



National Transportation Safety Board

Railroad Accident Brief

Southwestern Railroad Collision

Roswell, New Mexico

The Accident

On April 28, 2015, at 6:23 a.m. mountain daylight time, a westbound Southwestern Railroad (Southwestern) freight train with nine locomotives and 79 cars collided with Southwestern's Roswell Local standing freight train. The striking train traveled through a switch that was in the reverse position at the east end of Chisum siding just south of Roswell, New Mexico. The two crewmembers on the lead locomotive of the striking train jumped before impact. (See figure 1.) The engineer died, and the conductor was seriously injured. Nine locomotives derailed from the striking train. Two locomotives and three empty hopper cars derailed from the standing train. Southwestern, which owned both trains, estimated the damage at \$2.01 million. Sunrise was at 6:14 a.m.—9 minutes before the accident; visibility was 10 miles.

The crew of the standing train had secured their train on the Chisum siding and gone off duty at 6:00 a.m.; they were not in the area at the time of the accident. The conductor of the standing train later told a manager that he had failed to line the switch for normal main track movement at the Chisum siding.



Figure 1. Accident site. (Photo by New Mexico State Police.)

Standing Train

The crew of the Roswell Local standing train (LSWC-0021271) consisted of an engineer and a conductor.¹ They went on duty in Roswell on April 27, 2015, at 11:00 p.m., delivering and picking up cars from industry. After the crew completed the assigned duties, the conductor lined the switch in the reverse position and removed the derail device so the train could back into the siding.² When the train was in the siding, the crew secured it and went off duty without lining the switch for normal, main track movement. The engineer estimated that he was about 200 feet from the derail device when he stopped and applied the hand brakes on the two locomotives.

The conductor, who was in a highway vehicle, used his cell phone to call the train dispatcher and release the track warrant.³ The train dispatcher asked, “[Are] all switches lined for the main on track warrant Carl [Carlsbad] 21?” The conductor responded, “That is correct, yes.” Later, during the formal response to release the track warrant, the conductor said, “[A]ll report clear, in the clear; all switches lined for normal main line [track] movement.” The train dispatcher time-stamped this conversation completed at 4:40 a.m.; however, the conductor had not lined the switch for operations on the main track.

About 5:00 a.m., the conductor drove to the locomotives to pick up the engineer. Beside the locomotives was a fuel truck that was starting to fuel the engines. The conductor drove around the fuel truck and picked up the engineer, who was waiting on the side road parallel to the tracks. After getting into the vehicle, the engineer said he again asked if authority had been given up, and the conductor responded that it had been. Giving up the authority required that the conductor confirm the main track switches were in the proper positions and lined for main track movements. The conductor and the engineer drove to Roswell and went off duty at 6:00 a.m.

Striking Train

The engineer and the conductor of the striking train (MCLOCRL1-27A) went on duty April 27, 2015, at 8:30 p.m. in Clovis, New Mexico; their train was bound for Carlsbad, New Mexico.

According to event recorder data, the striking train approached the east switch at Chisum siding at 42 mph, and the engineer began emergency braking about 500 feet before reaching the switch. The train entered Chisum siding traveling about 40 mph and went 374 feet before striking the standing train at an impact speed of 32 mph. The heavier striking train shoved the standing train more than 195 feet. All nine locomotives on the striking train derailed, but the freight cars stayed on the track. The two locomotives and the first three cars of the standing train derailed. (See figure 2.)

¹ The *train engineer* is responsible for operating the train, while the *conductor* is responsible for the safe movement of the train.

² A *derail device* (often called a “derail”) is a track safety device designed to guide a car off the rails at a selected spot as a means of protection against collisions or other accidents. It is commonly used on spurs or sidings to prevent cars from fouling the main track.

³ The *track warrant* is a document the dispatcher issues to instruct the train’s crew about the limits of the train’s authorization on the main track.

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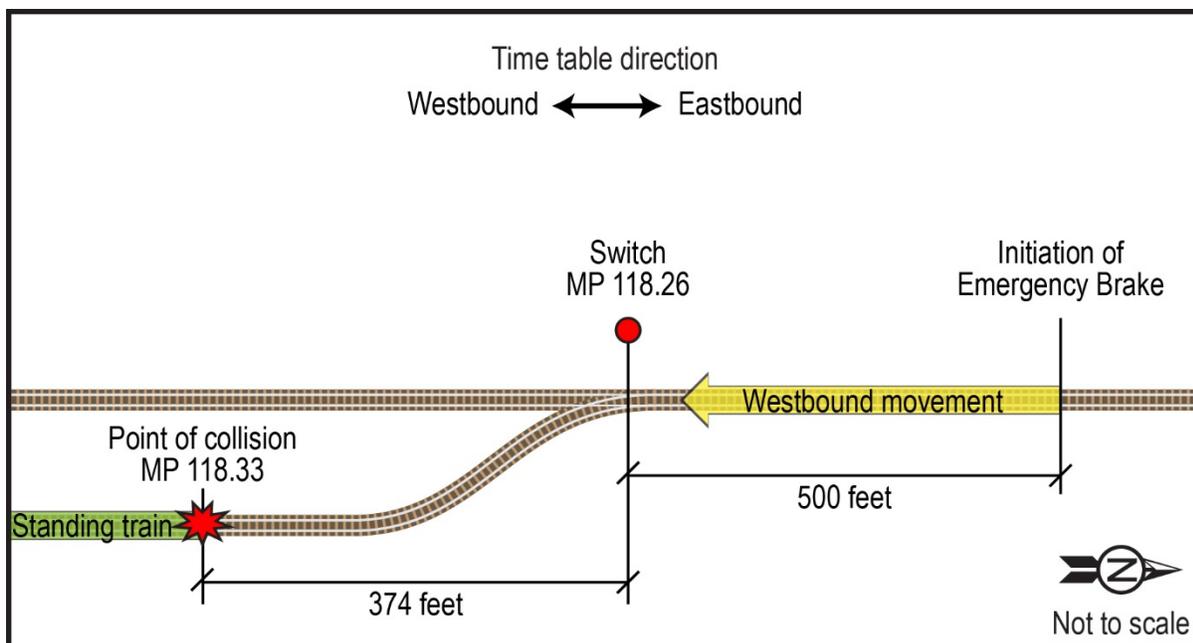


Figure 2. Diagram of accident site.

The conductor and the engineer jumped from the striking train before the collision. Emergency responders found the conductor on the left side of the train in the direction of travel with serious injuries; he was flown to a hospital in Amarillo, Texas. They found the engineer on the right side of the train; he died in the accident.

Method of Operations

Southwestern used track warrant authority in the operation of its trains. There were no wayside signals to govern or protect the train movements. Without the signals, strict compliance with the instructions within the track warrants and the associated operating rules provided the only protection between the trains. The operating rules defined this as nonsignaled territory, also called “dark territory.”

A train dispatcher issued track warrants to the crewmembers at their originating station or verbally over the radio while the train was en route. Track warrants provided authority for a train to occupy a main track and contained speed restrictions and other instructions. Crewmembers were required to release track warrants to the train dispatcher when a train cleared the defined limits of authority in the track warrant.

Southwestern’s Carlsbad subdivision consisted of a single main track between milepost 0.0 in Clovis and milepost 186 in Carlsbad. There were 11 sidings for meeting or passing other trains over the 186 miles. Freight traffic in the subdivision typically consisted of two through freight trains and two local freight trains each day, with an additional through freight train each week.

According to Southwestern’s track chart information, the track had no curves and a slight descending grade approaching the accident site.

Hand-Operated Switches

When securing a train on a siding track connected to the main track with a hand-operated switch, the *General Code of Operating Rules* requires crews to contact the train dispatcher when the switch is restored to position for main track movement and locked. The rules state:⁴

14.7 Reporting Clear of Limits

In non-signalized territory, comply with the requirements outlined in Rule 8.3 (Main Track Switches), and advise the train dispatcher:

When a hand-operated switch is used to clear the main track, except where Rule 6.13 (Yard Limits) or Rule 6.14 (Restricted Limits) are in effect, advise the train dispatcher of the position of the switch and that the switch is locked when reporting clear of track warrant limits. Train dispatcher shall repeat the reported switch position, and employee releasing the limits shall confirm to the train dispatcher this information is correct.

8.3 Main Track Switches

The main track switch may be left open ... [w]ithin TWC [track warrant control] territory when authorized by track warrant. Track warrant protection must be provided for this condition. The switch must not be considered restored to normal position until the train dispatcher is notified by an employee or train at that location.

According to postaccident interviews and the recorded transmission between the conductor of the standing train and the train dispatcher, the conductor announced that the main track switch had been returned to the normal position for main track operations after the standing train was clear of the main track on the siding track at Chisum siding.

Investigators examined the conditions at and around the east switch of Chisum siding. (See figure 3.) The switch at the east of the Chisum siding was lined and locked for the siding. The switch was under the striking train's derailed locomotives. After Southwestern cleared the derailed train, National Transportation Safety Board (NTSB) investigators performed a sight-distance observation at the same time of day as the accident using a similar locomotive. They observed the switch target from 2,239 feet away.

⁴ The Southwestern Railroad used the *General Code of Operating Rules*, seventh edition (effective April 1, 2010, and updated September 1, 2015) to instruct operating crews on policies and procedures.

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Figure 3. Investigator inspecting the switch stand and operating rod.

Equipment

The striking train (MCLOCRL1-27A) was 4,395 feet long and weighed 5,601 tons. It included nine locomotives and 79 mixed freight cars.

The standing train Roswell Local train (LSWC-0021271) consisted of two locomotives and 12 freight cars. Investigators examined all locomotives and railcars involved in the accident and found no deficiencies that would have contributed to the accident.

Personnel Information

Work/Rest History

Standing Train

The engineer had been awake for about 22 hours, and the conductor had been awake for almost 9 hours before they left the accident site.⁵ Both the engineer and the conductor had been on duty 7 hours.

Striking Train

At the time of the accident, the engineer had been on duty for 9 hours, 53 minutes.⁶ (See table.) The conductor had been on duty for about 9 hours, 48 minutes. Investigators could not obtain a detailed work/rest history for the crew of the striking train. The engineer of the striking

⁵ The engineer also said he rested for a while, but he did not say for how long.

⁶ With limbo time, the engineer's final release time was 7:00 p.m.

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train died in the accident. The conductor could not be interviewed because of the extent of his injuries.

Table. Periods of work and rest for the crew of the striking and standing trains. (Graphic by the NTSB)

Standing Train

Crewmember	Duty Status	April 24	April 25	April 26	April 27	April 28
engineer	rest	slept during night	slept during night	slept during night	awake: 8:00 a.m.	not available
engineer	work	off	on duty: 6:00 a.m. – 6:00 p.m.	off	on duty: 11:00 p.m.	off duty: 6:00 a.m.
conductor	rest	slept during night	slept during night	slept during night	awake: 6:30 a.m. nap: 8:00 p.m. – 9:30 p.m.	not available
conductor	work	off	on duty: 6:00 a.m. – 6:00 p.m.	off	on duty: 11:00 p.m.	off duty: 6:00 a.m.

Striking Train

Crewmember	Duty Status	April 24	April 25	April 26	April 27	April 28
engineer	rest	not available	not available	not available	not available	not available
engineer	work	on duty: 7:30 a.m. – 7:30 p.m.	on duty: 6:00 a.m. – 6:00 p.m.	on duty: 1:30 p.m.	off duty: 1:30 a.m. on duty: 8:30 p.m.	accident occurred at 6:23 a.m.
conductor	rest	not available	not available	not available	not available	not available
conductor	work	off	on duty: 9:30 a.m. – 9:30 p.m.	on duty: 4:00 p.m.	off duty: 4:00 a.m. on duty: 8:35 p.m.	accident occurred at 6:23 a.m.

Medical Factors – Toxicology

Standing Train - Crew

The engineer and the conductor tested negative for alcohol and other drugs.

Striking Train - Crew and Dispatcher

Specimens for toxicological testing were obtained from the conductor, the dispatcher on duty, and the deceased engineer. The dispatcher's US Department of Transportation (DOT)-mandated urine test results were negative for alcohol and tested-for drugs. The conductor's toxicology tests were requested by the NTSB and were positive for medications administered during his medical care and for oxycodone and its metabolite, oxymorphone, which were only present in urine. The engineer's toxicology tests identified significant levels of tetrahydrocannabinol (THC), the primary psychoactive chemical in marijuana. There were also levels of metabolites in his blood, urine, and tissues. The blood THC results ranged from 29.6 to 59 ng/mL, and varied based on the central or peripheral source of the blood tested. THC undergoes postmortem redistribution, which means that after death, blood levels can rise by two or three

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times as a result of the drug leaching back into tissues from storage sites in nearby organs.⁷ The presence of rolling papers and pipes in the locomotive cab suggests the engineer smoked rather than ingested the THC. The blood levels indicate the engineer had likely smoked marijuana between 30 minutes and 5 hours before the accident, and he may have had some degree of subjective effects from its psychoactive properties at the time of the accident.

However, the exact relationship between a person's blood or plasma THC concentration and its performance-impairing effects has been difficult to establish. The performance effects of marijuana vary. Following a dose of THC, infrequent users may feel "high", but perform faster on some performance tests than they do after using a placebo. In other cognitive tests, there is an increase in errors after THC use.⁸ Because metabolism changes with use, effects on daily users may be different in type and extent. Subjects experience feeling "high" quickly after beginning to smoke (or drink) THC and reach a maximum of feeling "high" after peak blood levels are reached. Thus, although it is likely the engineer was subjectively feeling "high" at the time, the operational evidence offers no indication of impairment: the train was operated below track speed, the train horn was sounded appropriately at prior highway-railroad grade crossings, and the train was placed into emergency braking prior to reaching the switch.

Therefore, it could not be determined if the THC in the engineer's system affected his response to the misaligned switch. Because the engineer had been on duty for almost 10 hours, he had likely used marijuana while on duty and had operated the train while under its influence.

Southwestern was concerned about whether the use of marijuana (or other illegal substances) was widespread. The company worked with the Federal Railroad Administration (FRA) to create a new toxicological testing program. On April 4, 2016, Southwestern stopped operations systemwide so all employees could attend a training class on the new drug and alcohol policy. The new policy required all employees—including supervisors—to provide urine samples for testing without prior notice. On the day of the class, 98 employees were asked to provide samples for testing. Five refused and were dismissed from employment; two more tested positive and were also dismissed.

The evidence collected in this accident investigation indicates that a member of the train crew was under the influence of marijuana. However, because the FRA has not required and Southwestern did not adopt inward-facing cameras for freight locomotives, the NTSB was unable to determine the actions of the crewmembers while operating the train, or even which crewmember was operating the train just prior to the accident.

The NTSB had similar issues when investigating the September 12, 2008, accident in Chatsworth, California. The NTSB was unable to determine the actions of the Metrolink engineer leading up to the collision and after discovering some illicit activities by the engineer during

⁷ N.P. Lemos and E.A. Ingle, "Cannabinoids in Postmortem Toxicology," *Journal of Analytical Toxicology* Vol. 35 (2011): 394-401.

⁸ H.V. Curran, C. Brignell, S. Fletcher, P. Middleton, and J. Henry, "Cognitive and subjective dose-response effects of acute oral Delta 9-tetrahydrocannabinol (THC) in infrequent cannabis users," *Psychopharmacology (Berl)* 164, no. 1 (2002): 61-70.

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previous trips, the NTSB realized that the railroad had no way of monitoring the engineer's activities to ensure appropriate behaviors.

This accident, in which 25 people were killed and 102 people were injured, underscored the importance of understanding the activities of crewmembers in the time leading up to the accident.⁹ As a result of that investigation, the NTSB made the following safety recommendations to the FRA:

Require the installation, in all controlling locomotive cabs and cab car operating compartments, of crash- and fire-protected inward- and outward-facing audio and image recorders capable of providing recordings to verify that train crew actions are in accordance with rules and procedures that are essential to safety as well as train conditions. The devices should have a minimum 12-hour continuous recording capability with recordings that are easily accessible for review, with appropriate limitations on public release, for the investigation of accidents or for use by management in carrying out efficiency testing and systemwide performance monitoring programs. (R-10-1)

Require that railroads regularly review and use in-cab audio and image recordings (with appropriate limitations on public release), in conjunction with other performance data, to verify that train crew actions are in accordance with rules and procedures that are essential to safety. (R-10-2)

The NTSB reiterated these recommendations following the May 12, 2015, derailment of a National Railroad Passenger Corporation (Amtrak) passenger train in Philadelphia, Pennsylvania, in which 8 passengers died and over 200 passengers were injured.¹⁰ At the time, the FRA said that it had begun the process of issuing a notice of proposed rulemaking mandating the installation of inward- and outward-facing recording devices in the controlling locomotive cab and cab car operating compartments. As a result of FRA's response, the NTSB classified Safety Recommendations R-10-1 and R-10-2 *Open—Acceptable Response*.

The NTSB believes that inward- and outward-facing audio and image recorders improve the quality of accident investigations and provide the opportunity for proactive steps by railroad management and the FRA to improve operational safety. Therefore, the NTSB reiterates Safety Recommendation R-10-1 and Safety Recommendation R-10-2 to the FRA.¹¹

The conductor was seriously injured when he jumped from the train. Postaccident toxicology tests performed after he received extensive emergency medical care showed various pain medications in his system; according to the medical records, most of these had been administered before the specimens were obtained. However, oxycodone and its metabolite,

⁹ National Transportation Safety Board, *Collision of Metrolink Train 111 With Union Pacific Train LOF65-12, Chatsworth, California, September 12, 2008*, [RAR-10/01](#) (Washington, DC: National Transportation Safety Board, 2010).

¹⁰ National Transportation Safety Board, *Derailment of Amtrak Passenger Train 188, Philadelphia, Pennsylvania, May 12, 2015*, [RAR-16/02](#) (Washington, DC: National Transportation Safety Board, 2016).

¹¹ At the time of the accident, Southwestern had a lease with the BNSF Railway Company to operate trains and maintain the track from Clovis, New Mexico, to Carlsbad, New Mexico. However, since then, BNSF has terminated the lease and currently operates this track with its own personnel and equipment.

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oxycodone, were present in the conductor's urine and had not been administered after the accident. Oxycodone is a Schedule II controlled substance available by prescription as an opioid analgesic and has potential impairing effects.¹² However, it was no longer present in the conductor's blood about 5 hours after the accident. Urine elimination of drugs is affected by the individual's metabolism of the drug itself, hydration status, and renal function. Drugs may be found in urine days after use and long after any impairing effects of the drug have worn off. As a result, the time when the conductor had last used the drug could not be determined. Given that the half-life of oxycodone is 4-6 hours and it was undetectable in his blood 5 hours after the accident, it is most likely that the conductor was not impaired by his use of this drug at the time of this accident.¹³

Operational Factors: Training, Certification, Discipline History

According to Southwestern's records, all four operating employees were trained, possessed current certifications, and did not have any disciplinary actions on their records.¹⁴

Personal Electronic Devices

Investigators examined cell phone records for all four crewmembers. The engineer and the conductor on the standing train had some activity, but the time and purpose coincided with acceptable usage while on duty.¹⁵ There was no text or voice activity during the time the main track switch should have been lined back for the main track.

The records for the deceased engineer and the injured conductor of the striking train showed there were no outgoing calls while they were on duty. Incoming calls went to voicemail.

Southwestern Railroad Managerial Oversight

Operational Testing

Title 49 *Code of Federal Regulations (CFR)* Part 217 contains specific requirements for the observation and testing of operating employees while performing duties. Southwestern maintained an operational testing/observation program to monitor the performance of employees operating trains and their compliance with railroad rules and federal laws.

The railroad's supervisors recorded more than 560 observations of employees in the Carlsbad Division in the 6 months before the accident, including whether employees had passed the tasks under observation. There were 56 entries documenting that an employee failed to perform a task according to a written procedure. These failures ranged from not using the proper radio

¹² National Institutes of Health, US National Library of Medicine, *Daily Med*, "[Oxycodone capsules](#)", accessed June 13, 2017.

¹³ Federal Aviation Administration, *Forensic Toxicology Drug Information*: "[Oxycodone](#)", accessed June 15, 2017.

¹⁴ Title 49 *Code of Federal Regulations (CFR)* Part 240 "Qualification and Certification of Locomotive Engineers" defines the requirements for engineer certification, and Title 49 *CFR* Part 242 "Qualification and Certification of Conductors" defines the requirements for conductor certification.

¹⁵ Both the FRA regulations (49 *CFR* Part 220, Subpart C) and Southwestern's operating rules allow limited use of cell phones while following certain requirements.

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procedure to not sounding the horn for a highway-rail grade crossing. Employees passed all 34 observations for drug and alcohol.¹⁶ There were no recorded observations for “main track switch verifications.”

Standing Train – Engineer

There was no record of a supervisor observing the engineer in the 6 months before the accident.

Standing Train – Conductor

A supervisor observed the conductor of the standing train once during the previous 6 months. The conductor was cited for failing to perform crew responsibilities on February 10, 2015. This stemmed from a problem with another engineer who failed to sound the horn for highway-rail grade crossings. The observing supervisor noted that the conductor shared in the responsibility because the conductor failed to correct the engineer for noncompliance.

Striking Train – Engineer

There was no record of a supervisor observing the engineer in the 6 months before the accident.

Striking Train – Conductor

A supervisor observed the conductor’s fitness for duty on January 30, 2015. This included the supervisor evaluating whether the employee was under the influence of alcohol or other drugs. The supervisor noted that he was fit for duty.

Errors of Omission

On the day of the accident, just after 8:00 a.m., the conductor of the standing train told a manager that he failed to line the switch at the accident site. Specifically, the conductor mentioned a fuel truck and said, “Maybe that was what distracted me. I know we gave our warrant back and told them that we lined the switches back but we didn’t.”¹⁷

Based on this statement and the available evidence, it is evident the conductor erred as he and the engineer left the Chisum siding. James Reason, an expert who studies the nature of errors, has characterized omissions as a “particularly worthwhile target since the failure to carry out necessary steps in the performance of a task is probably the single most common human error type.”¹⁸

¹⁶ The supervisors had received training on detecting the signs of drug and alcohol use by individuals, including smelling the employee’s breath and observing the appearance of the employee’s eyes.

¹⁷ The postaccident statement from the Southwestern Railroad vice president of operations may be found in the docket.

¹⁸ J. Reason, “How necessary steps in a task get omitted: revising old ideas to combat a persistent problem,” *Cognitive Technology*, 3 (January 2015):24–32.

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In a paper, Reason discusses the nature of omissions and how they occur. He identifies a number of task properties that are likely to increase the probability that a particular step will be omitted. Some of the more important of these features are:¹⁹

- The greater the informational loading of a particular task step—that is, the higher the demands imposed upon short-term memory—the more likely it is that items within that step will be omitted.²⁰
- Procedural steps that are functionally isolated—that is, those that are not obviously cued by preceding actions nor followed in a direct linear succession from them—are more likely to be left out.
- Recursive or repeated procedural steps are particularly prone to omission. In the case where two similar steps are required to achieve a particular goal, it is the second of these two steps that is most likely to be neglected.²¹
- Necessary steps that follow the achievement of the main goal of a task are likely to be omitted. This is an instance of a general principle: steps located near the end of a task sequence are more prone to omission. Such “premature exits” are due in part to the actor’s preoccupation with the next task, particularly when the current activity involves largely routine actions.²²
- Steps in which the item to be acted upon is concealed or lacking in conspicuity are liable to omission.
- Steps following unexpected interruptions are especially prone to omission. This can occur because the person loses her place in the action sequence and believes herself to be further along than she actually is, or because some unrelated action is unconsciously “counted in” as part of the task sequence.²³
- Tasks that involve planned departures from standard operating procedures or from habitual action sequences are liable to strong habit intrusions in which the currently intended actions are supplanted by a more frequently used routine in that context, and thus omitted.
- Actions that are triggered by weak, noisy, or ambiguous signals are likely to be omitted.

¹⁹ J. Reason, “Combating omission errors through task analysis and good reminders,” *Quality and Safety in Health Care* 11, no. 1 (March 2002):40-44.

²⁰ D.A. Norman, *The psychology of everyday things*. (New York: Basic Books, 1988).

²¹ C. Baber and N.A. Stanton, “Task analysis for error identification: a methodology for designing error-tolerant consumer products,” *Ergonomics* 37, no. 11 (2007):1923–1941.

²² J. Reason, *Human Error* (Cambridge: Cambridge University Press, 1990).

²³ J. Reason, *Human Error* (Cambridge, UK: Cambridge University Press, 1990).

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It is evident that several of Reason's task properties were manifested in the context of events that ultimately resulted in the conductor's failure to line the switch at the Chisum siding. Several of these are discussed below.

Steps following unexpected interruptions are especially prone to omission

This can occur because people lose their place in the action sequence and believe themselves to be further along than they actually are, or because some unrelated action is unconsciously counted as part of the task sequence.²⁴ The conductor recalled that about 4:30 a.m. he "got us [their train] in the clear" and that a fuel truck arrived in the area. He spoke with the truck's driver and removed the end-of-train device from the train; he and the engineer eventually left the area.²⁵

The arrival of the truck and the discussion with the truck driver were unexpected interruptions. This likely caused the conductor to lose his place in the sequence of steps required to complete his work successfully; at least two of the steps he had already accomplished by getting in the clear and removing the end-of-train device. A step that likely was "counted in" but was not performed was returning the switch to the lined position. The conductor was interrupted by the discussion with the fuel truck driver, and this likely contributed to his failure to line the main track switch.

Necessary steps that follow achievement of the main goal of a task are likely to be omitted

After the interruption with the fuel truck, the conductor called the train dispatcher, released the track warrant, and stated that the switches had been restored to their proper position at 4:40 a.m. By stating to the dispatcher that the task had been completed, the conductor acted on his belief that it had already been performed. Further, this communication with the train dispatcher not only interrupted the steps, but it also completed what would have normally been the final step. For these reasons, it would have been even less likely that the conductor would have returned to the omitted step.

This is an instance of a general principle: steps located near the end of a task sequence are more prone to omission. Such "premature exits" are due, in part, to the actor's preoccupation with the next task—particularly when the current activity involves largely routine actions.²⁶ Once the conductor believed he had completed the final goal (releasing the track warrant), his attention was directed to the next activity. The conductor said, "I just felt kind of tired driving," and he wanted to finish driving. He had evidently moved on to the next activity of leaving Chisum siding and going off duty. Consequently, lining the switch was omitted, and the conductor prematurely released the track warrant authority before lining the main track switch to its normal position. Therefore, the NTSB recommends that the FRA require railroads to develop a device or technique

²⁴ J. Reason, *Human Error*, (Cambridge, UK: Cambridge University Press, 1990).

²⁵ An *end-of-train device* is an electronic device mounted on the end of a freight train in lieu of a caboose. It transmits a radio message to the lead locomotive showing train line air pressure at the rear of the train and indicates when the rear of the train is in motion.

²⁶ J. Reason, *Human Error*, (Cambridge, UK: Cambridge University Press, 1990).

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to eliminate the possibility of employees failing to perform critical tasks such as lining a switch, lining a derail, or ensuring cars are in the clear.

Steps in which the item to be acted upon is concealed or lacking conspicuity are liable to omission

The investigation revealed that the switch banner located at the switch was a rectangular, nonilluminated red banner designed to indicate only two positions as a function of the actual switch position. When the conductor spoke with the truck driver about 4:30 a.m., it was dark outside. Because the banner was not conspicuous in the dark or just before dawn when the crew departed the area, it did not attract their attention and went undetected.

Fatigue

The conductor said he was tired while driving away from the work site, but had no difficulty staying awake during his shift. Further evidence indicates that the conductor confirmed to the engineer that he had “given up” the track authority, suggesting that, at the time, the conductor thought he had lined the switch to the main track.

NTSB has investigated many accidents across transportation modes where fatigue has caused or facilitated individuals to disengage from tasks, make mistakes in judgments and actions, and lose awareness of work contexts and demands. In essence, a fatigued operator can fail to perform a task. In this accident, investigators identified that the conductor committed an error of omission, along with indications that he felt tired at the end of his work shift. The conductor’s failure to realign the switch and his subsequent misrepresentation of his work is consistent with fatigue-induced behavior. Therefore, NTSB believes that the conductor’s error of omission was facilitated by fatigue.

Previous NTSB Recommendations

The NTSB has investigated multiple accidents in which crewmembers failed to line the switches properly. This accident is another example of crewmembers failing to line main track switches after completing a shift and leaving the work site. Following the January 6, 2005, accident at Graniteville, South Carolina, the NTSB made the following safety recommendation to the FRA:²⁷

Require that, along main lines in non-signaled territory, railroads install an automatically activated device, independent of the switch banner, that will, visually or electronically, compellingly capture the attention of employees involved with switch operations and clearly convey the status of the switch both in daylight and in darkness. (R-05-14)

²⁷ National Transportation Safety Board, *Collision of Norfolk Southern Freight Train 192 with Standing Norfolk Southern Local Train P22 with Subsequent Hazardous Materials Release, Graniteville, South Carolina, January 6, 2005*, [RAR-05/04](#) (Washington, DC: NTSB, 2004).

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After completing the Bettendorf, Iowa, accident investigation, the NTSB revisited the hazard of manually operated switches in nonsignaled territory. The NTSB issued the following recommendation to the FRA:²⁸

Require railroads to install, along main lines in non-signaled territory not equipped with positive train control, appropriate technology that warns approaching trains of incorrectly lined main track switches sufficiently in advance to permit stopping.
(R-12-27)

Safety Recommendation R-05-14 from the Graniteville accident was reclassified from *Open—Acceptable Alternate Response* to *Closed—Superseded* by Safety Recommendation R-12-27. This safety recommendation was designed to provide an additional layer of protection to prevent accidents due to single-point failures.

The FRA responded in a December 28, 2012, letter to the Bettendorf safety recommendation, stating, in part, “The preliminary cost-benefit analysis conducted related to this recommendation shows that rulemakings cannot be justified as having benefits outweighing cost.”

The NTSB replied on April 18, 2013, “... we urge the FRA to consider an appropriate alternate means of warning approaching trains of incorrectly lined main track switches.” Pending completion of a plan for doing this, Safety Recommendation R-12-27 was classified *Open—Unacceptable Response*.

The most recent correspondence from the FRA on this matter was on March 11, 2015. The FRA requested that the recommendation be classified *Open—Acceptable Alternate Response* with the following justification:

Several members of the Dark Territory Working Group, also involved with FRA’s System Safety Program rulemaking under Section 103 of the Rail Safety Improvement Act of 2008 (RSIA), determined the Dark Territory Working Group’s draft document was similar to the technology safety plan component of the System Safety Program rulemaking. Therefore, FRA recessed the Dark Territory Working Group until FRA’s Risk Reduction Program (similar to the System Safety Program rulemaking but applies to freight rail) and System Safety Program (applies to passenger rail) rulemakings are completed because their outcome may impact the Dark Territory Working Group’s recommendations. At that time, FRA will determine if the rulemakings sufficiently respond to these recommendations or if the working group needs to reconvene to address remaining issues.

Since March 11, 2015, the FRA has not issued the risk reduction rulemaking, and unprotected switches in nonsignaled territory still pose a hazard. The current response to the NTSB’s previous recommendations appears to have stagnated. The NTSB still considers the status of this recommendation to be *Open—Unacceptable Response*. Therefore, the NTSB reiterates Safety Recommendation R-12-27.

²⁸ National Transportation Safety Board, *Collision of Dakota, Minnesota & Eastern Railroad Freight Train and 19 Stationary Railcars in Bettendorf, Iowa, July 14, 2009*, [RAB-12/03](#) (Washington, DC: NTSB, 2012).

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was that the conductor of the Roswell Local train failed to return the switch for main track movement because he was fatigued. Contributing to the accident was that the striking train crew did not perceive the misaligned switch in non-signaled territory in time to avoid the collision.

Recommendations

New Recommendation

As a result of its investigation, the National Transportation Safety Board makes the following new safety recommendation:

To the Federal Railroad Administration:

Require railroads to develop a device or technique to eliminate the possibility of employees failing to perform critical tasks such as lining a switch, lining a derail, or ensuring cars are in the clear. (R-18-10)

Recommendations Reiterated in this Report

As a result of this accident investigation, the National Transportation Safety Board reiterates the following safety recommendations:

To the Federal Railroad Administration:

Require the installation, in all controlling locomotive cabs and cab car operating compartments of crash- and fire-protected inward- and outward-facing audio and image recorders capable of providing recordings to verify that train crew actions are in accordance with rules and procedures that are essential to safety as well as train operating conditions. The devices should have a minimum 12-hour continuous recording capability with recordings that are easily accessible for review, with appropriate limitations on public release, for the investigation of accidents or for use by management in carrying out efficiency testing and systemwide performance monitoring programs. (R-10-1)

Require that railroads regularly review and use in-cab audio and image recordings (with appropriate limitations on public release), in conjunction with other performance data, to verify that train crew actions are in accordance with rules and procedures that are essential to safety. (R-10-2)

Require railroads to install, along main lines in non-signaled territory not equipped with positive train control, appropriate technology that warns approaching trains of incorrectly lined main track switches sufficiently in advance to permit stopping. (R-12-27)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

ROBERT L. SUMWALT, III
Chairman

EARL F. WEENER
Member

T. BELLA DINH-ZARR
Member

Adopted: April 19, 2018

Board Member Statement

Member Earl F. Weener filed the following concurring statement on April 17, 2018. Chairman Robert L. Sumwalt, III, and Member T. Bella Dinh-Zarr joined in this statement.

I generally concur with the findings and recommendations contained in this report, but I am troubled by certain aspects of this accident that remain unexplained and some larger implications that the facts and circumstances of the events suggest. Three points, made clear at the Board Meeting, compel me to offer my opinion. First, the triggering event of this collision is a long-term, well-known hazard to this Board and one that has been the subject of National Transportation Safety Board (NTSB) recommendations which have not been adopted by the Federal Railroad Administration (FRA). Second, the drug use of rail employees in safety-sensitive positions already subject to random screens pursuant to US Department of Transportation (DOT) regulations, while alarming, is neither a new problem nor one that looks to be improving. Third, the standing train crew's failure to line the switch correctly need not have resulted in a fatality.

The NTSB has investigated numerous accidents involving incorrectly lined switches. I am concerned that history seems to be repeating. In 2005, the NTSB issued a report (RAR-05/04) regarding its investigation of a Graniteville, South Carolina, derailment that occurred due to the same kind of switch problem we saw in this accident. That report discussed historical accidents and issued recommendations to the FRA, R-05-14 (Closed and Superseded by R-12-27) and R-05-15, intended to create opportunities for approaching trains to detect and react to a switch that was not lined properly by a prior crew. Unfortunately, the FRA has not adopted either of these recommendations. Had either recommendation been accomplished, crews approaching incorrectly lined switches would have a better chance to avoid a collision.

The ability of a crew to react to a sudden emergency, however, depends on their ability to perceive danger and react swiftly and appropriately. Use of impairing substances can prevent the clarity necessary to make good decisions. In 1987, 16 people were killed in a train collision near Baltimore. The NTSB determined marijuana impairment was causal. Subsequent changes to transportation related drug policies were an improvement, however, almost 30 years later we have not eliminated this danger. Multiple recent NTSB investigations and remarks made by FRA officials during recent public appearances make it clear to me that drug use remains a problem in the rail industry. The striking engineer was subject to mandated DOT drug screens, but the current

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policies were not enough to prevent his illicit drug use. The engineer not only carried significant amounts of marijuana and paraphernalia into the cab of the locomotive, his toxicology tests showed amounts of tetrahydrocannabinol (THC) levels consistent with some degree of impairment and indicated that he had been using marijuana on duty, possibly while operating the train. Crew performance before and during the crash were central issues to this investigation, and we do not know to what extent drug impairment may have played a role. Inward-facing cameras could have provided valuable information, more importantly, the presence of the cameras might have deterred unsafe behavior and improved crew performance.

Cameras may also have helped better explain what I approximate was a 28- to 29-second delay between the time the banner on the switch was first visible, at 2,239 feet away, to the time the emergency brakes were activated, 500 feet from the switch. There was sufficient distance to stop the train and avoid the collision. Staff offered the explanation that crew expectations that the switch would be positioned correctly resulted in a lack of heightened vigilance and a slower reaction time. This explanation is troubling. We do not yet have fully automated trains because, to my knowledge, no computer can replace an experienced operator's ability to handle unusual or emergent situations. Our recent rail investigations in Chester, Pennsylvania, and Cimarron, Kansas, showed me the benefits of engineer vigilance and how it allows for swift reactions. The report does not indicate how often engineers in nonsignaled territory approach switches, but it seems possible to provide training advising engineers to be alert for potential human error and encouraging them to maintain special visual vigilance while approaching switches.

Finally, it is important to consider that had the engineer chosen to stay in the locomotive, which had enhanced crashworthiness, he would have survived the collision. I was surprised to learn that a crew facing an imminent crash is forced to guess whether they should stay with or jump from the train. While I agree with staff that every accident is different, I reject the idea that careful consideration of historical accidents would provide no useful data that could help to inform the choice of a crew faced with this life or death decision. Also, it seems crews should be made aware of any special crashworthiness of their equipment because this too could help them make the right choice. I hope that this important issue can be addressed in the future to provide crews the best information possible to help them survive collisions.

Humans will always be prone to error, and multiple modes of transportation have benefited from technological safeguards to detect mistakes before tragedy occurs. Advance warning is the best tool we can offer train crews faced with imminent collisions. President Trump has prioritized addressing the opioid epidemic and multiple states have decriminalized marijuana use, so railroads should be very aware of the importance of educating their employees about the dangers of drug use and committed to adopting effective drug policies. Rail transport is vital to the traveling public and critical to national commerce. We know the issues and have identified solutions. I remain convinced that collisions like this are entirely avoidable and hope that it does not take another 30 years to make the changes needed to prevent further loss of life.

For more details about this accident, visit the [NTSB investigations page](#), and search for NTSB accident identification number **DCA15MR008**.

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The NTSB has authority to investigate and establish the facts, circumstances, and cause or probable cause of a railroad accident in which there is a fatality or substantial property damage. (49 *United States Code* Section 1131(a)(1)(C) - *General authority*).

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” Title 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code* Section 1154(b).
