First ADDENDUM April 2023

Management of In-Train Forces: Challenges and Directions

Railroad Safety White Paper

Grady C. Cothen, Jr.

June 9, 2022, v3.0, SUPPLEMENT April 15, 2023
Errata to grady.cothen@verizon.net

Table of Contents

Introduction

The White Paper supplemented here was devoted to "management of in-train forces."[1] This is an issue for trains of virtually all lengths and tonnages, but longer trains present special challenges. Both train makeup and train handling are critical. These challenges can be mitigated with use of distributed power, properly networked using radio telemetry. However, distributed power is still not being employed consistently some seven years into Precision Scheduled Railroading (PSR). Further, as the National Academy of Sciences (NAS) committee on very long trains (VLTs) was advised in March of 2023, not all railroads are even using the most advanced radio communications features available for distributed power, let alone fully mastering the use of repeaters.

However, what has happened is that, even if DPUs are fully employed (e.g., mid-train and rear) there is still the temptation to build trains with segments that exceed prudent length and are not properly blocked. In grade or undulating territory, this can result in train air brakes showing off their faults—the reason the writer has described them as the "limiting factor" in responsible train marshalling and, particularly, automated train operations. Partial automated operations, using train energy management systems (TEMS), have not yet mastered air brakes, so they are normally cut out in grade territory.

Issues with TEMS and other on-board train technology continue to confound our understanding of accident outcomes. During the period the White Paper has been in revision, TEMS, and positive train control (PTC), have been integrated on some locomotives—but not all. Transitions from TEMS operation to manual operation seem to present challenges. De-skilling of locomotive engineers may be occurring in many circumstances, given reliance on TEMS and dynamic braking (to the exclusion of air brakes) and due to the limited time available for training in an industry barely able to handle the remaining traffic. Major railroads engaged in extensive interchange of full consists and use of various interline arrangements still show no outward sign of cooperating with respect to train marshalling principles.

This Addendum. Version 3.0 of the White Paper was completed in June of 2022, using the latest published accident reports as of that time, which brought us through February of 2022.

As the research for this update was concluded, reports were available through the end of 2022; and in the meantime, FRA has published some accident investigation reports of interest. Accordingly, this Addendum provides revisions and additions to Appendix B of the White Paper. This addendum has been circulated for review to a wide range of industry experts. Only a few responded, but those who did contributed significantly to this publication.

Being a single individual, the writer has continued to focus on events involving the four largest Class I railroads. You will note that two of those railroads are featured prominently in the

[1] The White Paper continues to be available at https://www.railwayage.com/safety/whire-paper-management-of-in-train-forces-challenges-and-directions/?RAchannel=home

Appendix. I have necessarily applied some judgment in the selection of events, because my focus has been management of in-train forces, a problem writ large in this era of PSR (or whatever alternate moniker may have, by now, been selected).

Omitted Research

The White Paper (v3.0) endeavored to survey literature associated with management of in-train forces and at least make a passing reference to pivotal studies, even if the writer is not technically qualified to parse many of the lessons that should be derived. The White Paper noted that public authorities in Canada had done a good deal of pioneering work. However, this writer missed a seminal study for the National Research Council (NRC) of Canada entitled *Industry Review of Long Train Operation and In-Train Force Limit,* authored by Elton Toma, Patrick Cullen, and Yan Liu (March 31, 2015).[2] Dr. Elton Toma is serving on the National Academy Committee dealing with these issues, and he called attention to this publication.

The NRC review, *inter alia*, traces the efforts of Canadian Pacific (CP) and Canadian National (CN) to address challenges associated with longer and heavier trains, with particular emphasis on mixed freight consists. The granularity with which the problem is approached, and the attention to actual outcomes, sheds considerable light on the opportunities for progress. After noting foundations available from prior research and CP and CN proprietary methods, the report concludes as follows:

> However, given the accidents that occurred between 2000 and 2010, the increase in train length and weight has not occurred without errors from which the railroads learned valuable lessons. Therefore, a new industry wide guideline for the safe operation of long train needs to be developed.

Marshalling Guidelines dated 2016 were developed and bore the Transport Canada insignia. They appear to be quite advanced and detailed. However, as late as 2020, the Transportation Safety Board of Canada was still expressing disappointment at the persistence of accidents involving management of in-train forces and the absence of *regulatory* action.[3] The extent to which the issue is thereby resolved in Canada is not clear to the writer, but undoubtedly the Canadian technical effort should be helpful to the regulator in the U.S.

Recent Developments

In the context of the NAS committee on very long trains, the AAR and major railroads have attempted to mount a defense to use of very long and heavy trains. The first defense is that the industry has run long trains safely for a long time. That is certainly true of unit trains carrying commodities such as coal and grain. But extensive use of very long trains for mixed freight

---

[2] Available at https://publications-cnrc.canada.ca/eng/view/object/?id=bcc92202-14a8-476b-9500-5a384c4ff003

[3] See Rail Safety Advisory 617-6/20, available at https://www.tsb.gc.ca/eng/securite-safety/rail/2020/r19t0107/r19t0107-617-06-20.html

("manifest trains") is quite new. This development creates huge challenges for train marshaling and train handling, and it comes as the industry is edging into automated operations.

The second defense can be fairly characterized as an admission that things did not go well in the early years of PSR. Things that should have been done to prepare for very long trains were not done, but—trust us—they are being put in place today. We learn by failing.

The third defense is that locomotive engineers find it easier to handle long trains than shorter trains. One can see why this defense is necessary, given the number of train handling accidents the major railroads are reporting. However, over the past 5 years that I have been exploring this issue, I have heard only two locomotive engineers say this. One was an engineer whose principal experience was in coal service (unit trains). The other was a system officer on a major railroad who spoke to the NAS committee in defense of his company's record.

It may be that there are situations where it is marginally easier to handle a heavy, long *unit train* than a short one; but how many short ones are on the system for direct comparison? Should we allow anecdotal judgments by some to blind us to the calculations engineers must make when they are handling three-mile-long mixed freight trains over uneven territory, in some cases still without distributed power? And, by the way, shouldn't this be easier with the help of train energy management systems? If so, why are we still seeing the apparently unnecessary derailments?

On the issue of train handling, an expert reviewer of the draft noted 49 Code of Federal Regulations, part 240, section 240.123(b):

> A railroad shall provide for the continuing education of certified locomotive engineers to ensure that each engineer maintains the necessary knowledge, skill and ability concerning personal safety, operating rules and practices, mechanical condition of equipment, methods of safe train handling (including familiarity with physical characteristics as determined by a qualified Designated Supervisor of Locomotive Engineers[DLSE]), and relevant Federal safety rules.

In defense of that railroad's training effort, a major railroad addressing the NAS VLT Committee called attention to a recent year in which road foremen (DSLE) conducted 4,000 on board check rides. This is a railroad that employed over 7,500 train and engine employees at the end of 2022. Many of these personnel were new, requiring additional supervision and on-board training. That railroad has also been in the process to adapting its trains and on-board technology throughout recent years. It is possible, of course, that the simulator exposure referenced by the railroad helped to fill the void. However, keep in mind that annual check rides or road-foreman-observed simulator exercises are required by regulation for each engineer every year; and many conductors and engineers are dual qualified. The defense seems tepid.

Another expert commenter on this paper noted the limitations of positive train control and TEMS, which are intended to coach or replace the engineer:

> Total length and total tonnage are inputted into PTC. PTC does not know proper train car placement. Its braking algorithm assumes proper car placement. TEMS also assumes proper train car placement when it is operating. My belief is if the train cars are not properly placed, then TEMS cannot adequately control the train. TEMS advises the engineer to revert to manual operation, but now the engineer must determine the issue and derive a proper train handling solution from multi-varied input. Trains are so long that past experience of "seat of the pants" feel is no longer a reliable indicator of the proper course for the engineer to take.

Despite some good efforts, we see that, in practice, safety has taken a back seat. The lesson should be that the well-intentioned career railroaders and technologists working in the industry will regularly be overruled by the "C suite". With classification yards closed and power short, it's "block to destination" and "get that train out." Accordingly, externally imposed discipline will be needed. In some cases, this could be nothing more than requiring the railroads to adhere to their own policies. In other cases, policies will first have to be adjusted.

Federal Railroad Administration. FRA has now come alive in public view, beyond its good work on accident investigations. On April 6, FRA released "Safety Advisory 2023-02, Train Makeup and Operational Safety Concerns" (hereafter SA-2023-02), which is appended to this document for reference. On March 27, 2023, FRA also offered the Railroad Safety Advisory Committee (RSAC) a draft task on "Train Braking Modernization" that appears to overlap some of the issues sketched out in this White Paper, including the future of ECP brakes. It is not clear to this writer whether the RSAC will tackle all the issues associated with management of in train forces, or whether a siloed staff will try to chop it up into discrete pieces (rather than a system approach, which is required). As this update was prepared, the brake modernization task statement was out for a vote by RSAC members.

Main line accident trends. There is some other good news to report. Based on initial filings with FRA and FRA's aggregation of the data, 2022 was a better year for main line derailments than those that preceded it. However, you will note from the events listed below that things did not go as well as portrayed by industry publicists. Even with the notable derailments of early 2023 being featured in the press, we may be headed in the right direction; but we are not out of the woods. Only sustained commitment to operating discipline will get us clear of real peril.

ECP Brakes

Public outrage over the East Palestine Ohio derailment of February 3, 2023, has led to a broader discussion of rail safety, including the fits and starts associated with ECP brakes. Careful readers will see in the accidents catalogued below further illustrations of why ECP brakes will be required if the industry is to play its rightful role in the future of North American transportation. Use of ECP brakes to moderate in-train forces would significantly reduce derailments attributed to train handling causes, without many of the substantial downsides associated with reliance on conventional air brakes. Communication with distributed power locomotives would be reliable and secure. End of train device functions would also be reliable and secure.

As noted in the White Paper, ECP brakes offer a tremendous opportunity to reduce the energy associated with obstruction and related collisions, whether at grade crossings or with the occurrence of flooding, sun kinks, fallen rocks and similar hazards. Some of those events could be prevented outright, others mitigated. For a recent example of the opportunities here, *see* https://www.wdrb.com/news/train-derails-in-hardin-county-after-semi-got-stuck-on-railroad-tracks/article_54211a14-c435-11ed-90f4-27c2aa9aaddf.html. Consider that, with ECP brakes, the crossing collision could have been prevented in this case without the inherent risk of derailment associated with emergency application of the conventional air brakes under conditions where the train is stretched.

Again, FRA's recent approach to the RSAC includes consideration of ECP brakes. We can only hope that the RSAC will take the issue seriously.

#

ADDENDUM to Appendix B

(See Appendix A to the White Paper for Acronyms)

	Event / Sources	Train consist / speed	Consequences	Cause(s)
36	UP 6/17/2020 Bancroft, ID 6180.54 (3/19/2023) FRA HQ-2020-1388	Loads, empties (total): 105, 76 (181) Power: 2 front, 1 DPU mid-train, 1 DPU rear Tons: 15,560 **Length: 13,170 feet** Speed: 35 mph	Derailed beginning at position 34 (empty) Cars derailed: 31 (30 of which were empty) Damages: $3.8m	UP: **H504—Buffing or slack action excessive, train make-up** FRA: H504—Buffing or slack action excessive, train make-up and H599—Other causes (engineer not trained to handle train of this length and tonnage)

Note to reader: This item has been revised considering the subsequent publication of the FRA accident investigation report and re-filing by UP (for the second time) at some point after 4/6/2022.

Explanation: The carrier narrative has remained constant through its filings.

> MNPPD-16 DERAILED 31 CARS AT G156 ON THE POCATELLO SUB DUE TO AN EXCESSIVE KIP FORCE CREATED BY THE TONNAGE PROFILE, WHICH CAUSED THE HEAVY REAR-END TO INCREASE SPEED WHILE DESCENDING ON UNDULATING GRADE. NO TRAIN HANDLING EXCEPTIONS WERE TAKEN.

The White Paper v3.0 had complained of the cause declared in the then current filing: E79L—Other locomotive defects (requires explanation in narrative, but there was none to account for the code selected. At some point circa 7/12/2022, FRA posted its accident investigation report to its web site and UP reverted to its initial cause code (consistent with FRA's primary findings).

FRA's report goes into great detail with respect to the make-up of the train, which originated at North Platte, and the handling of the train on undulating terrain. The presence of a block of EOCC-equipped cars involved in the first third of the train is noted. There is no indication in the report that a TEDs or TOES analysis was conducted, however. Although FRA speculates that train handling may have been a factor, in the end the agency settles on the notion that the engineer had not received sufficient training for the "Very Long Train" (UP designation)—the first the engineer had been asked to handle. The FRA report makes no suggestion regarding how this huge and unwieldy consist might have been handled with greater success.

	Event / Sources	Train consist / speed	Consequences	Cause(s)
36 A	BNSF Winslow AZ 7/6/2020 6180.54 (3/10/2023) FRA HQ-2020-1389 (circa 7/22/2022)	Loads, empties (total): 119, 24 (143) Power: 4 front, 2 DPUs mid-train Tons: 14,493 **Length: 10,954 feet** Speed: 4 mph	Derailed beginning at position 40 (empty) Cars derailed: 29 (20 loads, 9 empties) Damages: $766K	BNSF: H519—Dynamic braking, too rapid adjustment FRA: H519 *and see below*

Note to reader: This event was not covered in the White Paper v3.0; however, now that the FRA report is available, it appears to deserve mention.

Explanation: While both the railroad and FRA identify too rapid adjustment of the dynamic brake as the primary cause of the accident, FRA adds the following:

> **Contributing to the cause of the derailment was a block of 5 empty cars placed ahead of a block of 6,900 trailing tons, cause code H504—Buffing or slack action excessive, train make-up.** FRA fatigue analysis found fatigue was present in both the engineer and conductor which may have had a contributing effect, cause code H199—Employee physical condition.

FRA muddles the fatigue finding later in the same report, but this event occurred at 5:30 a.m. (dawn) after the crew had been on duty 9 hours and 50 minutes, so circadian effects could have been present.

The initial derailment occurred as the crew brought the consist to a stop using dynamic brakes in synchronous mode (head end to DPUs). The first car to derail was just behind the DPUs, an empty said to have been squeezed off by heavy tonnage to its rear. The general derailment apparently occurred as the train resumed movement. Again, from the FRA report, we are left to imagine whether train make-up was in accordance with all BNSF requirements at the time:

> Although the train was in compliance with current BNSF train make-up rules at the time of the derailment, BNSF System Special Instructions item 47 restricts any empty conventional car weighing less than 45 tons be placed [*sic*] ahead of trailing tonnage greater than 5,500 tons.

The first car derailing was BNSF 782042, apparently an empty refrigerator car (box car) with a tare weight of 89,700 pounds, which presumably would have been listed at just under 45 tons. It was part of a 5-car block of empties just behind the DPUs.

Based on the reports, it would appear that train handling was the dominant factor in the derailment(s), although fatigue may have been a factor in the engineer's handling of the train. It is possible, as well, that train placement was an essential component. However, FRA makes no reference to use of TEDs or TOES to evaluate in-train forces.

	Event / Sources	Train consist / speed	Consequences	Cause(s)
49	BNSF Ludlow, CA 3/3/2021 6180.54 (12/27/2022) & FRA-HQ-2021-0303-1417 (posted 12/19/2022)	Loads, empties (total): 72, 28 (100) Power: 3 front, 2 DPUs rear Tons: 10,528 Length: 6,621 feet Speed: 52 mph	As reported by BNSF: Derailed beginning at position 29 (load) Cars derailed: 46 (21 loads, 25 empties) Damages: $4.1m, 28K gallons of ethanol released (no evac.)	BNSF: **H504—Buffing or slack action excessive, train makeup** FRA: H504

Note to reader: This item is revised due to subsequent publication of the FRA report.

Explanation: FRA's report dropped some months after v3.0 was finalized. FRA agreed with the BNSF cause, but counted one fewer loaded car derailed, reported a precautionary evacuation (essentially without effect, given the remoteness of the derailment site), and concluded that the derailment occurred initially at car line 36, a boxcar with end-of-car cushioning, which was part of a block of 22 empty cars placed between loads ahead and behind it.

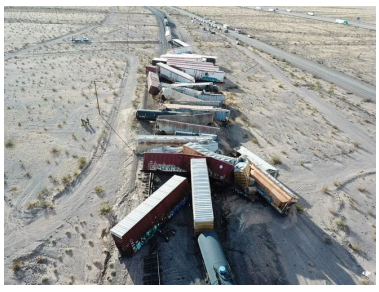
This was moderate grade territory, with the derailment resulting from a run-in as the bulk of the train crested a rise and began the descent. FRA's report does not explicitly state that the two DPUs at the rear were "fenced," but it appears clear that they were. Shortly prior to the derailment, the head end locomotive consist was operating at 49.8 mph with dynamic brakes at notch 3 while the DPUs were pushing at 53.1 mph, according to FRA.

FRA concluded—

> FRA has concluded the probable cause of the accident was in-train forces generated by the rear DPUs running in on the middle section of Train 1, which was compounded by train make-up, placing more tonnage behind empty cars.

The train placement was consistent with BNSF criteria, but just barely. Neither BNSF nor FRA faults crew handling. Neither speculates whether the result would have been better, or worse, had the Trip Optimizer not been cut out approaching the Ludlow control point. Neither report addresses whether use of a minimum set of the air brakes would have been helpful in avoiding the run-in (as might have been done with little decrement to efficiency with **ECP brakes**). Neither BNSF or FRA indicates that any train energy model (e.g., TOES or TEDS) was employed in determining the possible cause of the accident.

This accident is an example of the point driven home several times in the White Paper, i.e., management of in-train forces is *not* an issue limited to very long trains (>7,500 feet). Any analysis that begins with an arbitrary train length asks the wrong questions.



	Event / Sources	Train consist / speed	Consequences	Cause(s)
Note to reader: The following items are new entries.				
101 A	UP Rupert, ID 2/17/2022 6180.54 (4/10/2023) FRA SA-2023-02	Loads, empties (total): 89, 106 (195) Power: 3 front, 1 DPU mid-train, 1 DPU rear Tons: 14,017 **Length: >7,500 feet** Speed: 33 mph	Derailed at position 73 (empty) Cars derailed: 4 Damages: $13,534	UP: **H501—Improper train makeup at initial terminal** FRA: **Train makeup**
	Explanation: This item was added because it was featured in the Safety Advisory. Returning to the batch download in May of 2022 used to populate the February 2022 accidents, this accident was not yet reported, perhaps because the damage total was not yet determined. Here is FRA's take: On February 17, 2022, in Rupert, Idaho, a UP 195-car mixed freight, DPU train derailed 4 cars that consisted of 106 empty and 89 loaded cars with 14,017 trailing tons. The first car to derail was empty. The locomotives were configured as 3x1x1. The train was in the process of stopping due to a hot box detector warning. It was using dynamic braking on the head and mid locomotive consists while idling down on the rear consist as it traveled down a descending grade. The train contained five HazMat cars, but none of them derailed. Nearby residents were evacuated as a precautionary measure. The incident was attributed to improper train make-up. The railroad's narrative indicates that one or more train makeup or train length restrictions for the subdivision were added after the derailment.			
106	NS Dunkirk, NY 3/3/2022 6180.54 (3/13/2023)	Loads, empties (total): 162, 2 (164) Power: 3 front Tons: 18,592 **Length: >7,500 feet est.** Speed: 38 mph	Derailed at position 90 Cars derailed: 1 (load) Damages: $25K	NS: E34C—Draft gear broken or defective
	Explanation: This is a minor derailment illustrating the consequences in terms of equipment for egregious train make-up. The railroad's narrative: NS TRAIN 310.02 WENT INTO EMERGENCY WITH AIR NOT RESTORING ON THE SINGLE MAIN AT MP B 39.9 IN SHERIDAN, NY. UPON INSPECTION, THE EAST SET OF TRUCKS ON LINE 90 CAR (TTGX 604415) IS STILL UNDER THE CAR, BUT ALL THE WAY BACK AT THE WEST SET OF TRUCKS. LLINE 89 CAR (UTLX 642347) HAS A DRAWBAR WITH DAMAGE TO PLATFORM; A KNUCKLE ON LINE 104 CAR (UTLX 66197); AND LINE 156 CAR (TTGX 995067) AIR HOSE SEPARATION. None of the 13 hazmat cars in the train were damaged.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
107	UP Pittsburg, TX 3/6/2022 6180.54 (3/13/2023)	Loads, empties (total): 118, 40 (158) Power: 2 front, 1 DPU mid-train, 1 DPU rear Tons: 13,262 **Length: >7,500 feet est.** Speed: 42 mph	Derailed beginning at position 104 (93 ft. flat, empty) Cars derailed: 32 (12 loads, 20 empties) Damages: $2.1m	UP: **H504—Buffing or slack action excessive, train make-up**
	Explanation: Building a proper train is not that much easier with distributed power. Letting an energy management system handle the train does not eliminate the worries: TRAIN IMNMX-05 WAS TRAVELING SOUTHBOUND ON THE PINE BLUFF SUB AT APPROXIMATELY 42.4 MPH. EMS WAS ENGAGED WHEN TRAIN WENT INTO UDE AT MP 488.1. CONDUCTOR FOUND TWO SEPARATE CUTS OF CARS DERAILED BEHIND THE MID DP AND AHEAD OF REAR DP. NO RELEASES OR HAZMAT CARS DERAILED. NO INJURIES.			
108	NS Mascot, TN 3/12/2022 6180.54 (3/13/2023)	Loads, empties (total): 107, 24 (131) Power: 2 front Tons: 13,134 Length: ? Speed: 5 mph	Derailed beginning at position 38 Cars derailed: 23 Damages: $269K	NS: H519—Dynamic brake, too rapid adjustment
	Explanation: Heavy mixed freight train with marginal power. Of the 35 hazmat cars in the train, 1 was damaged but did not release product. Speed of derailment is given as 5 mph, but we don't know what the speed was when the engineer initiated the dynamic braking. A knowledgeable railroader commented on the draft of this addendum that even extended range dynamic brakes are less effective at very low speeds. Especially with a limited number of axles of dynamic brakes available, was this really the cause of the derailment?			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
109	UP Rockwell, IA 3/24/2022 6180.54 (3/13/2023)	Loads, empties (total): 169, 35 (204) Power: 2 front, 1 DPU mid-train, 1 DPU rear Tons: 23,315 **Length: >7,500 feet** Speed: 46 mph	Derail beginning at position 137 (empty 79 ft. flat) Cars derailed: 37 (27 loads, 10 empties) Damages: $1.8m	UP: **H504—Buffing or slack action excessive, train make-up** and H599E—Other causes related to train make-up or handling
	Explanation: The railroad's narrative trails off before completing the thought: MALNP-22 DERAILED 36 CARS AND 1 LOCOMOTIVE AT MP178.2 ON THE MASON CITY SUB. HEAD END TRAIN SPEED AT THE TIME OF DERAILMENT WAS 46MPH. THE HEAD CONSIST WAS IN T2, WITH THE MID AND REAR DP'S IN T3, NO AIR SET AND EMS ENGAGED. TRAIN HAD ENTERED A BOWLAND THE HEAD OF TRAIN WAS ON ASCENDING GRADE AND THE REAR ON DESCENDING GRADE. EMS REDUCED THROTTLE ON HEAD END TO T2, KEEPING THE MID AND REAR DP`S INT3. THIS CAUSED EXTREME RUN-IN BUFF FORCES. THESE FORCES CAN BE SEEN ON THE EVRS, AS WELL AS THE CAMERAS ON MID DP UNIT. PROGRAMMING SHOULD BE DESIGNED AS TO KEEP [*sic*] The reader may ask which it is: train make-up or faulty programing of the TEMS (EMS)? The engineer would have been forbidden to use a minimum air set to limit buff forces, as this would be "power braking." There might have been more latitude given for use of train air had the train been equipped with ECP brakes.			
110	UP Marathon, TX 3/30/2022 6180.54 (3/13/2023)	Loads, empties (total): 49, 100 (149) Power: 2 front, 1 DPU rear Tons: 8,003 Length: ? Speed: 28 mph	Derailed at position 128 (empty boxcar) Cars derailed: 1 Damages: $91K	UP: M405—Interaction of lateral/ vertical forces
	Explanation: None of the 49 hazmat cars was damaged. EMS was running, so the reference to a 3 mph overspeed in the narrative is interesting because it is unexplained: MSTKB-30, WHILE TRAVELING EAST AT 28 MPH THROUGH THE SIDING AT WARWICK WITH EMS RUNNING, THE CEMX558796 DERAILED BOTH SETS OF TRUCKS IN THE TURNOUT TO THE MAIN TRACK. NO INJURIES. NO HAZMAT. At the time of the incident the rail equipment was moving above the maximum for the track class reported			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
111	UP Colton, CA 4/7/2022 6180.54 (3/13/2023)	Loads, empties (total): 121, 18 (139) Power: 6 front, 1 DPU mid-train, 3 DPUs rear Tons: 16,513 Length: ? Speed: 30 mph [see explanation]	Derailed beginning at position 66 (loaded tank car) Cars derailed: 11 (5 loads, 6 empties) Damages: $573K	UP: **M405—Interaction of lateral / vertical forces**
	Explanation: The railroad's narrative shows some question about the speed at the time of derailment: MNPWC-01 WAS APPROACHING THE EAST END OF WEST COLTON YARD TRAVELING ON THE MAIN, ON THE ALHAMBRA SUBAT MP 536. TRAINS POWER CONFIGURATION WAS 6X1X3 AND HAD 139 CARS WITH 121 LOADS AND 18 EMPTIES. THE TRAIN EXPERIENCED A UDE AT MP 536.75, RESULTING IN THE DERAILMENT OF 11 CARS. UPON REVIEW OF EVENT RECORDER DATA BY OPCC & THE FIELD THERE WERE NO HUMAN FACTOR TRAIN HANDLING ISSUES NOTED. ADDITIONALLY TRAINSET DATA COMPLIED WITH ALL AUTOMATED TRAINSET MONITORING FUNCTIONS OUT OF ORIGIN WITH NO ADDITIONAL CHANGES TO PROFILE OR TRAIN LIST. TRACK STATIONS AND TRACK DATA INDICATE AN L/V RATIO WAS PRESENT AT 29.68. DEGREE OF CURVATURE AT 10.25, CROSSLEVEL AT POD OF .875, GAGE AT 57, WEIGHT OF CAR AT 30, TOTAL WEIGHT OF TRAIN AT 16513, AND SPEED OF TRAIN AT TIME OF DERAILMENT WAS 14 MPH. 1 DRUG POSITIVE--NOT DETERMINED TO BE A CAUSAL FACTOR. What is meant by "weight of car at 30" [not a loaded tank car]? Which tool was employed to determine L/V? What is being done about it? There was one (1) hazmat car in the train which was damaged but did not release product.			
112	UP on Kansas City Terminal Kansa City, KS 4/10/2022 6180.54 (3/13/2023)	Loads, empties (total): 53, 93 (146) Power: 5 front Tons: 9,867 Length: ? Speed: 24 mph	Derailed beginning at position 60 (empty gondola) Cars derailed: 5 empties Damages: $558K	UP: E24C—Centerplate disengaged from truck KCT: E4TC—Truck hunting
	Explanation: We will accept UP's conclusion that the centerplate became disengaged, but why? Neither railroad claims track anomalies or prior damage to the centerplate or bowl. Was train placement reviewed?			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
113	NS Aboite, IN 5/6/2022 6180.54 (3/13/2023)	Loads, empties (total): 115, 40 (155) Power: 4 front Tons: 15,875 **Length: >7,500 feet est.** Speed: 3 mph	Derailed beginning at position 6 Cars derailed: 6 loads Damages: $143K	NS: H503—Buffing or slack action excessive, train handling
	Explanation: The NS narrative has the train "pulling at 1.5% descending grade…" on the Roanoke GM Yard Lead. From this we are invited to imagine excessive run-in. Given the speed of 3 mph, the lack of a DPU in a 15,000-ton train, and no information regarding use of air brakes, we see more questions here than answers. The appearance is that this road train was moving back to the wye for the main after servicing the GM plant, and according to news reports at least one autorack was among the cars derailed. If NS will not send a local out to switch the GM plant, what customer would warrant that?			
114	NS Shenandoah, VA 5/9/2022 6180.54 (3/13/2023)	Loads, empties (total): 86, 85 (171) Power: 4 front Tons: 13,792 **Length: >7,500 feet est.** Speed: 11 mph	De-trucked one car, an empty covered hopper with NS number Cars derailed: 0 per report Damages: $50K to car, $500 to track	NS: E21C—Center sill broken or bent
	Explanation: It's not hard to imagine that in-train forces could be a factor, although prior damage in a yard could also have been a possibility.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
115	CSX Bloomington, MD 5/9/2022 6180.54 (3/11/2023)	Loads, empties (total): 0, 196 Power: 3 front, 3 mid-train DPUs Tons: 4,610 **Length: >7,500 feet** Speed: 10 mph	First position derailing unclear (report says empty gondola at position 1, which apparently meant first after lead units) Cars derailed: 9 Damages: $21K	CSX: E79L—Other locomotive defects (provide detail in narrative)
	Explanation: The railroad tries to clear up a confusing report with the narrative: WHILE TRAVELING WEST ON NUMBER ONE MAIN TRACK, E74007 DERAILED LINES ONE THRU NINE IN THEIR CONSISTAT BA 209.0. THE CSXT 3041 DROPPED LOAD WHEN PULLING ON GRADE THROUGH CURVES CAUSING FORCES ON THE HEAD END 3 LOCOMOTIVES WHICH RESULTED IN STRING LINING THE HEAD 9 CARS IN A CURVE. Lines 1-9 as numbered here would be cars behind the first 3 locomotives. CSXT3041 is shown in the report as in position 4, which we would have to imagine was the lead DPU. Did the other two units in the mid-train DPU consist drop load, as well? Was it simply a locomotive defect? Was there an issue with communications head end to lead DPU?			
116	NS Springfield, OH 5/12/2022 6180.54 (3/13/2022)	Loads, empties (total): 63, 60 (123) Power: 5 front Tons: 2,610 [*sic*] Length: Speed: 40 mph	Derailed beginning at position 57 (loaded gondola) Cars derailed: 26 Damages: $2.5m	NS: T199—Other track geometry defects
	Explanation: The railroad provides an apparently erroneous value for tonnage, which appears to be an NS specialty. The narrative: 170LC10 WAS TRAVELING EAST ON THE CJ MIANLINE AT MP 187.5, WHEN THEY REPORTED THAT THEY HAD DERAILED LINES 52-78. HIGH RAIL ROLLED UNDER LOADED AUTORACK (LINE 67) IN A 4 DEGREE CURVE ACCOUNT TRUCKSIDE L/V'S EXCEEDING RAIL B/H RESTRAINT RESULTING FROOM MULTIPLE TRACK GEOMETRY CONDITIONS OPERATING ON A CURVE-WORN PROFILE. If the rail rolled under line 67, that would be the first involved, not line 57. Was this accident evaluated for in-train forces contributing to the L/V force?			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
116 A	Kansas City Southern Railway Gravette, AR 5/16/2022 6180.54 (4/10/2022) FRA SA-2023-02	Loads, empties (total): 124, 1 (125) Power: 2 front 3 DPUs rear Tons: 17,113 Length: ? Speed: 31 mph	Derailed beginning at position 117 (empty) Cars derailed: 1 Damages: $360K	KCS: **H508—Improper train makeup** FRA: **Train makeup**
	Explanation: We add a KCS accident because it was featured in the FRA Safety Advisory. FRA tells us as follows: On May 16, 2022, in Gravette, Arkansas, a Kansas City Southern Railway DPU train with a total of 125 cars (one empty and 124 loaded) with a total trailing weight of 17,113 tons experienced a derailment, which involved one car. The locomotive configuration was 2x0x3. The incident occurred while the train was moving uphill and negotiating a curve, resulting in the derailment of the single empty car on the high side of the curve. The root cause of the derailment was identified as improper train makeup. This was evidently a train accepted from UP. Here is the KCS explanation: TRAIN TRAVELING SOUTHBOUND ON ASCENDING GRADE. DPU WAS SHOVING TRAIN UPHILL WHEN AN EMPTY COAL CAR DERAILED (11 CARS FROM REAR DPU) ON HIGH SIDE OF CURVE. UP CONSIST WAS INACCURATE & DIDNT INDICATE EMPTY CAR - IMPROPER TRAIN MAKEUP			
117	UP Bearden, AR 5/26/2022 6180.54 (3/13/2023)	Loads, empties (total): 79, 66 (145) Power: 3 front Tons: 11,681 **Length: 9,628 feet** Speed: 7 mph	Derailed beginning at position 35 (empty) when engineer responded to a signal going dark Cars derailed: 3 Damages: $14K	UP: H519—Dynamic brake, too rapid adjustment
	Explanation: The railroad's narrative: WHILE TRAVELING WEST ON THE PINE BLUFF SUB ON AN ADVANCED APPROACH, THE SIGNAL AT CP CB329 WENT DARKON THE MPBFW-25. THE ENGINEER SET 15LBS OF AIR AND FULL DYNAMICS WITH 11,691 TONS AND 9,628 FEET, RESULTING IN THE DERAILMENT OF 3 CARS. CAUSE OF THE DERAILMENT DETERMINED TO BE THE TRAIN HANDLING BY THE ENGINEER. THE TRAIN DID NOT HAVE TO BE STOPPED IN AN EMERGENCY OR AT LEAST WITH THIS TYPE OF A HEAVY REDUCTION. THE UNPLANNED STOP ABTH RULE STATES THE PROCEDURES TO USE WHEN MAKING AN UNPLANNED STOP IN THE SHORTEST DISTANCE POSSIBLE. This was a minor derailment, and the engineer might have done better, but train make-up might have made a difference. Certainly, with **ECP brakes** this would have been managed better. Adding a mid-train DPU to this 9,628 foot train might have helped as well.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
118	CSX Hamilton, OH 5/27/2022 6180.54 (3/11/2023)	Loads, empties (total): 99, 85 (184) Power: 2 front, 1 DPU mid-train Tons: 15,357 **Length: >7,500 feet** Speed: 13 mph	Derailed beginning at position 9 (empty boxcar) while traveling through crossover Cars derailed: 4 (2 empties, 2 loads) Damages: $109K	CSX: H518— Dynamic brake, excessive
	Explanation: Deserves review for train placement, handling of DPU.			
119	UP Lawrence, KS 6/17/2022 6180.54 (3/13/2023)	Loads, empties (total): 270 (all loads) Power: 2 front, 3 manual mid-train [*sic*], 1 manual rear [?] Tons: 38,610 **Length: >7,500 feet** Speed: 38 mph	Derailed beginning at position 173 Cars derailed: 42 Damages: $2m	UP: T207— Broken rail, detail fracture from shelling or head check
	Explanation: Note the tonnage. We get from the narrative that all of the mid- and end-of-train locomotives were DPUs, but anyone searching the data will have to go manual themselves to sort it out. Whether the train makeup or handling of the DPUs had anything to go with the rail break will not be known. As a curiosity, the accident record shows an engineer but no conductor on the train. Still, the conductor managed to report the derailment: TRAIN CBTNW-15 WAS OPERATING ON A SLIGHT DESCENDING GRADE, WITH THE HEAD AND MID-CONSIST IN LIGHT DYNAMIC BRAKING AND BOTH TRAVELING 38 MPH AT THE TIME OF THE UDE. THE REAR CONSIST WAS IN T2 AND TRAVELING 39 MPH. UPON INSPECTION, THE CONDUCTOR REPORTED 42 RAILCARS HAD DERAILED DUE TO DETAIL FRACTURE FROM SHELLING OR HEAD CHECK. CONSIST WAS 276 TOTAL.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
120	NS Whitley City, KY 7/10/2022 6180.54 (3/13/2023)	Loads, empties (total): 82, 117 (199) Power: 3 front Tons: 6,690 (?) **Length: >7,500 feet** Speed: 28 mph	Derailed beginning at position 167 (load) Cars derailed: 6 Damages: $318K	NS: H518—Dynamic brake, excessive
	Explanation: Again, the NS trailing tonnage number may need some review. Here is the narrative: NS TRAIN 168T609 TRAVELING NORTHBOUND WHEN TRAIN WAS PTC ENFORCED DUE TO THE SIGNAL AT 188.2 DROPPED TO A RESTRICTING SIGNAL. ENGINEER FAILED TO CONTROL SLACK DERAILING 6 CARS. How is the engineer supposed to control slack two miles back when he has just taken a penalty air brake application? Sure, you bail off the locomotive brakes, but is that sufficient? Of the 30 hazmat cars in the train, 1 was damaged but no product was released. With **ECP brakes**, no problem here. Adding a mid-train DPU might have helped, too.			
121	BNSF North Kansas City, MO 7/25/2022 6180.54 (3/11/2023)	Loads, empties (total): 115, 44 (159) Power: 3 front Tons: 17,177 **Length: >7,500 feet est**. Speed: 6 mph	Derailed beginning at position 36 (empty) Cars derailed: 12 (1 load, 11 empties) Damages: $238K	BNSF: H525—Independent brake, improper use
	Explanation: This was a low-speed move of a freight train in terminal limits. Use of the independent brake alone was said to have caused a run in. None of the 4 hazmat cars were damaged. Availability of **ECP brakes** would have given the engineer better options for handling this heavy mixed consist with several empties up front.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
122	UP Caldwell, TX 7/28/2022 6180.54 (3/13/2023)	Loads, empties (total): 109, 160 (269) Power: 4 front Tons: 18,793 **Length: >7,500 feet** Speed: 28 mph	Derailed beginning at position 171 (empty 57-foot boxcar) Cars derailed: 6 (empties) Damages: $53K	UP: H521—Dynamic brake, other improper use
	Explanation: The narrative does not explain how the engineer should have handled this more than 2-mile long train without the help of DPUs. Of course, it could have been under TEMS (EMS) control. None of the 66 hazmat cars in the train were damaged. Despite the train's length, weight, and makeup, use of **ECP brakes** (if permitted) might have prevented the derailment.			
123	NS Louisville, KY 8/8/2022 6180.54 (3/13/2023)	Loads, empties (total): 36, 63 (99) Power: 2 front Tons: 3,229 [?] Length: Speed: 3 mph	Derailed beginning at position 51 (empty) Cars derailed: 24 Damages: $174K	NS: H503—Buffing or slack action excessive, train handling and H509—Improper train inspection
	Explanation: We are advised as follows: NS TRAIN 23GTA07 DEPARTING LOUISVILLE YARD ON MAIN 1, DERAILED 24 CARS. The report shows 8 of 18 hazmat cars in the consist damaged but not releasing product. Given the potential here, perhaps the railroad has placed too much value on an "economy of words".			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
124	UP Sheffield [Hampton], IA 9/5/2022 6180.54 (3/14/2023) DOT F 5800.1 (3/21/2023) FRA SA-2023-02	Loads, empties (total): 131, 34 (165) Power: 2 front, 1 DPU rear Tons: 18,479 **Length: >7,500 feet** Speed: 45 mph	Derailed beginning at position 66 (empty) Cars derailed: 44 Damages: From FRA 6180.54: $2.4m (equipment, track, structures only) From PHMSA hazmat report— Material Loss: $ 276,000.00 Carrier Damage: $ 1,000,000.00 Property Damage: $ 0.00 Response Cost: $ 152,000.00 Remediation/Cleanup Cost: $750,000.00	UP: **H504—Buffing or slack action excessive, train makeup** FRA: **Train make-up**

Explanation: Of 26 hazmat cars, 14 were damaged, with 5 releasing product. UP narrative:

MALNP-02 WAS IN EMS AND TRAVELING SOUTHBOUND, WHEN THE TRAIN WENT INTO EMERGENCY AND DERAILED 44 CARS ON THE MAINLINE. CAR #: CTCX 725187 ASPHALT/VAPOR LINE RELEASE. CAR #: FHRX 260002 ASPHALT/TEAR NEAR BOV. CAR #: CTCX 725170 ASPHALT/TEAR NEAR BOV.CAR #: CTCX 725172 ASPHALT/PUNCTURE BL. CAR #: GATX60869 ASPHALT/PUNCTURE BL.

The rail bridge collapsed and asphalt entered a local creek.

FRA's Safety Advisory told it this way:

The train had 26 cars equipped with end-of-car cushioning devices and a 2x0x1 locomotive configuration. The head end of the train was ascending a 1% grade, while the rear end was descending a 1% grade during the incident. The derailment took place at the sag between the ascending and descending grades, with much of the train's weight concentrated at the head and rear ends. The train was a Key Train, carrying 26 loaded hazmat cars, of which 14 derailed and 5 released their contents. At the time of the derailment, EMS technology was operating the train. The assigned cause of the incident was excessive buffing or slack action due to train makeup.

	Event / Sources	Train consist / speed	Consequences	Cause(s)
125	UP Hearne, TX 9/17/2022 6180.54 (3/14/2023)	Loads, empties (total): 89, 142 (231) Power: 4 front, 1 DPU mid-train Tons: 16,938 **Length: >7,500 feet** Speed: 7 mph	Derailed 2 cars in terminal, beginning at position 152 Cars derailed: 2 (empty) Damages: $25K	UP: H503—Buffing or slack action excessive, train handling and H513—Automatic brake, other improper use
	Explanation: Here is the narrative: THE MSAEW-14 WAS PULLING OUT OF TRACK 357, HEADING SOUTH AT BRAZOS YARD WITH APPROXIMATELY 234 CARS TO MAKE A CUT, WHEN THE TRAIN DERAILED 2 CARS, DUE TO TRAIN HANDLING. This derailment is on a yard track, so will not be counted among the main line derailments. However, the move is identified as a freight train (not yard/switching). We do not really know what the engineer did wrong here, if anything. The point of including the record is that very long trains tax personnel during terminal operations as much as on the main line. There are other examples available.			
125 A	NS Albers, IL 9/19/2022 6180.54 (4/10/2023) FRA SA 2023-02	Loads, empties (total): 90, 42 (132) Power: 5 front [*sic*, see explanation] Tons: 6,686 [*sic*] Length: ? Speed: 44 mph	Derailed beginning at position 74 (empty) Cars derailed: 27 Damages: $2.2m NS report shows 21 hazmat cars in the train with 2 damaged but none releasing product	NS: **H506—Lateral drawbar force on curve excessive, train makeup** FRA: **Train makeup**
	Explanation: In its Safety Advisory, FRA told the story thus: On September 19, 2022, in Albers, Illinois, a NS train derailment occurred involving a 131-car mixed freight train (41 empty and 90 loaded) with a DPU and totaling 11,392 trailing tons. The first derailed car was empty and 27 cars derailed in total. Fifty-six cars were equipped with end-of-car cushioning devices. The locomotives were arranged in a 3x0x2 configuration, and Energy Management System (EMS) was active during the incident. The derailment occurred as the train traversed a slight descending grade and a 2-degree curve. Among the train's cars, 21 were carrying hazmat. Two of these hazmat cars derailed, and their contents were released. The assigned cause for the accident was excessive lateral drawbar force on the curve due to the train's makeup. Note the NS deviations from the FRA narrative: • Car count (132 vs. 131) • Locomotives (5 front only vs. 3 head-in and 2 DPUs rear) • Trailing tons (6,686 vs. 11,392) • No hazmat released vs. 2 cars releasing [Local press had one car leaking unspecified hazmat] NS was not required to report that the TEMS was engaged, but FRA added that detail.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
126	UP Houston, TX 10/20/2022 6180.54 (3/14/2023)	Loads, empties (total): 54, 113 (167) Power: 6 front Tons: 9,593 **Length: 11,173 feet** Speed: 7 mph	Derailed beginning at position 151 (empty) Cars derailed: 27 empties Damages: $142K	UP: H514—Failure to allow air brakes to fully release before proceeding
	Explanation: From the narrative, the consist was not handled properly, though the gradient seems garbled: THE MNLEW-18, WITH A CONSIST OF 5 LOCOMOTIVES, 4 ONLINE, 54 LOADS, 113 EMPTIES, 9593 TONS, AND 11173 FEET WAS TRAVERSING ON THE BELL LINE MAIN ENROUTE TO ENGLEWOOD YARD AND AS THE CREW WAS APPROACHING MP 1.26, THE ENGINEER BEGAN BRINGING THEIR TRAIN TO A STOP IN WAIT OF A PROCEED INDICATION. THE EOT READING REFLECTS DECREASING FROM 88 PSI TO 80 PSI AND PRIOR TO COMING TO A COMPLETE STOP, THE CREW RECEIVE A PROCEED INDICATION AND THE ENGINEER AND BEGAN THROTTLING UP WITH AIR STILL SET. THE WIDTH FROM THROTTLE 1 TO THROTTLE 3 WITH 8 PSI REFLECTING ON THE EOT AND TRAVELING 1 MPH RELEASING THE AUTOMATIC BRAKES, (SLOW SPEED RELEASE) RESULTED IN A 27 CAR DERAILMENT. DISTANCE TRAVELED UPON THE RELEASING OF THE BRAKES WAS 47 FEET. THERE WERE NO RELEASES OR INJURIES. There is no reason to quibble with the cause code here, but we can note that with **ECP brakes** the accident might have been avoided. Indeed, had the train had a mid-train DPU, the accident might have been mitigated.			
127	UP Topeka, KS 10/29/2022 6180.54 (3/14/2023)	Loads, empties (total): 64, 91 (155) Power: 3 front Tons: 11,222 **Length: >7,500 feet est.** Speed: 4 mph	Derailed beginning at position 53 (empty) Cars derailed: 10 Damages: $303K	UP: H523—Throttle, too rapid adjustment
	Explanation: The reader can judge the narrative: THE MHNTP-29 WAS CROSSING OVER FROM MAIN TRACK 2 TO MAIN TRACK 1 ON THE KANSAS SUB AND DERAILED 10 CARS. CONDUCTOR GOT OFF EQUIPMENT NEAR MP 68 ON THE KANSAS SUB AND AFTER MOVING APPROXIMATELY ANOTHER 3 CAR LENGTHS, TRAIN WENT INTO EMERGENCY. WHEN REVIEWING THE EVENT RECORDER, IT WAS DISCOVERED THAT THE TRAIN SLACK WAS BUNCHED RAPIDLY TO DROP OFF THE CREW MEMBER. WHEN ATTEMPTING TO CONTINUE MOVEMENT TO PULL BY, THE THROTTLE WAS ADJUSTED TOO RAPIDLY, CAUSING A STRING LINE DERAILMENT IN THE PRECEDING CURVE.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
128	NS Ravenna, OH 11/1/2022 6180.54 (3/13/2023)	Loads, empties (total): 188, 50 (238) Power: 4 front Tons: 24,538 **Length: >7,500 feet** Speed: 35 mph	Derailed beginning at position 121 (load) Cars derailed: 0 [*sic*] Damages: $1m	NS: **H504—Buffing or slack action excessive, train makeup**

Explanation: This was a monster train with no DPUs. Once again, NS is succinct:

> NS TRAIN M0QL201 TRAVELING EXPERIENCED A DERAILMENT. 300 TONS OF ROCK SALT OUT OF THREE CARS RIPPED OPEN. (NRC# 1351493 FOR SPILL)

The report says there were 63 hazmat cars in the train, with 2 damaged and none releasing. NS gives us a valid trailing tonnage this time, but omits the number of cars derailed. Local news reports at the time said 22 cars were derailed. As late as March 7, 2023, residents were still waiting for the scene to be cleaned up. https://fox8.com/news/residents-waiting-for-cleanup-months-after-train-cars-derailed-in-ravenna-twp/ We can expect both FRA and (belatedly) NTSB reports on this one.

Spectrum News posted this image, with the statement that "the train carried a variety of freight, but the involved cars were predominately autoracks…" Autoracks are normally equipped with end-of-car cushioning.

	Event / Sources	Train consist / speed	Consequences	Cause(s)
129	NS West Fairview, PA 12/1/2022 6180.54 (3/13/2023)	Loads, empties (total): 79, 71 (150) Power: 3 front Tons: 0 [*sic*] **Length: >7,500 feet est.** Speed: 2 mph	Derailed beginning at position 126 (empty) Cars derailed: 6 empties Damages: $158K (equipment only, no estimate for track and signal damage)	NS: M599—Other misc. causes [explanation required] and M505—Cause under active investigation
	Explanation: This is coded as a "cut of cars", but the narrative reads as follows: TRAIN 30A DERAILED 6 CARS WHILE DEPARTING ENOLA YARD We look forward to learning more as NS revises its report.			
130	UP Gilmer, TX 12/12/2022 6180.54 (3/14/2023)	Loads, empties (total): 89, 35 (124) Power: 3 front Tons: 12,144 Length: ? Speed: 26 mph	Derailed beginning at position 60 (load) Cars derailed: 14 Damages: $1.4m	UP: H503—Buffing or slack action excessive, train handling
	Explanation: This is a heavy train that might have benefitted from a mid-train DPU. Narrative: THE MNLEG-12 WAS COMING TO A STOP AND WENT INTO UDE. CONDUCTOR FOUND 14 CARS DERAILED TOWARDS THE MIDDLE OF THE TRAIN. NO HAZMAT RELEASES OR INJURIES OCCURRED. UPON INVESTIGATION, DOWNLOADS SHOW EXCESSIVE USE OF DYNAMIC BRAKES, CAUSING BUFF FORCES IN THE TRAIN AT THE POINT OF DERAILMENT Had the train been equipped with **ECP brakes**, the engineer could have brought the train to a safe stop without having to calibrate the effect of the dynamic brake effort and without concern that the train line would be slow to recharge. Was this train running under TEMS control just prior to the stop?			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
131	UP Denison, TX 12/12/2022 6180.54 (3/14/2023)	Loads, empties (total): 97, 77 (174) Power: 2 front, 1 manual rear [?] Tons: 12,014 **Length: >7,500 feet** Speed: 29 mph	Derailed beginning at position 92 (empty) Cars derailed: 4 empties Damages: $99K	UP: E39C—Other coupler and draft system defects [requires explanation in narrative]
	Explanation: The UP narrative is less than helpful, and is not compliant with reporting requirements: THE MSANP-11 WAS CROSSING OVER FROM MAIN ONE TO MAIN TWO, WHEN FOUR CARS DERAILED ON THE CROSSOVER, TAKING OUT THE SIGNAL MAST FOR MAIN TWO AND THE NORTH CROSSOVER SWITCH MACHINE. Was this really a manual helper at the back of the train in Denison Texas? Was TEMS running? Was the draft gear bad, or was it damaged by in-train forces?			
132	NS Garden City, GA 12/14/2022 6180.54 (3/13/2023)	Loads, empties (total): 51, 12 (63) Power: 3 front Tons: 6,219 **Length: 7,852 feet** Speed: 3 mph	Derailed, first car not given Cars derailed: 6 loads Damages: $203K	M505—Cause under active investigation
	Explanation: The NS narrative is helpful: TRAIN 290G513 PULLING SOUTH FROM MASON INTERMODAL FACILITY TO THE FOUNDATION LEAD WITH 3 LOCOMOTIVES, 51 LOADS, 12 EMPTIES, 6,219, AT 7,852 FEET DERAILED SIX CARS. We do not know what happened here, but it is illustrative of the reporting issues around intermodal cars, which can be single units or multi-platform articulated cars extending several hundred feet. The FRA reporting guide tells the railroads to treat multiple platforms as multiple cars and call out the presence of these cars in the narrative. None of this is done in practice.			

	Event / Sources	Train consist / speed	Consequences	Cause(s)
133	NS Roanoke, IN 12/29/2022 6180.54 (3/13/2023)	Loads, empties (total): 98, 34 (132) Power: 2 front Tons: 11,744 Length: ? Speed: 12 mph	Derailed beginning at position 37 (empty) Cars derailed: 9 Damages: $128K	NS: **H504—Buffing or slack action excessive, train makeup**
	Explanation: This is the same train assignment as item 113, above, at almost the same location. In the narratives for both, the railroad calls attention to the 1.5% grade down from the GM plant. A minimum set of **ECP brakes** would handle the situation. Even better, put on a local crew.			

If there is need for a further addendum, we will include the following, quoted from SA-2023-02:

On March 4, 2023, in Springfield, Ohio, a Norfolk Southern Railway (NS) 210-car mixed freight train totaling 17,966 trailing tons with Distributed Power Units (DPU) experienced a derailment involving 28 cars, including 21 empty and 7 loaded cars. The train had 82 cars equipped with end-of-car cushioning devices, and 18 of those derailed. The locomotives were arranged in a 3x2x0 configuration, with one headend locomotive offline. The train was traveling on an ascending 0.6% grade with a heavier part on a 0.7% downhill grade. The weight was mostly concentrated at the head and rear ends of the train. During the accident, dynamic braking was applied only to the headend locomotive consist, while the DPUs were idle, making it 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 70-72 and the subsequent pile-up. The train was classified as a Key Train,2 with 28 loaded hazardous materials (hazmat) cars distributed throughout. No hazmat cars derailed.

Bill Lackey, Springfield News-Sun via AP

Federal Railroad Administration Safety Advisory

display to show prompting to the train crew whenever a system fault related to braking prediction calculation exits. As this joint RFA involves requests for FRA's approval of the proposed material modifications to FRA-certified positive train control (PTC) systems, FRA is publishing this notice and inviting public comment on railroads' joint RFA to their PTCSPs.

DATES: FRA will consider comments received by May 1, 2023. FRA may consider comments received after that date to the extent practicable and without delaying implementation of valuable or necessary modifications to PTC systems.

ADDRESSES:

Comments: Comments may be submitted by going to *https://www.regulations.gov* and following the online instructions for submitting comments.

Instructions: All submissions must include the agency name and the applicable docket number. The relevant PTC docket numbers for the host railroads that filed a joint RFA to their PTCSPs are cited above and in the Supplementary Information section of this notice. For convenience, all active PTC dockets are hyperlinked on FRA's website at *https://railroads.dot.gov/research-development/program-areas/train-control/ptc/railroads-ptc-dockets*. All comments received will be posted without change to *https://www.regulations.gov;* this includes any personal information.

FOR FURTHER INFORMATION CONTACT: Gabe Neal, Staff Director, Signal, Train Control, and Crossings Division, telephone: 816–516–7168, email: *Gabe.Neal@dot.gov*.

SUPPLEMENTARY INFORMATION: In general, Title 49 United States Code (U.S.C.) Section 20157(h) requires FRA to certify that a host railroad's PTC system complies with Title 49 Code of Federal Regulations (CFR) part 236, subpart I, before the technology may be operated in revenue service. Before making certain changes to an FRA-certified PTC system or the associated FRA-approved PTCSP, a host railroad must submit, and obtain FRA's approval of, an RFA to its PTCSP under 49 CFR 236.1021.

Under 49 CFR 236.1021(e), FRA's regulations provide that FRA will publish a notice in the **Federal Register** and invite public comment in accordance with 49 CFR part 211, if an RFA includes a request for approval of a material modification of a signal and train control system. Accordingly, this notice informs the public that the twenty host railroads' recent, joint RFA to their PTCSPs is available in their respective public PTC dockets, and this notice provides an opportunity for public comment.

On March 22, 2023, the following twenty host railroads jointly submitted an RFA to their respective PTCSPs for their Interoperable Electronic Train Management Systems (I–ETMS): Alaska Railroad; The Belt Railway Company of Chicago; BNSF Railway; Caltrain; Canadian National Railway; Canadian Pacific Railway; Consolidated Rail Corporation; CSX Transportation, Inc.; Kansas City Southern Railway; Kansas City Terminal Railway; National Railroad Passenger Corporation (Amtrak); New Mexico Rail Runner Express; Norfolk Southern Railway; North County Transit District; Northeast Illinois Regional Commuter Railroad Corporation (Metra); Northern Indiana Commuter Transportation District; South Florida Regional Transportation Authority; Southern California Regional Rail Authority (Metrolink); Terminal Railroad Association of St. Louis; and Union Pacific Railroad. Their joint RFA is available in Docket Numbers FRA–2010–0028, –0029, –0039, –0042, –0043, –0045, –0048, –0049, –0051, –0054, –0056, –0057, –0058, –0059, –0060, –0061, –0062, –0064, –0065, and –0070. Interested parties are invited to comment on this RFA by submitting written comments or data. During FRA's review of these railroads' joint RFA, FRA will consider any comments or data submitted within the timeline specified in this notice and to the extent practicable, without delaying implementation of valuable or necessary modifications to PTC systems. *See* 49 CFR 236.1021; *see also* 49 CFR 236.1011(e). Under 49 CFR 236.1021, FRA maintains the authority to approve, approve with conditions, or deny these railroads' joint RFA to their PTCSPs at FRA's sole discretion.

Privacy Act Notice

In accordance with 49 CFR 211.3, FRA solicits comments from the public to better inform its decisions. DOT posts these comments, without edit, including any personal information the commenter provides, to *https://www.regulations.gov,* as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at *https://www.transportation.gov/privacy*. See *https://www.regulations.gov/privacy-notice* for the privacy notice of *regulations.gov*. To facilitate comment tracking, we encourage commenters to provide their name, or the name of their organization; however, submission of names is completely optional. If you wish to provide comments containing proprietary or confidential information, please contact FRA for alternate submission instructions.

Issued in Washington, DC.

Carolyn R. Hayward-Williams,

Director, Office of Railroad Systems and Technology.

[FR Doc. 2023–07558 Filed 4–10–23; 8:45 am]

BILLING CODE 4910–06–P

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

Safety Advisory 2023–02; Train Makeup and Operational Safety Concerns

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

ACTION: Notice of Safety Advisory.

SUMMARY: FRA is issuing Safety Advisory 2023–02 to emphasize significant concerns related to train makeup and to ensure that all railroads exercise due diligence and recognize the importance of taking proactive measures to address potential safety risks related to operating train builds with varying configurations, load and empty placement, distributed power arrangements, and other factors. FRA has noticed a rising trend in recent incidents where train build and makeup have been identified as a potential cause or contributing factor. In response, FRA incorporates train simulations into its investigative process when it is suspected that high in-train forces may have contributed to train accidents. To address these concerns, FRA is providing recommendations for freight railroads to improve the safety of their train build processes and practices.

FOR FURTHER INFORMATION CONTACT: Christian Holt, Staff Director, Operating Practices Division, Office of Railroad Safety, FRA, 1200 New Jersey Avenue SE, Washington, DC 20590, telephone (202) 366–0978.

SUPPLEMENTARY INFORMATION:

Significant Incidents

On March 4, 2023, in Springfield, Ohio, a Norfolk Southern Railway (NS) 210-car mixed freight train totaling 17,966 trailing tons with Distributed Power Units (DPU) experienced a derailment involving 28 cars, including 21 empty and 7 loaded cars. The train had 82 cars equipped with end-of-car cushioning devices, and 18 of those derailed. The locomotives were arranged in a 3x2x0 configuration,[1] with

[1] 3x2x0 represents 3 headend locomotives, 2 mid DPU's, 0 rear DPU's.

one headend locomotive offline. The train was traveling on an ascending 0.6% grade with a heavier part on a 0.7% downhill grade. The weight was mostly concentrated at the head and rear ends of the train. During the accident, dynamic braking was applied only to the headend locomotive consist, while the DPUs were idle, making it 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 70–72 and the subsequent pile-up. The train was classified as a Key Train,[2] with 28 loaded hazardous materials (hazmat) cars distributed throughout. No hazmat cars derailed.

On September 19, 2022, in Albers, Illinois, a NS train derailment occurred involving a 131-car mixed freight train (41 empty and 90 loaded) with a DPU and totaling 11,392 trailing tons. The first derailed car was empty and 27 cars derailed in total. Fifty-six. cars were equipped with end-of-car cushioning devices. The locomotives were arranged in a 3x0x2 configuration, and Energy Management System (EMS) was active during the incident. The derailment occurred as the train traversed a slight descending grade and a 2-degree curve. Among the train's cars, 21 were carrying hazmat. Two of these hazmat cars derailed, and their contents were released. The assigned cause for the accident was excessive lateral drawbar force on the curve due to the train's makeup.

On September 5, 2022, in Hampton, Iowa, a Union Pacific Railroad Company (UP) 165-car mixed freight train (34 empty and 131 loaded) with a total trailing weight of 18,479 tons experienced a derailment involving 44 cars. The train had 26 cars equipped with end-of-car cushioning devices and a 2x0x1 locomotive configuration. The head end of the train was ascending a 1% grade, while the rear end was descending a 1% grade during the incident. The derailment took place at the sag between the ascending and descending grades, with much of the train's weight concentrated at the head and rear ends. The train was a Key Train, carrying 26 loaded hazmat cars, of which 14 derailed and 5 released their contents. At the time of the derailment, EMS technology was operating the train. The assigned cause of the incident was excessive buffing or slack action due to train makeup.

On May 16, 2022, in Gravette, Arkansas, a Kansas City Southern Railway DPU train with a total of 125 cars (one empty and 124 loaded) with a total trailing weight of 17,113 tons experienced a derailment, which involved one car. The locomotive configuration was 2x0x3. The incident occurred while the train was moving uphill and negotiating a curve, resulting in the derailment of the single empty car on the high side of the curve. The root cause of the derailment was identified as improper train makeup.

On February 17, 2022, in Rupert, Idaho, a UP 195-car mixed freight, DPU train derailed 4 cars that consisted of 106 empty and 89 loaded cars with 14,017 trailing tons. The first car to derail was empty. The locomotives were configured as 3x1x1. The train was in the process of stopping due to a hot box detector warning. It was using dynamic braking on the head and mid locomotive consists while idling down on the rear consist as it traveled down a descending grade. The train contained five HazMat cars, but none of them derailed. Nearby residents were evacuated as a precautionary measure. The incident was attributed to improper train make-up.

On May 16, 2021, in Sibley, Iowa, a UP 159-car mixed freight train (43 empty and 116 loaded), weighing a total of 16,545 tons, with a 2x1x0 DPU configuration experienced a derailment, resulting in 47 derailed cars. The first car to derail was empty and equipped with an end-of-car cushioning device, as were 12 other derailed cars. At the time of the incident, the train navigated a grade, with the front section ascending and the rear section descending a grade steeper than 1%. Dynamic braking was used before the derailment but was switched to idle shortly before the accident. The derailment took place in a curve located in a sag between the ascending and descending grades. This Key Train contained 26 loaded hazmat cars, of which 14 derailed and 5 released their contents. As a result, the nearby town was evacuated for three days. The cause of the derailment was determined to be excessive buffing or slack action due to the train's makeup.

The analysis of the recent train accidents reveals several common characteristics and patterns:

1. Train Length: Each of the accident trains had 125 or more cars.

2. Distributed Power Units (DPUs): The fact that all accident trains featured DPUs underscores the importance of correctly utilizing and managing DPUs to enhance train handling and minimize the likelihood of accidents. While DPUs can contribute to improved train control, they should not be considered a replacement for proper train car placement and makeup.

3. Trailing Tons: All accident trains far exceeded 4,000 trailing tons, which is the maximum weight threshold established by the AAR's 1992 *Train Make-up Manual,* for considering train makeup for mixed merchandise trains with a grade less than 2.0% and maximum track curvature less than 8 degrees.

4. First Car Derailed: In each accident, the first car to derail was an empty car.

5. Train Type: Five out of the six accidents involved mixed freight trains, which typically require more complex train makeup considerations.

6. Hazmat Cars: Five out of the six accident trains contained hazmat cars, highlighting the potential risks associated with transporting hazardous materials in long, complex consists.

7. Derailed Hazmat Cars: In three of the accidents, hazmat cars were derailed, increasing the risk of hazardous material release and environmental damage.

8. Hazmat Release: Three of the accidents resulted in the release of hazardous materials, posing a threat to public safety and the environment.

9. Evacuations: Two of the accidents led to the evacuation of local populations due to the release of hazardous materials.

10. Key Trains: Three of the six accident trains were classified as Key Trains, which are trains with a higher level of potential risk due to the nature of the cargo they carry or their operational characteristics.

Technologies such as DPUs, energy management systems, and dynamic braking can be used in conjunction with proper train car placement and makeup. While these technologies can improve train handling and fuel efficiency, they cannot replace the need for correct car placement and assembly. Railroads must prioritize proper train makeup to maintain safety, prevent accidents, and optimize train performance. Further, all operating employees must be properly trained in these technologies and the handling of complex trains to ensure safe operation and minimize human error.

[2] 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 Hazard1 (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).

Recommended Actions

To improve train safety and reduce the risk of accidents, FRA recommends the following best practices:

1. Review and update train makeup policies, procedures, and guidelines to ensure they are comprehensive, effective, and current.

2. Ensure that all personnel involved in train makeup decisions and operations receive appropriate training, guidance, and supervision to effectively execute train makeup policies, procedures, and guidelines to ensure safe operations.

3. Establish a system to regularly monitor and assess train makeup practices, with a focus on identifying and addressing potential safety risks.

4. Encourage open communication and collaboration among all stakeholders, including train crews, dispatchers, yardmasters, and maintenance personnel, to ensure a comprehensive understanding of train makeup factors and their potential impact on safety. Personnel should be encouraged and empowered to adhere to train makeup policies, procedures, and guidelines, even if it delays a train.

5. Develop and implement strategies to mitigate the risks associated with train build factors, such as the proper use of distributed power, train length limitations, and other operational train handling practices.

6. Enhance incident investigation procedures to specifically address train makeup factors and their potential contribution to the cause of the incident.

FRA encourages freight railroads to take actions consistent with the preceding recommendations. FRA may modify this Safety Advisory 2023–02, 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, DC.

John Karl Alexy,

Associate Administrator for Railroad Safety Chief Safety Officer.

[FR Doc. 2023–07579 Filed 4–10–23; 8:45 am]

BILLING CODE 4910–06–P

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

[Docket No. FRA–2010–0030]

Massachusetts Bay Transportation Authority's Request To Amend Its Positive Train Control System

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

ACTION: Notice of availability and request for comments.

Section 20157(h) requires FRA to certify that a host railroad's PTC system complies with Title 49 Code of Federal Regulations (CFR) part 236, subpart I, before the technology may be operated in revenue service. Before making certain changes to an FRA-certified PTC system or the associated FRA-approved PTC Safety Plan (PTCSP), a host railroad must submit, and obtain FRA's approval of, an RFA to its PTC system or PTCSP under 49 CFR 236.1021.

Under 49 CFR 236.1021(e), FRA's regulations provide that FRA will