4910-06-P

U.S. DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

Safety Advisory 2023-03; Accident Mitigation and Train Length

AGENCY: Federal Railroad Administration (FRA), U.S. Department of Transportation (DOT).

ACTION: Notice of Safety Advisory.

SUMMARY: Freight train length has increased in recent years, and while research is ongoing related to operational aspects of long trains, including brake system performance, it is known that the in-train forces longer trains experience are generally stronger and more complex than those in shorter train consists. FRA is issuing this Safety Advisory to ensure railroads and railroad employees are aware of the potential complexities associated with operating longer trains and to ensure they take appropriate measures to address those complexities to ensure the safe operation of such trains. Among other things, this Safety Advisory recommends that railroads review their operating rules and existing locomotive engineer certification programs to address operational complexities of train length, take appropriate action to prevent the loss of communications between end-of-train devices, and mitigate the impacts of long trains on blocked crossings.

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Disclaimer: This Safety Advisory is considered guidance pursuant to DOT Order 2100.6A (June 7, 2021). Except when referencing laws, regulations, policies, or orders, the information in this Safety Advisory does not have the force and effect of law and is not binding in any way. This document does not review or replace any previously issued guidance.

SUPPLEMENTARY INFORMATION:

I. Background

Freight-train length, particularly for Class I railroads, has increased in recent years.[1] The operation of longer trains presents different, more complex, operational challenges, which can be exacerbated by the weight and makeup of the trains.[2] Accordingly, FRA's Office of Research, Development, and Technology is currently studying the air brake system performance and resulting train dynamics of trains comprised of up to 200 cars.[3] Additionally, in response to the mandate of Section 22422 of the Infrastructure Investment and Jobs Act,[4] the National Academies of Sciences, Engineering and Medicine (NAS) is conducting a study of the impacts of trains longer than 7,500 feet.[5] The estimate to complete both FRA and NAS's studies is 2024.

While this research is ongoing, FRA is issuing this Safety Advisory to ensure railroads and railroad employees are aware of the potential complexities involved in the

[1] *See* GAO's May 2019 report titled RAIL SAFETY: Freight Trains Are Getting Longer, and Additional Information is Needed to Assess Their Impact, GAO-19-443 (available at https://www.gao.gov/assets/gao-19-443.pdf).
[2] *See* FRA Safety Advisory 2023-02, *Train Makeup and Operational Safety Concerns*, for a discussion of how train makeup affects safety. FRA Safety Advisory 2023-02 is available at: https://www.federalregister.gov/documents/2023/04/11/2023-07579/safety-advisory-2023-02-train-makeup-and-operational-safety-concerns.
[3] *See* https://railroads.dot.gov/sites/fra.dot.gov/files/2022-12/2023_RDT_CurrentProjects_complete_FINAL.pdf.
[4] Pub. L. 117-58 (Nov. 15, 2021).
[5] *See* NAS https://www.nationalacademies.org/our-work/impacts-of-trains-longer-than-7500-feet.

operation of longer trains, and appropriate actions are taken to address these complexities. This Safety Advisory also makes clear that train length is a critical factor to consider when building any train, just as consideration of a consist's configuration is critical, as outlined in FRA Safety Advisory 2023-02.[6]

FRA has identified three significant incidents (discussed below) that have occurred since 2022 involving trains with more than 200 cars, where train handling and train makeup is believed to have caused, or contributed to, the incidents. These incidents (which occurred in Springfield, Ohio; Ravenna, Ohio; and Rockwell, Iowa) involved trains that were 12,250 feet or longer and weighed over 17,000 trailing tons. FRA believes these incidents demonstrate the need for railroads and railroad employees to be particularly mindful of the complexities of operating longer trains, which include, but are not limited to: (1) train makeup and handling; (2) railroad braking and train handling rules, policies, and procedures; (3) protecting against the loss of end-of-train (EOT) device communications; and (4) where applicable, protecting against the loss of radio communications among crew members. These technical complexities make it critical that employees assigned to operate longer trains are adequately trained and qualified for the most demanding service for which they can be called. Additionally, these technical complexities make it necessary to ensure that a railroad's operational testing program adequately assesses and evaluates whether employees are appropriately equipped and demonstrate the capability to fully address those complexities in real world operating scenarios.

Springfield, Ohio – March 4, 2023

[6] https://www.federalregister.gov/documents/2023/04/11/2023-07579/safety-advisory-2023-02-train-makeup-and-operational-safety-concerns.

On March 4, 2023, at approximately 4:54 p.m. a Norfolk Southern Railway (NS) 210-car, mixed-freight train totaling 13,470 feet and 17,966 trailing tons with distributed power units (DPUs) experienced a derailment involving 28 cars, including 21 empty and 7 loaded cars in Springfield, Ohio. The train had 82 cars equipped with end-of-car cushioning devices, and 18 of those derailed. The train consisted of three head-end locomotives and two mid-train DPUs, with one head-end locomotive offline. The train was traveling on an ascending 0.6% grade with the heavier part of the consist (the back end) on a 0.7% downhill grade. The weight was mostly concentrated at the head and rear ends of the train. During the incident, dynamic braking was applied only to the head-end locomotive consist, while the DPUs were idle, making the train function like a conventional train. The derailment happened at the sag between ascending and descending grades, with short, empty rail cars designed to ship coiled steel being the first to derail. Buff forces peaked as the downhill portion of the train ran-in, causing the derailment of cars 70 through 72 (the short coil cars) and the subsequent pile-up. The train was classified as a key train,[7] with 28 loaded hazardous materials (hazmat) cars distributed throughout. No hazmat cars derailed. FRA's investigation into this incident is currently ongoing, but preliminary indications show excessive buff force due to train makeup and train handling are the primary causes of the incident.

Ravenna, Ohio – November 1, 2022

[7] As defined by Association of American Railroads (AAR) Circular OT-55, available at https://public.railinc.com/sites/default/files/documents/OT-55.pdf, a "Key Train" is any train with: (1) One tank car load of Poison or Toxic Inhalation Hazard (PIH or TIH) (Hazard Zone A, B, C, or D), anhydrous ammonia (UN1005), or ammonia solutions (UN3318); (2) 20 car loads or intermodal portable tank loads of any combination of hazardous material; or (3) One or more car loads of Spent Nuclear Fuel (SNF), High Level Radioactive Waste (HLRW).

On November 1, 2022, at approximately 7:04 p.m., a NS 238-car, mixed-freight train totaling 15,657 feet and 24,538 trailing tons with DPUs experienced a derailment involving 22 cars, in Ravenna, Ohio. The train included 188 loads and 50 empties, and was powered by two head-end locomotives and two mid-train DPUs. The incident occurred on the NS Keystone Subdivision main track. The derailment happened during an undesired emergency air brake application, the cause of which is still under investigation. The train was designated as a key train, and 2 of the 63 hazmat cars derailed, in addition to 20 other cars. In the consist, 56 cars were equipped with end-of-car cushioning devices. The train was initially operating with the energy management system engaged, but reverted to manual operation prior to the derailment. The railroad reported the cause of the incident as buffing or excessive slack action due to train makeup, but FRA's investigation is ongoing.

Rockwell, Iowa – March 24, 2022

On March 24, 2022, at approximately 1:59 a.m., a southbound Union Pacific Railroad (UP) train totaling 12,250 feet long and 23,315 trailing tons experienced a derailment of 37 cars in Rockwell, Iowa. The train was traveling at a speed of 46 miles per hour at the time of the incident. The train consisted of two head-end locomotives, one mid-train DPU, one rear DPU, and a total of 204 cars consisting of 169 loads and 35 empties. At the time of the incident, the energy management system was engaged, the train's head-end was ascending with the rear portion descending, causing the slack to run in, leading to compression at the middle of the train. This incident is still under investigation and the analysis of in-train forces is ongoing, but preliminary indications are that the primary cause of the incident was buffing or excessive slack action due to train makeup.

II. The Complexities of Operating Longer Trains

As noted above, the operation of longer trains involves technical challenges pertaining to (1) train makeup and handling; (2) railroad braking and train handling rules, policies, and procedures; (3) protecting against the loss of EOT device communications; and (4) where applicable, protecting against the loss of radio communication among crew members.

Train Makeup and Handling

FRA notes that recently issued Safety Advisory 2023-02 addresses train makeup and accompanying operational safety concerns. FRA reiterates the recommendations in that Safety Advisory as applied to longer trains.

Railroad Braking and Train Handling Rules, Policies, and Procedures

Air brake and train handling (ABTH) rules are the basis for the safe operation of any train, but as noted above, longer trains may pose unique challenges that must be comprehensively addressed in railroads' ABTH rules. ABTH rules are developed from experience and are based on factors such as the designs and types of rolling equipment in a consist, whether the equipment is loaded or empty, and the placement of that equipment in a train's consist. FRA recognizes that railroads regularly update their ABTH rules, but FRA is concerned that some railroads' ABTH rules do not sufficiently address issues related to train length such as, but not limited to:

- The maximum number of powered axles in stretch (powered) and dynamic braking;
- Train consist comprised of long-short car combinations;
- The placement of loaded and empty cars within a train consist;
- End-of-car cushioning devices;

- Air brakes;
- The use of distributed power, if equipped;
- Operating over grades and through curves;
- Cold weather operations; and
- Train automatic operation (energy management systems), including transfer from automatic to manual operating scenarios.

Accordingly, this Safety Advisory recommends that railroads review their existing ABTH rules and update those rules as necessary to ensure they comprehensively address the complexities associated with train length in the railroad's operations.

Protecting Against the Loss of EOT Device Communications

Railroads have used EOT devices for years to monitor brake pipe pressure at the rear of the train. More recently, the functionality of these devices has expanded to assist in emergency braking. Two-way EOT device systems are comprised of a rear-of-train unit (rear unit) located on the last car of a train and a front-of-train unit (front unit) located in the cab of the locomotive controlling the train. An EOT system is linked by radio signals that will automatically transmit an emergency brake signal from the controlling locomotive to the rear of the train when an emergency brake application is initiated. The system additionally allows for the engineer in the controlling locomotive to manually activate a switch which sends a radio signal to the rear unit EOT device that is tied into the air brake system, opens an internal valve, and initiates an emergency brake application.

Due to the distance EOT device signals must travel on longer trains, the greater the risk that signal communications may be lost between the front and rear units. Thus, longer trains are more prone to experience EOT device loss of signal communications

than shorter train consists. Other factors, such as the local topography and weather conditions, can present further challenges to EOT devices maintaining communications. A loss of communication between EOT devices can be temporary or permanent, and can result in an emergency air brake signal from the controlling locomotive taking longer to propagate through the entire train (effectively slowing down braking of the entire consist), or in the event of a train air brake line blockage, a loss of communication between the EOT devices will result in the emergency signal not being transmitted to the rear EOT device, as evidenced by the fatal UP Granite Canyon accident that occurred on October 4, 2018.

Accordingly, this Safety Advisory recommends that railroads implement technologies, policies, procedures, and any necessary hardware enhancements to ensure two-way EOT devices maintain continuous and undisrupted communications to and from the front and rear units. Additionally, this Safety Advisory recommends that railroads develop, implement, and maintain clear rules to follow in the event of a loss of communication between EOT devices.

Protecting Against the Loss of Radio Communications Among Crew Members

Effective radio voice communications are crucial for ensuring the safety of railroad employees and train operations. A longer train can present a radio voice communication problem for an operating employee traveling a long distance away from the lead locomotive. Portable radio handsets generally used might not have sufficient radio signal strength to provide clear communication over great distances or undulating topography. This problem is particularly concerning during emergency situations, where clear communication is critical. For instance, if an operating employee is injured and

unable to contact the locomotive engineer, delays in getting timely aid to the operating employee may occur.

As a result, this Safety Advisory recommends that railroads adopt enhanced technologies and, as necessary, procedures for maintaining radio voice communications with a contingency plan if voice communications are lost between operating employees.

III. Employee Training and Qualification Considerations

Training Generally

The potential complexities involved with the operation of longer trains make it particularly critical that locomotive engineers (and all other crew members) are adequately trained and qualified to safely perform their duties. FRA is concerned that certified locomotive engineers may receive basic train handling training that was typically satisfactory for historical operations over particular territories, but given railroads' current increased operation of longer trains, such training may no longer be adequate. FRA reminds railroads of the regulatory requirement at 49 CFR 240.211(a) for railroads to, prior to initially certifying or recertifying any person as a locomotive engineer, determine that the person has demonstrated the skills necessary to safely operate locomotives or trains in the most demanding class or type of service that the person will be permitted to perform. In the context of longer trains, the engineer must be adequately trained in their operation and demonstrate an ability to safely do so prior to being called for such operation. For example, an engineer who has safely operated a 100-car consist over a particular territory for the past five years, but has never been trained and qualified on a longer consist, should not be called to operate a 200-car train without additional training on the operational complexities involved.

A locomotive engineer cannot be expected to safely operate in a more demanding service without proper additional training that covers the unique challenges and complexities those trains present. This training concern extends to the designated supervisors of locomotive engineers, who are responsible for understanding these territories, operations, and associated risks, and are expected to be involved in the training, testing, and qualifying of locomotive engineers.

Part 240 Locomotive Engineer Certification Programs

Appendix B to 49 CFR part 240 outlines the procedures that railroads must describe in their locomotive engineer certification programs, and the level of detail required for the training, qualification, and certification of locomotive engineers. Accordingly, FRA expects each railroad to design its program to address that railroad's specific operations and FRA expects railroads to adjust their programs as the nature or circumstances of operations change. Specifically, if a railroad creates a more demanding operating environment through the operation of longer trains, that railroad's locomotive engineer certification program must be updated to reflect that more demanding environment. For this reason, FRA recommends that each railroad with a submitted program, review whether updates to their programs are necessary to ensure: (1) the complexities of that railroad's operations are adequately addressed in the program, and (2) its employees are adequately trained and qualified to operate in the most demanding service. FRA notes that the use of distributed power and energy management systems typically involved in longer train operations place new demands on locomotive engineers and, as such, those employees must be trained and qualified on these additional complexities.

Part 217 Operational Testing

Under 49 CFR part 217, railroads are required to conduct operational tests. These operational tests are vital for determining that employees are properly trained and fully aware of the rules and regulations governing safe operations. By identifying and addressing any potential training and compliance issues revealed by effective operational testing of longer trains, railroads can mitigate the potential risk of accidents and incidents. As new operations and technology are introduced, operational testing must be adjusted accordingly.

IV. Blocked Public Highway-Rail Grade Crossings

Blocked crossings occur when trains occupy highway-rail grade crossings and impede the flow of motor vehicle or pedestrian traffic over railroad tracks for extended periods of time. Blocked crossings pose numerous potential safety risks – frustrated individuals may be tempted to crawl, on, over, under, or between stopped railcars and blocked crossings can hinder emergency services' access to individuals in need of fire, police, or EMS assistance. Residents of communities through which railroads operate often rely on specific highway-rail grade crossings for daily commutes and other essential activities. Local knowledge of these crossings has developed over time, allowing community members to navigate through those crossings safely and efficiently. However, longer trains may, in certain instances, mean that trains are occupying these crossings for longer periods, potentially blocking access to homes, hospitals, schools, or businesses, and causing unexpected disruptions. Local emergency responders, such as police, fire, and ambulance services, can be severely impacted if emergency responders must find an alternate route when a train is blocking a crossing or if there is no alternative route.

Longer trains may also present challenges for pedestrians as the trains occupy pedestrian crossings for longer periods of time. Blocked crossings near schools are especially critical safety hazards due to the potential for children to cut through the idling trains.

Depending on the length of time that a crossing is blocked, the type of vehicles at a blocked crossing, and the configuration of the highway, motor vehicle drivers could be expected to take greater risks and commit dangerous maneuvers in an attempt to seek an alternate route. Motor vehicle drivers may also be more tempted to "outrun the train" by speeding to cross the tracks before the oncoming train reaches the crossing, particularly at locations that are frequently blocked by trains. Although trains of any length may block highway-rail grade crossings for a variety of reasons, the operation of longer trains may, in certain instances, exacerbate the impact of blocked crossings on communities. Accordingly, FRA recommends that railroads identify geographic areas with highway-rail grade crossings that could be impacted by longer trains, and work with local communities and emergency responders to identify and implement methods of preventing, or at least mitigating, the impacts of such blockages. These actions could include: identifying alternative routes for critical emergency response needs, establishing and maintaining clear lines of communication between the railroad and local authorities, or developing protocols for resolving concerns surrounding emergency response and blocked crossings.

V. Recommended Actions

Due to the complexities involved in the operation of longer trains, and to ensure the safety of the Nation's railroads, their employees, and the general public, FRA recommends that freight railroads take the following actions:

1. Review ABTH rules, or supplements, to ensure those rules adequately address the complexities associated with the railroad's operation of longer trains.

2. Implement technologies, policies, procedures, and/or any necessary hardware enhancements to ensure two-way EOT devices maintain undisrupted communications to and from the head-end and rear-end units. Develop, implement, and maintain clear policies, procedures, and rules that address instances of the loss of communications between EOT devices.

3. Adopt enhanced technologies and/or procedures for maintaining radio voice communications with a contingency plan if voice communications are lost between operating employees.

4. Identify changes to crew training, train handling procedures, train makeup, DPU requirements, limitations to length or tonnage, speed restrictions, track, mechanical, and brake inspection and maintenance requirements necessary to ensure safe operations of longer trains.

5. Review, and update as necessary, each railroad's current 49 CFR part 240 locomotive engineer certification program to ensure the program addresses all levels of operations, including the operation of longer trains.

6. Review and evaluate existing operational testing data as required by 49 CFR 217.9(e) relevant to the operation of longer trains. If longer train operations are conducted, or if any potential training or compliance issues are identified, consider increasing the frequency of operational testing and/or modifying the types of operational testing performed to address those deficiencies.

7. Identify geographic areas that could be impacted by longer trains at highway-rail grade crossings, take action to minimize blocked crossings by considering train

length when taking any action that causes any part of a train to occupy a crossing, and work with local communities and emergency responders to prevent or at least mitigate the impacts of blocked crossings should they occur.

8. Conduct post-accident simulator evaluations and assign accurate primary and contributing cause codes for reportable and accountable accidents and incidents. A detailed narrative is basic to an understanding of the factors leading to, and the consequences arising from, an accident.

FRA encourages freight railroads to take actions consistent with the preceding recommendations. FRA may modify this Safety Advisory 2023-03, issue additional safety advisories, or take other appropriate action necessary to ensure the highest level of safety on the Nation's railroads, including pursing other corrective measures under its rail safety authority.

Issued in Washington, D.C.

Amitabha Bose,
Administrator.