Inv-2448

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

SOUTHERN RAILWAY

SALUDA, N. C.

SEPTEMBER 25, 1940

INVESTICATION NO. 2448

SUMMARY

Inv.2448

Railroad:	Southern
Date:	September 25, 1940
Location:	Saluda, N. C.
Kind of accident:	Derailment
Train involved:	Freight
Train number:	Second 150
Engine number:	4052
Consist:	37 cars and caboose
Speed:	25-45 m.p.h.
Operation:	Timetable, train orders and automatic block-signal and automatic train-stop system
Track:	Single; tangent; maximum of 4.8 percent descending grade on main track and 2.78 percent ascending grade on safety track
Weather:	Raining
Time:	5:45 a.m.
Casualties:	1 killed; 2 injured
Cause:	Failure to control speed of train on descending grade

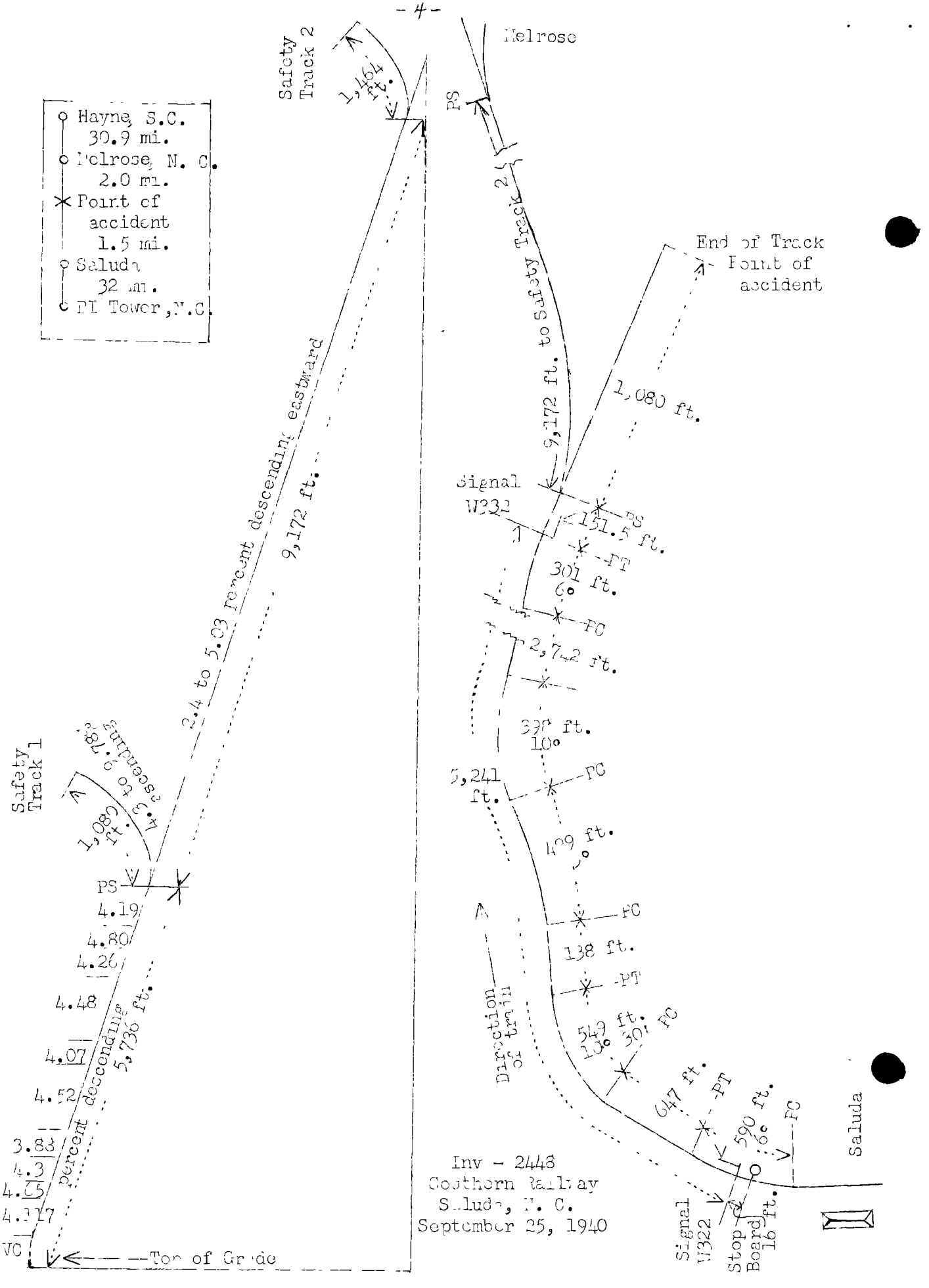
Inv-2448
November 28, 1940.

To the Commission:

On September 25, 1940, there was a derailment of a freight train on the Southern Railway near Saluda, N.C., which resulted in the death of one employee and the injury of two employees.

Location and Method of Operation

This accident occurred on that part of the Asheville Division which extends between BI Tower, Asheville, N.C., and Hayne, S.C., a distance of 66 miles. In the vicinity of the point of accident this is a single-track line over which trains are operated by timetable, train orders and an automatic block-signal and automatic train-stop system; an absolute manual block system for all trains, except east-bound helper engines moving light to follow other than first-class trains, is in effect between Saluda and Melrose, N.C., located respectively, 33 and 35.1 miles east of BI Tower. The accident occurred 9,301 feet east of the station at Saluda, at the end of a stub track known as Safety Track No. 1. As the point of accident is approached from the west, a series of short curves and tangents is followed by a 6° curve to the right 301 feet in length, then a tangent 151.5 feet to the switch of Safety Track No. 1 and 1,080 feet beyond to the end of the safety track where the derailment occurred. From a point 1,185 feet east of Saluda to Melrose the grade for east-bound trains is descending a distance of 2.63 miles and varies between 3.88 and 5.03 percent. From the vertical curve at the top of the mountain the grade to the switch of Safety Track No. 1 is almost continuously in excess of 4 percent; the maximum percentage is 4.8 and the minimum is 3.88. Stub tracks laid on ascending grade, designated as Safety Track No. 1 and Safety Track No. 2, are provided to stop trains which are out of control on the main track descending grade, and are located at points, respectively, 1.09 and 2.63 miles east of the top of the grade. Safety Track No. 1 is 1,060 feet in length, and its grade varies between 4.70 and 9.73 percent ascending eastward. Safety Track No. 2 is 1,474 feet in length and its grade varies between 5.47 and 10.97 percent ascending eastward. The normal position of the switches of the safety tracks is for entrance to these tracks. Two 12-inch by 12-inch timbers fastened to the rails by 7/8-inch chains, and a mound of earth 60 feet long, 3 feet high, and 14 feet wide at the bottom and 9 feet wide at the top, provide a barrier at the end of Safety Track No. 1. Immediately beyond the end of this track there is a slope which descends 30 feet in a distance of 119 feet. The rails of the safety track were covered with sand 1/8 inch deep.


Hayne, S.C.
30.9 mi.
Helrose, N. C.
2.0 mi.
Point of accident
1.5 mi.
Saluda
32 mi.
PI Tower, N.C.
Safety Track 2
1,464 ft.
Helrose
PS
2°
9,172 ft. to Safety Track 2
End of Track
Point of accident
1,080 ft.
Signal W322
151.5 ft.
PS
PT
301 ft.
6°
PC
2,742 ft.
328 ft.
10°
PC
5,241 ft.
429 ft.
2°
PC
138 ft.
PT
549 ft.
30°
PC
647 ft.
PT
590 ft.
6°
PC
Saluda
Direction of train
Signal W322
Stop Board
16 ft.
Safety Track 1
1,080 ft.
2°
PS
4.19
4.80
4.26
4.48
4.07
4.52
3.83
4.13
4.15
4.17
VC
2.4 to 5.03 percent descending eastward
9,172 ft.
5,736 ft.
2.53 percent descending
Top of Grade
Inv - 2448
Southern Railway
Saluda, N. C.
September 25, 1940

Signals W-322 and W-332, which govern eastward movements, are located 5,409 and 168 feet, respectively, west of the switch of Safety Track No. 1. They are 2-indication color-light signals. The aspects, indications and names are as follows:

Aspect	Indication	Name
Red	Stop; then proceed	Stop and Proceed Signal
Yellow	Approach next signal prepared to stop	Approach Signal

When the switch of Safety Track No. 1 is lined normally, signal W-322 displays an approach indication and signal W-332 displays a stop-and-proceed indication. When the switch is lined for the main track, signal W-332 displays an approach indication, the most favorable indication that can be displayed between Saluda and Melrose.

The automatic train-stop system is of the intermittent-inductive type and engines are equipped with acknowledging devices. When an automatic-train-stop brake application is forestalled by an engineman, no train may proceed under his control.

Rules of the operating department read in whole or in part as follows:

RULES GOVERNING THE HANDLING OF TRAINS ON MOUNTAIN GRADES.

Between * * *
Saluda and Melrose
* * *
Descending

A. Before beginning the descent, all trains must stop and inspect and test the air brakes and hand brakes.
B. * * *
C. Handles of all retaining valves must be turned up.
D. * * *
E. The inspections and tests prescribed in the preceding paragraphs, will be made by car inspectors when provided, otherwise by trainmen under supervision of conductor.

* * *

RULES GOVERNING THE USE OF SAFETY TRACKS 1 AND 2 ON SALUDA MOUNTAIN.

EASTBOUND TRAINS

1. Enginemen of East bound trains or engines must give one long sound of the whistle (_____) at the whistling post one-half mile west of each safety switch to notify the switchtender of their approach.

2. At the next whistling post 800 feet West of each switch enginemen will, if their train or engine is under full control, call for the main track by giving one long one short and one long sounds of the whistle (_____ ___ _____) to be repeated until answered.

3. When hearing this signal the switchtender will set the switch for the main track and give proceed signal by hand or lamp to the engineman which he must answer by two short sounds of the whistle (___ ___).

4. Switchtenders must not under any circumstances set the switch for the main track for an approaching East bound train or engine unless the whistle signal is given as prescribed.

5. If the engineman does not promptly answer the proceed signal given by the switchtender the switch must be immediately set for the safety track and not again set for the main track until the prescribed whistle signal is repeated.

6. If the enginemen after answering the switchtender's proceed signal finds the train or engine is beyond control he must give one short sound of the whistle (___) and the switchtender must immediately set the switch for the safety track.

Rules of the Association of American Railroads for Maintenance of Brake and Train Air Signal Equipment, which have been adopted by the carrier, read in whole or in part as follows:

25.(a) After the brake system on a freight train is charged to not less than 5 lbs. below the standard pressure for that train, and on a passenger train when charged to at least 70 lbs., a fifteen pound service reduction must be made upon request or proper signal, then note the number of pounds of brake pipe leakage per minute as indicated by the brake pipe gauge, after which the reduction must be increased to a total of twenty pounds. Then an examination of the train brakes must be made to determine if brakes are applied in service application on each car; that the piston travel is correct, and that brake rigging does not bind or foul.

(b) When the examination has been completed in accordance with rule 25 (a) proper release signal must be given and each brake examined to see that it releases properly.

27. Piston travel less than seven inches or more than nine inches, must be adjusted to nominally eight inches.

28. When the test is completed the inspector or trainman who made the test will personally inform the engineman and conductor, and advise them the number of cars in train and the number having inoperative brakes.

43. When one or more cars are added to a train at any point subsequent to a terminal test the cars added, when in the position they are to be hauled in the train, must be tested as prescribed * * *. Before proceeding, it must be known that the brake pipe pressure is being restored as indicated by the caboose gauge and that the rear brakes are released. * * *

44. Before a train is operated down a grade requiring the use of retaining valves, it must be known that they are in such condition that the speed of the train can be safely controlled by the engineman.

Bulletin instructions read in whole or in part as follows:

SPECIAL BULLETIN

Asheville, N.C., January 11, 1930.

ALL CONCERNED:

* * *

I call your attention particularly to Page 138, Standard Book of Rules, which requires that before beginning descent all trains must stop and inspect and test the air brakes. A car with defective brakes must be set out and handles of all retaining valves must be turned up. Where inspectors are not provided, this inspection must be made by the trainmen, under supervision of Conductor.

* * *

BULLETIN

Asheville, N.C.
October 5, 1933

ALL ENGINE AND TRAIN CREWS:

* * *

Effective October 6, 1933, we will start operation of a few trains with the regular retainers. The following rules will govern the operation of these trains:

No train shall be allowed to depart from Saluda until the brake pipe has been charged to one hundred (100) pounds pressure for at least three (3) minutes, this to allow time for charging all auxiliaries to one hundred (100) pounds pressure.

No train shall exceed the speed limit of ten (10) miles per hour at any time while descending the mountain, as specified in the Book of Rules. This means that eighteen (18) minutes or more must be consumed between the "STOP BOARD" at summit of mountain and Melrose Telegraph Office.

As soon as practicable after the engine turns the summit of the grade and without waiting for the train to attain a speed of ten (10) miles per hour, a brake application of about ten (10) pounds should be made, immediately releasing in order to fill the brake cylinders, retaining valve pipe so as to force

the shoes against the wheels. Applications thereafter should be made as frequently as necessary in order to keep speed of the train at all times slow enough that a five (5) to eight (8) pounds brake pipe reduction will stop the train.

Before descending the grade all retaining valve handles must be turned up, single pressure valve handles all the way up and double pressure valve handles half way up.

* * *

* * *

SPECIAL BULLETIN

Asheville, N.C., December 25, 1934

ALL FREIGHT TRAIN AND ENGINEMEN:

Effective at once, the practice of freight trains making brake test while standing at station Saluda will be discontinued, and the following will govern:

> "When a freight train is stopped at Saluda for the purpose of meeting a westbound train, or for any other cause, the brake test MUST NOT BE MADE UNTIL IMMEDIATELY BEFORE TRAIN BEGINS THE DESCENT, and the test must be made after train has been stopped at 'STOP BOARD' LOCATED JUST EAST OF EAST PASSING TRACK SWITCH."

There is to be no change in the manner of testing the brakes, turning up retainers, etc., as required by the rules and previous instructions.

After inspection has been made and everything is found O.K. for departure of train, the Conductor or Flagman MUST BEFORE TRAIN IS STARTED, GIVE A GO-AHEAD SIGNAL TO ENGINEER IF THE FULL AIR BRAKE PRESSURE IS ON CABOOSE, and Engineer must acknowledge such signal before he leaves.

* * *

The Stop Board referred to in the above instructions is located at the summit of Saluda Mountain, 1,496 feet east of Saluda station.

Between Saluda and Melrose the maximum authorized speed for freight trains is 10 miles per hour.

It was dark and rain was falling at the time of the accident, which occurred at 5:45 a.m.

Description

Second 150, an east-bound second-class freight train, with Conductor Parris and Engineman Pope in charge, consisted of engine 4052, of the 2-8-8-2 type, 27 loaded and 10 empty cars, and a caboose. This train departed from Asheville, 33.9 miles west of Saluda, at 3:20 a.m., according to the train sheet, 7 hours 20 minutes late, departed from BI Tower, the last open office, at 3:58 a.m., 7 hours 43 minutes late, stopped at Saluda station to unload employees with tools and material, and, after the retaining valves were set in operating position and inspection of brakes on a portion of the train was made, this train departed from that point about 5:30 a.m. Soon afterward the train became out of control on the descending grade, and, while moving at a speed estimated at 25 to 45 miles per hour, entered Safety Track No. 1 and was derailed at the end of the safety track.

The engine and first two cars were derailed and stopped with the front end of the engine 119 feet beyond and 30 feet below the end of the safety track. The engine remained upright; the running gear, which was buried in the ground, and the cab were badly damaged. The engine truck was disengaged and lodged under the front driving wheels of the rear driving unit. The tender stopped at an angle of 45 degrees to the engine and its rear end was inclined upward at an angle of 30 degrees; the tender cistern broke loose from the frame and the left bulkhead stopped against the left corner of the engine cab. The first two cars were derailed and stopped, slightly damaged, behind the engine. The front truck of the third car was derailed but the car was not damaged.

The employee killed was the fireman and the employees injured were the engineman and the front brakeman.

Summary of Evidence

Engineman Pope, of Second 150, stated that before his train departed from Asheville a terminal air-brake test was made by the car inspectors; however, they did not report the condition of the brakes. Since it is not customary at that point for an inspector to observe that each brake is released, the engineman did not observe whether it was done in this instance. At Hendersonville, 12.1 miles west of Saluda, two cars were added to his train but the air brakes on these cars were not tested. He said that after a terminal air-

brake test is made it is not customary to test the brakes of cars added to a train en route. Because it was necessary to unload two employees at Saluda he stopped his train by a service application of the brakes and the engine stood about 5 or 6 car lengths east of Saluda station; this application was not released until the crew had examined the brakes. He then released the brakes and the crew set the retaining valves for use. The front brakeman informed him that the conductor had said the train was ready to depart and that it was unnecessary to stop at the stop board. Brake-pipe pressure of 70 pounds and main-reservoir pressure of 100 pounds were being maintained. The train, assisted by a helper engine, left Saluda at 5:30 a.m. and the speed was 3 or 4 miles per hour when the engine passed the summit of the grade. He applied the independent brake to bunch the slack and at this time turned on the driving-wheel sprinkling system; when the engine was about 4 or 5 car lengths east of the top of the grade he made a 10-pound brake-pipe reduction, but did not feel the train slow down at all and after the train had gone about 2 more car lengths, realizing that this brake application was not controlling the speed of the train, he made a further brake-pipe reduction of 25 pounds; the two reductions totaled 35 pounds. The train did not reduce speed but continued down the grade at a moderate rate, and he did not release this application until shortly before the engine entered Safety Track No. 1, when, in an endeavor to restore the brake-pipe pressure, he placed the brake valve in release position a few seconds, then moved it to emergency position. Because of the restrictive indications displayed by signals W-322 and W-332 he operated the acknowledging lever of the automatic train-stop device. Between the top of the grade and Safety Track No. 1 he opened and closed the sander valve alternately. He said that the speed of his train was 25 or 30 miles per hour when it entered the safety track and it had not been reduced appreciably when the derailment occurred. He said that the engine and the tender brakes were held applied continuously after the train left the summit. He said that some enginemen did and others did not increase the brake-pipe pressure to 100 pounds at the top of the grade involved, and he knew of no instructions to that effect. He operated his train on the descending grade without changing from 70 pounds brake-pipe and 100 pounds main-reservoir pressures. He said that this was his second trip on the type of engine involved and the first trip down the grade involved in charge of a tonnage train. He was not familiar with the duplex-type compressor governor, and he did not know that it is possible to cut out the low-pressure head so that the excess-pressure head-adjustment will control the main-reservoir pressure. He said he had been working as a hostler for the past 3 or 4 years; prior to 1935 he was fireman on a Saluda helper engine and had worked as an

emergency engineman occasionally; he had been returned to the enginemen's extra board about 1-1/2 months ago but had not read the bulletin book. He was examined orally on the operating rules in January 1940. He had last attended air-brake instruction classes about 2 years prior to the accident; at that time oral instruction pertaining to the AB brake only was given. He said that he had never been examined on the proper operation of the train air-brake system for descending Saluda Mountain. He was familiar with the short-cycle method of brake operation. He said that the brakes on the locomotive were in good condition, but at some points en route from Asheville heavier braking than usual had been required to control the train. He thought his failure to control the speed of the train was because his train contained a number of Interstate Railroad cars, the brakes of which were not so effective as those of cars of other lines. It was raining at the time of the accident.

Front Brakeman Billings, of Second 150, stated that the air brakes were tested at Asheville; however, the inspector gave only a lantern signal to indicate that the inspection was completed and did not inform the engineman of the number of operative brakes. The brakeman said that this procedure is customary. At Hendersonville two cars were added to the train but the brakes were not tested. He said that if a terminal test has been made it is not customary to examine the brakes of cars added to a train. When his train stopped at Saluda he proceeded toward the rear of the train and examined the cars until he met the flagman; all the brakes were applied on the portion of the train that he examined. The flagman inquired if he had set the retaining valves on the front end of the train for use. The brakeman replied that he had not done so and that the rules required they should not be set until the train stopped at the summit. The flagman instructed him to set the retaining valves on the front portion of the train for use, since the flagman had already set them on the rear portion, and stated that it would not be necessary to stop at the top of the grade. The front brakeman set the retaining valves on the front portion of the train for use and told the engineman that they were ready to leave. A helper engine assisted in starting the train away from Saluda. The air brakes were applied when their engine was about 4 car lengths east of the summit and were not released until just before the engine entered Safety Track No. 1, when the engineman placed the brake valve in release position a short period, then made an emergency application.

Conductor Parris, of Second 150, stated that a terminal air-brake test was made at Asheville and the car inspectors reported that the brakes and the retaining valves were func-

tioning properly. Before the train departed from Asheville the conductor informed the engineman of the number of cars in the train and the tonnage. He advised the engineman to proceed 7 or 8 car lengths past the stop sign at the summit so that the train could be started without assistance, and, because of 17 Interstate Railroad cars in the train, to be careful when the train was descending the grade. Two cars were added to the train at Hendersonville; however, the brakes on these cars were not tested as required by the rules; the conductor said that when cars are added to a train subsequent to a terminal brake-test it is not customary to examine each brake to determine whether it applies and releases. When the train stopped at Saluda station he and the flagman proceeded toward the front end of the train. Seeing the front brakeman proceeding toward the rear of the train, he assumed from the motions of the brakeman's lantern that the brakeman was setting the retaining valves for use. As he was doubtful whether the engineman would stop at the stop sign at the summit he instructed the flagman to set the retaining valves on the rear portion of the train. The conductor returned to the caboose and coupled a helper engine to the rear to assist in starting. He started toward the front end again and met the flagman who informed him that all retaining valves were set for use. The conductor understood that the rules required him to know that all brakes were operative but thought that he complied with the rules by instructing the flagman to attend to that duty. About 5:30 a.m., the engineman having sounded a proceed signal, the conductor gave a proceed lantern-signal and then boarded the caboose. When his train was moving at a speed of about 5 miles per hour just east of Saluda station the helper engine was detached and he went inside the caboose. At this time he observed that the caboose gauge indicated 65 pounds brake-pipe pressure. The engine had passed the top of the grade about 10 car lengths and was moving at a speed of about 10 miles per hour when the caboose air-gauge indicated a brake-pipe reduction; the brake-pipe pressure dropped slowly to zero and the conductor became alarmed, thinking that the train was out of control. As the train approached a point about 800 feet west of Safety Track No. 1 the brake-pipe pressure was restored to 65 pounds for a short period, then became depleted. The train entered the safety track at a speed of about 35 miles per hour. The accident occurred at 5:45 a.m., at which time it was dark and rain was falling. He said that he had made numerous trips down Saluda Mountain and was familiar with the instructions requiring brake-pipe pressure to be increased to 100 pounds before a train descends this mountain. This was the first instance that a train in his charge was operated with brake-pipe pressure less than 100 pounds. He was examined on the rules in January 1940, and was familiar with the rules pertaining to operation on Saluda Mountain. He

examined the train subsequent to the accident and found all brakes applied and all retaining valves set for use. He understood that he was responsible for air-brake tests at points where required but said the manner in which his crew tested the air brakes at Saluda was customary. He had never been criticized by the officials for his performance at that point. He said that the brakes on Interstate Railroad cars are not so effective as those on cars of other lines.

Flagman Kendrick, of Second 150, stated that when his train stopped at Saluda station the conductor instructed him to set up the retaining valves on the rear portion of the train as he thought the front brakeman was setting them on the front portion. The flagman proceeded toward the front end and inspected the rear portion of the train to ascertain if the brakes were applied. When he reached the tenth car from the rear the brakes released and he did not know whether the remainder of the brakes were applied. The front brakeman informed him that the retaining valves were not set for use; the flagman then instructed him to set them. The flagman proceeded toward the rear and set the retaining valves on the rear portion of the train. He boarded the caboose and observed that the gauge indicated only 65 pounds brake-pipe pressure but he thought the gauge was defective. The conductor got on the caboose after the train had started and the flagman called his attention to the fact that the gauge indicated 65 pounds only. The conductor remarked that it had indicated the same pressure en route from Asheville. Soon after the caboose passed the summit the conductor remarked that the train was out of control. The train entered the safety track at a speed of about 35 miles per hour. The flagman said that on all trips when he had been front brakeman the engineman had increased the brake-pipe pressure to 100 pounds before the train descended Saluda Mountain and that on all occasions when he was flagman the caboose gauge indicated brake-pipe pressure of about 70 pounds. He said that he had been out of service from 1929 until August 1940, and when he returned to duty he was examined orally on rules; however, he was not familiar with the special bulletins issued during the time he was out of service.

Engineman Hawkins, of Extra 5076, stated that his engine was coupled to the rear of Second 150 at Saluda and assisted in starting that train. He said the speed of the train was about 5 miles per hour when his engine was uncoupled from it at a point about half way between the station and the overhead bridge, which is located about 700 feet east of the station.

Switchtender Pace, on duty at Safety Track No. 1, stated that Second 150, moving at a speed of 40 or 45 miles per hour, entered Safety Track No. 1 at 5:45 a.m.

Master Mechanic Anderson stated that he arrived at the scene of the accident at 8:30 a.m. and examined engine 4052. The throttle was closed, the automatic brake-valve was in emergency position, the independent brake-valve in application position, and the reverse gear in position for full forward motion. On each driving-wheel tire there was a slid-flat spot varying between 3 and 6 inches in length. On each tender wheel there was a slid-flat spot about 4 inches long. The air gauges were compared with test gauges and found to be accurate. During the process of being rerailed the brake rigging of the engine was damaged. Engine 4052 was equipped with two 8-1/2-inch cross-compound compressors and type M-3 feed-valve. Subsequent to the accident tests of the duplex governor and the feed-valve disclosed that the brake-pipe feed-valve was adjusted at 80 pounds pressure, the low-pressure head of the governor at 134 pounds, and the high-pressure head of the governor at 150 pounds. The cut-out cock in the main-reservoir pipe to the low-pressure head of the compressor governor was found cut in. He explained that possibly the discrepancy between the testimony stating that brake-pipe pressure was 70 pounds and the test disclosing the feed-valve was adjusted for 80 pounds was accounted for by the regulating device being disturbed at the time of the derailment. A test of 37 undamaged units of the train involved disclosed brake-pipe leakage of 1-1/2 pounds per minute.

Engineman Patterson, of Extra 5076, stated that subsequent to the accident his engine, headed west, was coupled to the west end of a draft of 16 cars, which was moved eastward to Melrose. After the cars were moved from Safety Track No. 1 to the main track he made a service application of the brakes, and then the retaining valves were set for use. Brake-pipe pressure of 90 pounds and main-reservoir pressure of 110 pounds were being maintained. After the retaining valves were set for use he released the brakes and, when the brake-pipe pressure was restored to 90 pounds, he started the train. Soon afterward he made a brake-pipe reduction of from 5 to 10 pounds, and, observing that it was effective, placed the brake valve in release position and observed that the brake-pipe pressure was restored to 90 pounds. About 1 mile west of Melrose he made another reduction of from 5 to 10 pounds, which retarded the speed of the train to 12 or 15 miles per hour, and he again placed the brake valve in release position. Soon afterward the speed increased and he made a 10 or 15-pound brake-pipe reduction; however, this reduction did not seem to retard the speed. Realizing that the train was out of control, he did not sound the whistle signal for the switch at Safety Track No. 2 to be lined for the main track. The train entered Safety Track No. 2 at a speed of 20 or 25 miles per hour and he placed

and kept the brake valve in service position until the brake-pipe pressure was depleted. After the train struck the sand on the rails of the safety track it stopped in a distance of 14 car lengths. Because the engine was not equipped with a driving-wheel watering device he held the engine and the tender brakes released. He said that he was familiar with bulletin instructions requiring the brake-pipe pressure to be increased to 100 pounds when a train is descending Saluda Mountain; however, he had adjusted the brake-pipe feed-valve to 90 pounds pressure because he considered that pressure adequate to control the speed of a train. He stated that he has operated many trains down this grade and has always used 90 pounds brake-pipe pressure.

Fireman Pope, of Extra 5076, corroborated the statement of Engineman Patterson. He said that the rails were dry en route to Melrose.

Conductor Seay, of Extra 5076, stated that when the 16 Interstate Railroad cars of the train of Second 150 were moved from Safety Track No. 1, the air brakes were used to hold the cars, then the hand brakes on about 10 cars were applied and the retaining valves on all cars were set for use. Immediately after this draft of cars was started the brakeman applied the hand brakes on the remainder of the cars. The cars became out of control and entered Safety Track No. 2 at a speed of 15 or 18 miles per hour. His experience with Interstate Railroad cars on Saluda Mountain was that the air brakes are not very effective when the speed is greater than 6 or 8 miles per hour.

Brakeman Moody, of Extra 5076, corroborated the statement of Conductor Seay.

Conductor Waggoner stated that subsequent to the accident engine 4058 moved 34 of the 37 cars of Second 150 from Melrose to Tryon, 5.8 miles east of Melrose. The air brakes were tested at Melrose and they controlled the speed of the train properly on the grade, which averaged 1.37 percent descending between Melrose and Tryon.

Car Inspector Everhart stated that he assisted in making a terminal air-brake test on Second 150 at Asheville. The yard air-line was coupled to charge the train air-brake system to 70 pounds pressure. A brake-pipe reduction of about 20 pounds was made and each brake was examined to determine whether it applied; brake-cylinder piston travel was corrected wherever needed. Special instructions require that the piston travel on cars moving eastward from Asheville be adjusted to between 5 and 7 inches. Prior to the air-brake test special 40-

pound retaining valves were installed on 16 Interstate Railroad cars. He said that 40-pound retaining valves are required on these cars because the light-weight braking ratio is less than on cars of other lines. After an interval of 3 minutes a retaining-valve test disclosed all retaining valves to be functioning properly. After the engine was attached to the train the engineman made a brake-pipe reduction of about 18 pounds. The car inspector did not time the brake-pipe leakage but estimated that it was about 2 pounds per minute. After the brakes were released the inspector gave a proceed lantern-signal, which is customary as an indication that the test is completed and all brakes are operative.

Car Inspector Fox corroborated the statement of Inspector Everhart.

Air Brake Machinist Smith stated that he inspected engine 4052 before it left Asheville on the date of the accident. The engine was in good condition and the brake equipment was in suitable condition for service. Subsequent to the accident the automatic brake-valve, the air-compressor governor, the brake-pipe feed-valve and the distributing valve of engine 4052 were attached to another engine and tested; they functioned properly.

General Foreman of Car Repairs Glover stated that subsequent to the accident the air gauge, with which the caboose involved was equipped, was tested and found to be accurate. He said that because of brake-pipe pressure gradient in many instances there is a variation of 5 pounds between pressures indicated by the duplex air gauge of the engine and the brake-pipe air gauge of the caboose. He stated that all inspectors under his supervision were observed periodically to determine whether they conducted air-brake tests in accordance with instructions; he had not observed any non-compliance with the rules recently.

Air Brake Instructor Bradbury stated that air-brake instructions for operation of trains on Saluda Mountain were as follows: Trains should be stopped at the crest of the mountain, the brake-pipe pressure increased to 100 pounds, and the main-reservoir pressure increased to 150 pounds; when the brake-pipe is fully charged a reduction of 15 to 20 pounds should be made, after which the train crew must examine each brake to determine if it applies; if any brake is inoperative, or if piston travel is excessive, that unit must be set off. After the test is completed, the brakes should be released and the retaining valves set for use. Enginemen should wait 3 minutes to insure that auxiliary reservoirs are charged before the train departs. Shortly after the engine passes over the summit and before a speed of 10 miles per hour is attained an initial brake-pipe reduction of 10 or 15 pounds should be made;

then released a sufficient time to restore the brake-pipe pressure; during this time triple valves assume release position while the retaining valves retain brake-cylinder pressure proportionate to the brake-pipe reduction but not exceeding the adjustment of the valve. Brake application and release cycles should be made thereafter at frequent intervals to control the speed of the train so that a further brake-pipe reduction of 5 or 8 pounds would stop a train at any point on the descending grade. Brake-pipe pressure is increased to 100 pounds so that a liberal margin of brake-pipe pressure will exist during the short-cycle braking. Special retaining valves used on Interstate Railroad cars are 40-pound spring-type single-head pressure valves designed to retain 40 pounds pressure in the brake cylinder after triple valves assume release position. A retaining valve of this type is attached to a short nipple, and applied by disconnecting the retaining-valve pipe at the triple valve and screwing the nipple into the triple-valve exhaust. Engines used on Saluda Mountain are equipped with duplex compressor-governors; the low-pressure head is adjusted to 100 pounds and the high-pressure head to 150 pounds. A cut-out cock adjacent to the automatic brake-valve is provided in the pipe between the brake valve and the low-pressure head of the compressor governor; when this cock is closed the high-pressure head controls the main-reservoir pressure. M-3 type brake-pipe feed-valves are used and are provided with hand-wheel regulating devices. He said that 20 to 26 brake-application cycles are required to control an average coal train descending Saluda Mountain. The last air-brake instruction classes were held in July 1939; at this time operation of AB brakes only was discussed. He said that since no car with an inoperative brake is permitted to leave a terminal on the railroad involved a hand or lantern signal to proceed can be accepted as information that the air-brake test is completed and all brakes are operative.

General Road Foreman of Engines Sink stated that enginemen and firemen are required to attend a class on operating rules once each year; however, they are not instructed regularly on air-brake rules.

Trainmaster Lewis stated that train and engine service employees are examined orally on operating rules once each year. If an employee has been out of service he is examined on rules before he is permitted to return to service; however, during 2 months prior to the accident this rule was not followed because of emergency conditions created by floods. Engineman Pope was last examined in January 1940; he was assigned to service as an engineman during the flood in August 1940, but was not examined at that time. Although Engineman

Pope had not been performing service as an engineman, since he was promoted, the trainmaster assumed that he had read and understood existing bulletins. The trainmaster said that he observed the performance of Engineman Pope on the day prior to the accident and he was certain that this engineman was qualified to perform service in this territory. The fireman and the flagman, after being out of service several years, had returned to service under the same conditions. His opinion, based on observation, was that crews complied with rules and special instructions pertaining to operation of trains descending Saluda Mountain. Brake-pipe pressure of 100 pounds was maintained on all engines which he had ridden down the mountain. He said that he did not recall having read or explained bulletins concerning operation of trains on Saluda Mountain to employees at classes on the operating rules.

According to records of the railroad, Engineman Pope entered service as a fireman on July 3[illegible], 1913; he was promoted to engineman on April 14, 1923. Since the date of his promotion, he worked 1,874 days as fireman, 3,516 days as hostler, and 119 days as engineman. During 1940 he worked as engineman 34 days.

The consist of Second 150, and the weight and theoretical braking power of each unit were as follows:

	Unit or Car	Light Weight (Pounds)	Gross Weight (Pounds)	Total Braking Power (Pounds)	Percentage Braking Power: Light Weight	Percentage Braking Power: Gross Weight
C-ET	Eng 4052	430,000	469,000	215,000	50.0	45.8
	Tender	76,100	121,400	59,760	78.5	31.2
	SAL 99701	40,100	40,100	26,240	65.4	65.4
	UTLX 70565	44,900	44,300	27,576	61.4	61.4
	PFEX 97935	53,900	80,500	26,700	49.5	33.2
	INT 5089	39,400	151,700	24,444	62.0	16.1
	INT 2460	37,800	135,400	24,444	64.6	18.0
	INT 5385	39,700	151,700	24,[illegible]	61.5	16.1
	INT 5338	39,900	148,[illegible]00	24,444	61.2	16.5
	INT 2318	38,000	134,100	24,444	64.3	18.2
	INT 2312	37,100	134,400	24,444	65.8	18.1
	INT 2735	37,400	135,200	24,444	65.3	18.4
	INT 5659	39,400	151,500	24,444	62.0	16.1
	INT 2085	39,900	140,700	24,444	61.2	17.4
AB	INT 6783	40,800	154,100	26,438	64.9	17.1
	INT 5927	38,100	153,[illegible]00	24,444	64.1	15.9
	INT 5865	38,800	140,100	24,444	63.0	17.4
	INT 6731	39,600	140,800	24,444	61.5	17.4
	INT 5507	37,400	139,900	24,444	65.4	17.5
	INT 2134	36,600	128,400	24,444	66.7	19.3
	INT 5225	40,000	141,000	24,444	61.1	17.3
	INT 6047	40,000	141,000	24,444	61.7	17.3
	UTLX 50358	53,000	56,200	35,112	66.4	62.4
	GATX 30398	50,300	50,300	29,815	58.8	58.8
	SOU 112350	42,700	168,500	32,452	75.6	19.2
	SOU 111415	41,800	164,600	31,452	75.2	19.1
	SOU 285228	41,800	159,200	31,452	75.2	19.7
	SOU 109338	39,500	159,400	31,452	79.6	19.7
	SOU 107883	42,300	162,300	31,452	74.3	19.4
	SOU 112139	42,700	159,700	31,452	73.6	19.7
	N&W 41761	48,100	106,100	29,280	60.8	27.6
	N&W 41951	48,300	106,000	29,280	60.6	27.6
AB	FWDX 20050	56,200	104,400	31,172	55.4	30.0
	GRCX 2127	41,400	41,400	27,324	65.7	65.7
	GRCX 2156	41,100	41,100	27,324	66.2	66.2
AB	UTLX 17771	45,700	45,700	27,[illegible]72	60.0	60.0
	UTLX 38790	49,700	49,700	30,270	60.9	60.9
K-1	SDRX 6686	35,500	35,500	21,552	60.7	60.7
	S&A 8169	50,100	50,100	30,084	60.0	60.0
H-1	Caboose	43,000	43,000	24,000	55.8	55.8

Note: All brake cylinders except those on the engine, the tender, SDRX 6686, and the caboose, were 10 inches in diameter; the cylinders on the engine and the tender were 14 inches in diameter and the cylinders on SDRX 6686, and the caboose were 8 inches in diameter. The engine and the tender were provided with No. 6-ET equipment; the caboose with H-1 triple valve; SDRX 6686 with K-1 triple; INT 6783, FWDX 20050, and UTLX 17771 with AB valves; the remainder of the cars had K-2 triples.

At the time of the accident, sixteen of the Interstate Railroad cars were equipped with 40-pound special retaining valves; one car was equipped with a 15-pound weight retaining valve, and the remaining 20 cars were equipped with 10-20 pound spring type retaining valves. After the accident tests of special 40-pound retaining valves disclosed they retained brake-cylinder pressures as follows: Seven retained 40 pounds, 2 retained 35 pounds, 6 retained 30 pounds, and 1 retained 15 pounds. The piston travel on all cars except the first car, which was damaged, varied between 6-1/2 inches and 8 inches; 16 were less than 7 inches. All air-brake equipment had been cleaned within a period of one year prior to the accident. The engine and tender weighed 330.2 tons, and the train, 2,139 tons. The average number of tons per brake was 61.7. The average percentage of braking power for the gross weight of the entire train was 26.3; the average percentage of the braking power of the loaded cars was 19.1; the average percentage of the loaded Interstate Railroad cars was 17.2.

In connection with this investigation information was obtained concerning seven instances since August 1939, of trains which used Safety Tracks Nos. 1 and 2 on Saluda Mountain. From the investigation it is clear that operating officers expect an engineman to allow his train to enter the safety tracks unless he is certain that he has his train under full control.

Discussion

According to the evidence, Second 150 stopped at Saluda station. While the train was standing at that point, an air-brake test was made and then all retaining valves were set for use. Brake-pipe pressure of 70 pounds was being maintained. After leaving the station the train passed the summit of the grade at a speed of about 3 or 4 miles per hour, according to the engineman's statement, and after the engine entered upon the descending grade, the engineman applied the independent brake and shortly afterward made a brake-pipe reduction of about 10 pounds; at this time the speed was about 10 miles per hour, according to the conductor. The engineman realized at once that the speed of the train was not being controlled and made a further brake-pipe reduction of 25 pounds. The brakes were held applied until the engine was a short distance west of Safety Track No. 1; then in an effort to restore the brake-pipe pressure, the engineman placed the brake valve in release position momentarily and then made an emergency brake application. This failed to control the speed of the train, which entered the safety track at a speed estimated to have been between 25 and 45 miles per hour, and was derailed at the end of the safety track.

Subsequent to the accident, tests disclosed that the automatic brake-valve and the air-regulating devices were in proper operating condition. The evidence indicates that the brake equipment on each unit of the train was operative.

The braking ratio of the Interstate Railroad cars involved was from 61.1 to 66.7 percent of their light weight, and from 15.9 to 19.3 percent of their loaded weight; the average percentage of braking power for the gross weight was 17.2. The light-weight braking-power percentage conformed to the A.A.R. requirement of 60 percent or more, but on 12 cars the braking ratio based upon loaded weight was less than 18 percent.

In order to provide proper safeguards for the operation of trains descending this mountain grade, the railroad company had issued certain rules and instructions which were designed to insure that brake equipment was in proper operating condition and that the method of operation on the grade would properly control trains. In addition to the air-brake tests which are prescribed in detail, to be made at the initial terminal for each train, at points en route where cars are added to the train, and at the crest of the grade, to insure that brake equipment on all cars is in proper operating condition before starting down the grade, special bulletin instructions required that brake-pipe pressure on each train be increased to 100 pounds before starting down the grade, to provide improved performance and increased braking power. In view of the severe operating requirements attending operation on this heavy mountain grade, all practical safeguards should be employed and operating practices necessary for safe operation should be rigidly adhered to. Nevertheless, the investigation of this accident disclosed that many requirements of rules and instructions were not complied with in this instance, and there was considerable evidence which indicated that it was not common practice to comply properly with some of these requirements. As shown by the evidence, in making the terminal air-brake test at Asheville brake-pipe leakage on the train involved was not noted, the car inspector did not report to the engineman the condition of the brakes and the number of cars, and the train departed without the engineman receiving definite information concerning the condition of the brakes in his train. No air-brake test was made on cars added to the train at Hendersonville. The brake test at Saluda was made at the station instead of at the top of the grade and the train was not stopped at the summit. Brake-pipe and main-reservoir pressures were not increased to the specified amounts before the train started down the grade.

Subsequent to the accident, 16 of the cars in the train involved in this accident were handled in Extra 5076 from Safety Track No. 1 to the foot of the grade. Although these were Interstate Railroad cars loaded with coal, the engineman increased brake-pipe pressure to only 90 instead of to 100 pounds, which he stated was his common practice. Even though hand brakes were used in addition to the air brakes, this train also got out of control and entered Safety Track No. 2.

The investigation disclosed that the engineman involved in this accident was unaware of instructions concerning the method of handling east-bound trains on Saluda Mountain; he had not performed service as an engineman except in emergencies for several years, and had not read bulletins pertaining to train air-brake operation on the grade involved. He was unaware that main-reservoir pressure could be increased by turning the cut-out cock in the pipe leading to the low-pressure head of the compressor governor. When employed as fireman he had observed some enginemen increase brake-pipe pressure before descending the grade; however, others did not increase the pressure but he did not know that this was required. Notwithstanding his limited experience as an engineman and his lack of knowledge of air-brake equipment and operating practices and requirements, as disclosed by this accident and the subsequent investigation, this engineman was permitted to operate a tonnage train down this heavy mountain grade for the first time without instruction or examination to determine definitely that he was familiar with the operating requirements and practices in effect and that he was properly qualified for operation on this grade. According to the trainmaster, the engineman was placed in service a short time prior to the accident because of increased traffic; the trainmaster was of the opinion, based on observation, that the engineman was proficient and capable. Had the engineman been examined to determine his proficiency, undoubtedly his lack of knowledge concerning air-brake apparatus and operating requirements and practices on the grade would have been discovered. Had the engineman operated the train air-brake apparatus in accordance with instructions, or if the conductor, who knew brake-pipe pressure should be increased to 100 pounds, had taken action to stop the train as soon as he observed that the pressure at the rear end was only 65 pounds when the train was leaving Saluda, it is probable that this accident would have been averted. The evidence indicated that the fireman and the flagman had returned to service but a short time prior to the accident after being out of service a number of years, and

were not familiar with existing bulletins. The facts in this case indicate inadequate instruction and supervision, and direct attention to the necessity for prompt corrective measures.

Conclusion

This accident was caused by failure to control the speed of a train properly on a descending grade.

Respectfully submitted,

S. N. MILLS,

Director.