

National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



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SYSTEM SAFETY

Group Chair's Factual Report

June 27, 2022

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A. ACCIDENT

Location: Reed, Pennsylvania
Date: December 8, 2021
Time: 11:20 a.m. (local)
16:20 UTC
Spike Machine (Spiker): Spiker 2

B. SYSTEM SAFETY GROUP

Group Chair	Michael R. Hoepf, Ph.D. National Transportation Safety Board
Group Member	Chad Haller Federal Railroad Administration
Group Member	Joe Young Norfolk Southern
Group Member	Forrest Koerner-Fox National Salvage
Group Member	Sheldon Swain Brotherhood of Maintenance of Way Employees

C. SUMMARY

On December 8, 2021, about 11:20 a.m. local time, an employee (contract worker) of National Salvage and Service Corporation (National Salvage) was killed when the operator of a Norfolk Southern Corporation (Norfolk Southern) spike machine (spiker) reversed direction and struck him in Reed, Pennsylvania. Near the accident (Norfolk Southern main track Buffalo line at milepost BR 295.1), three spikers (Spiker 1, Spiker 2, & Spiker 3) were generally being operated from north to south. The contract worker was impacted by Spiker 2, which was moving north. The Spiker 2 operator said he did not see the contract worker before or during the reverse movement. The Spiker 3 operator said the contract worker was standing in the gauge (distance between the rails) at the time he was struck. The weather was clear with no precipitation.

D. FACTUAL INFORMATION

1.0 Operation Overview

The objective for the day for Norfolk Southern's R-12 Gang on December 8, 2021, was to replace 1,342 feet of continuous welded rail between milepost BR295.00 and milepost BR 295.25.¹ The R12 Gang typically consisted of about 25 Norfolk Southern employees, and about 15 rail-bound roadway maintenance machines. On the day of the accident, 3 of the roadway maintenance machines in operation were spikers.

The spikers are generally sequenced near the end of the equipment line-up and tasked with track gauging and spiking cross-ties. On the day of the accident, Spiker 1 (also referred to as the Gauger Spiker) was the first spiker in the series (southernmost). Spiker 2 was in the middle, and Spiker 3 was the last spiker (northernmost).



Spiker 2 Exterior - NTSB photograph shows the roadway maintenance machine (Spiker 2) involved in the accident on Norfolk Southern's main track Buffalo line in Reed, PA.

¹ This information presented in this overview is taken from the NTSB Track and Engineering Factual Report, which contains further details of the operation and is available in the public docket.

Accompanying the R12 Gang on the day of the accident (as was typical), were two National Salvage employees (contract workers). One was a boom truck operator, and the other was a laborer (referred to as the 'contract worker' in this report) who worked on the ground and was tasked with marking old rail for scrap and resale purposes. Typically, this contract worker would assist the boom truck operator with cutting rail after he completed marking the objective rail segment for the day. This was the employee who sustained fatal injuries upon being impacted by Spiker 2. Thus, the system safety investigation focused on the Spiker 2 operator and the contract worker.

2.0 Spiker 2 Operator

2.1 Work History

The Spiker 2 operator was hired by Norfolk Southern on 10/2/2012.² Norfolk Southern machine qualification records indicate that he became qualified to operate spikers effective 8/21/2014.³ Norfolk Southern conducted 16 rules checks for the Spiker 2 operator in 2021.⁴ He was found to be compliant with the rules on all but one occasion. The Spiker 2 operator completed training activities pertaining to:⁵

- Hazardous Materials for Engineering (5/23/2017)
- Roadway Maintenance Machine Operator Qualification - 49 CFR 214.355 (3/21/2018)
- Flagman Qualification - 49 CFR 214.351 (3/21/2018)
- Watchmen Lookout Qualification - 49 CFR 214.349 (3/21/2018)
- 49 CFR 214 Subpart C Roadway Worker (3/21/2018)
- Track Safety Standards: Continuous Welded Rail (11/9/2020)
- Bridge Worker Safety (11/9/2020)
- Shunts - Controlling Activation During Track Work (11/9/2020)
- Backhoe Safety (11/9/2020)
- Spiking Lesson/Practice/Assessment (1/18/2021)
- Tools, Components, Switches, Derails & Mock-ups (1/18/2021)
- Safety: Preventing Sprains and Strains (6/1/2021)

² Document: Spiker 2 Operator Career Service Record

³ Document: Spiker 2 Operator Machine Qualification

⁴ Document: Spiker 2 Operator Rules Checks

⁵ Document: Spiker 2 Operator Training

2.2 Schedule

The Spiker 2 operator's work schedule preceding the accident is indicated in the table below:⁶

Date	Start Time	End Time	Hours
11/8/2021	8:00 AM	8:30 PM	12:30
11/9/2021	8:00 AM	7:00 PM	11:00
11/10/2021	8:00 AM	7:00 PM	11:00
11/11/2021	8:00 AM	6:30 PM	10:30
11/15/2021	8:00 AM	9:00 PM	13:00
11/16/2021	8:00 AM	7:00 PM	11:00
11/17/2021	8:00 AM	8:30 PM	12:30
11/18/2021	8:00 AM	7:00 PM	11:00
11/22/2021	5:30 AM	4:30 PM	11:00
11/23/2021	5:30 AM	4:30 PM	11:00
11/29/2021	5:30 AM	4:30 PM	11:00
11/30/2021	5:30 AM	4:30 PM	11:00
12/1/2021	5:30 AM	6:00 PM	12:30
12/2/2021	5:30 AM	4:30 PM	11:00
12/6/2021	5:30 AM	4:30 PM	11:00
12/7/2021	5:30 AM	4:30 PM	11:00
12/8/2021	5:30 AM	6:30 PM	13:00

⁶ Document: Spiker 2 Operator Hours of Service. Note that the R12 Gang stopped working on 12/8/2021 when the accident occurred. The table above is based on company records.

3.0 Contract Worker

3.1 Work History

The contract worker was hired by National Salvage August 5, 2019. He had a contractor certification for Norfolk Southern.⁷ The certification is required by Norfolk Southern and is provided at completion of roadway worker protection training. Training areas covered include general safety, terms and definitions, job briefings and communication, working limits, train approach warning and individual train detection, on track equipment, on track safety on adjacent tracks, and alternate methods of protection.

The contract worker also had an eRailSafe System Badge.⁸ According to the company's website, *"eRailSafe enables Class I and short line railroads to monitor and maintain a history of all contractor employees that have access to their property. The purpose of the program is to improve the security of railroad employees, operations, and facilities."*⁹ The eRailSafe System Badge signifies:

1. Criminal background checks – applicants are required to submit to background investigations
2. Safety awareness & testing – applicants must complete required safety and security awareness training tests for their assigned railroad
3. Badging
 - a. Applicants are required to wear eRailSafe ID badges when working on railroad property
 - b. Badges are issued upon successful completion of background investigation and compliance testing

National Salvage provided six completed safety inspection checklists for the contract worker between 1/22/2020 and 2/23/2021.¹⁰ Areas of inspection included: personal protective equipment, radio procedures, spacing of equipment, and working and walking conditions. The records indicate that the contract worker demonstrated positive performance in the areas of inspection, and no corrective actions were needed.

⁷ Document: Contract Worker Contractor Certification, issued 12/22/2020, expired 12/22/2021 (was valid at the time of the accident)

⁸ Contract Worker eRailSafe Badge, issued 6/10/2021, expires 6/2/2023

⁹ <https://erailsafe.com/usa/>

¹⁰ Document: Contract Worker Safety Inspection Checklist. Note that only the 7/15/2020 checklist is uploaded to the docket

3.2 Schedule

The contract worker's work schedule preceding the accident is indicated in the table below:¹¹

Date	Start Time	End Time	Hours
11/8/2021	5:49 AM	9:20 PM	15:31
11/9/2021	6:17 AM	5:05 PM	10:48
11/10/2021	6:08 AM	6:09 PM	12:01
11/11/2021	6:04 AM	6:46 PM	12:42
11/12/2021	6:01 AM	3:01 PM	9:00
11/15/2021	6:14 AM	6:55 PM	12:41
11/16/2021	6:04 AM	3:54 PM	9:50
11/17/2021	5:06 AM	8:41 PM	15:35
11/18/2021	6:01 AM	6:42 PM	12:41
11/19/2021	6:18 AM	2:36 PM	8:18
11/22/2021	6:19 AM	5:34 PM	11:15
11/23/2021	6:03 AM	3:12 PM	9:09
11/29/2021	6:04 AM	6:01 PM	11:57
11/30/2021	5:32 AM	5:19 PM	11:47
12/1/2021	5:32 AM	6:32 PM	13:00
12/2/2021	5:37 AM	5:41 PM	12:04
12/3/2021	6:06 AM	1:51 PM	7:45
12/6/2021	5:35 AM	8:36 PM	15:01
12/7/2021	5:35 AM	6:45 PM	13:10
12/8/2021	5:30 AM	11:20 AM	5:50

¹¹ Document: Contract Worker Hours of Service. The table above is based on company records except for the end time on 12/8/2021, which was amended to reflect the time of the accident.

4.0 Interviews

4.1 Spiker 1 Operator

The system safety and track and engineering investigative groups conducted a brief interview with the Norfolk Southern Spiker 1 operator. Given the limited scope of the discussion, the conversation was not recorded and transcribed. However, the team created the following record of conversation.

The Spiker 1 operator said he had about 10 years of experience, including about 2 and one-half months with the R12 Gang (using the same spiker the entire time). Regarding the morning of the accident, he said he needed to wait for the rest of the gang to work ahead of him. About 5-7 minutes before the accident, he saw the National Salvage contract worker to his left (east) between the main and siding. The contract worker crossed the main and walked down to the access road. The Spiker 1 operator made eye contact with the contract worker as he walked north on the access road. He stopped his machine and paused his work activities because he was unsure what the contract worker was doing. Then (while the machine was still stopped), the contract worker crossed the main track again, walking behind the machine. The Spiker 1 operator remained stopped. The contract worker then proceeded to walk north between the main and the siding. Once the contract worker was out of his view, the Spiker 1 operator started working again. He said the contract worker was wearing a hardhat as well as pants and a hoodie that both had reflective stripes.

4.2 Spiker 2 Operator

The interview transcript for the Norfolk Southern Spiker 2 operator is available in the public docket.¹²

The Spiker 2 operator said that he had worked as a trackman, an anchor machine operator, an adzer¹³ operator, and a spiker operator. He had been assigned to the spiker he was operating at the time of the accident for about 2 -3 months. He said that the spiker is equipped with a functioning backup alarm, and that he also sounds the horn three times before initiating a reverse movement. Regarding the volume of the horn, he said that it "sounds like a Prius."

While operating the spiker on the day of the accident, he indicated that he was looking down at the rail when driving spikes. However, he periodically looked up to determine the distance to the spiker in front of him (Spiker 1). He said that when he neared the machine in front of him, he looked back to see if he could reverse and help the spiker behind him (Spiker 3). He indicated that he "regularly" initiated reverse movements to help Spiker 3 get "caught up."

The Spiker 2 operator indicated that he went on duty the morning of the accident around 6:30 am, when he reported to the vans outside the hotel and initiated the drive to the worksite. He said the drive was about 30 - 40 minutes, and the job briefing at the worksite was conducted around 7:30 am. He said that during the job briefing, pertinent safety hazards were discussed, as well as the work plan for the day. He said that after the job briefing, he proceeded to start his machine, as they "already had track." He estimated that there were about 18 - 19 roadway maintenance machines and a truck involved in the operation. The Spiker 2 operator said that it was a normal day prior to the accident, visibility was adequate, and the operation was "running smooth."

¹² Document: Spiker 2 Operator Interview

¹³ An adzer is a roadway maintenance machine that performs the task of ballast removal from between ties at the tie plate area, then adzes (smooths) the cross ties at the tie plate seat for the placement of new tie plates. Afterward, debris and wood shavings are swept away from the tie plate seat area.

Regarding the accident sequence, the Spiker 2 operator said that prior to initiating the reverse movement, he looked at his rearview mirror to see how far Spiker 3 was behind him. He decided that Spiker 3 was far enough (he could not recall the specific distance) behind him that it was safe to make the reverse movement. Before moving, he said that he sounded the horn three times. After initiating the move, he said that he "felt like I ran over a weld." He looked down and saw that his machine had impacted the contract worker, who was underneath the spiker. He then communicated the emergency over the radio.

The Spiker 2 operator said that he was not expecting anyone to be behind him when he initiated the reverse movement, and he had "no idea" what the contract worker was doing behind him. When asked about the frequency in which he would see the contract worker in the gauge¹⁴ between the spikers he said, "I would never see him there."

The Spiker 2 operator said that he was staying at a hotel near the work location. He said that he typically goes to sleep around 8:00 or 9:00 pm and wakes around 3:00 am. He said that after work on December 7 (the day before the accident), he got back to the hotel around 4:00 pm. He indicated that he did not feel fatigued, and that he "felt fine" on the day of the accident. He said that he was not using his cell phone at the time of the accident, nor was he under the influence of drugs.

¹⁴ 'Gauge' refers to the distance between the two rails of a railway track. Persons standing in the gauge are at susceptible to being impacted by moving roadway maintenance machines, trains, etc.

4.3 Spiker 3 Operator

The interview transcript for the Norfolk Southern Spiker 3 operator is available in the public docket.¹⁵

The Spiker 3 operator said that he had about 3 and a half years of experience working on the railroad, having started in 2018. He said that he had about a year of experience working as a spiker operator and started working with the R12 Gang in September of 2021. He said that it was common for the Spiker 2 operator to initiate reverse movements to help him catch up.

The Spiker 3 operator indicated that generally he did not “know a whole lot about what” the contract worker did, though he did see him “regularly throughout the day.” However, prior to the accident, he could not recall ever seeing the contract worker in the gauge between Spiker 2 and Spiker 3.

The Spiker 3 operator said that he saw the contract worker being impacted by Spiker 2. He said that the contract worker was facing east when he was impacted and believed that he was “looking down at something.” He said that the contract worker was standing in the gauge. He did not recall the contract worker holding anything in his hands or using any equipment.

The Spiker 3 operator said that he did not hear any audible warnings coming from Spiker 2 (i.e., horn, automatic change of direction alarm), but noted that his “machine is very loud,” and he was wearing hearing protection. He indicated that spikers are “just too loud,” and “if you’ve ever been around a spiker, you know [how] loud it is.”

¹⁵ Document: Spiker 3 Operator Interview

4.4 Track Laborer

The interview transcript for the Norfolk Southern track laborer is available in the public docket.¹⁶

The track laborer said he started working for Norfolk Southern on August 23, 2021, at which time he proceeded to complete two weeks of training. He then joined the R12 Gang. Regarding the Spiker 2 operator, he said that he is “a really good teacher,” a “really good machine operator,” and “absolutely” a safe railroader.

The track laborer said that he did not remember all the details of the job briefing. However, he did recall that “one safety tip that was given... was to watch the 25-foot rule,” and there was discussion about the importance of ensuring that workers remain in view of the machine operators.¹⁷ The track worker recalled seeing the contract worker at the job briefing. He said that the contract worker had presented an “inspirational quote” at the briefing, and that “he was a good man.”

At the time of the accident, the track laborer indicated that he was inside the cab of Spiker 2 working as a ‘feeder.’ The task entails sitting in the middle seat of the machine, picking up spikes from the bin, and loading them into the top of the slot. He saw the contract worker walking north between the main track and the siding (east of the spiker) about five minutes before the accident occurred. He indicated that the Spiker 2 operator was “spiking forward to the south” at the time. The track laborer said that he was not surprised to see the contract worker because it was common for people to walk by the machine as they move towards the rear of the operation. He said that the contract worker “seemed like he was walking to the rear to go down to where his coworker was to start working on cutting the rail.”

Regarding the clothing being worn by the contract worker, the track laborer said that he “would not call it reflective.” He said that he was wearing black winter pants, and a black hoodie which had “the slightest bit of green, like tiger stripes on it.” The contract worker was not wearing a safety vest.

Regarding potential safety enhancements to prevent future accidents, the track laborer suggested “better communication” between “people on the ground” and machine operators.

¹⁶ Document: Track Laborer Interview

¹⁷ Norfolk Southern has an operating rule that requires their workers and contractors to stay at least 25 feet away from roadway maintenance machines (e.g., spikers)

4.5 Adzer Operator

The system safety and track and engineering investigative groups conducted a brief interview with the Norfolk Southern adzer operator. Given the limited scope of the discussion, the conversation was not recorded and transcribed. However, the team created the following record of conversation.

The adzer operator said that he had started working for the day before a train needed to pass. He stopped the adzer so that the train could pass. He said the National Salvage contract worker typically worked around the glue cart. He said he saw the contract worker slowly marking rail in front of the adzer. He said the contract worker typically did not slow his progress. About an hour after they started work for the day (less than halfway through the job), the contract worker called over the radio and asked to pass the adzer. The work location at the time was about 400 feet into the curve (around milepost 295). The adzer operator stopped the machine to let the contract worker pass safely from the south side of machine to the north side. He did not recall how much time passed between their radio conversation and the accident.

4.6 Boom Truck Operator

The system safety and track and engineering investigative groups conducted a brief interview with the National Salvage boom truck operator. Given the limited scope of the discussion, the conversation was not recorded and transcribed. However, the team created the following record of conversation.

He said the contract worker would first attend the job briefing, and then drive to his work location. The contract worker would try to get the rail marked before the gang arrived. He said the contract worker marked the rail before it was taken out of the track. After the contract worker finished marking rail, he would go to the rear of the operation to help cut the rail. The boom truck operator said that the contract worker sometimes called him as he walked back but did not on the day of the accident. The boom truck operator did not know if the contract worker ever checked his work on his walk to the back of the operation (after he finished marking the rail for the day).

The boom truck operator indicated that the segment of rail that was being replaced on the day of the accident was difficult to mark because it had many holes and welds. He said the contract worker was very detail oriented, so it sometimes took him a little longer than others to mark the rail. On the day of the accident, he heard the contract worker say over the radio that marking the rail was taking longer than usual. He said it would typically take the contract worker about 1 - 1.5 hours to mark the rail for a given day of work. At the time of the accident, the boom truck operator was near the 289.9 crossing. The last time he spoke with the contract worker was at the start of the day near milepost 297. They were getting the truck ready to start work. A train passed the gang on the day of the accident, at which time the boom truck operator was still located at the rear of the operation.

The boom truck operator said that the contract worker was very good at getting the attention of the operator of the first roadway maintenance machine to ensure that he was in the clear. He said that the contract worker often asked for permission to walk by roadway maintenance machines.

The boom truck operator said that the contract worker's workbook was very detailed and included the lengths of rail. He said that scrap was tallied at the bottom of the pages.

4.7 Supervisor

The interview transcript for the Norfolk Southern supervisor is available in the public docket.¹⁸

The supervisor said that he started his railroad career as a laborer. Subsequently, he was promoted to foreman and ultimately his current position (supervisor), which he had been for about 2 and a half years. In his role, he discussed several of his safety responsibilities. He said that he starts the job briefings, and discusses several topics, among them safety hazards likely to be encountered on the job. He said that he is also responsible for ensuring that the workers have the proper personal protective equipment (PPE). He also oversees track protection and machine safety.

The supervisor discussed the job briefing topics on the morning of the accident. To his recollection, the hazards discussed included getting on and off roadway maintenance machines, communication, "frosty rail," ensuring that machine operators can see workers on the ground (and vice versa), and adjacent track protection.

The supervisor indicated that it was a typical day and that he was able to obtain "plenty of track time." He said that he was working with a foreman when he heard that an emergency had occurred.

The supervisor discussed the typical activities of the contract worker. He said that usually the contract worker drives his truck up to the front of the operation ahead of all the machines and performs his marking. He indicated that the contract worker understood that he needed to stay away from the dangerous machines, such as the adzer. He indicated that generally once the contract worker finished marking the rail for the day, he returned to the rear of the operation where he started "torching the rail." He described the contract worker as "extremely safe, very detailed, very meticulous on the way he did things."

The supervisor said that he "had no idea" what the contract worker was doing standing between the spikers on the day of the accident. Prior to the accident, he heard the contract worker communicate with the adzer operator on the radio because he needed him to stop the machine so that he could safely walk by.

The supervisor said, "We do have machines with backup cameras on them."

¹⁸ Document: Supervisor Interview

5.0 Spiker 2 Visibility Observations

Visibility observations were undertaken at the accident site.¹⁹ One person sat in the cab of Spiker 2 (which was facing south) and looked out the left rear-view mirror while sitting in the left seat. The right mirror is not visible from this position. Another person who was of a similar height as the National Salvage contract worker moved to different positions behind the spiker. Specifically, they stood on the left (east) side of the track (on the tie - outside the gauge) and walked north (away from the spiker) until partially visible, then fully visible to the person in the cab. These distances were recorded (see chart below). The same observations were recorded with the person standing in the center of the track, and then the right (west) side of the track.

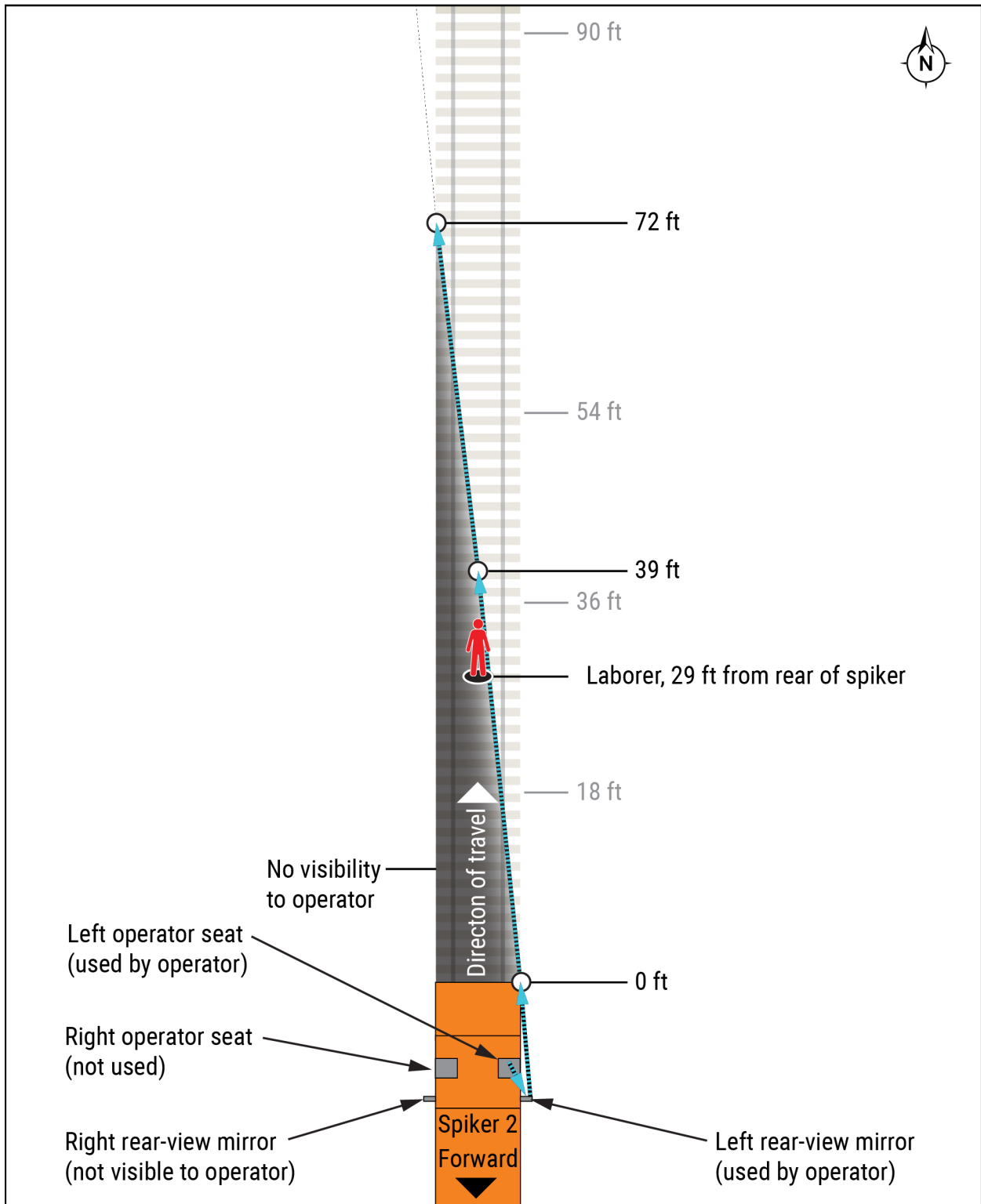
Table 1. Spiker 2 Visibility Observations

Track Position	First Visible	Fully Visible
Left (east)	0 feet	9 feet 6 inches
Middle	39 feet	43 feet 5 inches
Right (west)	72 feet	76 feet 6 inches

¹⁹ These observations are specific to the location and circumstances of the accident. Differences in visibility would be expected based on track geometry (e.g., tangent vs. degree of curvature), operator seat position, etc.



Spiker 2 Mirror - NTSB photograph that shows the left rear-view mirror of Spiker 2 from the perspective of the left operator seat.



Spiker 2 Visibility Diagram - NTSB diagram of view from Spiker 2 left rear-view mirror based on measurements from visibility observations with location of contract worker (a laborer) at start of accident sequence indicated.

6.0 Cell Phone Usage

NTSB reviewed the cell phone records for the Spiker 2 operator and the contract worker and determined that neither was using a phone near the time of the accident.

7.0 Medical

Under Federal Railroad Administration (FRA) regulation, maintenance-of-way employees, including maintenance-of-way contractor employees are subject to random and post-accident toxicological testing.²⁰ FRA minimum safety standards require qualification and certification programs for engineers²¹ and conductors,²² but not for maintenance-of-way employees. The qualification and certification programs required by FRA include vision and hearing criteria for affected employees. An NTSB medical factual report is available in the public docket.

²⁰ See Title 49 Subtitle B Chapter II Part 219 - Control of Alcohol and Drug Use. Note that the Norfolk Southern Spiker 2 operator and National Salvage contract worker were both maintenance-of-way employees. Maintenance-of-way refers to the maintenance, construction, and improvement of rail infrastructure, including tracks, ballast, grade, and lineside infrastructure such as signals and signs.

²¹ See Title 49 Subtitle B Chapter II Part 240 - Qualification and Certification of Locomotive Engineers

²² See Title 49 Subtitle B Chapter II Part 242 - Qualification and Certification of Conductors

E. CHIEF REVIEW

Submitted by:

Mike Hoepf, Ph.D.
System Safety Investigator

/s/ June 27, 2022

Approved by:

Bob Beaton, Ph.D., CPE
Chief, System Safety Division

/s/ June 27, 2022