Inv-2382

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

CHESAPEAKE AND OHIO RAILWAY

TRACE, KY.

SEPTEMBER 22, 1939

INVESTIGATION NO. 2382

SUMMARY

Inv-2382

Railroad:	Chesapeake and Ohio
Date:	September 22, 1939
Location:	Trace, Ky.
Kind of accident:	Derailment
Train involved:	Mixed
Train number:	127
Engine number:	971
Consist:	6 cars
Speed:	30 m. p. h.
Operation:	Timetable, train orders and manual block system
Track:	Single; 7°30' curve; 3.85 percent descending grade
Time:	1:45 p. m.
Weather:	Clear
Casualties:	2 killed
Cause:	Excessive speed on sharp curve; failure to control speed properly on descending grade.

Inv-2382

December 22, 1939.

To the Commission:

On September 22, 1939, there was a derailment of a mixed train on the Chesapeake and Ohio Railway at Trace, Ky., which resulted in the death of two employees.

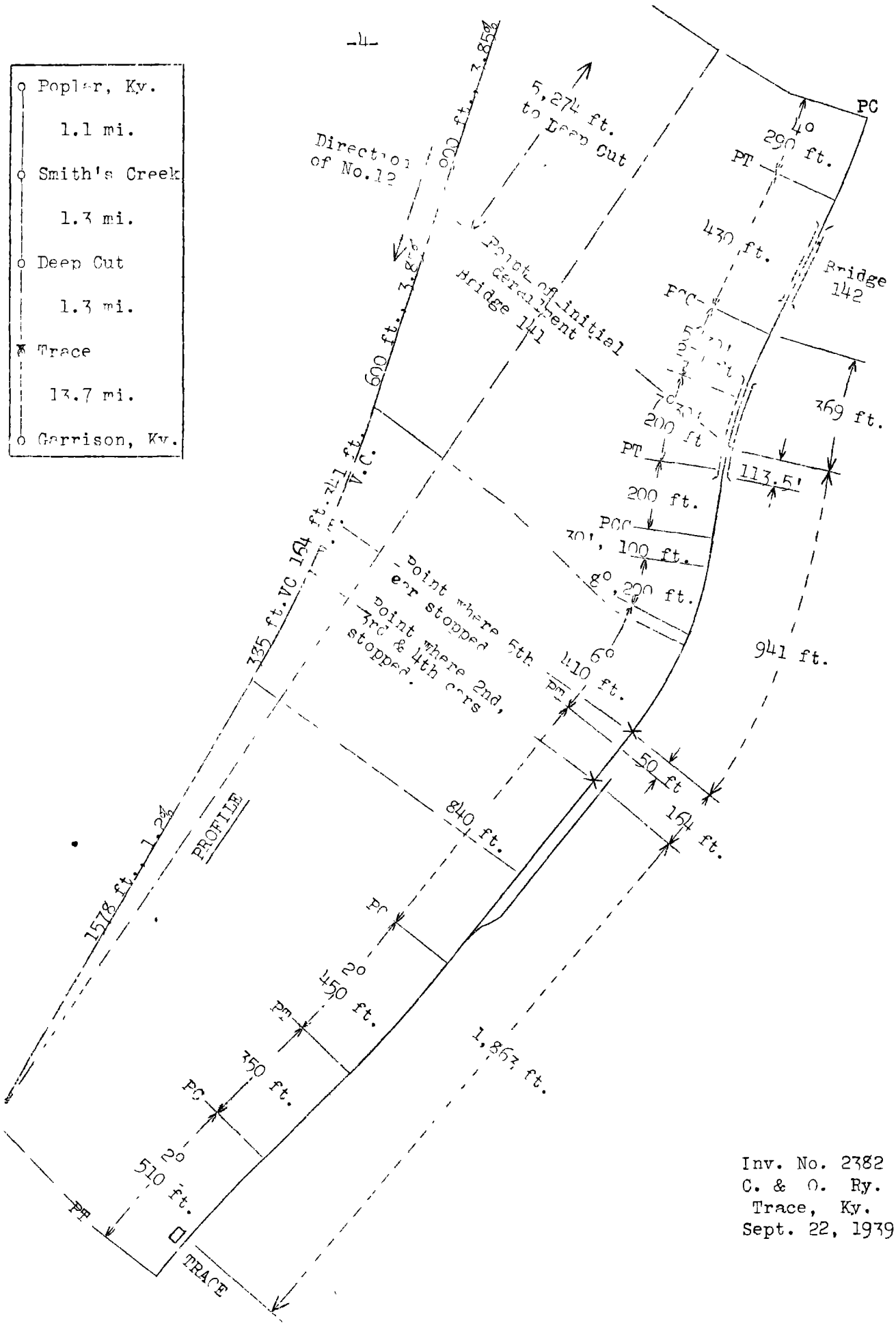
Location and Method of Operation

This accident occurred on that part of the Cincinnati and Russell Divisions designated as the Kinniconnick and Freestone Sub-division which extends between Garrison and Poplar, Ky., a distance of 17.4 miles. This is a single-track line over which trains are operated by timetable, train orders, and a manual block system. The initial derailment occurred on Bridge 141 at a point approximately 2,968 feet east of the station at Trace. Approaching from the east there is a series of short curves and tangents followed in succession by a 4° curve to the right 290 feet in length, a tangent 430 feet in length, and a compound curve to the left 450 feet in length, the east portion of which is of 5°30' curvature a distance of 250 feet and the remainder of 7°30' curvature; the derailment occurred on this curve at a point approximately 369 feet from its east end. Proceeding westward from the west end of this curve there are in succession a tangent 200 feet in length, a compound curve to the right 710 feet in length with a maximum curvature of 8°, and a tangent a distance of 840 feet.

The grade for west-bound trains from Poplar to Deep Cut is ascending, the maximum gradient being 3.4 percent. From the switch of the siding at Deep Cut to Trace, a distance of about 1.30 miles, the grade is descending, the gradient in succession being 3.6 percent a distance of 1,720 feet, 4.0 percent a distance of 2,500 feet, and 3.85 percent a distance of 900 feet to the point of derailment and 600 feet beyond, and then there is a vertical curve 890 feet in length.

The track structure consists of 85-pound rail, 33 feet in length, laid on 18 or 19 treated oak and untreated hardwood ties to the rail length; it is single-spiked, fully tieplated, provided with gage rods on curves, ballasted with crushed rock to a depth of 6 or 8 inches, and well maintained for branch-line service.

Bridge 141, which spans a small creek and a road, is 329.7 feet long, and the maximum depth below the bridge is 25 feet 10 inches. It is constructed of 2 abutments and 21 wooden bents; the latter vary from 3 feet 10-1/2 inches to 23 feet 10 inches in height and are spaced at intervals varying between 12 feet 8 inches and 16 feet. Three-ply wooden stringers, 8 inches by



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16 inches, are provided. The bridge is equipped with 56-pound guard rails laid inside the running rails and spiked to alternate ties; wooden guard rails are applied outside the running rails. The bridge is built on the alinement of a compound curve having a maximum curvature of 7°30'. The cross-levels vary from 5-1/4 inches superelevation at the east end to level at the west end; the derailment occurred 113.5 feet east of the west end of the bridge, at which point there was practically no superelevation. The bridge is designed for Cooper's E-52 rating.

Rule 103(c) of the book of operating rules provides in part as follows:

> Rule 103(c) Before starting down any grade where the use of retaining valves will be necessary, the engineman will designate how many retainers to turn up, and it will be the duty of the conductor to see that the proper number, as designated by the engineman, are turned up, and that they are turned down at the proper point.
>
> On grades of one and one-half per cent. or more, all retainers must be turned up, unless otherwise provided, and on grades less than one and one-half per cent. the engineman will designate how many to turn up.
>
> * * *

Special instructions of the current timetable are in part as follows:

> Mixed trains and freight trains between Deep Cut and Trace westbound * * * will be handled by air brakes as per Rule 103(c), as applied to grades of more than one and one-half percent.

In the vicinity of the point of accident the maximum authorized speed for all trains between points 1-3/4 miles and 1/4 mile east of the point of accident is 10 miles per hour and between the latter point and the point of accident it is 20 miles per hour.

The weather was clear at the time of the accident, which occurred at 1:45 p. m.

Description

No. 127, a west-bound second-class mixed train, consisted of 12 cars of limestone and 1 baggage-express-passenger car, hauled by engine 971, and was in charge of Conductor Parker and Engineman Carr. This train left Poplar, 3.7 miles east of Trace, at 12:57 p. m. according to the train sheet, 2 hours 2 minutes late. At Smith's Creek, 2.6 miles east of Trace, the train was separated between the sixth and seventh cars in order to double to Deep Cut because of the ascending grade. The front portion had proceeded only a short distance when the engine stalled and this draft was separated between the third and the fourth cars. The first 3 cars were set out at Deep Cut, then the engine returned and took the next 3 cars to Deep Cut. After being reassembled the engine proceeded with the 6 cars and soon thereafter the engineman lost control of the speed of the train on the descending grade. The sixth car became derailed on Bridge 141 and the west end of the bridge was demolished; this car rolled over on its right side on top of the wreckage of the west end of the bridge. The fifth car became derailed and stopped at a point 941 feet beyond. The second, third, and fourth cars also were derailed and stopped 164 feet west of the fifth car. All cars except the sixth car remained upright and practically in line with the track. The engine and the first car stopped approximately 1/2 mile west of the point of derailment.

The employees killed were the conductor and the front brakeman.

Summary of Evidence

Engineman Carr, of No. 127, stated that when leaving Poplar his train consisted of 12 cars of limestone and a combination car. At Smith's Creek the train stopped and, in order to negotiate the grade to Deep Cut, the first 6 cars were cut off. The engine had proceeded with this draft of cars only a short distance when it became stalled, whereupon the first 3 cars were taken to Deep Cut and placed on the spur track. After a service brake-pipe reduction was made the angle cock at the front end of the first car of this cut was closed and the hand brakes on all cars were applied. The engine returned to the point where it had stalled and brought the next 3 cars to Deep Cut and they were coupled to the 3 cars on the spur track. A heavy service brake-pipe reduction was made, and watching the gauge, he saw that the air was cut in; there was no emergency action of the AB valves, as the pressure was equalized. A brake-pipe pressure of 90 pounds and a main reservoir pressure of 130 pounds were maintained. After restoring the brake-pipe pressure at Deep Cut, an air-brake test was made. He said that

the conductor and the brakeman set all the retaining valves for use, then came to the engine while the normal brake-pipe pressure was being restored. The conductor instructed him to go when ready and not to stop to close the switch; then the conductor and the brakeman walked back and got on the rear car. The engineman waited a few minutes longer to give the auxiliary reservoirs sufficient time to become recharged and started, using only sufficient steam to start the train. Before the last car had passed the spur switch he made a 10-pound brake-pipe reduction, and the brakes responded promptly. After moving about 20 car lengths the speed was 5 or 6 miles per hour and another brake-pipe reduction was made, which he thought would stop the train. The speed was retarded for a short distance, but after moving a distance of 15 car lengths it had increased again to approximately 15 miles per hour, at which time the engine was about 5 car lengths east of Bridge 142, located about 500 feet east of Bridge 141. At this time he observed that the main-reservoir pressure was good and the brake-pipe pressure was 70 pounds; he then moved the brake valve to emergency position. The speed of the train was retarded momentarily but almost immediately the train gathered momentum until it reached the point of accident. He had not looked back and did not know at what point the train had become separated. The engine and one car stopped at the station at Trace, which was approximately 1/4 mile beyond the point where the second, third, and fourth cars stopped. He thought the speed of his train when passing Bridge 141 was 30 miles per hour, but he observed nothing unusual about the way the engine rode at that point. Before leaving Deep Cut he had examined the sand pipes; the sand flowed freely and was deposited on the rails. He had used sand heavily at all times while braking. The exhaust after each brake-pipe reduction seemed to be of the proper duration for six cars. The engine and tender brakes were not permitted to apply until after the speed got beyond control. In view of the circumstances, he realized after the accident that the engine and tender brakes should not have been released. He had made numerous trips over this branch, the last trip having been 10 or 12 days prior to the day of the accident, but had never handled more than two loaded cars in the train between Deep Cut and Trace. He said that he had been instructed to handle the train brakes by the short-cycle method of braking on descending grades between Deep Cut and Trace. He understood that before descending a grade in excess of 1-1/2 percent, the brakes must be tested, all retaining valves set for use, and, after the retaining valve test is made, wait an additional 10 minutes to insure that the brake-pipe and auxiliary-reservoir pressures have been restored before starting down a grade. As soon as the speed will permit, a brake-pipe reduction must be made, and, when the speed has been retarded

sufficiently, the brakes must be released; the retaining valves will then function while the brake pipe is being recharged to normal pressure. If the speed can not be controlled properly by a service application of the brakes, an emergency application must be made, or the hand brakes used; he knew of no instance wherein such action had been necessary on the K.& F. Branch. All air-brake instruction had been verbal and he did not think it possible for any person to remember all details. No instruction had been given relative to the maximum speed permitted before the initial brake-pipe reduction should be made but he thought that it should not be in excess of 4 miles per hour; the speed should not be in excess of 2 miles per hour at the time of release. During the 30-second release interval the speed would normally increase about 4 or 5 miles per hour. The total elapsed running time from Deep Cut to Trace should not be less than 8 or 9 minutes. In the air-brake instruction car, he demonstrated short-cycle braking with the following results:

	ON ENGINE		AB VALVE		
Application	Brake-pipe reduction	Brake-cylinder pressure	Brake-pipe reduction	Brake-cylinder pressure High	Brake-cylinder pressure Low
No. 1	8 pounds	15 pounds	8 pounds	19 pounds	15 pounds
No. 2	10 "	17 "	9 "	40 "	30 "
No. 3	9 "	20 "	9 "	54 "	30 "
No. 4	10 "	22 "	10 "	59 "	34 "
No. 5	9 "	20 "	9 "	54 "	33 "
No. 6	(15) "	(33) "	(14) "	(66) "	
	(10) "	(60) "	(5) "	(71) "	19 "

() Two reductions

Application in two reductions followed by emergency as used on day of the accident resulted as follows:

	ON ENGINE		AB VALVE	
	Brake-pipe reduction	Brake-cylinder pressure	Brake-pipe reduction	Brake cylinder pressure
Service	11 pounds	0 pounds	10 pounds	25 pounds
Service	12 "	7 "	10 "	66 "
Emergency	67 "	30-45 "	70 "	80 "

Note: 90 pounds brake-pipe pressure; 130 pounds main reservoir pressure. Maximum brake-cylinder pressure, 74 pounds in service, 80 pounds in emergency. AAR 3-position, 10-20 retaining valve, set in high value position, was used with the AB valve.

Fireman Ostendorf, of No. 127, stated that the train stopped at Smith's Creek and 6 cars were cut off to be taken to Deep Cut. About 1 mile farther on, the engine stalled with the 6 cars and it was necessary to double to Deep Cut, with 3 cars in each portion. After reassembling the 6 cars at Deep Cut, the air brakes were tested and the retaining valves were set for use. The conductor then instructed the engineman to go when he was ready. The engineman waited an additional 10 or 12 minutes for the air pressure to be restored to normal, after which the air gauge indicated 90 pounds brake-pipe pressure and 130 pounds main-reservoir pressure. The engineman used only sufficient steam to start the train, and, after moving 4 or 5 car lengths, made a brake-pipe reduction, to which the brakes responded promptly. After proceeding 15 or 18 car lengths, a second reduction was made, at which time the speed was 5 or 6 miles per hour. This reduction seemed to decrease the speed, but, after moving about 12 car lengths farther, the speed had increased to 8 or 10 miles per hour, at which time the engineman placed the brake valve in emergency position. There was a slight response to the emergency application, and then the train began to gather momentum. He had felt confident that the engineman had control of the speed until the time that the emergency application was made. He thought the speed of the train approaching Bridge 141 was 25 miles per hour. The engineman had not used the engine and tender brakes until after the speed of the train got beyond control. When leaving Deep Cut, he observed that the conductor and the brakeman were on the rear car but he did not look back after that. There was nothing unusual in the way the engine rode over Bridge 141, except for the rocking motion to be expected at the speed it was moving. The engine and 1 car stopped at a point about 15 or 20 car lengths beyond the point where the second, third, and fourth cars stopped. It was his opinion that the cars were loaded exceptionally heavily, otherwise the engine would have been able to haul the 6 cars up the grade to Deep Cut. He witnessed the engineman's demonstration of short-cycle braking in the air-brake instruction car, and said that it conformed to the air-brake instructions which had been given by the instructor.

Rear Brakeman Sutt, of No. 127, stated that the train stopped at Smith's Creek, where the first six cars were cut off in order to double to Deep Cut. He remained with the rear portion of the train and did not know of any trouble until informed that a wreck had occurred on the other side of the hill. He walked from Deep Cut to the scene of the accident, inspecting the track en route; he saw no indication of dragging equipment and no braking burns on the rails until within one car length of the point where the sixth car was derailed. At the scene of the accident he observed that the retaining valves on three of

the wrecked cars were set in the high-pressure position.

Track Walker McClees stated that just prior to the accident he had patrolled the track involved and saw nothing unsafe or which might have contributed to the derailment. No. 127 passed him at a point about 0.8 mile east of the point of accident. He observed that the conductor and the brakeman were on the brake step of the rear car. The speed of the train was about 25 miles per hour at that point but the conductor and the brakeman did not appear to be alarmed. He followed the train around the curve to a point where he could watch its progress and it seemed to increase speed until the time of derailment. He then proceeded to the scene of the accident, examining the track en route, but found no marks or indication of derailment until he reached Bridge 141, which he found to be out of line. He had been over the bridge 45 minutes prior to the time of the accident and had observed nothing wrong; also he had been under the bridge and was positive that there was no bent out of line at that time. It was his opinion that the derailment was caused by excessive speed.

Section Foreman Bradford stated that he arrived at the scene of the accident about 3 p. m. About 3 or 4 hours later he inspected the derailed equipment and found the angle cocks of all cars open except the one at the rear of the sixth car.

Mrs. McGlone, an eyewitness, was on the porch of her home, which is located to the south side of the track at a point approximately 1,100 feet east of Bridge 141, when No. 127 passed. She stated that the brakeman was attempting to set the hand brake on the rear car and the conductor was on the rear end-sill trying to reach the air hose. The speed of the train was twice as fast as usual, and the cars were lurching badly.

W. A. Jordan, an eyewitness, stated that he was at the station at Trace waiting for No. 127. When the train approached it was in three portions, and soon afterward the cars became derailed; the engine and one car continued beyond him.

System Bridge Inspector Perry stated that on July 17, 1939, he examined Bridge 141 thoroughly, and it was safe to carry the type of equipment used on this branch. He inspected the bridge after the accident and observed that the tenth bent from the west end was displaced; it was his opinion that the bent had been displaced by the lurching of the locomotive because of high speed.

Supervisor of Bridges and Structures Walker corroborated the statement of Bridge Inspector Perry in all essential details.

Division Engineer Pattison stated that he arrived at the scene of the accident at 5:15 p. m. He examined the track east of the point of accident but found no mark of derailment until he reached the seventh bent of Bridge 141. He observed that bents Nos. 2, 3, 4, and 5, numbered from the west end of Bridge 141, were demolished, the chord was out of line, 100 feet of decking were destroyed, and the ties were shifted out of place by dragging equipment. There were two separate flange marks on the top of the north rail, the first mark beginning at a point 113.5 feet east of the west end of the bridge and extending westward 3 feet 5-1/2 inches and diagonally toward the outside of the rail; the second mark overlapped the first by 2 inches and extended 4 feet 7-1/2 inches westward and outward to within 1/4 inch of the outside of the rail. On the ties there were no marks leading away from these marks on the rail. At a point 9 feet west of these flange marks there was a flange mark on a tie inside the high rail and a tread mark on the tie-plate of that tie. At a point 4 feet 4 inches west of the first flange mark on the rail the outer guard rail was cut deeply a distance of about 11 feet 6 inches, beyond which it was broken entirely away from the bridge. Flange marks made by skewed trucks were found on 13 bridge ties and these marks continued on the ties beyond the west end of the bridge. A second series of marks, evidently made by two pairs of derailed wheels, led from the west end of the bridge to the point where the second car stopped, which was approximately 700 feet beyond. The forward truck of the sixth car was found leaning against a tree on the south side of the track, 24 feet distant from the center-line of the track. Examination of the bridge structure disclosed that there was no rotted or defective timber which could have contributed to the cause of the accident. The gage of the track on the bridge varied from 4 feet 8-1/2 inches to 4 feet 8-3/4 inches and the superelevation ranged from 4 inches to 5-1/4 inches. Bridge 141 was designed to equal a Cooper's E-52 rating, while the locomotive involved was the equivalent of Cooper's E-44 rating. He examined the cars and found that all the angle cocks were open, except the one at the rear of the last car. It was his opinion that excessive speed on the 7°30' curve was the cause of the derailment.

Car Inspector Dempsey stated that all cars dispatched to the K.& F. Branch are given an air-brake and retaining-valve test before leaving Garrison. The empty cars are placed for loading and then brought back loaded a day or two later; the cars involved in the accident had been inspected at Garrison a few days before the day of the accident. He examined all the cars involved at the scene of the accident and found no defect that might have caused any car to become uncoupled under ordinary circumstances. The angle cocks on the second, third,

and fourth cars were in open position. After the accident the first three cars of No. 127 were brought to Garrison where he made an air-brake test and found that the brakes and the retaining valves functioned properly. All the brake shoes showed indications of having been heated; there were no flat spots on the wheels.

After the accident, Machinist Kehoe inspected the air-brake equipment on engine 971, and found it to be in proper condition. The condition of the brake shoes of the engine and tender did not indicate that they had been heated.

General Air Brake Inspector Anderson stated that an air-brake test on engine 971 and the equipment involved in the accident was made with the air operating through all cars but with some parts not operative, because of having been damaged in the accident. This test disclosed that 8 minutes were required to charge the air-brake system from zero to 90 pounds pressure. A 10-pound brake-pipe reduction was made, then a 12-pound brake-pipe reduction, and later an emergency application. After each reduction the train was checked and the brakes were found to apply properly in each case. The brakes were then released and a test made of the retaining valves, which disclosed that they were working properly. He stated that the manner in which the brakes on No. 127 were manipulated after leaving Deep Cut was not in accordance with verbal instructions given to all enginemen in regard to short-cycle braking on heavy grades. The verbal instructions for braking while using retaining valves are that when the speed of the train requires it a brake-pipe reduction shall be made and, if proper results are obtained, the brake valve shall then be placed in release position and the braking system recharged, after which another brake-pipe reduction shall be made and this operation repeated at 50-second intervals down the grade. In the event that the speed is not controlled properly by the initial brake-pipe reduction, the engineman must immediately apply the brakes in emergency. He will then arrange with the conductor for hand brakes to be used to control the train down the grade; supervisory officials must be informed of such action so that an investigation may be made to ascertain why the air brakes failed to function properly. No written instructions had been issued relative to short-cycle braking, because of the variable factors involved. Enginemen have been instructed to release the engine and tender brakes while braking on grades in order that the driving-wheel tires might not become overheated.

Road Foreman of Engines Shelton stated that he made frequent trips over the K.& F. Branch and had never experienced

any difficulty in handling a train down the grade from Deep Cut. When leaving Deep Cut on his last trip the train consisted of 10 or 11 loaded cars; the retainers were turned up and the train stalled during short-cycle braking operations. He stated that there were no written instructions issued for descending the grade involved but that, after the AB brake came into use, enginemen had been instructed verbally in regard to the importance of having the brake system fully charged prior to descending a grade; also, the importance of not letting the speed become excessive between short-cycle braking applications. He had known Engineman Carr since 1910 and considered him a very careful man.

Records of the railroad company disclose that Engineman Carr attended air-brake instruction classes twice during 1939.

Locomotive 971, involved in this accident, is of the 2-8-0 type and has a total weight of 200,675 pounds, distributed as follows: engine truck 24,525 pounds, drivers 176,150 pounds. The center of the first driver is 8 feet 7-1/2 inches from the center of the engine-truck wheel. The rigid driving wheel-base is 17 feet in length; the driving wheels are spaced, center to center, 66 inches between Nos. 1 and 2, 60 inches between Nos. 2 and 3, and 78 inches between Nos. 3 and 4. The total weight of the tender is 169,220 pounds. The tender trucks are of the 4-wheel type. The truck wheels are 33 inches in diameter, and are spaced 70 inches between wheel spaces; there is a space of 9 feet 8 inches between the wheel centers of the trailing wheels of the first truck and the leading wheels of the second truck. The engine was designed equivalent to Cooper's E-44 rating. It is equipped with No. 6-ET brake equipment, an 8-1/2-inch cross-compound air pump, an M-3-A brake-pipe feed valve, and a single-top pump governor.

According to data furnished by the railroad, the braking ratio of the engine was 50 percent of the weight on drivers; the braking ratio of the tender was 80 percent of its light weight; the six cars involved were as follows:

Initial	No.	Light weight, pounds	Capacity, pounds	Total weight, pounds	Brake ratio, empty percent	Brake ratio, loaded percent
C. & O.	110162	40,400	100,000	152,000	62.4	19.5
"	111042	40,800	100,000	152,000	61.7	19.6
"	112041	41,800	100,000	152,000	60.3	19.8
"	112211	40,800	100,000	152,000	61.7	19.6
"	127345	39,600	100,000	152,000	65.0	20.1
"	131697	40,300	100,000	152,000	64.6	20.2

As the cars involved had not been weighed prior to the time of derailment, the total weights of the cars are based on the average weight of similar cars in a 12-day movement. All cars had complete AB brake equipment. All braking ratios are based on 50 pounds brake-cylinder pressure.

Observations of the Commission's Inspectors

The Commission's inspectors examined the equipment involved and found that the height of all couplers was uniform and that there was no defect in the coupling mechanisms. The side-bearing clearance on all cars was uniform and within the prescribed limits. There was no indication on the track between Deep Cut and the point where the engine and one car stopped of sand having been used or of any skid burn on the rails.

Discussion

According to the evidence, No. 127 stopped at Smith's Creek and cut off the first six cars in the train in order to double to Deep Cut. After proceeding approximately 1 mile the engine stalled on the ascending grade, and then the six cars were doubled to the spur track at Deep Cut in two cuts of three cars each. The six cars were recoupled at Deep Cut, an air-brake test was made, and the retainers were set for use. The engineman waited 8 or 10 minutes longer in order that the auxiliary reservoirs might be fully charged, then used steam to start the train. At that time the fireman observed that the air gauge indicated 90 pounds brake-pipe pressure and 130 pounds main-reservoir pressure. A 10-pound brake-pipe reduction was made when the last car was passing over the siding switch, and the brakes responded properly, but, after moving a distance of 15 or 20 car lengths, the speed had accelerated to 5 or 6 miles per hour and a second brake-pipe reduction was made, which the engineman thought would stop the train. The speed was retarded somewhat but after the train moved a distance of 12 to 15 car

lengths more the speed increased to about 15 miles per hour. The brake valve then was placed in emergency position, at which time, according to the statement of the engineman, the train was about 500 feet east of Bridge 141. The emergency application momentarily retarded the speed of the train; then the speed increased and was approximately 50 miles per hour at Bridge 141, where the derailment occurred. The point of accident was on a 7°30' curve, at a point where there was practically no superelevation; the speed restriction was 30 miles per hour. The evidence indicated that the speed was considerably in excess of 30 miles per hour and that the cars were rolling excessively. There were flange marks leading diagonally from the gage side to the outside of the ball of the outside rail; this indicates that the cars were rolling and thrusting from side to side sufficiently to lift wheels on the outside of the curve high enough for the flanges to drop on the ball of the rail.

The engineman was an experienced man and had attended periodical air-brake instruction classes, having attended two classes in the current year. At these classes verbal instructions were given on the short-cycle method of brake operation when descending grades with retaining valves in use. The instructions were to the effect that after a brake-pipe reduction was made, if proper results were obtained, the brake valve should be moved to release position, then allow 60 seconds for the air-brake system to recharge; the short-cycle braking operation should be repeated until reaching the foot of the grade. Statements of the engineman were somewhat conflicting; he stated that the total distance the train moved from the switch at Deep Cut to the point where the emergency application was made was 35 car lengths, which would be approximately 1,500 feet; he stated also that at the time of the emergency application he was about 5 car lengths east of Bridge 142, which is approximately 4,500 feet west of the switch at Deep Cut.

Examination of the track between Deep Cut and Bridge 141 disclosed no skid burn on the rails until very close to Bridge 141. There were no flat spots found on the wheels of the engine or the cars. Tests conducted after the accident disclosed that the air-brakes on engine 971 and the cars involved in this accident were functioning properly. As a result of the investigation it appears that the engineman delayed the initial application of the air brakes on the descending grade until his train had attained a rate of speed in excess of that at which the train could be controlled by the service application which he made, and the emergency application was not made until the speed of the train was entirely beyond control. The engineman was fully informed with respect to the short-cycle

method of braking on grades; he had intended to use this method but the train was not properly controlled by his first brake-pipe reduction, and instead of immediately making an emergency application he made a second service reduction which was inadequate to control his train. After the accident he demonstrated in the air brake instruction car that he was familiar with the short-cycle method of brake operation.

The engineman said he had been cautioned with regard to overheating the driving-wheel tires and had been instructed to hold the engine and tender brakes released on descending grades; the air-brake instructor stated that the engineman had been instructed not to use the engine and tender brakes to the extent that the driving-wheel tires might be loosened.

The braking ratio of the equipment involved conformed to the standards of the carrier. The total weight of the six loaded cars was about 912,000 pounds, and the engine and tender, 369,895 pounds; the total weight of the train was approximately 1,281,895 pounds. As the engine and tender brakes were held released this resulted in about 29 percent of the total weight of the train running freely on the steep descending grade involved; therefore, it follows that not only the factor of retardation was diminished, but this weight running freely added impetus, proportionate to the weight, speed, and grade, exerted as a drawbar pull on the six loaded cars, tending to nullify to a considerable extent the effectiveness of the six brakes which were applied. By the time all the brakes were applied it was too late to control the speed of the train.

Conclusion

This accident was caused by excessive speed on a sharp curve, because of failure to control the speed properly on a descending grade.

Respectfully submitted,

S. N. MILLS,

Director.