between HRRC and Middlesex that failed to identify repeated unsafe actions of HRRC and Middlesex employees. (Section 2.4)
- The FRA's lack of annual evaluations to assess which railroads have inadequate safety performance and, therefore, are required to establish risk reduction programs. (Section 2.5)

The NTSB's review of the circumstances that led to this accident found that the following areas were either not factors in or were not causal to the accident:

- *Fatigue impairment*. The driller operator reported that he did not have any disturbances with his work commute times or his home life activities that affected his sleep. Likewise, he had a consistent work schedule with two excused days off in the past week. His work shifts began and ended at reasonable and expected times each day. He had between 8 and 10 hours of sleep opportunity per night in the 2 weeks leading up to the accident and he likely was not fatigued at the time of the accident.
- *Drug or alcohol impairment*. The postaccident toxicological testing did not indicate impairment of the driller operator or the worker who was struck.
- *Weather and visibility*. Visibility was clear, and the weather did not contribute to the accident.

- *Physical condition of the track*. Examination of the track showed it had no impact on the circumstances of the accident.

- *The mechanical condition of the driller's braking system*. Through examining the driller and completing braking performance evaluations, the NTSB determined that its braking system was functioning as intended at the time of the accident.

Therefore, the NTSB concludes that none of the following issues contributed to the accident: (1) driller operator fatigue; (2) the driller operator's and struck worker's impairment from drugs or alcohol; (3) weather and visibility; (4) the physical condition of the track and signal infrastructure; or (5) the mechanical condition of the driller's braking system.

2.2 Driller Operation

The driller operator told the NTSB that, as he reapproached the accident location, he first saw employee 2 when traversing a bridge about 300 feet south of the accident location. Employee 2 told investigators the driller did not slow down as it approached him and said he had to move quickly out of the way to avoid being struck by the driller. At the same time, employee 1 was between the rails (in the path the driller was traveling) operating a handheld gas-powered leaf blower. The driller operator said he did not see employee 1 or the rail cart, which was located behind employee 1, until the moment of impact.

The NTSB's sight distance observations and braking tests showed that an operator could see people on the tracks about 1,300 feet from the accident location and that the driller could stop in less than 100 feet at the speed it was traveling. Although there is no evidence to indicate that he did see anyone on the track during the reverse movement, the sight distance observations and braking tests suggest that, had the operator begun to apply the driller's brakes when he crossed the bridge and reportedly saw employee 2, then he would have been able to stop the driller before reaching the positions of the two on-track employees.

Therefore, the NTSB concludes that the driller operator had sufficient sight distance to see the employees on the tracks and stop the driller before striking employee 1.

Investigators attempted to determine whether mobile phone usage by the driller operator or other employees contributed to the accident. Employee 3 made a written statement indicating he was using his mobile phone while riding on the driller in the moments leading up the accident but later said in his interview with investigators that his phone was in his pocket. Employee 3's cell phone records indicate he was not using native calling or texting applications around the time of the accident. Investigators were unable to obtain records of employee 3's cellular data usage. The driller operator's phone records indicate he was not using native calling or texting applications around the time of the accident; these records do indicate about 53 megabytes of data usage over about a 42-minute period that started about 17 minutes before the accident. Because of the limitations of these records, it cannot be determined if this data usage was from user-initiated activity or from automatic background activity that can take place while a phone is on but not in use. Therefore, investigators were unable to determine if cell phone usage by the driller operator or other employees contributed to the accident.

To safely operate the driller—as with any RMM or motor vehicle—an operator must keep watch of the driller's intended path to ensure it is clear and to stop short of any obstructions or people in that path. A security camera captured footage of the driller about 2 minutes before the accident, showing it traveling about 13 mph in reverse with the driller operator and employee 3 both looking down and away from its direction of movement and its wide-angle mirror. During his interview, the driller operator said he did not see employee 1 or the rail cart before they were struck, even though there were no restrictions to visibility, and the employees on the tracks would have been visible to the operator for about 60 seconds before the accident. During employee 3's interview, he said that just before the accident, he was facing forward—not actively observing the movement. There was no FRA regulation or operating procedure that would require RMM passengers to have any responsibility for RMM movements. Therefore, the NTSB concludes that the driller struck the employee because the driller operator did not actively observe the driller's path of travel or monitor the RMM's rearview mirror as he approached the work group, so he was unaware of the need to stop.

2.3 RMM Safety Technology

At the time of the accident, the driller operator, accompanied by employee 3, was making a sustained reverse movement. Based on available video evidence, the driller operator and employee 3 were seated facing the front of the driller and looking downward for at least a portion of the time the driller moved in reverse. To see the driller's direction of travel and objects within their path of travel, the operator or employee 3 would have had to physically turn around in their fixed-position, forward-facing seats and look backward, while the operator kept his body oriented forward to ensure his feet remained in contact with the driller controls. Alternatively, the operator or employee 3 could have observed the driller's direction of travel using the small, wide-angle mirrors visible from their seats when facing forward, though objects or people in their path would be seen more quickly and easily by turning to face the direction of movement.

Safe movement of the driller is a key responsibility of the driller operator. The safety of all its movements relies on the driller operator maintaining a watchful lookout for hazards in the driller's path and stopping the movement before any collision. Because the driller was not equipped with safety devices (other than a wide-angle mirror) to aid the operator's lookout for hazards, the lapse in the driller operator's attention and/or judgment resulted in severe consequences.[22]

Human performance research consistently asserts that people are fallible; that is, people commit errors in judgment and action that are due to distraction, disengagement from work activities, incapacitation, or other dysfunctions (Reason 2013). Without supplemental safety devices, operators are a potential single source of error in the safe operation of RMMs. Collision detection and avoidance technologies mitigate the risk of human error.

In recent years, commercial technologies for RMMs have become available to prevent or mitigate collisions, including RMM-to-RMM collisions, RMM-to-person collisions, and collisions involving movable RMM extensions such as booms or arms.

The simplest configurations—vision enhancement technologies consisting of cameras and monitors—provide operators with views of blind spots and difficult-to-see locations around the RMM. In more advanced configurations, collision warning technologies consisting of cameras, radar, lidar sensors, or radio communications detect and recognize people or other objects in the path of an RMM and alert operators to take corrective action.[23] Similarly, people detection systems monitor the working area around an RMM, not its path of travel, including the range of motion of booms or other extensions. These systems alert the operator to the presence of people near the RMM, allowing the operator to avoid striking them. Finally, in collision avoidance systems, the detection technologies are integrated with the movement controls of the RMM and can automatically intervene to stop an RMM movement to prevent or mitigate an imminent collision.

[22] Middlesex equips company-owned RMMs with backup cameras, but the driller involved in this accident was leased and was not equipped with such a camera.

[23] *Lidar*, which stands for light detection and ranging, is a remote sensing method that uses laser light to measure distances to an object.

Collision warning and avoidance systems provide employee protection beyond sole reliance on operators by providing warnings or automatically intervening when an operator makes a mistake. In the case of the driller operator in this accident, a collision avoidance system could have mitigated the human error—the failure to watch the path of the driller—from leading to a fatality by stopping the RMM when the employee on the track was detected.

Several previous accidents investigated by the NTSB demonstrate that improved safety features on RMMs (that is, collision avoidance systems, alarms, or backup cameras) could augment the operator's understanding of the surrounding environment. In December 2021, a roadway worker was struck and killed by a reversing RMM in Reed, Pennsylvania (NTSB 2023). In that accident, the operator of the RMM initiated a reverse movement when a contract worker was about 29 feet behind the machine but not visible to the operator because of blind spots behind the RMM. Had the RMM been equipped with a backup camera, the operator would have been able to detect the worker before reversing the machine. As a result of the investigation, the NTSB issued a safety recommendation to the FRA to address this lack of visibility:

> Require all newly manufactured and all rebuilt and remanufactured roadway maintenance machines to be equipped with backup cameras. (R-23-22) [24]

The FRA responded on September 19, 2024, stating that its Railroad Safety Advisory Committee (RSAC) Roadway Worker Protection Working Group was evaluating safety features of on-track RMMs subject to the requirements of 49 *CFR* 214, Subpart D. Specifically, the working group was evaluating industry's current use of back-up cameras and other safety features on newly built and rebuilt/remanufactured on-track RMMs. Examples of other safety features the working group was considering included operator presence controls, collision avoidance technology, and hi-rail limit control systems. The working group considered applying these safety features to both new and existing RMMs but could not gain consensus for existing on-track RMMs. The working group's efforts regarding newly built on-track RMMs are in process, and the FRA will consider any recommendations resulting from this RSAC task once the task is completed. On October 9, 2024, the working group reported to the RSAC that they voted to discontinue talks regarding RMM safety features.

[24] Safety Recommendation R-23-22 is currently classified Open—Initial Response Received.

Backup cameras provide additional information to RMM operators and can prevent accidents like the one in Reed. However, since issuing Safety Recommendation R-23-22, we have determined that, in some cases, a backup camera alone would not be sufficient. In the present accident, the driller operator had a clear field-of-view of the employees on the track but did not adequately maintain a lookout for the employees or other objects on the track or use the mirror that was present. Because the driller operator and employee 3 were not sufficiently engaged in the safe movement of the driller, it is unlikely that they would have paid more attention to their movement had a monitor displaying images from a backup camera been present. Unlike backup cameras, collision avoidance systems can operate independently of human attention or action. The systems can automatically intervene to stop movements and prevent or mitigate the consequences of accidents. Therefore, it stands to reason that these technologies could save lives if implemented in the rail industry, which are already being voluntarily adopted by multiple class 1 railroads.

The NTSB investigated a February 2024 fatality in which another roadway worker was struck and killed by a reversing RMM in Roanoke Rapids, North Carolina (NTSB 2025b). Similar to the Reed accident, the roadway worker was struck shortly after an RMM began a reverse movement. Like in the Great Barrington accident, poor rearward visibility may not have been the primary safety issue. Backup cameras are a safety improvement, but they do not eliminate the potential for human error. Although people usually strive for rules compliance and safe behavior, they make mistakes and lose attention, which can lead to accidents.

In this accident, and the accidents in Roanoke Rapids and Reed, safe operations relied solely on employees' compliance with procedures, contained in railroad rules and required by federal regulations, related to working around RMMs. Compliance requires, in part, the employees' constant attention and vigilance to the rules and to safety. All three of these accidents might have been prevented if the RMMs involved were equipped with a collision warning or avoidance system that alerted the operator to stop the RMM movement or if the RMM movement automatically stopped when an impending collision was detected.

A notable difference between a collision warning system and a collision avoidance system is the requirement for operator intervention in a collision warning system. The operator must detect the warning, correctly interpret it, then respond to the warning by applying the brakes to stop the RMM movement. A collision avoidance system, on the other hand, eliminates any element of human error by automatically stopping the RMM movement when the system detects an impending collision. There is no delay waiting for the operator to react, and the brakes are applied automatically by the system. Further, even when an operator is incapacitated, the system will respond when it detects an impending collision, and it will automatically stop the RMM movement.

The amount of time it takes an operator to detect a warning, correctly identify it, and appropriately react by stopping the RMM movement may be significant. Many RMMs, including the driller in this accident, present challenges to operators detecting various types of warnings including loud operating environments, steel wheels with no suspension system to dampen vibrations during traveling, or an operator needing to look in multiple directions when traveling or performing the work they may be doing. These challenges with collision warning systems are all overcome with collision avoidance systems that can automatically stop movements because they do not rely at all on a human operator.

The NTSB has identified some situations in which a backup camera alone would not be sufficient to prevent an incursion with a roadway worker, and, unlike backup cameras or collision warning systems, collision avoidance systems do not rely on the attention or action of a human operator. These systems can intervene automatically to stop movements and prevent accidents. Because collision avoidance systems are currently available, and because of the drawbacks of camera systems alone, the NTSB classifies Safety Recommendation R-23-22 Closed—Superseded.

The NTSB concludes that the use of collision avoidance systems on RMMs can save lives by automatically intervening to prevent an impending collision when an operator does not act to stop an RMM movement. The NTSB recommends that the FRA require all on-track RMMs to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision.

RMMs have various designs and functions, and some can present various safety hazards beyond on-track collisions during forward and reverse movements. For example, the NTSB investigated an April 2024 railroad employee fatality in which a manager was struck and killed by the bucket of a hi-rail excavator operated by a contractor employee near McNeil, Arkansas (NTSB 2025a). Just before being fatally struck, the manager walked into the working area of the hi-rail excavator, within the range of the excavator's boom. The manager did not communicate with the excavator operator before approaching the RMM, and the operator was unaware of the manager's presence until he saw him being struck. In the McNeil accident, the fatal strike of the excavator's bucket occurred outside the width of the RMM but within the working area of the on-track excavator. In such a case, the RMM was stationary, and a collision avoidance system would not have provided the necessary safety functions to prevent an accident involving an extension or boom that covers a more encompassing work area than just the track in front or behind the RMM.

As mentioned above, one technology configuration for RMMs is a people detection system that monitors the working area and alerts operators to the presence of people within a hazardous working distance of the RMM, including within the range of extensions like booms. The manufacturer of the excavator involved in the McNeil, Arkansas, accident offered a people detection system that could be installed on new machines and retrofitted to existing machines. However, such a system was not installed on the McNeil accident excavator.

The McNeil accident demonstrated that additional safety technology could have provided a layer of protection for the workers by notifying the operator, who could have stopped all movements and prevented or reduced the severity of the accident. Different RMMs can present safety hazards other than forward- and reverse-movement collisions, such as those posed by RMMs with booms or other movable extensions. Therefore, the NTSB concludes that installing people detection systems on RMMs with booms or other moveable extensions can reduce accidents by alerting operators to take preventive action when people enter RMM work zones. The NTSB recommends that the FRA require all on-track RMMs with booms or other movable extensions to be equipped with a 360° people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity.

The fatal Reed, Roanoke Rapids, and McNeil accidents occurred on Class I railroads during RMM movements just like the accident in Great Barrington, Massachusetts, which occurred on a short line railroad with contract workers. The Roanoke Rapids accident involved railroad employees, and the Reed accident involved a railroad employee machine operator and a railroad contractor being struck. The McNeil accident involved a railroad contractor machine operator striking a railroad employee. Accidents involving RMMs occur on railroads of all sizes and involve contract and railroad employees alike, because the nature of the work performed by Class I railroads does not differ from that performed by smaller railroads or railroad contractors. Railroads of all sizes use RMMs to perform operations such as tie replacements, track surfacing, and installation of lag screws. Similarly, the nature of the work performed with contractor-owned, -leased, or -operated equipment does not differ from that performed by railroad-owned or -operated equipment.

Therefore, the NTSB recommends that Class I railroads, HRRC, and Middlesex require all on-track RMMs, including leased or contracted RMMs, to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision. The NTSB also recommends that Class I railroads require all on-track RMMs with booms or other movable extensions, including leased or contracted RMMs, to be equipped with a 360° people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity.

The Great Barrington accident involved a combination of a railroad contractor performing maintenance-of-way work and a short line railroad employee serving as an RWIC. The ASLRRA and National Railroad Construction and Maintenance Association (NRC) are trade associations with broad railroad industry reach and missions that include improving safety, and they are positioned to inform their constituents about the risks associated with the use of RMMs. ASLRRA represents short line railroads like HRRC; therefore, the NTSB recommends that the ASLRRA and the NRC inform their members of the safety benefits of equipping RMMs with collision avoidance systems and, when RMMs have movable extensions, a people detection system that alerts operators of nearby workers.

2.4 Supervision and Communication

FRA regulations in 49 *CFR* Part 214 require each roadway work group that will be fouling the track to have an RWIC designated by their employer to provide on-track safety for the group and instruct roadway workers in the on-track safety procedures to be used and followed during the performance of their work.

The FRA defines a roadway work group as two or more roadway workers engaged in a common task and requires each work group to have its own qualified RWIC who is engaged with and knowledgeable of the tasks performed by the group. On the day of the accident, the HRRC RWIC controlled working limits through exclusive track occupancy in the area where Middlesex employees were working. During his interview with the NTSB, the RWIC said that he did not know that there would be two separate work groups on the day of the accident. He added that he thought all 24 Middlesex employees present at the morning briefing would be supporting the bridge work. He said he was aware that employees would be aligning RMMs at Lanes in the morning and was present during some of this work, but he believed this work was to support the bridge work.

It was the RWIC’s responsibility to keep informed of daily tasking and coordinate with the roadway workers to ensure the daily job briefings and on-track safety plans were consistent with each day’s work. It is common for work plans to change day to day, or even throughout a day. RWICs must routinely change on-track safety procedures and ensure that all roadway workers are informed about these changes. HRRC managers were not involved in the daily work planning unless engaged by the RWIC or Middlesex supervisors. Although the RWIC was responsible for communicating and overseeing the day's events to the entire crew, he never initiated the required discussion of daily tasking with the Middlesex supervisors who had the working knowledge of the planned work.

The work locations of work group 1 (working at the bridge) and work group 2 (performing drilling and lagging operations) were more than 6 miles apart at the time of the accident, and the two groups were not engaged in a common task. Therefore, two RWICs should have been present, because FRA regulations required an employee qualified as an RWIC to be assigned to each work group. Contrary to FRA regulations, only a single RWIC was in place on the day of the accident, and at the time of the accident, he was located with work group 1 at the bridge. Since the RWIC was not aware of the second work group until after the accident, the RWIC never instructed work group 2 on any on-track safety procedures specific to work group 2's plans to drill and lag near the accident location.

Additionally, roadway workers participating in on-track safety job briefings are required to acknowledge their understanding of the job briefing. During his interview, the RWIC stated that employees acknowledged their understanding of the job briefing by signing a job briefing form. He further acknowledged that he gathered their signatures while Middlesex supervisors were conducting their subsequent briefing of safety issues during the Middlesex daily huddle. Of further note, the Middlesex employees did not receive their specific work tasks, including the drilling and lagging task assignments, until after the RWIC completed his briefing and the Middlesex supervisors finished their daily huddle. The NTSB interviewed 11 people present during the morning briefings but were unable to determine if the RWIC was present when employees were assigned to work group 2 and tasked with the lagging work at the accident location.

Even though the RWIC was aware of the work being performed on the bridge and that RMMs would be in use at that worksite, his job briefing was generic; it did not identify the specific RMMs that would be used on the main track. In addition, the job briefing did not include specific safety procedures communicating the requirement for all on-track RMM movements to only be made under RWIC direction. Additionally, the briefing did not include procedures addressing communication between RMM operators and roadway workers assigned to work near RMMs.

The NTSB concludes that communication between the HRRC RWIC and Middlesex supervisors was insufficient because the RWIC was not aware of all the work being conducted on the day of the accident, resulting in work group 2 working without a proper on-track safety briefing or having a second, FRA-mandated RWIC engaged in supervising work, coordinating on-track RMM movements, or properly locking switches used for RMM movements when unmonitored as required by FRA regulations.

FRA regulations in 49 *CFR* Part 214 require RMM movements within working limits established by exclusive track occupancy to be made only under the direction of the RWIC. On the day of the accident, the RWIC unlocked the switch at Lanes so that Middlesex employees could move RMMs onto the main track within the working limits. He then left the switch unlocked and did not ask which specific RMMs would be accessing the main track then drove to the bridge work location. About this same time, work group 2 was moving various RMMs at Lanes to access the driller and lagger they needed for the day's work and to prepare other RMMs for work on future days. Leaving the switch unlocked violated Northeast Operating Rules Advisory Committee Rule 104, which requires that after an employee operates a switch or fixed derail, they are to "ensure that, when not in use, each switch or derail is in the proper position, and is locked, hooked, or latched, if so equipped," as well as the requirement under 49 *CFR* 214.321 for the RWIC to direct all RMM movements within his working limits.

The RWIC's actions at the switch allowed Middlesex employees from work group 2 to move both the lagger and driller from Lanes onto the main track and to their worksite without communicating with the RWIC, who was responsible for ensuring these movements were made safely. Over the duration of the project, the switch was routinely left unlocked and unattended during the workday, which reinforced this unauthorized and risky behavior. Additionally, the RWIC regularly permitted Middlesex employees to operate the switch and move RMMs despite their lack of qualification or formal authorization to do so. Had the switch been locked, the work group would have had to contact the RWIC to unlock and operate the switch, making him aware of work group 2 and the need for a second RWIC to coordinate this work group's RMM movements.

When asked by the NTSB during his interview if he saw the driller and lagger on the main track at Lanes, the RWIC said that he was not paying attention and that Middlesex was responsible for staging RMMs.

In this accident, safety risks were introduced by an inadequate on-track safety briefing, a lack of communication regarding authorization of RMM movements, no communication between the RWIC and work group 2 regarding their work activities, and a lack of communication between the driller operator and employees 1 and 2.

The NTSB is concerned that such communication issues are not unique to HRRC and Middlesex. Other NTSB investigations have found that similar failures in job briefings and job site communication contributed to the accident. In the investigation into an Amtrak train that collided with maintenance-of-way equipment on April 3, 2016, near Chester, Pennsylvania, which resulted in two fatalities and 39 injuries, the NTSB determined that inadequate communication and the lack of a job briefing surrounding a shift change of foreman contributed to the accident (NTSB 2017). Similarly, the NTSB determined that a job briefing that did not address risks associated with the work contributed to the May 25, 2015, BNSF Railway employee fatality in Minneapolis, Minnesota (NTSB 2016). Additionally, in NTSB's investigation into the HRRC roadway worker fatality near North Canaan in 2020, we found that—because of a lack of communication—the RMM operator was unaware of the fatally injured RWIC's intended movements into a close-clearance location moments before he was struck by the RMM (NTSB 2022).

After 11 roadway worker fatalities in 2013, the NTSB initiated a special investigation that identified inadequate job briefings as a safety issue in the resulting *Special Investigation Report on Railroad and Rail Transit Worker Protection* (NTSB 2014). There is a pattern of inadequate job briefings and communication between roadway workers contributing to roadway worker fatalities investigated by NTSB. This accident is the latest to demonstrate the risks introduced to roadway workers by a lack of proper communication.

Therefore, the NTSB recommends that the ASLRA and NRC urge their members to inform their employees of the circumstances of this accident, the importance of thorough job briefings with railroad contractors, and the requirement to communicate on-track activities and movements with the RWIC.

2.5 Safety Management Systems and Risk Reduction Plans

A safety management system is a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies, and procedures. An effective safety management system program can help companies reduce and prevent accidents and accident-related loss of life, time, and resources. Currently, many industry sectors worldwide have recognized the benefits of effective safety management, including aviation and maritime. A safety management system aids personnel with goal setting, planning, and measuring performance.

This investigation identified risks and failures at HRRC that, had they been properly addressed, may have prevented the accident. First, the breakdown in communication between HRRC and Middlesex resulted in work group 2 working without the supervision of an RWIC coordinating its RMM movements. Second, HRRC RWICs routinely left a main track switch unlocked and unsupervised, which enabled unqualified Middlesex employees to have access to the main track upon which the RWIC was required to coordinate all RMM movements. Third, HRRC had no standard of communication between the RWIC and Middlesex supervisors or work groups while at work sites. Finally, HRRC's managers did not identify and correct any of these issues even though they were repeated failures throughout the Middlesex project.

The NTSB concludes that had HRRC implemented an effective safety management system before the accident, it would have increased the likelihood that HRRC would identify and correct the lack of coordination between HRRC and Middlesex, which allowed Middlesex employees to operate unsupervised on the tracks.

In October 2008, the Rail Safety Improvement Act of 2008 (2008 RSIA) mandated that the FRA establish regulations that require each Class I railroad and those railroads determined to have inadequate safety performance, to establish an RRP to reduce the numbers and rates of railroad accidents, injuries, and fatalities (Public Law 110-432).

In June 2009, the NTSB investigated a Canadian National Railway Company derailment in Cherry Valley, Illinois, that resulted in a postaccident fire, hazardous materials release, a fatality, and nine injuries. As a result of the investigation, we recommended that the FRA:

> Require that safety management systems and the associated key principles (including top-down ownership and policies, analysis of operational incidents and accidents, hazard identification and risk management, prevention and mitigation programs, and continuous evaluation and improvement programs) be incorporated into railroads' risk reduction programs required by Public Law 110-432, Rail Safety Improvement Act of 2008, enacted October 16, 2008. (R-12-3) [25]

On February 18, 2020, the FRA published regulations in 49 *CFR* Part 271 that enacted the requirements of the 2008 RSIA, included the key principles of safety management systems as recommended by the NTSB, and established the FRA's procedure for determining which short line railroads would be required to implement an RRP. On November 17, 2021, the NTSB classified Safety Recommendation R-12-3 Open—Acceptable Response pending the FRA's review and finding that all railroads'

[25] Safety Recommendation R-12-3 is currently classified Open—Acceptable Response.

system safety programs and RRP plans met the requirements of the applicable rule. On February 8, 2024, the FRA responded that all system safety program and RRP plans had been submitted, reviewed, and approved by the FRA.

In the FRA's RRP regulations, Class I Railroads and those short line railroads it determined to have inadequate safety performance are required to implement an RRP. Railroads that are not required by the FRA to implement an RRP may choose to voluntarily adopt an RRP. In support of this regulation, the FRA developed a process to determine which short railroads have inadequate safety performance, that is defined in 49 *CFR* Part 271, and to require those railroads to establish an RRP. The FRA uses a two-phase annual analysis, composed of both a quantitative analysis of accident and injury data and a qualitative assessment. One of the ways in which the FRA identifies railroads as potentially having inadequate safety performance in the first (quantitative) phase of analysis is to determine whether a railroad had at least one employee fatality in the previous 3 years. The second phase of the analysis is described in regulation by the FRA as being a qualitative assessment that considers documentation provided by a specific railroad supporting claims that their safety performance is adequate, any comments received by the FRA from railroad employees, and the railroad's compliance history with the FRA. After the second-phase assessment, if the FRA determines a railroad has inadequate safety performance, the evaluated railroad is required to establish and use an RRP for at least 5 years.

The NTSB investigated an October 14, 2020, HRRC employee fatality near North Canaan, Connecticut. Under the FRA's assessment program, a fatality such as occurred in North Canaan would indicate to the FRA the possible inadequate safety performance of HRRC under FRA's evaluation criteria outlined in the regulation. However, although RRP regulations went into effect in February 2020, the FRA had not conducted the regulatorily required annual analysis in 2020, 2021, 2022, or before the present accident. The FRA told the NTSB that they did not perform the annual analysis for each of these years because they elected to work with ASLRRA to develop an RRP template program before making any determinations of inadequate safety performance. Following the Great Barrington accident, the FRA conducted and completed in 2024 the required annual analysis using accident and injury data from 2020 through 2022 in the first phase and determined that HRRC had inadequate safety performance. The FRA notified HRRC of this determination on October 21, 2024, and instructed HRRC to establish an RRP.

If the FRA had performed an annual analysis to identify railroads with inadequate safety performance in 2021, as required by 49 *CFR* Part 271, HRRC likely would have been required by the FRA to establish an RRP before the accident.

The FRA's second phase of qualitative assessment is conducted to determine if an RRP to reduce accidents and injuries is required, so it is important that the FRA complete the annual analysis each year as required by regulation to determine which railroads require a second phase assessment. The NTSB concludes that if the FRA does not perform an annual analysis of short line railroads' safety performance, then it will continue to miss opportunities to require RRPs that can identify and mitigate risks for railroads demonstrating inadequate safety performance. Therefore, NTSB reiterates Safety Recommendation R-12-3 to the FRA and classifies it as Open—Unacceptable Response.

3 Conclusions

3.1 Findings

1. None of the following issues contributed to the accident: (1) driller operator fatigue; (2) the driller operator's and struck worker's impairment from drugs or alcohol; (3) weather and visibility; (4) the physical condition of the track and signal infrastructure; or (5) the mechanical condition of the driller's braking system.

2. The driller operator had sufficient sight distance to see the employees on the tracks and stop the driller before striking employee 1.

3. The driller struck the employee because the driller operator did not actively observe the driller's path of travel or monitor the roadway maintenance machine's (RMM) rearview mirror as he approached the work group, so he was unaware of the need to stop.

4. Because the driller was not equipped with safety devices (other than a wide-angle mirror) to aid the operator's lookout for hazards, the lapse in the driller operator's attention and/or judgment resulted in severe consequences.

5. The use of collision avoidance systems on RMMs can save lives by automatically intervening to prevent an impending collision when an operator does not act to stop an RMM movement.

6. Installing people detection systems on RMMs with booms or other moveable extensions can reduce accidents by alerting operators to take preventive action when people enter RMM work zones.

7. Communication between the Housatonic Railroad Company roadway worker-in-charge (RWIC) and Middlesex Corporation supervisors was insufficient because the RWIC was not aware of all the work being conducted on the day of the accident, resulting in work group 2 working without a proper on-track safety briefing or having a second, Federal Railroad Administration (FRA)–mandated RWIC engaged in supervising work and coordinating on-track roadway maintenance machine movements, or properly locking switches used for roadway maintenance machine movements when unmonitored as required by FRA regulations.

8. Had the Housatonic Railroad Company (HRRC) implemented an effective safety management system before the accident, it would have increased the likelihood that HRRC would identify and correct the lack of coordination between HRRC and Middlesex Corporation, which allowed Middlesex employees to operate unsupervised on the tracks.

9. If the FRA does not perform an annual analysis of short line railroads' safety performance, then it will continue to miss opportunities to require risk reduction programs that can identify and mitigate risks for railroads demonstrating inadequate safety performance.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the Great Barrington, Massachusetts, roadway maintenance worker fatality was the Middlesex Corporation driller operator's failure to actively observe that the driller's path of travel was clear. Contributing to the accident was the Housatonic Railroad Company roadway worker-in-charge's (RWIC) lack of awareness of daily tasking, which prevented him from conducting an adequate job briefing for all tasks being performed, the RWIC's lack of awareness of on-track roadway maintenance machine movements without his knowledge or authorization, the absence of a required second RWIC for work group 2, and no communications between the RWIC and work group 2 about their work activities prior to the accident, which resulted in his lack of awareness that a second work group or work site existed.

4 Recommendations

New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations.

To the Federal Railroad Administration:

Require all on-track roadway maintenance machines (RMMs) to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision. (R-25-6)

Require on-track roadway maintenance machines with booms or other movable extensions to be equipped with a 360° people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity. (R-25-7)

To all Class I Railroads, the Housatonic Railroad Company, and Middlesex Corporation:

Require all on-track roadway maintenance machines (RMMs), including leased or contracted RMMs, to be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision. (R-25-8)

To all Class I Railroads:

Require all on-track RMMs with booms or other movable extensions, including leased or contracted RMMs, be equipped with a 360°people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity. (R-25-9)

To the American Short Line and Regional Railroad Association and the National Railroad Construction and Maintenance Association:

Inform your members of the safety benefits of equipping roadway maintenance machines (RMMs) with collision avoidance systems and, when RMMs have movable extensions, a people detection system that alerts operators of nearby workers. (R-25-10)

Urge your members to inform their employees of the circumstances of this accident, the importance of thorough job briefings with railroad contractors, and the requirement to communicate on-track activities and movements with the roadway worker-in-charge. (R-25-11)

Previously Issued Recommendation Reiterated and Classified in This Report

The National Transportation Safety Board reiterates and classifies the following safety Recommendation:

To the Federal Railroad Administration:

Require that safety management systems and the associated key principles (including top-down ownership and policies, analysis of operational incidents and accidents, hazard identification and risk management, prevention and mitigation programs, and continuous evaluation and improvement programs) be incorporated into railroads' risk reduction programs required by Public Law 110-432, Rail Safety Improvement Act of 2008, enacted October 16, 2008. (R-12-3)

Safety Recommendation R-12-3 is reiterated and classified Open—Unacceptable Response in section 2.5 of this report.

Previously Issued Recommendation Classified in This Report

The National Transportation Safety Board classifies the following safety Recommendation:

To the Federal Railroad Administration:

Require all newly manufactured and all rebuilt and remanufactured roadway maintenance machines to be equipped with backup cameras. (R-23-22)

Safety Recommendation R-23-22 is classified Closed—Superseded in section 2.3 of this report.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JENNIFER L. HOMENDY
Chairwoman

MICHAEL GRAHAM
Member

THOMAS CHAPMAN
Member

J. TODD INMAN
Member

Report Date: August 4, 2025

Appendixes

Appendix A: Investigation

The National Transportation Safety Board was notified of this accident on August 4, 2023. Members of the investigative team arrived on scene on August 5, 2023. The National Transportation Safety Board team consisted of an investigator-in-charge, an operations investigator, two track investigators, and a TDA Specialist, as well as other supporting personnel. The Federal Railroad Administration, Massachusetts Department of Transportation, Housatonic Railroad Company, Middlesex Corporation, the Great Barrington Police Department, and the Great Barrington Fire Department were parties to the investigation.

Appendix B: Consolidated Recommendation Information

Title 49 *United States Code* 1117(b) requires the following information on the recommendations in this report.

For each recommendation–

(1) a brief summary of the Board's collection and analysis of the specific accident investigation information most relevant to the recommendation;

(2) a description of the Board's use of external information, including studies, reports, and experts, other than the findings of a specific accident investigation, if any were used to inform or support the recommendation, including a brief summary of the specific safety benefits and other effects identified by each study, report, or expert; and

(3) a brief summary of any examples of actions taken by regulated entities before the publication of the safety recommendation, to the extent such actions are known to the Board, which were consistent with the recommendation.

To the Federal Railroad Administration:

R-25-6

Require all on-track roadway maintenance machines (RMMs) be equipped with collision avoidance systems that can detect people, objects, or other machines on the ground and automatically stop the RMM before a collision.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.3, RMM Safety Technology. Information supporting (b)(1) can be found on page 31; (b)(2) is not applicable; and (b)(3) is not applicable.

R-25-7

Require all on-track roadway maintenance machines with booms or other movable extensions be equipped with a 360° people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.3, RMM Safety Technology. Information supporting (b)(1) can be found on page 32; (b)(2) is not applicable; and (b)(3) is not applicable.

To all Class I Railroads, the Housatonic Railroad Company, and Middlesex Corporation:

R-25-8

Require all on-track roadway maintenance machines (RMMs), including leased or contracted RMMs, to be equipped with collision avoidance systems that can detect people, objects, and other machines on the ground and automatically stop the RMM before a collision.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.3, RMM Safety Technology. Information supporting (b)(1) can be found on page 33; (b)(2) is not applicable; and (b)(3) is not applicable.

To all Class I Railroads:

R-25-9

Require all on-track roadway maintenance machines (RMMs) with booms or other movable extensions, including leased or contracted RMMs, be equipped with a 360° people detection system that covers the length of the boom or extension in all directions and alerts operators when people are within an unsafe proximity.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.3, RMM Safety Technology. Information supporting (b)(1) can be found on page 33; (b)(2) is not applicable; and (b)(3) is not applicable.

To the American Short Line and Regional Railroad Association and the National Railroad Construction and Maintenance Association:

R-25-10

Inform your members of the safety benefits of equipping roadway maintenance machines (RMMs) with collision avoidance systems and, when RMMs have movable extensions, a people detection system that alerts operators of nearby workers.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.3, RMM Safety Technology. Information supporting (b)(1) can be found on page 33; (b)(2) is not applicable; and (b)(3) is not applicable.

R-25-11

Urge your members to inform their employees of the circumstances of this accident, the importance of thorough job briefings with railroad contractors, and the requirement to communicate on-track activities and movements with the roadway worker-in-charge.

Information that addresses the requirements of 49 USC 1117(b), as applicable, can be found in section 2.4, Supervision and Communication. Information supporting (b)(1) can be found on page 36; (b)(2) is not applicable; and (b)(3) is not applicable.

References

NTSB (National Transportation Safety Board). 2014. *Special Investigation Report on Railroad and Rail Transit Roadway Worker Protection, September 24, 2014*. NTSB/SIR-14/03. Washington, DC: NTSB.

–––. 2016. *BNSF Railway Employee Fatality, Minneapolis, Minnesota, May 25, 2015*. NTSB/RAB-16/04. Washington, DC: NTSB.

–––. 2017. *Amtrak Train Collision with Maintenance-of-Way Equipment, Chester, Pennsylvania, April 3, 2016*. NTSB/RAR-17/02. Washington, DC: NTSB.

–––. 2022. *Housatonic Railroad Company Employee Fatality, North Canaan, Connecticut, October 14, 2020*. NTSB-RIR-22/01. Washington, DC: NTSB.

–––. 2023. *Railroad Worker Fatality, Reed, Pennsylvania, December 8, 2021*. NTSB-RIR-23/14. Washington, DC: NTSB.

–––. 2025a. *Union Pacific Railroad Employee Fatality, McNeil, Arkansas, April 11, 2024*. NTSB-RIR-25/04. Washington, DC: NTSB.

–––. 2025b. *CSX Transportation Employee Fatality, Roanoke Rapids, North Carolina, February 13, 2024*. NTSB-RIR-25/07. Washington, DC: NTSB.

For more detailed background information on this report, visit the NTSB Case Analysis and Reporting Online (CAROL) website and search for NTSB accident ID [RRD23FR015]. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting –

National Transportation Safety Board
Records Management Division, CIO-40
490 L'Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551

Copies of NTSB publications may be downloaded at no cost from the National Technical Information Service, at the National Technical Reports Library search page, using product number PB2025-100110. For additional assistance, contact–

National Technical Information Service
5301 Shawnee Rd.
Alexandria, VA 22312
(800) 553-6847 or (703) 605-6000
NTIS website