Brotherhood of Locomotive Engineers and Trainmen

A Division of the Rail Conference
International Brotherhood of Teamsters

Safety Task Force

INDEPENDENCE, OHIO

Before the National Transportation Safety Board

NTSB Accident Number: RRD19FR001

Class: Regional

October 4, 2018

Proposed findings, probable cause, and safety recommendations, in connection with the collision of two Union Pacific Railroad freight trains near Granite Canyon, Wyoming.

Stephen J. Bruno, BLET-Safety Task Force, National Chairman
Brian Fransen, BLET-Safety Task Force, Party Spokesman

FINAL SUBMISSION

The Brotherhood of Locomotive Engineers and Trainmen ("BLET"), a division of the International Brotherhood of Teamsters ("IBT"), was granted party status by the Board in the above-referenced investigation. BLET respectfully submits these proposed, findings, probable cause, and safety recommendations to the Board for consideration.

ACCIDENT SYNOPSIS

On October 4, 2018, at approximately 7:38 p.m. Mountain Daylight Time ("MDT"),[1] an eastbound Union Pacific Railroad ("UP") mixed freight train struck the rear end of a stationary eastbound UP mixed freight train at milepost ("MP") 527.1 on Main Track No. 1 of the UP North Platte Division, Laramie Subdivision. Two UP employees were fatally injured in the accident. The accident occurred near Granite Canyon, Wyoming (between Laramie, WY and Cheyenne, WY). The territory where the accident occurred is double main track, and is governed by centralized traffic control ("CTC") rules,[2] and is under the control of the UP Train Dispatcher in Omaha, NE. At the time of the collision, the striking eastbound train was operating on a downhill grade of 1.55% at 56 miles per hour ("MPH"). The controlling locomotive of the striking train (UP 5412) was equipped with Positive Train Control ("PTC")[3] and PTC was operational on Main Track No. 1. At the time of the accident, the weather was clear, the wind was from the southwest at about 10 MPH with a temperature of 45˚ F. Damages are estimated at approximately $3.5 million.

[1] All times throughout report will be Mountain Daylight Time.

[2] Centralized Traffic Control is a signaling system that uses block signal systems to authorize train movements.

[3] Positive Train Control is a system designed to prevent certain train collisions, overspeed incidents, incursions into established work zone limits, and the movement of a train through a Main Track switch in the improper position.

Figure 1 - Overview of collision *(Photo courtesy of UP)*

ACCIDENT NARRATIVE

Train Information:

Striking Train – MGRCY04:

The striking UP freight train (MGRCY04) originated in Green River, WY (MP 816.9), and was destined for Cheyenne, WY (MP 509.5). The train consisted of three (3) locomotives — all on the head-end (front) of the train — with UP 5412 as the controlling locomotive. The train had ninety-five (95) loads and ten (10) empties for a total of 105 cars, weighing 12,417 tons, and was 6,581 feet in length.

Stationary Train – MPCNP03:

The stationary UP freight train (MPCNP03) consisted of three (3) locomotives. UP 7113 and UP 7620 were on the head-end of the train, with UP 7113 as the controlling locomotive. UP 9008 was in the middle of the train operating as a Distributed Power Unit ("DPU").[4] The train had ninety (90) loads and sixty-seven (67) empties for a total of 157 cars, weighing 13,474 tons, and was 10,103 feet in length.

Method of Operation:

The Laramie Subdivision is part of the UP North Platte Division between Rawlins, WY (MP 682.8) and Cheyenne, WY (MP 509.5). At the location of the accident (MP 527.1) there are two (2)

[4] Distributed Power is a term referring to the physical distribution of locomotives at intermediate points throughout the train. The distributed locomotives are remotely controlled from the controlling locomotive.

main tracks, each with a maximum authorized speed ("MAS") of 70 MPH. [5] Both main tracks have CTC signals enabling trains to operate in both directions.

UP Rules and/or Documents for TY&E: [6]

Below is a comprehensive list of the relevant documents for this accident investigation provided by UP:

- *General Code of Operating Rules ("GCOR"),* Seventh Edition, effective April 1, 2015
- *UP Air Brake and Train Handling Rules,* effective May 2, 2016
- *UP Special Instructions,* effective December 11, 2017
- *UP North Platte Division Timetable No. 5,* effective December 11, 2017
- *UP Safety Rules,* effective June 1, 2017
- *General Track Bulletins for the MGRCY04 and MPCNP03*

Regulatory Requirements:

An end-of-train device ("EOT") capable of placing the train into emergency braking from either end of the train was required on train MGRCY04 by 49 CFR § 232.405(a) and (b) which state,

> **§ 232.405 Design and performance standards for two-way end-of-train devices**
>
> Two-way end-of-train devices shall be designed and perform with the features applicable to one-way end-of-train devices described in § 232.403, except those included in § 232.403(b)(3). In addition, a two-way end-of-train device shall be designed and perform with the following features:
>
> (a) An emergency brake application command from the front unit of the device shall activate the emergency air valve at the rear of the train within one second.
>
> (b) The rear unit of the device shall send an acknowledgment message to the front unit immediately upon receipt of an emergency brake application command. The front unit shall listen for this acknowledgment and repeat the brake application command if the acknowledgment is not correctly received.

Moreover, the two-way EOT must be tested in accordance with the requirements of 49 CFR § 232.409(c) which states,

> A two-way end-of-train device shall be tested at the initial terminal or other point of installation to determine that the device is capable of initiating an emergency power brake application from the rear of the train. If this test is conducted by a person other than a member of the train crew, the locomotive engineer shall be notified that a successful test

[5] *See* Appendix A at the end of this report for the relevant portions of the UP Timetable.

[6] Train, Yard and Engine employees.

> was performed. The notification required by this paragraph may be provided to the locomotive engineer by any means determined appropriate by the railroad; however, a written or electronic record of the notification shall be maintained in the cab of the controlling locomotive and shall include the date and time of the test, the location where the test was performed, and the name of the person conducting the test.

In addition, 49 CFR § 232.405(f) requires that

> "All locomotives ordered on or after August 1, 2001, or placed in service for the first time on or after August 1, 2003, shall be designed to automatically activate the two-way end-of-train device to effectuate an emergency brake application whenever it becomes necessary for the locomotive engineer to place the train air brakes in emergency." (emphasis added)

The controlling locomotive of train MGRCY04 (UP 5412) was manufactured in 2004; therefore, it was required to be equipped with this feature, which ensures that the Locomotive Engineer would be able to bypass a potential blockage and effectuate an emergency brake application from the rear of the train.

To comply with the intention of the regulations obviously requires that the controlling locomotive is capable of transmitting and the EOT device is capable of receiving an "activate emergency brake application" radio signal. Interruption, interference, or a sufficient degradation of the strength of the radio signal from the controlling locomotive could defeat this purpose of the EOT device. Undoubtedly, a radio signals' effectiveness is compromised with increasing distance. Thus, it is essential that the signal be tested at the train's full length or greater.

UP train crews – Striking Train (MGRCY04):

To fully understand the facts and circumstances that led to this accident we must examine the actions taken by the two separate crews who operated the striking train. The initial crew went on duty at Green River Yard and operated the train to Rawlins Yard. The accident crew went on duty at Rawlins Yard and operated the train until the collision.

Initial Crew:

Green River, Wyoming (MP 816.9) to Rawlins, Wyoming (MP 682.8):

The initial train crew began their tour of duty at 12:01 a.m. on October 4, 2018. Their train had been built by the Green River remote control operation ("RCO") switch crew[7] in the UP Green River Yard. After arriving at their on-duty location, the crew contacted the Green River Yardmaster for instructions, who informed them that their train was on two (2) separate yard tracks — Yard Tracks No. 19 and 20 — and would need to be assembled by them. The Locomotive Engineer and Conductor were transported by company vehicle to the Green River Diesel Facility and boarded their assigned locomotives (UP 5412, UP 5842, UP 5003). Both sections of the train had previously received a Class I Initial Terminal Air Test[8] by UP Qualified Mechanical Inspectors ("QMI" and/or Carmen).

The EOT was then armed[9] and tested for emergency capabilities while the train was still in two separate sections on track No. 20 and track No. 19. The purpose of this test is to ensure that the Locomotive Engineer can place the train into an emergency braking application, using the EOT, from the rear end of the train. The test was performed without either section of the train's cars being coupled to the controlling locomotive. The locomotives were in the Green River Yard Diesel Facility at the time the test was conducted. The EOT emergency brake test was completed after the Carmen had attached the EOT to the rear portion of the second set of cars, which were standing on track No. 20. The MGRCY04 completed the assembly of their train by coupling the cars on track No. 19 with cars on track No. 20. Although the train was fully assembled by combining the two sections into one, essentially doubling the length of the train, the EOT was not tested again to ensure that the emergency braking capabilities were functional from the rear end of the train nor was the radio signal tested at the train's final full length.

[7] Remote Control Operation (or "RCO") is a form of train crew absent a Locomotive Engineer operating the locomotive in a conventional style.

[8] *See* 49 CFR § 232.205.

[9] *See* Appendix B at the end of this report. "Armed" means that the receiving display unit on the controlling locomotive is receiving telemetry transmissions from the EOT, and that it has the capability of placing the train into emergency braking application from the rear of the train via the use of a toggle switch or the emergency brake valve on equipped locomotives.

Prior to departure from Green River Yard, the Locomotive Engineer performed the mandatory Class III brake test.[10] The crew departed Green River Yard (MP 816.9) at 3:09 a.m., with seventy-six (76) loads and ten (10) empties, weighing 9,935 tons, and was 5,627 feet long. All three locomotives were on the head-end of the train. The Locomotive Engineer stated that the trip from Green River to Rawlins (traveling approximately 134.1 miles) was unremarkable. The crew arrived in Rawlins, WY at 6:38 a.m. and secured their train in Rawlins Yard. The crew went off duty at 7:15 a.m. on October 4, 2018.

Accident Train Crew:

Rawlins, Wyoming to Accident Site (MP 527.1):

The accident train crew of MGRCY04 who operated the train between Rawlins, WY and the accident site (MP 527.1) went on duty at 8:45 a.m. on October 4, 2018. They boarded the train in Rawlins Yard (MP 683) and departed at 9:51 a.m. The crew received instructions to stop in Laramie, Wyoming (MP 565.6) and pick up additional cars from Laramie Yard.

Upon arrival at Laramie Yard, the crew added 19 cars to the head end of their train directly behind the three locomotives. The crew was observed by a local UP supervisor while they were adding the cars and performing the required air tests. He observed that the Conductor used a handheld air gauge at the rear of the 19 cars and performed a Class I air test on the cars before they were added back to the train. The UP Supervisor also confirmed that the Conductor observed/inspected the brake application and release on each car.[11] The crew then added the 19 cars to the head-end of their train and performed a Class III brake application and release test on the entire train.

The train departed Laramie at 4:56 p.m. with 95 loads, 10 empties, weighing 12,417 tons, and a length of 6,581 feet. This is approximately twice the distance between the controlling locomotive and the EOT device when it was tested at Green River Yard.

[10] *See* 49 CFR § 232.211.

[11] Refer to Transcript of UP Supervisor J. Carrigan's testimony, page 5 (lines 16-25, page 6 (lines 1-7) and page 11 (lines 18-19).

After departing Laramie, the MGRCY04 did not stop again prior to the accident. When the train crested the grade at MP 540, the Locomotive Engineer applied dynamic braking to control the train's speed. Due to the tons per operative brake ("TOB") ratio and the number of locomotives that were available for dynamic braking, the train's speed was restricted to 25 MPH.[12]

In an attempt to comply with the requirements of the rule, the Locomotive Engineer applied a minimum brake pipe application (a 5-7 pounds per square inch ("psi") reduction) at approximately MP 536.68 while traveling at 20 MPH. At that time he had not received an indication that the controlling locomotive had lost communication with the EOT device. At MP 531.83, the Locomotive Engineer reduced the brake pipe further to a total of 10 lbs. psi, in an effort to control the speed of the train at 20 MPH.

The speed began to increase and reached 25 MPH at which time the Locomotive Engineer further reduced the brake pipe pressure to 17 lbs. psi. At MP 531.09 the Locomotive Engineer further reduced the brake pipe pressure to 26 lbs. psi (a full service reduction)[13] as the train's speed increased to 27 MPH. According to the controlling locomotive's event recorder download, at MP 530.84 the train speed was still increasing when the Locomotive Engineer initiated an emergency brake application by moving the automatic brake handle into the emergency position of the brake valve. As cited above, 49 CFR § 232.405(f) requires this locomotive to be capable of automatically activating the two-way end-of-train device to effectuate an emergency brake application when the locomotive engineer placed the train's automatic brake handle into the emergency position, which did not occur.

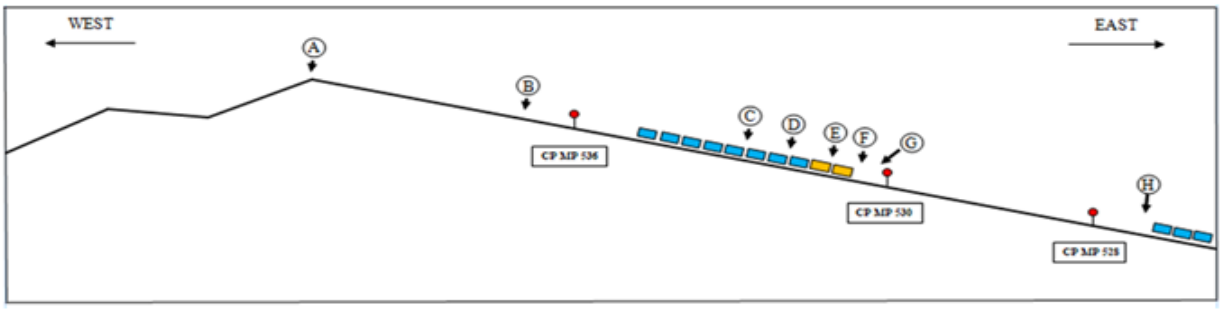
The train continued out of control, increased its speed to 56 MPH[14] and eventually collided with the standing train at MP 527.12. The forces of the collision were so severe that both crew members were fatally injured. In addition, three (3) locomotives and fifty-six (56) cars on the striking train,

[12] Restrictions are outlined in UPRR SI-12. *See* Appendix C.

[13] A full service brake pipe reduction is defined as when the locomotive's auxiliary reservoir and the train's brake pipe equalize. At this point, any further reduction of the brake pipe pressure is ineffective with the exception of an emergency braking application.

[14] This data was from the event recorder of the controlling locomotive of the striking train (UP 5412).

and nine (9) cars on the standing train derailed causing in excess of $3.5 million in property damage.



	LOCATION	SPEED	DESCRIPTION OF ACTIVITY
A	MP 540	16 MPH	Crest of Grade
B	MP 536.68	20 MPH	Locomotive Engineer makes an initial 5-7 PSI brake pipe reduction (minimum brake pipe reduction)
C	MP 531.83	21 MPH	Brake pipe reduction increased to 10 PSI
D	MP 531.32	25 MPH	Brake pipe reduction increased to 17 PSI
E	MP 531.09	27 MPH	Brake pipe reduction increased to 26 PSI (full service application)
F	MP 530.84	29 MPH	Locomotive Engineer placed train into emergency
G	MP 530.72	30 MPH	EOT status changed to "FR NO COMM"
H	MP 527.12	56 MPH	MGRCY04 collided with the rear of the MPCNP03

Figure 2 - Schematic of accident events[15]

[15] *See* Appendix D at the end of this report for the Up Grade Chart and map of Sherman Hill and vicinity.

Union Pacific ("UP") Train Dispatcher Communications and Actions:

The UP Train Dispatcher territories and districts change near the accident site. The uncontrolled movement of MGRCY04 started on Train Dispatcher P-14's district. The standing train (MPCNP03) was on Train Dispatcher P-15's district. According to the radio recordings, the crew of the MGRCY04 (UP 5412) called the Train Dispatcher (P-14) at 7:36:10 p.m. and reported that the train was "not stopping" and was "picking up speed". Both the Locomotive Engineer and the Conductor were using their individual base radio handsets to communicate with the Train Dispatcher. During the transmissions different voices can be heard, but investigators could not identify which individual was making each comment. The following is a transcript of the first radio transmission recorded between the accident train crew and the UP P-14 Train Dispatcher:

> **Train Dispatcher (P-14):** Dispatcher 13 answering emergency call, Buford Tower, Over.
>
> **Unknown 1:** Yeah, this ah, 5412's dumped and it's ah not stopping . . . it's - - - won't stop. It's kind of picking up speed too.
>
> **Train Dispatcher (P-14):** UP 5-4-1-2 dumped its air and you said correct? Over.
>
> **Unknown 1:** That is correct. Over.
>
> **Train Dispatcher (P-14):** What . . . do you mean you are in UDE?[16] Over.
>
> **Unknown 2:** No - - - dumped the air and, ah, the train is still gaining speed, ah, we're 37 MPH, gaining, going downhill. We're gonna go past Granite . . . we're gonna blow through all these lights. Over.
>
> **Train Dispatcher (P-14):** Emergency, emergency, emergency . . . uncontrolled movement, headed east . . . CPW530, main track one . . . emergency, emergency, emergency. Over. - - - - - - - - Emergency, emergency, emergency . . . uncontrolled movement, headed east, main track one . . . CPW530. Over.

During the interview after the accident had occurred, the P-14 Train Dispatcher stated, "I grabbed my emergency book" when she received the initial notification from the crew so she could follow the appropriate steps. The Train Dispatcher's immediate supervisor (UP Corridor Manager) also noticed the emergency call light at the Train Dispatcher's work station and initiated the call for local emergency response.

At 7:38:21 p.m., (2 minutes and 11 seconds post-initial call by the MGRCY04) the P-14 Train Dispatcher asked the crew of the UP 5412 for a status report. The crew responded that the train

[16] UDE refers to "Undesired Emergency" brake application.

was still picking up speed and had reached a speed of 51 MPH. They also relayed that they had no brakes and asked the Train Dispatcher to clear a path in front of them. Clearing a path in front of the MGRCY04 was not an option due to the fact that the MPCNC03 was stopped in front of them on Main Track No. 1. There also was a westbound train that was stopped on Main Track No. 2. The following is a transcript of the second transmission between the accident train crew and the P-14 Train Dispatcher:

> **Train Dispatcher (P-14):** UP Dispatcher 13, UP 5-4-1-2. Over.
> **Unknown 1:** 5-4-1-2, go ahead
> **Train Dispatcher (P-14):** Any change there? Over.
> **Unknown 1:** No. We're doing 51 miles an hour. It's picking up speed.
> **Unknown 1:** 52
> **Unknown 2:** We have no brakes.
> **Unknown 1:** We have no brakes.
> **Unknown 2:** You need to clear all our paths . . . (unintelligible) . . .
> **Unknown 1:** (unintelligible) . . . please clear all our paths.

The adjacent UP P-15 Train Dispatcher responded to the emergency and initiated communication with the train ahead (MPCNP03), which was stopped on his district. The P-15 Train Dispatcher also used the protocol "emergency, emergency, emergency, uncontrolled movement" and added the location. The MPCNP03 was stopped east of the uncontrolled movement due to the presence of other trains on the same track ahead of it. The stationary train crew had dismounted and were clear of their train before the collision occurred.

MGRCY04 (Striking Train) Crew Information:

A. Locomotive Engineer

The Locomotive Engineer was a forty-year-old male who was hired by the Union Pacific Railroad on August 7, 2006. He passed his promotion to Conductor and later entered the engineer training program and was certified as a Locomotive Engineer on November 20, 2014. The Locomotive Engineer had a current 49 CFR 240 certification that was due to expire on June 28, 2021. At the time the accident occurred, this route was his regular job assignment. He had passed medical, hearing, and vision examinations in order to obtain his Locomotive Engineer certification in June 2018, and was determined to be fit for duty.

B. Conductor

The Conductor was a thirty-nine-year-old male who was hired by the Union Pacific Railroad on March 9, 1998. He was hired as a track laborer and moved through many positions in the engineering department. He transferred to the operating department as a brakeman on March 2, 2015. He was first certified as a Conductor on September 17, 2015. His last Conductor certification was on December 13, 2017, and his certification would have expired on January 11, 2021. At the time the accident occurred, this was his regular job assignment. He had passed medical, hearing, and vision examinations in order to obtain his conductor certification in December 2017, and was determined to be fit for duty.

Post-Accident Toxicological Testing:

Toxicological specimens were taken from the Locomotive Engineer and the Conductor who were fatally injured as a result of the accident, and they were sent to the Civil Aerospace Medical Institute (CAMI) in Oklahoma City, Oklahoma for analysis. Post-accident testing for both employees was negative for alcohol and drugs.

Cell Phone Records:

A review of the cell phone records from both the Locomotive Engineer and the Conductor indicate that there was no cellular phone activity leading up to or during the accident.

Post-Accident Actions by UP:

Since the accident near Granite Canyon, Wyoming the UP railroad has installed a total of twenty-seven (27) additional radio signal "repeaters"[17] between the crest of grade (MP 540) and the site of the accident (MP 527.1).

Anecdotal comments from TY&E employees after the accident occurred indicate that there was concern regarding the loss of communications in the area of the accident and that the issue had

[17] The term "repeaters" refers to radio signal transmitters placed strategically in the field in order to enhance transmissions between radio and/or EOT communications. A repeater is a combination of a radio receiver and a radio transmitter that receives a weak or low-level signal and retransmits it at a higher level or higher power, so that the signal can cover longer distances without degradation.

been reported to UP on numerous occasions. We suggest NTSB follow up with confidential interviews of operating employees who regularly operated over this territory and determine if indeed such communication failures were reported and received and, if so, why did UP decline to address the matter prior to the accident.

Head-End Train Device ("HTD") Post-accident Testing:

The HTD (termed Head-End Unit, or HEU, by UP)[18] was retrieved from the UP 5412 locomotive and analyzed at the manufacturer's (Wabtec) facility. Functional testing determined the device was operating within manufacturer specification and with no malfunctions noted. The National Transportation Safety Board ("NTSB"), Federal Railroad Administration ("FRA"), UP, and Wabtec agreed to the following findings per the NTSB Train Telemetry Factual Group report, p. 3, stating in relevant part:

> "From the initial signal from the locomotive computer, the signal will be transmitted for two minutes to then it will stop sending the signal until another command for emergency is received. If an engineer initiates another emergency during the two-minute time frame, the two-minute window is not extended. After the two-minute window the HTD will not send a signal unless directed again by the locomotive computer. A locomotive engineer would have to initiate another emergency application attempt to initiate an ETD emergency command." (emphasis added)

Event recorder data downloaded from the controlling locomotive verifies that, when the Locomotive Engineer placed the train into emergency, the EOT device never activated an emergency application of the brakes, and that the "initiate emergency application of the brakes" signal was never received by the EOT. After two (2) minutes, the controlling locomotive's HTD stopped sending the signal to the EOT. The train travelled five (5) additional minutes after the Locomotive Engineer placed the train in emergency.

To summarize, when a Locomotive Engineer requests an emergency application of the brakes, the locomotive computer will transmit the "initiate emergency application of the brakes" for a period of two (2) minutes and then will stop sending the signal until another request is made after the

[18] *See* Appendix B at the end of this report.

expiration of the 2-minute period. Many, if not most, Locomotive Engineers are not aware of and not trained on this feature. BLET believes this was a contributing factor to this accident.

Accordingly, we strongly urge NTSB to recommend that two remedial steps be taken;

1. The systems should be redesigned so that the HTD continuously sends an "initiate emergency application of the brakes" signal to the EOT until the train comes to a complete stop. If signal continuity between the HTD and the EOT is temporarily interrupted — because, for example, of a combination of train length and topography, as may well be the case here — restoration of continuity will immediately result in the intended EOT-initiated emergency application, regardless of how long the interruption has lasted.
2. During the interim until all HTD systems are fully redesigned in accordance with item (1) above, TY&E employees across the United States be instructed on a the current 2-minute time limit, and trained to physically cycle the automatic brake valve handle from emergency to handle-off and back to emergency two minutes after the initial application, and again every two minutes thereafter until either the train stops or the crew evacuates the locomotive cab.

EOT Failure:

There are four (4) credible explanations for the failure of the EOT device to initiate an emergency application of the brakes when the Locomotive Engineer placed the automatic brake handle in the emergency braking position:

A. The device was not functioning properly
B. The signal from the controlling locomotive to the EOT device failed to initiate
C. Something interfered with the signal from the controlling locomotive to the EOT
D. The signal strength was insufficient to activate the EOT at the full train length, given the topography at the location where the emergency brake application was initiated

The EOT was tested in the Green River Yard — albeit at approximately half the train's final length — prior to departure, where it did receive an "initiate emergency application of the brakes" signal from the controlling locomotive, and the device performed as intended. Therefore, it is reasonable to conclude that if the device did receive a signal it would have performed as it did when tested in the yard. Accordingly, a failure of the EOT itself and a failure to initiate a signal (Scenarios A and B above) can be ruled out.

We cannot say definitively whether the mountainous obstacles in Granite Canyon, the sheer length of the train, or some combination of both prevented the signal from reaching the EOT device on train MGRCY04. However, the EOT device never activated an emergency application of the brakes as it travelled for an additional five (5) minutes after the Locomotive Engineer placed the train in emergency and covered an additional 3.7 miles during that time. Therefore, it is extremely unlikely that physical characteristics of the terrain was the sole reason the EOT did not receive the signal.

The length of the train cannot be ruled out as a factor, because the emergency braking was never tested at the train's eventual complete length. Furthermore, the train continued to operate after the "lost communication" alert was recorded and the EOT never initiated an emergency application of the brakes from the rear of the train. In Scenario C or D above, the distance the signal had to travel, (i.e. the length of the train) negatively impacted the signal. Therefore, we conclude that the length of the train was the primary contributing factor of the Granite Canyon accident.

Prior to the introduction of EOTs, two train crew members were stationed at the rear of a train, in a caboose. One of these crewmembers would have opened an emergency brake valve located in the caboose in order to prevent the runaway that occurred here. Indeed, it was precisely to prevent accidents like these that FRA promulgated EOT regulations requiring the ability to place a train into emergency from the rear end of the train.

Undoubtedly, the kinked air hose was a contributing factor to this accident. The accident would not have occurred if the air hose had not been kinked. However, we cannot lose sight of the fact that FRA recognized the danger of blocked air hoses decades ago when the Agency implemented the EOT rule. This history establishes that the entire railroad community, regulated and regulators, recognize that blocked air hoses are a common operational occurrence and properly installed, maintained and tested safety devices and/or appliances are required to address that inevitability. Therefore, we urge the Board to reject the predictable urging of the industry to assign the probable cause of this accident to the blocked air hose.

PROBABLE CAUSE

The Brotherhood of Locomotive Engineers and Trainmen concludes that the probable cause of the October 4, 2018 collision near Granite Canyon, Wyoming was the result of three (3) significant contributing factors that led to the Locomotive Engineer's inability to place the entire train into an emergency brake pipe application, which resulted in the MGRCY04 colliding with the rear end of the MPCNP03 at approximately MP 527 on the Laramie Subdivision.

A. Communication Loss between EOT and UP Locomotive 5412's HTD Displaying Front to Rear No Communication ("FR NO COMM")

When the controlling locomotive's HTD lost communication with the EOT, the Locomotive Engineer was unable to initiate an emergency application of the train's brakes from the rear end of the train. Combined with the loss of air brake continuity between the 19th and 20th car in the train, the Locomotive Engineer was only afforded nineteen (19) cars of emergency braking capability, plus the three locomotives, to stop the 105-car train. This lack of a vital function caused the train to uncontrollably accelerate until the collision occurred.

Either the radio telemetry signal was too weak to reach the EOT device or the signal was blocked and never reached the EOT because of the topography of Granite Canyon. Because the transmitted signal to the EOT was not tested at its full length we cannot rule out that distance was the cause of the signal interruption. Moreover, because the regulation allows the devices to be out of communication for up to 16'30" and then reset the consecutive clock with a brief return to "communicating" status, it is possible that the device was out of communication for more time than it was in communication during the trip.

When the EOT rule was implemented 22 years ago, FRA cited sixteen accidents to support its decision to implement regulations for two-way telemetry devices. Those accidents are cited in Table 1 on page 291 of the January 2, 1997 final rule[19] and date as far back as 1991, nearly three decades ago. A review of the cited accidents establishes that the average length of those trains was approximately 84 cars (approximately 4,200 feet based on 50-foot car lengths).[20] Train's

[19] *See* FRA Docket No. PB-9, Notice No.6, and Appendix E at the end of this report.

[20] Form FRA F 6180.54 data does not reflect train length in their synopsis.

today are often twice as long. The train length in the Granite Canyon accident was 105 cars (6,581 feet) while the train length of the February 1, 1996 Cajon Pass accident was 49 cars (3,218 feet). *See* NTSB Report RAR-96-05; 62 Fed. Reg. 279 (Jan. 2, 1997). In the instant accident, the telemetry signal from the locomotive to the EOT had to travel twice the distance as it would have had to travel in the Cajon Pass accident.

Obviously, the longer a train is, the greater the possibility is that a physical characteristic of the earth will interfere with a radio signal from the controlling locomotive to the EOT device, particularly in canyons, cuts and passes. While the train in this accident is relatively close to the average lengths of the trains FRA analyzed when developing the rule average train lengths have steadily increased for decades[21] and FRA has yet to consider how current EOT telemetry regulations addresses signal strength vs distance and/or obstructions. Although the FRA oversees all aspects of freight railroad safety, the Agency has shown no interest in limiting train length or defining what constitutes a "long" train.

We cannot say definitively whether the sheer length of the train, the mountainous obstacles in Granite Canyon, or some combination of both prevented the radio signal from reaching the EOT device on train MGRCY04. The length of the train itself cannot be ruled out as the root cause of the accident because the train continued to operate after the "lost communication" alert (FR NO COMM) was recorded and the EOT never did initiate an emergency application of the brakes from the rear of the train. However, we can conclude with a reasonable degree of certainty that the length of the train was a primary contributing factor in the Granite Canyon accident.

We believe that the 16'30" minute threshold to report a loss of communication is far too broad and we recommend FRA revisit this regulation and implement three changes to 49 CFR 232 detailed below to reestablish the intended operational safety effect of the rule.

B. Improper Arming of End of Train Device at Green River, WY

The failure to retest the emergency brake feature of the EOT once the train was fully assembled was a contributing factor to this accident. The UP Carmen armed the EOT device while it was

[21] *See* GAO-19-443 May 2019 Report titled *Rail Safety: Freight Trains Are Getting Longer and Additional Information Is Needed to Assess Their Impact* page 11.

attached to what eventually would be the rear car of the train. 49 CFR § 232.409(c) requires that the EOT be tested for emergency capabilities "at the initial terminal or any other point of installation." Although the rule allows for alternate means of testing the functionality of the EOT device, it is unreasonable to conclude that the regulators intended the testing of the EOT devices capability to initiate an emergency brake application can be satisfied when the device is less than half the distance from where it will be stationed under actual operation. This requirement can be fulfilled only when the EOT is on the rear of the fully assembled train.

In this instance, the test of the device was done before the train was fully assembled. Therefore, it could not have been done "at the rear of the train" because the train was not assembled until the cars on Track 19 and those on Track 20 had been coupled, and the train line established. The test did establish that if the EOT device received a signal that the EOT would initiate an emergency application of the brakes, at least for the length of the draft of cars on which it had been tested. Therefore, it is reasonable to conclude that the EOT device would have functioned as intended had the device received the "activate emergency brake application" radio signal when the Locomotive Engineer placed the automatic brake handle into the emergency position. However, ensuring that the strength of the signal was sufficient to be received at the full length of the train was never tested.

We contend that 49 CFR § 232.409(c) requires testing at the actual rear of the train, and not merely on the car that would eventually become the rear of the train to determine if the signal strength is sufficient. The EOT device was tested from a distance of approximately 48 cars. The eventual rear of the train that departed Green River Yard from Track 20 was 86 cars in distance. In Laramie, the accident crew added 19 cars making the train a total of 105 cars. This was the length of the train at the time of the EOT "FR NC" alert, which notified the Locomotive Engineer of the lost communication prior to the eventual accident.

C. Blocked Air Hose on Railcar SSW 87597

The event recorder download data from the UP 5412 reflected that the brake pipe was partially blocked when the train was in a bunched condition (increasing the cubic feet per minute "CFM" on the air flow meter "AFM"), and was subsequently unblocked when the train was in a stretched condition (reduced CFM on the AFM). In the post-accident on scene investigation, investigators recovered the intermediate air hose from the SSW 87597, which was positioned as the 20th railcar in the train. Between Green River and Laramie, this railcar was positioned as the first car in the train. The crew then added nineteen (19) cars to the head end of the train in Laramie, making the SSW 87597 the 20th car in the train. After these cars were added, the MGRCY04 did not stop again until the collision occurred.

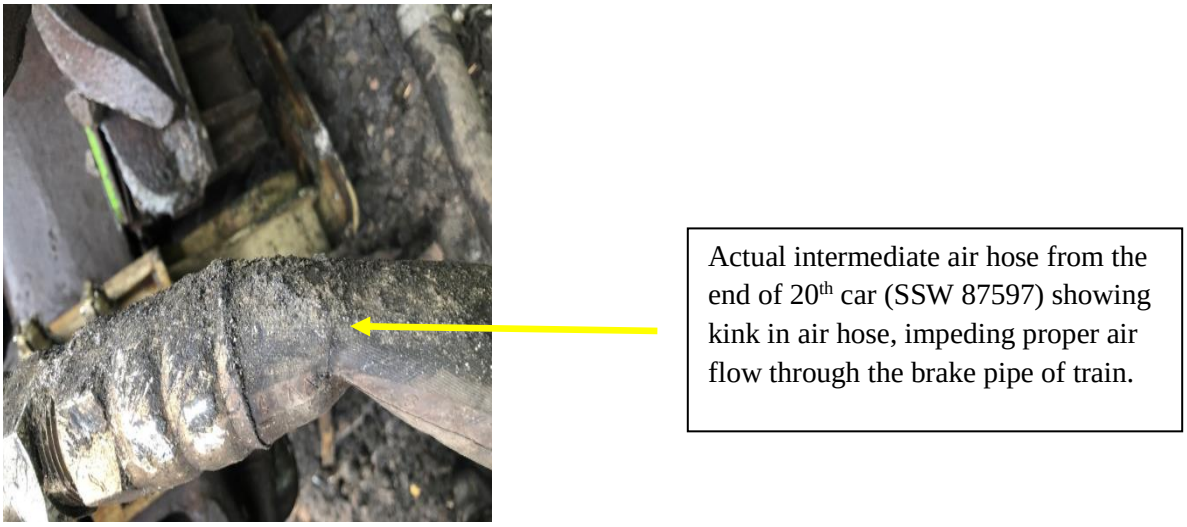


Figure 3 - *Photo courtesy of NTSB*

As noted above, the presence of a blockage (e.g., ice, debris, etc.) or a kink in the air hose of a freight car is not an uncommon occurrence in the railroad industry. The Board has recognized this in past accidents, such as NTSB RAR-96/05 (File No. DCA-96-MR-002). This accident involved the derailment of freight train H-BALT1-31 on the ATSF Railway Company near Cajon Junction, California on February 1, 1996. In this accident, a train line blockage was found to be a probable cause. Had the train been afforded a working EOT device, the accident may have been avoided. Below are some highlights of the NTSB findings of that similar accident.

- It was determined that an unknown train line blockage or restriction, probably between the fifth and ninth cars, resulted in responsive brakes on only the locomotive units and

possibly the first eight cars, and, thus, the Locomotive Engineer was unable to slow or stop H-BALT1-31.

- Had H-BALT1-31 been equipped with a fully functioning two-way end-of-train device, the Locomotive Engineer could have applied the brakes from the rear of train and the derailment may have been avoided.

- It was determined that the failure of the transmitter module of the HTD device on locomotive ATSF 157 to generate sufficient wattage power would not allow the Locomotive Engineer of H-BALT1-31 to arm the two-way head-end/end-of-train device system.

Figure 4 - Example of a kinked air hose found on a similar style freight car that was found between Cheyenne and Laramie, Wyoming after the instant accident at Granite Canyon, Wyoming *(Photo courtesy of UP*)

PROPOSED RECOMMENDATIONS

To the Federal Railroad Administration ("FRA"):

1. Revise Subpart E of 49 CFR Part 232 to require that, when an emergency brake application is made on the controlling locomotive, the HTD continuously sends an "initiate emergency application of the brakes" signal to the EOT until the train comes to a complete stop.

2. Require that EOT testing for emergency brake applications be conducted (A) at the initial terminal or other point of installation not prior to the train having been fully assembled, and (B) each time the trains consist is lengthened.

3. Require that the Locomotive Engineer be informed immediately upon the loss of communication between the controlling locomotive and the EOT device.

4. Require that trains shall be brought to a safe stop upon a loss of communication that lasts longer than 4 minutes and 59 seconds.

5. Establish regulations mandating that all controlling locomotives that fall within the guidelines of 49 CFR §232.405(f), and are being used to perform an initial terminal air brake test, be tested to ensure that the emergency brake valve activates the emergency braking capabilities of the EOT on the rear end of the train.

6. Revise 49 CFR Part 225 to require that railroads report EOT communications interruptions by date, time, location and duration, and review data submitted in these reports with a particular emphasis on train lengths, as recommended in the GAO-19-443 Report.

7. Immediately begin collecting comprehensive data on train length in feet in order to assist future investigations regarding in-train forces, and loss of communication issues with EOTs, as recommended in the GAO-19-443 Report.

8. Require railroads to track all safety concerns to be made readily available for all TY&E employees.

To the Union Pacific Railway Company ("UP"):

1. Discontinue the practice of allowing the arming and emergency capability testing of an end of train device to be performed prior to the train being fully assembled.

2. Establish rules requiring the retesting of the emergency capability testing of the end of train device whenever a train is lengthened.

3. Redesign the EOT two-way telemetry system so that — upon an emergency brake application initiated in the locomotive cab — the HTD continuously sends an "initiate emergency application of the brakes" signal to the EOT until the train comes to a complete stop. In the interim, instruct your TY&E employees that there is a 2-minute time limit for the HTD to signal the EOT, after which the transmission ceases, and train them to physically cycle the automatic brake valve handle from emergency to handle-off and back to emergency two minutes after the initial emergency application, and again every two minutes thereafter until either the train stops or the crew evacuates the locomotive cab.

4. Require that the Locomotive Engineer be informed immediately upon the loss of communication between the controlling locomotive and the EOT device, and that trains shall be brought to a safe stop upon a loss of communication that lasts longer than 4 minutes and 59 seconds.

5. Establish rules requiring that all controlling locomotives that fall within the guidelines of 49 CFR §232.405(f), and are being used to perform an initial terminal air brake test, be tested to ensure that the emergency brake valve activates the emergency braking capabilities of the EOT on the rear end of the train.

6. Develop a tracking system that logs all safety concerns to be made readily available for all TY&E employees.

To the Association of American Railroads ("AAR"):

1. Recommend that your members revisit their rules and discontinue the practice of arming and testing the emergency capabilities of an end of train device prior to the train being fully assembled.

2. Recommend that your members redesign the EOT two-way telemetry system so that — upon an emergency brake application initiated in the locomotive cab — the HTD continuously sends an "initiate emergency application of the brakes" signal to the EOT until

the train comes to a complete stop. In the interim, instruct your TY&E employees that there is a 2-minute time limit for the HTD to signal the EOT, after which the transmission ceases, and train them to physically cycle the automatic brake valve handle from emergency to handle-off and back to emergency two minutes after the initial emergency application, and again every two minutes thereafter until either the train stops or the crew evacuates the locomotive cab.

3. Recommend that your members require that the Locomotive Engineer be informed immediately upon the loss of communication between the controlling locomotive and the EOT device, and that trains shall be brought to a safe stop upon a loss of communication that lasts longer than 4 minutes and 59 seconds.

4. Recommend that your members require the retesting of the emergency capability testing of the end of train device whenever a train is lengthened.

5. Recommend that your members who are performing initial terminal brake tests test the emergency brake valve on the controlling locomotive per 49 CFR §232.405(f) to ensure it activates the emergency braking capabilities of the EOT on the rear end of the train.

6. Immediately begin collecting comprehensive data on train length in feet to assist future investigations regarding train length, in-train forces, and loss of communication concerns with EOTs, as recommended in the GAO-19-443 Report.

7. Recommend to your members that they develop a tracking system that logs all safety concerns to be made readily available for all TY&E employees.

To the Surface Transportation Board ("STB"):

1. Immediately begin collecting comprehensive data on train length in feet to assist future investigations regarding train length, in-train forces, and loss of communication concerns with EOTs, as recommended in the GAO-19-443 Report.

To the National Transportation Safety Board ("NTSB"):

1. Recommend to Wabtec that its two-way EOT telemetry system be redesigned so that — upon an emergency brake application initiated in the locomotive cab — the HTD continuously sends an "initiate emergency application of the brakes" signal to the EOT until the train comes to a complete stop.

2. Recommend to the FRA, AAR, and STB to incorporate train lengths into their respective reports in order to assist with future investigations.

3. Recommend to the FRA, AAR, and the UP to immediately cease arming and testing of the emergency capabilities of an EOT prior to the train being fully assembled, and require retesting whenever the trains consist is lengthened.

4. Recommend to the FRA, AAR, and the UP to develop a tracking system that logs all safety concerns to be made readily available for all TY&E employees.

CERTIFICATE OF SERVICE

I certify that on September 13, 2019, I have electronically served upon Mr. Robert Gordon (robert.gordon@ntsb.gov), Investigator in Charge, National Transportation Safety Board, a complete and accurate copy of these proposed findings regarding the freight train collision occurring on the Union Pacific Railroad property on October 4, 2018 in Granite Canyon, WY (NTSB Docket No. RRD19FR001). An electronic copy of same was also forwarded to the individuals listed below in this certificate of service, as required by 49 CFR § 831.14 (a) (Proposed Findings).

Mr. Robert Gordon
Investigator–in-Charge, RRD-19-FR-001
National Transportation Safety Board
490 L'Enfant Plaza, SW
Washington, DC 20594
Email: robert.gordon@ntsb.gov

John F. Allberry, UP
General Director Northern Region
Email: [redacted]

Mark Williams, FRA
Railroad Safety Specialist
Email: [redacted]

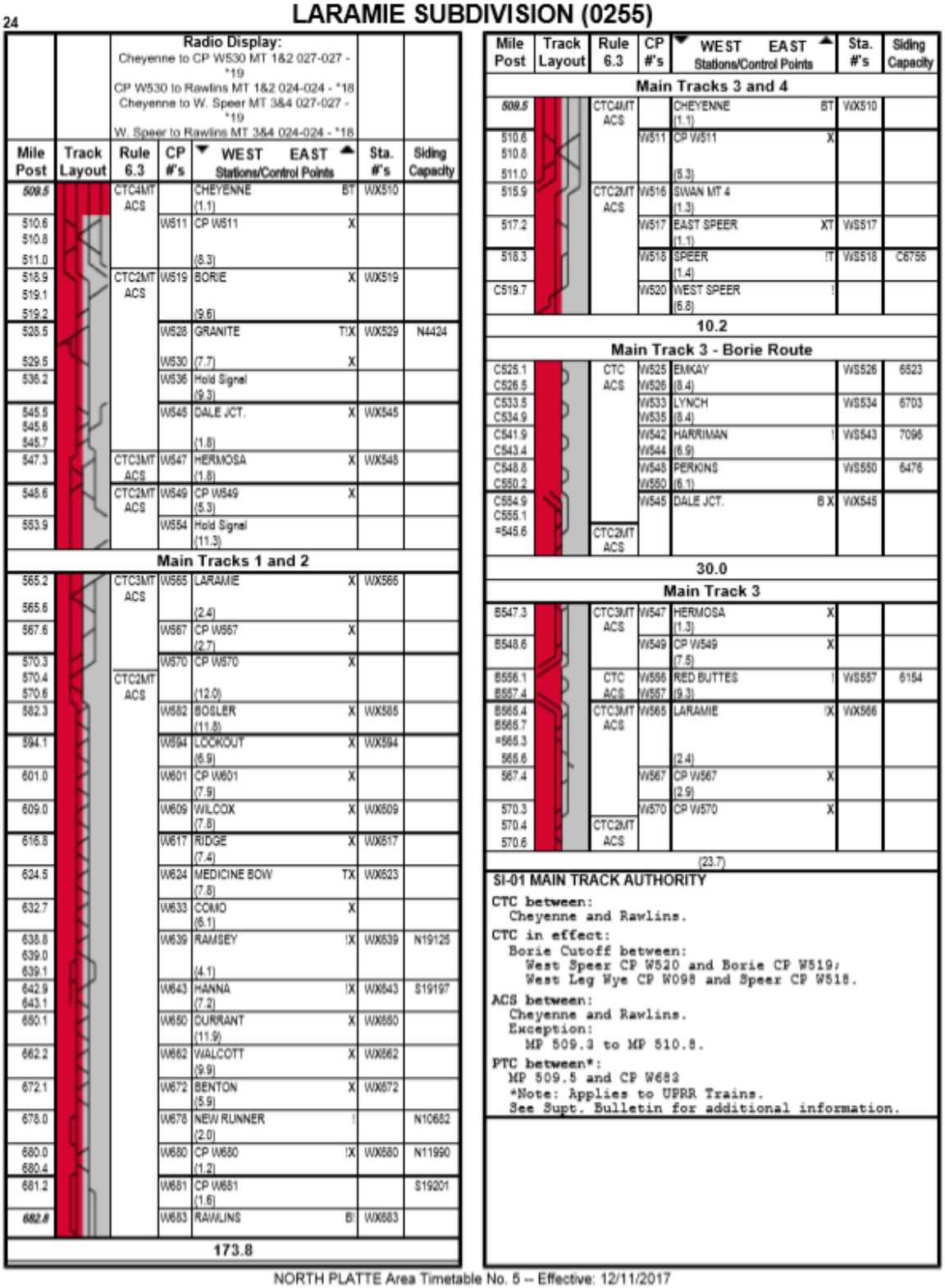
Carl Smith, SMART-TD
SMART-TD Safety Team
Email: [redacted]

Sincerely yours,

[redacted]

Stephen J. Bruno
National Secretary-Treasurer
Safety Task Force National Chairmen
Brotherhood of Locomotive Engineers & Trainmen
7061 East Pleasant Valley Road
Independence, OH 44131

Appendix A



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LARAMIE SUBDIVISION (0255)

Radio Display:
Cheyenne to CP W530 MT 1&2 027-027 - *19
CP W530 to Rawlins MT 1&2 024-024 - *18
Cheyenne to W. Speer MT 3&4 027-027 - *19
W. Speer to Rawlins MT 3&4 024-024 - *18

Mile Post	Track Layout	Rule 6.3	CP #'s	WEST ▼ EAST ▲ Stations/Control Points		Sta. #'s	Siding Capacity
509.5		CTC4MT ACS		CHEYENNE (1.1)	BT	WX510	
510.6			W511	CP W511	X		
510.8							
511.0				(8.3)			
518.9		CTC2MT ACS	W519	BORIE	X	WX519	
519.1							
519.2				(9.6)			
528.5			W528	GRANITE	TIX	WX529	N4424
529.5			W530	(7.7)	X		
536.2			W536	Hold Signal (9.3)			
545.5			W545	DALE JCT.	X	WX545	
545.6							
545.7				(1.8)			
547.3		CTC3MT ACS	W547	HERMOSA (1.8)	X	WX548	
548.6		CTC2MT ACS	W549	CP W549 (5.3)	X		
553.9			W554	Hold Signal (11.3)			
Main Tracks 1 and 2							
565.2		CTC3MT ACS	W565	LARAMIE	X	WX566	
565.6				(2.4)			
567.6			W567	CP W567 (2.7)	X		
570.3			W570	CP W570	X		
570.4		CTC2MT ACS					
570.6				(12.0)			
582.3			W582	BOSLER (11.8)	X	WX585	
594.1			W594	LOOKOUT (6.9)	X	WX594	
601.0			W601	CP W601 (7.9)	X		
609.0			W609	WILCOX (7.8)	X	WX609	
616.8			W617	RIDGE (7.4)	X	WX617	
624.5			W624	MEDICINE BOW (7.8)	TX	WX623	
632.7			W633	COMO (6.1)	X		
638.8			W639	RAMSEY	IX	WX639	N19125
639.0							
639.1				(4.1)			
642.9			W643	HANNA	IX	WX643	S19197
643.1				(7.2)			
650.1			W650	DURRANT (11.9)	X	WX660	
662.2			W662	WALCOTT (9.9)	X	WX662	
672.1			W672	BENTON (5.9)	X	WX672	
678.0			W678	NEW RUNNER (2.0)	!		N10682
680.0			W680	CP W680 (1.2)	IX	WX680	N11990
680.4							
681.2			W681	CP W681 (1.6)			S19201
682.8			W683	RAWLINS	BI	WX683	
173.8							

Mile Post	Track Layout	Rule 6.3	CP #'s	WEST ▼ EAST ▲ Stations/Control Points		Sta. #'s	Siding Capacity
Main Tracks 3 and 4							
509.5		CTC4MT ACS		CHEYENNE (1.1)	BT	WX510	
510.6			W511	CP W511	X		
510.8							
511.0				(5.3)			
515.9		CTC2MT ACS	W516	SWAN MT 4 (1.3)			
517.2			W517	EAST SPEER (1.1)	XT	WS517	
518.3			W518	SPEER (1.4)	!T	WS518	C6756
C519.7			W520	WEST SPEER (6.8)	!		
10.2							
Main Track 3 - Borie Route							
C525.1		CTC ACS	W525	EMKAY		WS526	6523
C526.5			W526	(8.4)			
C533.5			W533	LYNCH		WS534	6703
C534.9			W535	(8.4)			
C541.9			W542	HARRIMAN	!	WS543	7096
C543.4			W544	(6.9)			
C548.8			W548	PERKINS		WS550	6476
C550.2			W550	(6.1)			
C554.9			W545	DALE JCT.	BX	WX545	
C555.1							
=545.6		CTC2MT ACS					
30.0							
Main Track 3							
B547.3		CTC3MT ACS	W547	HERMOSA (1.3)	X		
B548.6			W549	CP W549 (7.5)	X		
B556.1		CTC ACS	W556	RED BUTTES	!	WS557	6154
B557.4			W557	(9.3)			
B565.4		CTC3MT ACS	W565	LARAMIE	IX	WX566	
B565.7							
=565.3							
565.6				(2.4)			
567.4			W567	CP W567 (2.9)	X		
570.3			W570	CP W570	X		
570.4		CTC2MT ACS					
570.6							
(23.7)							

SI-01 MAIN TRACK AUTHORITY

CTC between:
Cheyenne and Rawlins.
CTC in effect:
Borie Cutoff between:
West Speer CP W520 and Borie CP W519;
West Leg Wye CP W098 and Speer CP W518.
ACS between:
Cheyenne and Rawlins.
Exception:
MP 509.3 to MP 510.8.
PTC between*:
MP 509.5 and CP W683
*Note: Applies to UPRR Trains.
See Supt. Bulletin for additional information.

NORTH PLATTE Area Timetable No. 5 -- Effective: 12/11/2017

UNION PACIFIC RAILROAD COMPANY

NORTH PLATTE TIMETABLE NO. 5
EFFECTIVE December 11, 2017
LARAMIE SUBDIVISION GENERAL ORDER NO. 3

PURPOSE:

SI-08: Change rule numbers referenced for helping stalled DP trains.

Previous Changes:

SI-02: Change Maximum Speed Table.

SI-03: Change maximum speed for North Siding between CP W639 and CP W643; delete restriction on Hansen Track in Cheyenne Yard.

SI-12: Change TPOB / TPDBA Maximum Speed Tables.

North Platte Area Timetable #5 in effect at 0900C on December 11, 2017

Timetable subdivision information and instructions not modified by this General Order remain in effect.

EFFECTIVE: 1057C, May 04, 2018

CANCELLATIONS:

This order cancels all previous orders for the LARAMIE Subdivision.

SI-02 - MAXIMUM SPEED TABLE

Under header reading:

Between Mileposts	**PSGR**	**FRT**
B547.3 and 570.4 MT 3		
(Except as Below)	**70**	**60**

Change that part reading:

B565.3 and 570.4	40	40

To read:

B565.4 and 570.4	40	40

SI-03 - OTHER SPEED RESTRICTIONS

Effective at 0900C on March 15, 2018;

1. Thru Sidings & Turnouts.

Change part reading:

North siding between:
CP W639 and CP W643 25

To read:

North siding between:
CP W639 and CP W643 40

3. Misc. Speed Restrictions.

Delete part reading:

Cheyenne Yard - Hansen Trk. 551
(From the 01/552 switch to the
east 01/534 switch) 5

SI-08 - RULES ITEMS

Change referenced rule numbers as follows (instructions unchanged):
Change rule number 32.12.3 to read 33.6.4;
Change rule number 32.12.4 to read 33.6.5;
Change rule number 32.12.5 to read 33.6.1.

SI-12 - TONNAGE RESTRICTIONS/TPOB

Effective at 0900C on March 15, 2018;
Change table with header **Eastward Buford CP W536 to Cheyenne CP W511** to read:

1

LARAMIE SUBDIVISION (0255)

SI-02 MAXIMUM SPEED TABLE

Maximum Speed	MPH PSGR	FRT
Between Mileposts 509.5 and 565.3 MT 1 & 2		
(Except as Below)	**70**	**55**
509.5 and 510.4	35	35
510.4 and 511.8	40	40
514.8 and 515.8	60	55
518.8 and 519.1	60	55
522.1 and 525.6	50	45
528.6 and 532.1	50	40
532.1 and 536.9	60	55
537.9 and 540.5	45	40
540.5 and 544.1	50	45
544.1 and 565.3	45	40
Between Mileposts 565.3 and 682.8 MT 1 & 2	**PSGR**	**FRT**
(Except as Below)	**79**	**70**
565.3 and 565.4 MT 1	45	40
587.7 and 588.3	65	55
593.3 and 593.8	75	65
598.5 and 602.5	65	55
637.5 and 637.8	65	55
643.4 and 656.4	65	55
661.0 and 666.6	65	55
680.9 and 682.8	55	50
Between Mileposts 509.5 and C555.1 MT 3 & 4	**PSGR**	**FRT**
(Except as Below)	**50**	**50**
509.5 and 511.1 MT 4 WWD	20+	20+
509.5 and 510.5 MT 4 EWD	20+	20+
509.5 and 510.5	35	35
510.5 and 511.8	40	40
C553.5 and C555.1 MT 3	40	40
Between Mileposts B547.3 and 570.4 MT 3	**PSGR**	**FRT**
(Except as Below)	**70**	**60**
B547.3 and B549.0	45	40
B549.4 and B553.7	65	55
B559.4 and B561.4	65	55
B565.3 and 570.4	40	40

SI-03 OTHER SPEED RESTRICTIONS

Maximum Speed	MPH
1. Thru Sidings & Turnouts.	
South siding between:	
CP W639 and CP W643	40
North siding between:	
CP W639 and CP W643	25
Rawlins: North and South sidings	40
Exception: Siding Granite	20
Speer, EmKay, Lynch, Harriman, Perkins,	
Red Buttes, New Runner	25
2. Dual Control Switch Turnouts.	
CP W545, CP W570, CP W582, CP W594,	
CP W601, CP W609, CP W617, CP W624,	
CP W633, CP W639, CP W643, CP W650,	
CP W662, CP W672, CP W680, CP W683	40
CP W511	40
Exceptions:	
East set crossovers between	
MT 2 & MT 3 and all crossovers	
between MT 3 & MT 4 or yard Leads	25
CP W517 to the Greeley Sub.,	
CP W519, CP W528, CP W530,	
CP W547, CP W549, CP W567	25
CP W565	40
Exceptions:	
West crossover	
between MT 2 & MT 3	25
MT 3 to East Yard Lead	15
CP W519 - Movements between:	
Borie Cut-off and MT 1	15
Borie Cut-off and MT 2	25
3. Misc. Speed Restrictions.	
Connection track (Borie Cut-off)	
between MP 99.9 and MP 103.2	30
Connection track (straight route)	
between MP B565.4 (MT 3)	
and MP 565.3 (MT 2)	
Passenger	70
Freight	60
Cheyenne Yard - Hansen Trk. 551	
(From the 01/552 switch to the	
east 01/534 switch)	5
4. Key Trains: Crude Oil / High Hazard Flammable (No Exceptions)	

SI-04 MAIN TRACK DESIGNATIONS

Main tracks designated:

MT 1 & 2 between Cheyenne and Rawlins via Buford;
MT 3 & 4 between Cheyenne and West Speer MP C519.7;
MT 3 between West Speer and Dale Jct. MP C555.1 via EmKay;
MT 3 between Hermosa and CP W570 MP 570.7 via Red Buttes.

Connection tracks between:
CP W519 and CP W520 designated the 'Borie Cutoff';
CP W098 and CP W518 designated the 'West Leg Wye'.

SI-05 MILEPOST EQUATIONS

MP 517.24 MT 4 = MP 98.39 Greeley Sub.;
MP 518.27 MT 4 = MP 98.55 (West Leg Wye);
MP C555.10 MT 3 = MP 545.56 MT 2;
MP B565.67 MT 3 = MP 565.31 MT 3;
MP 605.84 = MP 606.00;
MP 617.26 = MP 617.60;
MP 631.38 = MP 631.79;
MP 659.83 = MP 660.00.

Borie cutoff:
MP 99.92 = MP C519.77 (Laramie Sub. MT 3 & MT 4;
MP 103.16 = MP 519.09 (Laramie Sub. MT 2).

Appendix B

32.9: Telemetry

32.9 Telemetry

Rule Updated Date

January 20, 2012

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32.9.1: Emergency Application Capability from Rear of Train

32.9.1 *49 CFR 232.407* Reference Rule 31.8.3	**Emergency Application Capability from Rear of Train** **A. Requirements** Trains must be operated with the ability to place the train in emergency from the rear. The following trains are exempt from the requirement of this rule:

Glossary Grade	• Passenger and Commuter Trains. • Light engine consist with 8 or fewer units. • Locals, road switchers, and work trains that do not operate on mountain grades. • Trains that do not exceed 30 MPH and do not operate in heavy grade or mountain grade territory. Application: Locals, road switchers, and work trains must: • Not exceed 4,000 trailing tons • Travel over a distance that can normally be operated by a single crew in a single tour of duty. **B. Providing Emergency Application Capability from Rear of Train** Any one of the following methods fulfills the requirement to provide emergency application capability from the rear of the train: • An operable, two-way, end-of-train telemetry system (HEU/EOT), which must be armed and tested at point of installation. • Distributed power placed on rear of train. • Trains with a manned helper, caboose/shoving platform, or passenger equipment at the rear of train equipped with an emergency brake valve and manned by an employee equipped with two-way radio communication with the engineer at head end of train.

32.9.3: Arming HEU/EOT

32.9.3 *49 CFR* *232.409*	**Arming HEU/EOT** To arm the HEU: 1. Press the TEST button on the EOT, which will display the ARM NOW message on the HEU. 2. Immediately press the COMMUNICATIONS TEST/ARM button on the HEU, which will display the ARMD message and light the EMERG ENABLED status LED at the same time. If NOT ARMD appears on the HEU, the system did not accept the arming sequence. Repeat steps above. Some foreign HEU/EOT systems are self-arming when telemetry is established and may be so indicated by a "*" displayed on the HEU.

32.9.4: Testing HEU/EOT

32.9.4 *49 CFR* *232.407* *232.409*	**Testing HEU/EOT** To test the emergency application capability from the rear of the train, do the following: 1. Close the angle cock ahead of the last car. 2. Initiate an EOT emergency from the lead locomotive HEU. The brake pipe pressure on the EOT must reduce to 0-psi. 3. Open the angle cock and determine that brake pipe pressure is restored before proceeding.

	A. Establishing Communications If the End of Train Telemetry System is unable to establish communications at the installation point, train may be moved a maximum of one mile at Restricted Speed in an attempt to establish communications. **B. Engineer Notification** When the test of the emergency application capability from the rear is conducted, the engineer must be notified verbally or in writing that the test was successfully performed. If verbal notification is made, the train crew must record this notification on Air Brake Test form. The written notification must include the following: • Date and Time of test. • Location of test. • Name of employee conducting test. Written notification must be maintained in the cab of the controlling locomotive.

32.9.5: Emergency Switch

32.9.5 *49 CFR 232.409*	**Emergency Switch** Once a system is properly armed, an emergency brake application can be made at any time. To initiate an emergency brake application at the end of the train: 1. Lift the red cover of the EMERGENCY SWITCH. 2. Push the toggle switch up. 3. Verify that: **a.** The EMERGENCY message briefly appears in the message display window. **b.** The brake pipe pressure reading quickly drops to 0-psi. **c.** The LOW PRES message is displayed while the last car pressure is below 45-psi.

32.9.6: Loss of Emergency Application Capability from Rear of Train

32.9.6
 	
49 CFR 232.407
 	
Reference Rule Glossary
	Loss of Emergency Application Capability from Rear of Train
	Trains required to be equipped with rear-of-train emergency capability are considered to have an en route failure when any one of the following conditions occurs:
	
	• EOT/HEU indicates:
	  • Loss of front to rear communication. Message = FR NOCOM or NOCOM.
	  • Emergency valve not enabled. Message = NOT ARMD and/or "Emergency Enabled" indicator NOT illuminated.
	  • Emergency valve failure or EOT valve failure. Message = VALVFAIL.
	• Loss of communication exceeding 16 minutes 30 seconds as indicated by control console for distributed power locomotive on lead controlling locomotive at head end of train.
	• A loss of voice radio communication between a manned helper, caboose, or passenger equipment at the rear of the train and the lead controlling locomotive.
	
	When an en route failure occurs:
	
	• On other than mountain grades:
	  • Train must not exceed 30 MPH.
	  • Notify dispatcher.
	• On mountain grades, train must not proceed until:
	  • Failure is corrected.
	
	  or
	
	  • Another method of compliance is used.
	
	When communication is lost on mountain grade, a train may:
	
	• Move a train length to attempt to reestablish communication or sufficient distance to clear obstruction.
	• Move train in sections due to en route failure.
	• Continue during a loss of radio communication between the employee at rear of train, provided train does not exceed 5 MPH above maximum authorized speed.
	
	In the event of an emergency, use the emergency toggle switch to initiate emergency application, even if NO COM condition exists.

Appendix C

28

LARAMIE SUBDIVISION (0255)

SI-12 TONNAGE RESTRICTIONS/TPOB

Maximum Gross Weight Restrictions:
158 Tons, Restrictions A and N.

Tonnage/Speed Restrictions - Freight Trains

Eastward Buford CP W536 to Cheyenne CP W511
on MT 1 and MT 2. Maximum allowable speed applies until lead engine reaches CP W511.

Tons Per Operative Brake:	Tons Per Dynamic Brake Axle:	Maximum Speed
59 or less	No Dynamic Required	No restrictions
60-79	500 or less	No restrictions
	Over 500	25 MPH
80-99	500 or less	35 MPH
	Over 500	25 MPH
100-132	250 or less	35 MPH
	251 to 350	30 MPH
	351 to 750	25 MPH
	Over 750	20 MPH
	350 or less	30 MPH
	351 to 750	25 MPH
	Over 750	20 MPH

Eastward Dala Jct. CPW 545 to Cheyenne CPW 511
on MT 3 and MT 4. Maximum allowable speed applies until lead engine reaches CP W511.

Tons Per Operative Brake:	Tons Per Dynamic Brake Axle:	Maximum Speed
99 or less	500 or less	No restrictions
	Over 500	40 MPH MP C555.1 - C553.5
	Over 500	45 MPH MP C553.5 - C511.8
100 & over	500 or less	40 MPH
	Over 500	30 MPH

Westward West Hermosa
CP W549 to Red Buttes CP W556 on MT 3. Maximum allowable speed applies until lead engine reaches CP W556.

Tons Per Operative Brake:	Tons Per Dynamic Brake Axle:	Maximum Speed
59 or less	No Dynamic Required	40 MPH
60-99	250 or less	40 MPH
	250+ to 500	30 MPH
	500+ to 1000	25 MPH
	over 1000	20 MPH
100-132	250 or less	30 MPH
	250+ to 500	25 MPH
	Over 500	20 MPH
Over 132	500 or less	25 MPH
	Over 500	20 MPH

SI-13 TRAIN MAKE-UP RESTRICTIONS

TPOB RESTRICTION
The following applies when operating between Cheyenne and Rawlins;
Trains consisting entirely of doublestack cars may use up to 33 EOBA if train exceeds 100 TPOB.

SSI Item 5-B Maximum Train Length.
Auto Trains between Cheyenne and Chicago:
A train made up entirely of loaded multi-level cars (auto racks) with more than 80 cars/platforms and up to 8,500 feet requires a rear DPU. If train length exceeds 8,500 feet, a cut-in DPU must also be placed in the train according to SSI Item 5-C part 3-B.
Train length must not exceed 10,000 feet. Up to five (5) conventional cars weighing 45 tons or more may be placed on the head end of the train.

Auto Trains West of Cheyenne:
Westward trains made up entirely of loaded multi-level cars (auto racks) may operate with more than 80 cars/platforms provided:
1. Train must operate with rear DPU, and
2. Train length behind head end consist to DPU must not exceed 8500 feet.

SI-14 MISC. INSTRUCTIONS

Cheyenne: all arriving trains must contact Yardmaster once arrival track is determined.

Westward Trains on New Way North or New Way South leads must pass the sign reading "Approach Section" before the signal will activate.

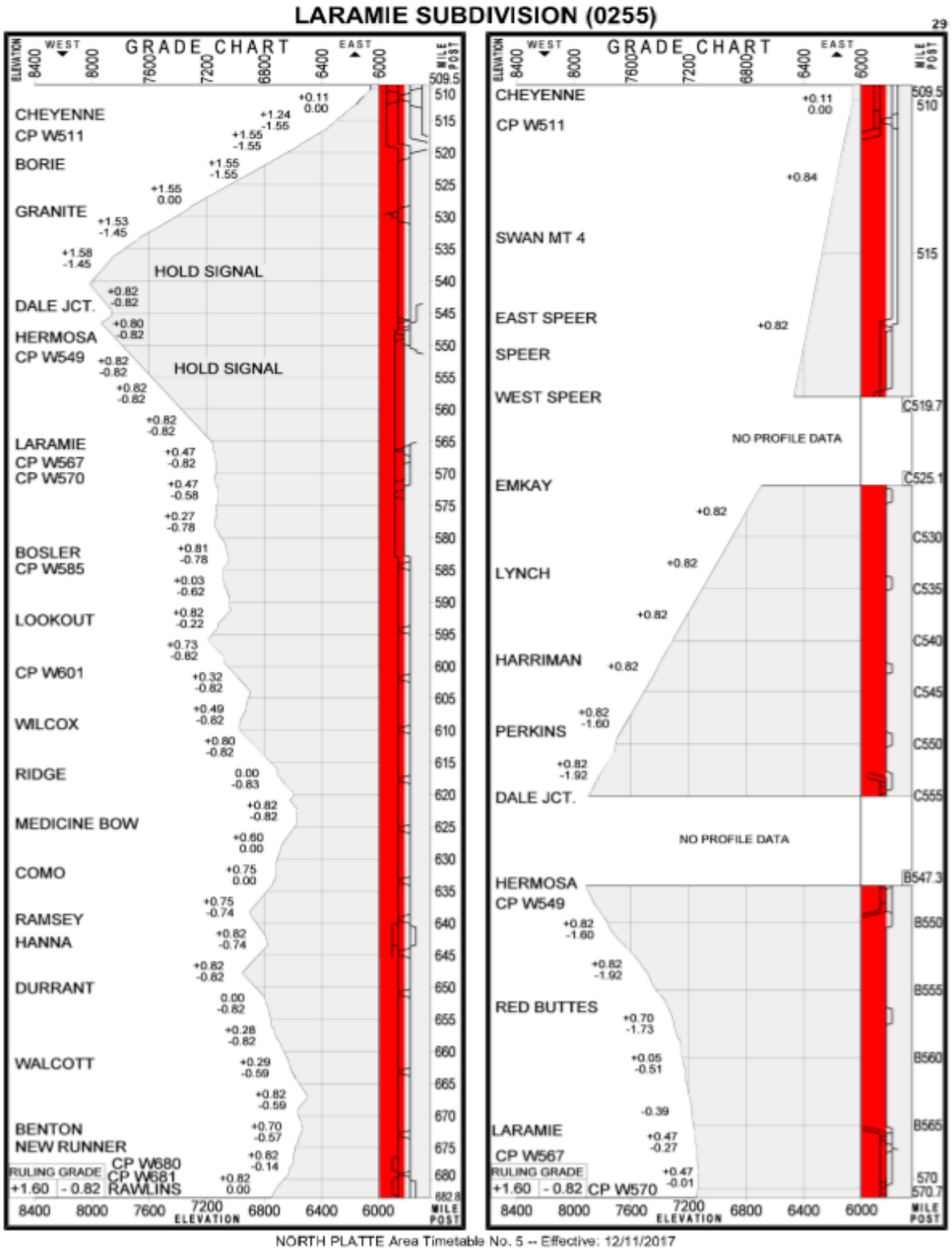
Engine Servicing Facility: Before entering any trackage at the Cheyenne Engine Servicing Facility, permission must be obtained from the Roundhouse Foreman who can be reached on Radio Channel 024-024.

Rawlins Fueling Facilities: Amber lights are located at main track fueling facilities between MT 1 and the North Siding, and between MT 2 and the South Siding. These lights will be on and flashing when mechanical forces are fueling or working on or about the fuel rack. When amber lights are on and flashing, trains must approach this area at restricted speed, ring bell, and be on the lookout for employees working in this area. After departing fuel rack, trains must move a sufficient distance to allow fueling of locomotives on all tracks.

Set Out Tracks

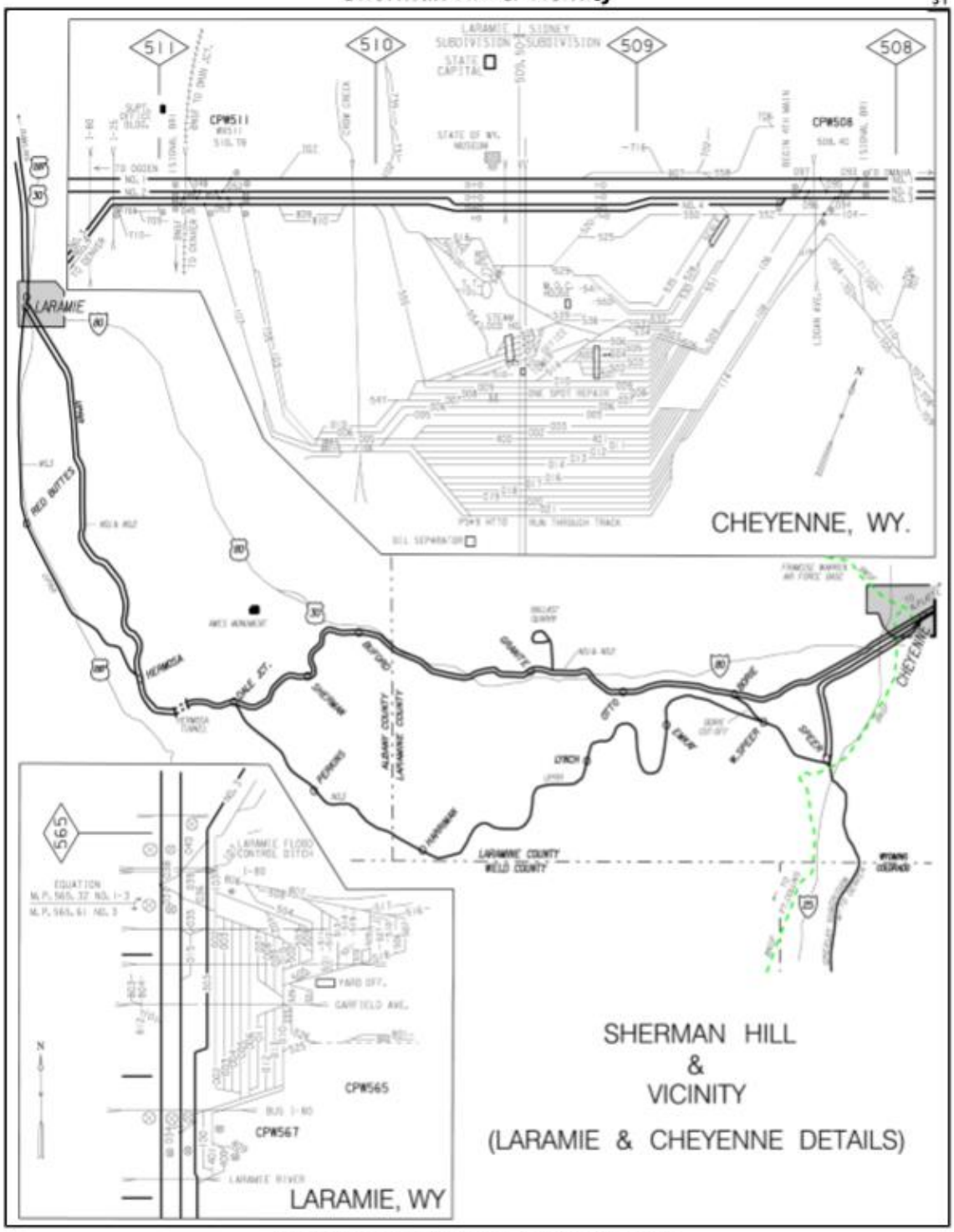
MP	Name	Track	Access Direction	Length
519.2	Borie	MT 2	East	
536.2	Buford	MT 1	East	
539.1	Buford	MT 1	West	
543.1	Dale	MT 2	East	
548.2 548.5	Hermosa Rock	MT 3	Both	
553.8	Colores	MT 1	East	
561.7	Forelle	MT 2	East	
585.6	Bosler	MT 1	West	
590.7	Cooper Lake	MT 2	East	
593.9	Lookout	MT 1	West	
605.1 605.7	Rock River	MT 1	Both	
622.9 623.5	Medicine Bow	MT 2	Both	
642.5	Hannah	S SDG	West	
662.0	Walcott	MT 1	West	

Appendix D



NORTH PLATTE Area Timetable No. 5 -- Effective: 12/11/2017

Sherman Hill & Vicinity



Appendix E

Date	Place	RR	Length	Tons	Car count	Cause
9-18-91	Sprague, WA	N/A	N/A	N/A	N/A	N/A on FRA database
3-4-91	Waterfall, WY	UP	4,850 (est.)	8,670	72x25=97	Cars rolled away after cutting off from train
3-7-92	Kansas City, MO	GWWR	2,200 (est.)	2,870	26x18=44	Unable to stop-found locos not set up properly nor EOT functioning (B/O antenna)
6-11-92	Money, MS	IC	6,300 (est.)	11,836	92 x 34=126	Unable to stop for a meet
10-1-93	Keystone, NE	UP	5,650 (est.)	14,859	113x0=113	Head-on, brake pipe obstruction 15-19 deep
10-11-93	Fulton, KY	IC	N/A	226	N/A	Cars rolled back into them after set out
12-21-93	Wood, IA	CCP	N/A	0	N/A	After cutting away-cars rolled away
12-25-93	Seward, NE	BN	5,800 (est.)	15,089	115x1=116	Air would not set on train
1-18-94	Cowen, WV	CSXT	4,500 (est.)	11,800	90x0 = 90	EOT never displayed in emergency
9-7-94	Gillette, WY	BN	10,260 (est.)	15,504	114x0=114	Unattended train rolled away
11-22-94	Tennessee Pass, CO	DRGW	4,860 (est.)	7,069	54x0=54	Improper train control
12-14-94	Cajon, CA	ATSF	5,261 (stack train)	4,882	29x0=29	BP Obstruction
2-9-95	Nelsons, WI	WC	N/A	5,890	N/A	Departed yard without initial terminal brake test-couldn't stop
2-9-95	Argonne, MI	N/A	N/A	N/A	N/A	N/A
2-1-96	Cajon, CA	ATSF	3,218	5,025	45x4=49	3 possibilities; kinked hose, closed angle cock, or object in Brake Pipe. Inconclusive result from inv.
2-14-96	E. St. Paul, MN	BN	4,450 (est.)	8,528	74x18=89	Runaway into yard

- In the 1989 Helena, MT accident, NTSB recommendation to FRA requiring for the first time having two-way EOTs (NTSB Safety Recommendation R-89-82).

- Due to the FRA's database not including length per accident train (Form FRA F 6180.54), the lengths are based on 50-foot car lengths (aside from where NTSB determined the train length).

- Based on the above, the average train length would then be: 57,349.9 ÷ 11 = 5,214 feet

- For eleven (11) of the sixteen (16) cases cited above we were able to obtain information that the overall car count was 921, which, divided by 11, equals 84 cars per train.