Inv-2374

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

DENVER AND RIO GRANDE WESTERN RAILROAD

AND THE

ATCHISON, TOPEKA & SANTA FE RAILWAY-COLORADO

AND SOUTHERN RAILWAY

SOUTH DENVER, COLO.

AUGUST 12, 1939

INVESTIGATION NO. 2374

SUMMARY

Inv-2374

Railroads:	Denver and Rio Grande Western and the Atchison, Topeka & Santa Fe-Colorado and Southern	
Date:	August 12, 1939	
Location:	South Denver, Colo.	
Kind of accident:	Side collision	
Trains involved:	Santa Fe passenger	: Rio Grande passenger
Train numbers:	6	: First 1
Engine numbers:	3700	: 801 and 1800
Consist:	10 cars	: 16 cars
Speed:	10-25 m.p.h.	: 18 m.p.h.
Operation:	Timetable and train orders	: Timetable and train orders
	Crossing governed by mechanical interlocking	
Track:	Double; tangent; level	: Double;tangent;level
Weather:	Clear	
Time:	9:10 a.m.	
Casualties:	2 killed and 18 injured	
Cause:	Failure to control speed of Rio Grande train in compliance with interlocking signal indications	

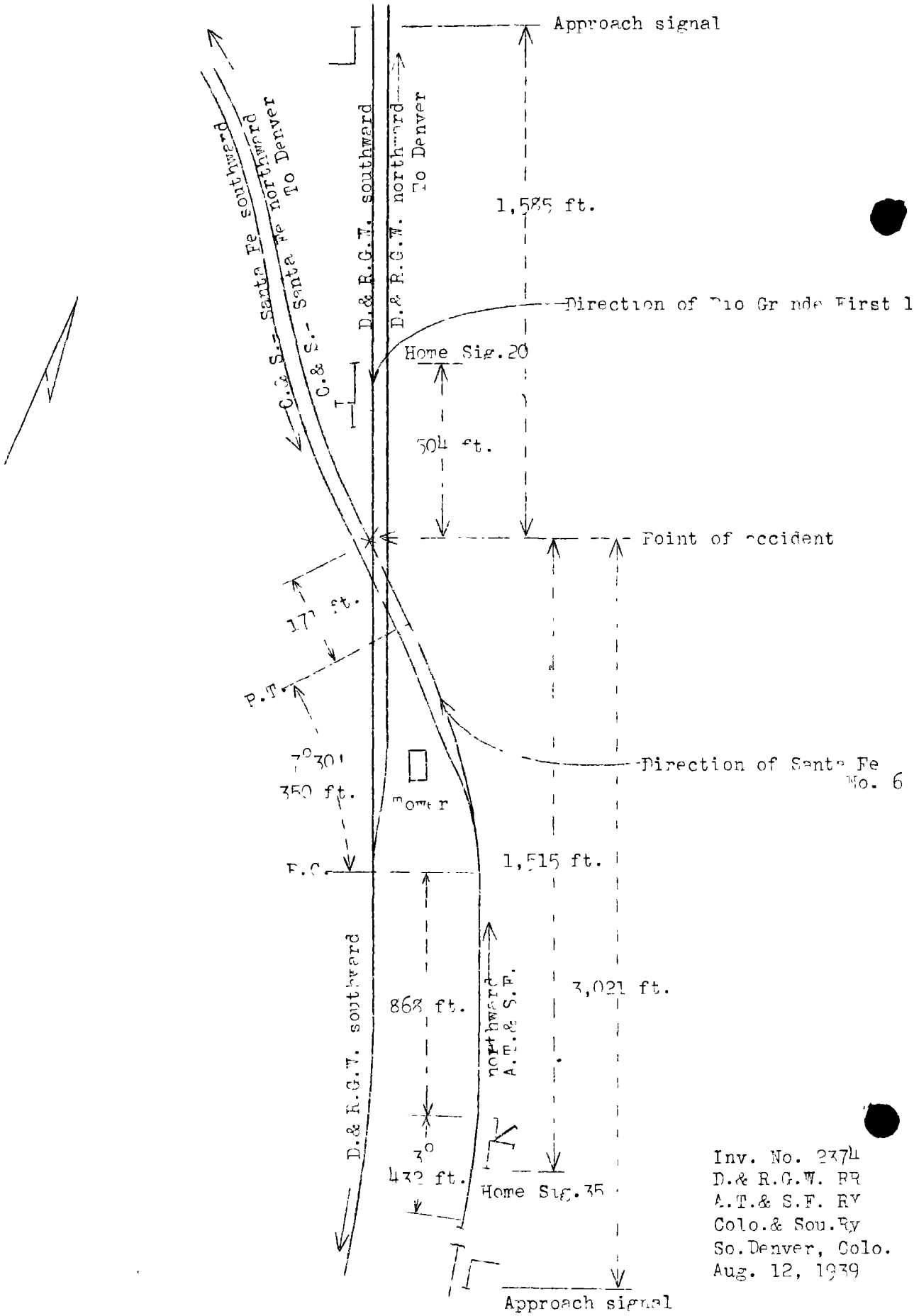
To the Commission:

On August 12, 1939, there was a side collision between an Atchison, Topeka & Santa Fe Railway passenger train and a Denver and Rio Grande Western Railroad passenger train at the intersection of the tracks of the Atchison, Topeka & Santa Fe Railway-Colorado and Southern Railway and the Denver and Rio Grande Western Railroad at South Denver, Colo., which resulted in the death of 1 passenger and 1 employee and the injury of 16 passengers and 2 dining-car employees. The Atchison, Topeka & Santa Fe and the Denver and Rio Grande Western hereinafter will be referred to as the Santa Fe and the Rio Grande, respectively. The investigation of this accident was made in conjunction with a representative of the Public Utilities Commission of Colorado.

Location and Method of Operation

This accident occurred at the intersection of that part of the Denver Division of the Rio Grande designated as the Denver District which extends between Denver Union Depot and South Denver, Colo., a distance of 3.6 miles, and that part of the Denver Terminal Division of the Colorado and Southern Railway designated as the Denver and South Denver Subdivision which extends between the same points, a distance of 4.1 miles; the latter is a joint line of the Santa Fe-Colorado & Southern. Both are double-track lines over which trains are operated by timetable and train orders, no block system being in use. The crossing is protected by an interlocking, maintained and operated by the Rio Grande. South of the crossing these double-track lines merge into single tracks which extend between South Denver and Bragdon, Colo., and are used as a double-track line by all three railroads. On the Rio Grande line between Denver and South Denver trains are governed by the Santa Fe operating rules. The accident occurred within yard limits.

The double-track line of the Santa Fe - C. & S. crosses the double track line of the Rio Grande at an angle of 25°45'. Approaching the crossing on the Rio Grande southward track there is a compound curve to the right 1,345 feet in length, which consists of a 0°11' curve 1,145 feet long and a 2° curve 200 feet long, followed by a tangent 3,462 feet to the crossing and 1,010 feet beyond. The grade for southward trains is generally ascending, varying from 0.55 to 0.58 percent to within 1,200 feet of the crossing; it is then level. Approaching the crossing from the south on the Santa Fe - C. & S. track there are, successively, a 3° curve to the left 432 feet in



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length, a tangent 868 feet in length, a 7°30' curve to the left 350 feet in length, and a tangent 171 feet to the crossing. The grade for north-bound trains is 0.31 percent descending a distance of 1,300 feet then level 1,950 feet, 0.9 percent descending a distance of 250 feet, and then level a distance of 100 feet to the crossing.

At the time of this accident the interlocking machine, located in a tower in the southeast angle of the crossing, was a Saxby-Farmer mechanical machine with 26 working levers. There were no track circuits in this interlocking. In addition to mechanical locking on the machine, normal-indication electric locks were attached to the signal levers. The signals involved were of the 1-arm, upper-quadrant, semaphore type. The approach signal on each line was fixed in horizontal position; it was oil lighted and displayed a yellow aspect; its indication was "proceed at restricted speed." The home signal was electrically operated from the tower and its normal position was stop. The approach signal and home signal No. 35, governing northward movements on the Santa Fe - C. & S., were located 3,021 and 1,515 feet, respectively, south of the crossing. The indications and aspects of home signal No. 35 were as follows:

Green - Proceed. Name - Clear.
Yellow- Proceed at restricted speed.
Name - Restricted speed.
Red - Stop. Name - Stop.

Restricted speed was defined: Proceed prepared to stop short of train, obstruction, or anything that may require the speed of a train to be reduced. The approach signal and home signal No. 20, governing southward movements on the Rio Grande, were located 1,585 and 504 feet, respectively, north of the crossing. The indications and aspects of home signal No. 20 were as follows:

Green - Proceed. Name - Clear.
Red - Stop. Name - Stop.

Both the approach and home signals on the Rio Grande could be seen by the engineman of a south-bound engine approximately 3,600 feet north of the crossing. The fireman could see both signals when 3,170 feet from the crossing.

The following interlocking rules of the operating department of the Santa Fe read in part as follows:

786. No engine, train or portion of a train must be allowed to stand within the stop signal limits of an interlocking plant while opposing routes are cleared or being cleared for trains.

787. *** A home signal shall be restored so as to display the most restrictive indication as soon as the front portion of the train for which it was cleared has passed beyond the farthest switch governed by the home signal.

The crossing involved is within the city limits of Denver, within which territory a maximum authorized speed of 25 miles per hour is imposed by city ordinance.

Rule 26 of the Rio Grande timetable read in part as follows:

Highway crossings: While head of train is passing the highway crossings of cities and towns named below, indicated speed must not be exceeded. ***

Denver - Between Union Depot and Colfax Avenue, passenger trains twelve (12) miles per hour; *** Between Colfax Avenue and South Denver, passenger trains twenty (20) miles per hour; ***

Rule 23 of the C. & S. timetable read in part as follows:

South Denver - The D. & R. G. W. Crossing and Double Track Junction are protected by standard interlocking system. When proper signals are clear, trains may cross at a speed not exceeding fifteen (15) miles per hour. ***

The weather was clear at the time of the accident, which occurred about 9:10 a.m.

Description

No. 6, a north-bound Santa Fe passenger train, consisted of one baggage car, one chair car, one smoking car, one chair car, three standard Pullman sleeping cars, one cafe lounge car, one standard Pullman sleeping car, and one tourist Pullman car, of all-steel construction, in the order named, hauled by engine

3700, and was in charge of Conductor Mock and Engineman Heath. This train departed from Pueblo, Colo., 115.4 miles south of South Denver, at 6:09 a.m., according to the train sheet, 1 hour 9 minutes late, passed Englewood, 4 miles south of South Denver, at 9:05 a.m., 1 hour 7 minutes late, passed home signal No. 35, which displayed a proceed indication, and, while passing over the crossing at South Denver at a speed variously estimated to have been from 10 to 25 miles per hour, was struck by Rio Grande First 1.

First 1, a south-bound Rio Grande passenger train, consisted of one baggage car, one mail car, four coaches, two tourist Pullman cars, one dining car, six standard Pullman cars, and one lounge car, of all-steel construction, in the order named, hauled by helper engine 801 and engine 1800, and was in charge of Conductor Foster and Enginemen Medae and Williams. This train departed from Denver, 3.6 miles north of South Denver, at 9:01 a.m., according to the train sheet, 16 minutes late; passed Burnham, 1.6 miles north of South Denver, at 9:06 a.m., 13 minutes late; passed home signal No. 20 displaying a stop indication, and collided on the crossing with the third car of Santa Fe No. 6 while moving at a speed of 18 miles per hour, according to the speed-recorder tape with which the second engine was equipped.

Rio Grande engine 801 leaned toward the left with its rear end across the Rio Grande southward track and its front end across the Santa Fe - C. & S. tracks and 42 feet north of the center of the crossing; it was badly damaged. The tender was derailed toward the left and stopped at an angle across both Rio Grande main tracks. The second engine in this train was slightly damaged, but was not derailed. The engine and first three cars of the Santa Fe train stopped with the rear end of the third car approximately 115 feet north of the center of the crossing. The rear truck of the third car was derailed; this car had been struck by the engine of the Rio Grande train at a point about 35 feet from its north end and its side was scraped and badly crushed. The fourth car stopped on its left side with its front end about 54 feet west of the Santa Fe northward track and its rear end fouling the southward track. The fifth car stopped on the crossing with its front truck derailed and the rear truck partially derailed. The front truck of the sixth car was derailed.

The employee killed was the conductor of the Santa Fe train.

Summary of Evidence

Engineman Heath, of Santa Fe No. 6, stated that home signal No. 35 displayed a proceed indication. He called its indication and was answered by the fireman. His train was operated over the crossing at a speed of 10 or 12 miles per hour. As he rounded the curve just before reaching the crossing he saw the Rio Grande train approaching, but until immediately before the occurrence of the accident thought that it was going to stop short of the crossing.

The statement of Fireman Stevens, of Santa Fe No. 6, corroborated that of the engineman.

Flagman Haggens and Porter Jones, of Santa Fe No. 6, stated they observed that home signal No. 35 displayed a clear indication and they estimated that the speed of their train was 10 or 12 miles per hour at the time of the accident.

Engineman Medae, of the first engine of Rio Grande First 1, stated that when the air brakes were tested at Denver he considered the time consumed not sufficient for an inspection of each car. The fireman received a proceed signal from the conductor, and then they departed. He then made a running test of the air brakes, first making a 15-pound brake-pipe reduction and then an additional 5-pound reduction, and he was satisfied with the results. He released the air brakes and sounded the engine whistle twice, indicating that the test had been made. After passing Ellsworth Street, located 1,585 feet north of the approach signal, he called the red aspect displayed by the home signal, which was repeated by the fireman, at which time the speed of his train was between 35 and 40 miles per hour. When passing the 2000-foot railroad-crossing sign he closed the throttle and when at a point two car-lengths north of the distant signal he made a 15-pound brake-pipe reduction, but the speed was not reduced according to his expectation and he made an additional 5-pound brake-pipe reduction. When approaching the home signal it appeared to him that the train was not going to stop at the desired point and he therefore placed the brake valve in emergency position when two car-lengths from the signal; he heard the exhaust but there was no reduction in speed. The train was moving at a speed of 10 or 12 miles per hour; it continued at that speed to the crossing where it struck the Santa Fe train. Engineman Medae estimated that the distance between the distant and the home signals was 1,800 feet and the distance between the home signal and the crossing 150 feet; the actual distances between those points were 1,081 and 504 feet, respectively. Prior to the accident Engineman Medae had last been given a

general physical examination in March, 1936. Subsequent to the accident he was given a complete physical examination; his condition was normal and his vision without glasses was normal for a man of his age, which was 56.

The statement of Fireman Bovee, of the first engine of Rio Grande First 1, practically corroborated that of the engineman as to the speed of their train approaching South Denver, the indication of the home signal, and the brake-pipe reductions made. After the home signal was called he put in a fire and turned on the blower. When he resumed his place on his seatbox his train was about two car-lengths from the home signal and at the same time he saw the Santa Fe train. He estimated that the speed of his train was between 12 and 15 miles per hour when passing the home signal and 8 or 10 miles per hour at the time of the accident.

Engineman Williams, of the second engine of Rio Grande First 1, stated that when the running test of the air brakes was made, leaving Denver, his gauge showed a reduction in brake-pipe pressure of 10 or 12 pounds. His engine was equipped with a pilot valve, and, when approaching Ellsworth Street, the gauge showed a speed of between 35 and 40 miles per hour. Observing the red aspect of the home signal he closed the throttle and opened the sanders. The smoke from the first engine then started to trail down on his side and obscured his view of the signal. He did not again see that signal until they were passing it. In the vicinity of the 2000-foot railroad crossing sign he felt an application of the air brakes and his gauge showed that a reduction of about 10 pounds had been made; at no time did he feel a further reduction. The speed was being reduced and he thought that the train was going to stop at the home signal. In another statement, however, he said that when the speed of the train was not reduced he figured the home signal must have cleared, although he did not feel the first engine working steam. His gauge did not show much change at any time, and when the accident occurred it showed a brake-pipe pressure of 30 or 50 pounds and immediately registered zero. He estimated the speed when passing the home signal to have been between 15 and 20 miles per hour, and 8 or 10 miles per hour at the time of the accident. Although he saw the red aspect of the home signal as they passed it, he did not apply the air brakes because they were too close to the crossing. His fireman warned him to jump off, but he stood in the gangway; he then saw the Santa Fe train. Engineman Williams further stated that the maximum speed attained was between 30 and 35 miles per hour, that the pilot valve registered about 7 miles per hour more than the actual speed, and that he had observed the gauge hands did not always register accurately. After the

accident another helper engine was coupled to the train and the train proceeded to Pueblo and no difficulty was experienced en route.

Fireman Boyle, of the second engine of Rio Grande First 1, stated that when approaching the South Denver interlocking the speed of their train was between 35 and 40 miles per hour. His engineman called the red aspect of the home signal and closed the throttle. After passing the distant signal he felt an application of the air brakes and the brakes remained applied up to the time of the accident; he did not feel a further reduction or an emergency application. The speed had been reduced to 10 or 12 miles per hour when passing the home signal, and when the train was four or five car-lengths from the crossing he saw the Santa Fe train. He jumped off, at which time the speed of his train was 8 or 10 miles per hour.

Conductor Foster, of Rio Grande First 1, stated that when approaching South Denver he was in the third car of the train. He felt a gradual reduction in speed, but did not realize that anything was wrong until he felt an emergency application of the air brakes just prior to the shock. His first thought was that the first engine had broken away.

Head Brakeman Naples, of Rio Grande First 1, stated that as his train was reducing speed when approaching South Denver he opened the trap door on the left side of the third car and stepped down on one of the steps expecting to receive train orders at the tower, but, looking ahead, he saw the fireman jump off. He, himself, then jumped off and as he struck the ground he heard a sound like an emergency application of the air brakes.

Flagman Freeman, of Rio Grande First 1, stated that their speed was 35 miles per hour when he felt an application of the air brakes. He opened the door expecting to receive train orders and heard a heavy application of the air brakes but was unable to say whether it was an emergency application.

C. & S. switch engine 605, with a cut of cars, stopped about 9:05 a.m. on the Santa Fe - C. & S. southward track just north of the home signal governing that track, and the members of this crew witnessed the occurrence of the accident. Their statements indicated that the Rio Grande train approached South Denver at a speed of 35 or 40 miles per hour, that when the train was in the vicinity of the approach signal steam was shut off, and that the speed was variously estimated to have been from 15 to 25 miles per hour when passing the home signal and from 5 to 15 miles per hour at the time of the accident.

The engineman of the C. & S. switch engine sounded a warning whistle signal when he saw that the Rio Grande train would not stop at the home signal. The estimates of the speed of the Santa Fe train were from 12 to 25 miles per hour.

Car Inspector Asbury, of the C. & S., stated that he was in the vicinity of the crossing involved and witnessed the occurrence of the accident. He saw the Rio Grande train as it approached at a high rate of speed; it was working steam, which was shut off in the vicinity of the distant signal. It then appeared that the brakes were applied and he expected the train to stop; he did not see any fire flying from the wheels. He estimated that the speed was 15 miles per hour when passing the home signal and not more than 5 miles per hour at the time of the accident.

Towerman Marlatt, at South Denver, stated that after receiving a report that Santa Fe No. 6 left Englewood at 9:05 a.m., he lined the route for that train, but did not clear the home signal until he saw the train approaching. The home signal governing the Rio Grande southward track was in stop position. He thought the Santa Fe train passed his tower between 9:09 and 9:10 a.m., and when the engine was about two car lengths beyond the tower he looked up and saw the Rio Grande train approaching.

Road Foreman of Equipment Heald, of the Rio Grande, arrived at the scene of accident about 9:35 a.m. Engine 1800 had been backed away about 100 feet. Engine 801 had a very hot fire and the air pump was racing. He boarded the engine, shut off the steam and the air pump, and shook out the fire. At this time he observed that the throttle was shut off and the reverse lever was in position for forward motion. He did not examine the brake valve at that time, but a short time later he found the brake valve in service position, the distributing valve broken off, a hole in the pressure chamber, the train line broken off below the brake valve, and the double-heading cock open. The brake valve worked freely.

Engineman Provost, of Rio Grande engine 1704, stated that after the accident his engine replaced engine 801 in the Rio Grande train and he operated this engine from South Denver to Palmer Lake, a distance of 48.3 miles, making several stops en route, and the air brakes functioned properly. The train handled in the usual and normal manner throughout the trip.

General Air Brake Instructor Rawlings, of the Rio Grande, stated that shortly after the accident he and Car Foreman Ray inspected and tested the air-brake equipment on First 1. After

making a 20-pound reduction from a 90-pound brake-pipe pressure the piston travel was measured and found to be from 7 to 8 inches on all cars except one which was equipped with four brake cylinders, known as the unit clasp type; the piston travel on this car was 5 inches. Nine of the cars were equipped with Universal valves and seven with LN equipment. None of the brake shoes showed any receding from the wheels; this indicated very little brake-cylinder leakage. The brakes were then released. The brake pipe was recharged, a 5-pound reduction was made from engine 1800, and the brakes became applied on all cars. The brake-pipe leakage was less than 1 pound per minute. Engine 1800 was equipped with No. 8 ET brake equipment; a thorough test revealed no defects. It was impossible at that time to test engine 801 on account of its damaged condition. Instructor Rawlings stated that with the type of equipment involved an emergency application can be obtained following a service reduction, and, in addition, whenever the brake-pipe pressure falls below 35 pounds, the air brakes automatically become applied in emergency. It was his opinion that a train with this type of equipment could be stopped on level track from a speed of 35 miles per hour in about 618 feet, and from a speed of 40 miles per hour in about 800 feet. He stated that when riding the engines equipped with pilot valves he has checked them many times and has never found one that did not register accurately.

General Air Brake Instructor Rawlings and Air Brake Machinist Dunlap, of the Rio Grande, and Mechanical Expert Collins, of the Westinghouse Air Brake Company, conducted a test of the H-6 automatic brake-valve, which was removed from engine 801. This test was made on August 16 on a standard 4-B test rack in Burnham Shop. The brake valve functioned properly and passed all the test limits specified in the test code of the Westinghouse Air Brake Company. The angle cock, which was removed from the rear of the tender of engine 801, was examined thoroughly and found to be in first class condition and to have standard full-size opening with no obstructions. Examination of the brake-pipe hose, which was removed from the engine and the tender, revealed all hose, nipples, and couplings to be in first-class condition and free from obstructions. There was no indication of kinking or collapsed hose lining.

Inspection and test of the air-brake equipment of engines 801 and 1800 before being made up in First 1 on the morning of the accident was made at Burnham roundhouse by Air Brake Inspector Cable, who found the engines in good condition. The only repairs he made were to change the brake shoes and adjust the driver brakes and tank brakes on engine 801 and to adjust the engine and the tank brakes on engine 1800.

Car Inspector Berghorn inspected and tested the air-brake equipment on eleven of the cars of Rio Grande First 1 at the Burnham coach yard; after making the necessary adjustments the equipment was in good condition.

Chief Interchange Inspector Ford and Car Inspectors Shriver and Peterson made the terminal air-brake test of Rio Grande First 1 at Denver before its departure and the air brakes functioned properly.

Signal Engineer Molis, of the Rio Grande, stated that the pilot valve tape with which engine 1800 was equipped showed that the highest speed attained was 42 miles per hour, which was at a point approximately 400 feet north of the approach signal, and from that point southward to a point approximately 400 feet north of the home signal there was a gradual reduction to a speed of 37 miles per hour. Then there was a very rapid deceleration and the tape registered a speed of 18 miles per hour the instant before the train stopped. He stated that these pilot-valve tapes are within 5 percent of being accurate.

Observations of Commission's Inspectors

On August 17, the Commission's inspectors and Air Brake Instructor Rawlings rode Rio Grande No. 1, which was hauled by engine 1800, from Denver to Colorado Springs to check the speed-recorder tape with respect to its accuracy. The engine was equipped with the same pilot valve as involved in the accident. Two of the men were on the engine and two were on the rear end of the train. The speed was checked between mile posts with a stop watch, and the average of these recordings on both the engine and the rear of the train compared favorably. The tape was removed from the engine at Colorado Springs and was checked with the speeds that had been noted, and in all cases the average miles per hour for the territory checked agreed within a reasonable degree of accuracy with the miles per hour recorded by the pilot valve.

On August 16 an inspection was made of the interlocking plant at South Denver. It appeared to be well maintained and to provide the protection for which it was intended.

Discussion

The evidence indicated that the Rio Grande train neared the approach signal at a high rate of speed for the territory involved, that the stop indication of the home signal was observed by the engine crews of both engines, that action was taken by the engineman of the first engine to reduce the speed

of his train, but apparently sufficient braking power was not used to bring the train under control in time to avert the accident. The engineman of the first engine stated that when passing the 2000-foot railroad-crossing sign at a speed of between 35 and 40 miles per hour he closed the throttle and when approximately two car lengths north of the approach signal, which is located 1,585 feet from the crossing, he made a 15-pound brake-pipe reduction, followed this by an additional 5-pound brake-pipe reduction, and, nearing the home signal when he saw that the train would not stop short of this signal, he placed the brake valve in emergency position. He heard the exhaust but there was no reduction in speed and the train continued at a speed of 10 or 12 miles per hour to the crossing where it struck the Santa Fe train. The statements of the engineman of the second engine and the other members of the crew indicated that they felt only one reduction made, which was in the vicinity of the approach signal and no further reduction was felt until immediately before or at the time of the collision.

The speed-recorder tape, with which engine 1800 was equipped, showed that from a speed of 42 miles per hour at a point approximately 400 feet north of the approach signal there was a gradual reduction in speed to about 37 miles per hour at a point approximately 400 feet north of the home signal. From that point southward there was a rapid deceleration and the tape registered 18 miles per hour the instant before the train stopped. After the accident the pilot valve on the second engine was checked and it was found to record the speed within a reasonable degree of accuracy. Subsequent to the accident the air-brake equipment was found to be in good operative condition. The road foreman of engines boarded the engine a short time after the accident; he found the throttle closed, the reverse lever in position for forward motion, and later he observed the brake valve in service position. It is therefore obvious that the engineman of the first engine did not make the brake-pipe reductions as stated by him, or undoubtedly he would have brought his train under control in time to have prevented the accident.

Special time-table rules restricted the speed of passenger trains to 20 miles per hour at street grade crossings between Colfax Avenue and South Denver. Colfax Avenue is located approximately 7 blocks north of Burnham, which in turn is located 1.6 miles north of South Denver. There are seven street crossings located between Burnham and the approach signal at South Denver, the last one being located 875 feet north of the signal. If the engineman had observed the street-crossing speed restriction he would have had his train under control and undoubtedly would have been able to stop before passing the home signal.

The enginoman of the second engine stated that he observed the red aspect of the home signal when nearing the approach signal, but on account of the smoke from the first engine trailing down on his side and obscuring his view he did not again see the home signal until passing it. In one statement he said that he thought the train would stop at the home signal, and in another statement he said he figured that the home signal must have cleared when the speed of the train was not reduced, and that his gauge did not show much change at any time after a 10-pound reduction was made in the vicinity of the 2000-foot railroad-crossing sign. The home signal is located 504 feet from the crossing, and had the enginoman of the second engine taken proper action when passing that signal, undoubtedly this accident would have been averted.

Conclusion

This accident was caused by failure to control the speed of the Rio Grande train in compliance with interlocking signal indications.

Respectfully submitted,

S. J. MILLS,

Director.