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INTERSTATE COMMERCE COMMISSION
WASHINGTON

INVESTIGATION NO. 2701
THE PENNSYLVANIA RAILROAD COMPANY
REPORT IN RE ACCIDENT
NEAR MIMSON, N. J., ON
MAY 23, 1943

SUMMARY

Railroad: Pennsylvania
Date: May 23, 1943
Location: Minson, N. J.
Kind of accident: Derailment
Train involved: Passenger
Train number: 1020
Engine number: 3806
Consist: 15 cars
Estimated speed: 15-30 m. p. n.
Operation: Interlocking
Track: Single; 14°30' curve; 0.8 percent descending grade westward
Weather: Clear
Time: About 10:03 p. m.
Casualties: 14 killed; 81 injured
Cause: Accident caused by excessive speed on sharp curve

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 2701

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS
UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

THE PENNSYLVANIA RAILROAD COMPANY

June 26, 1943.

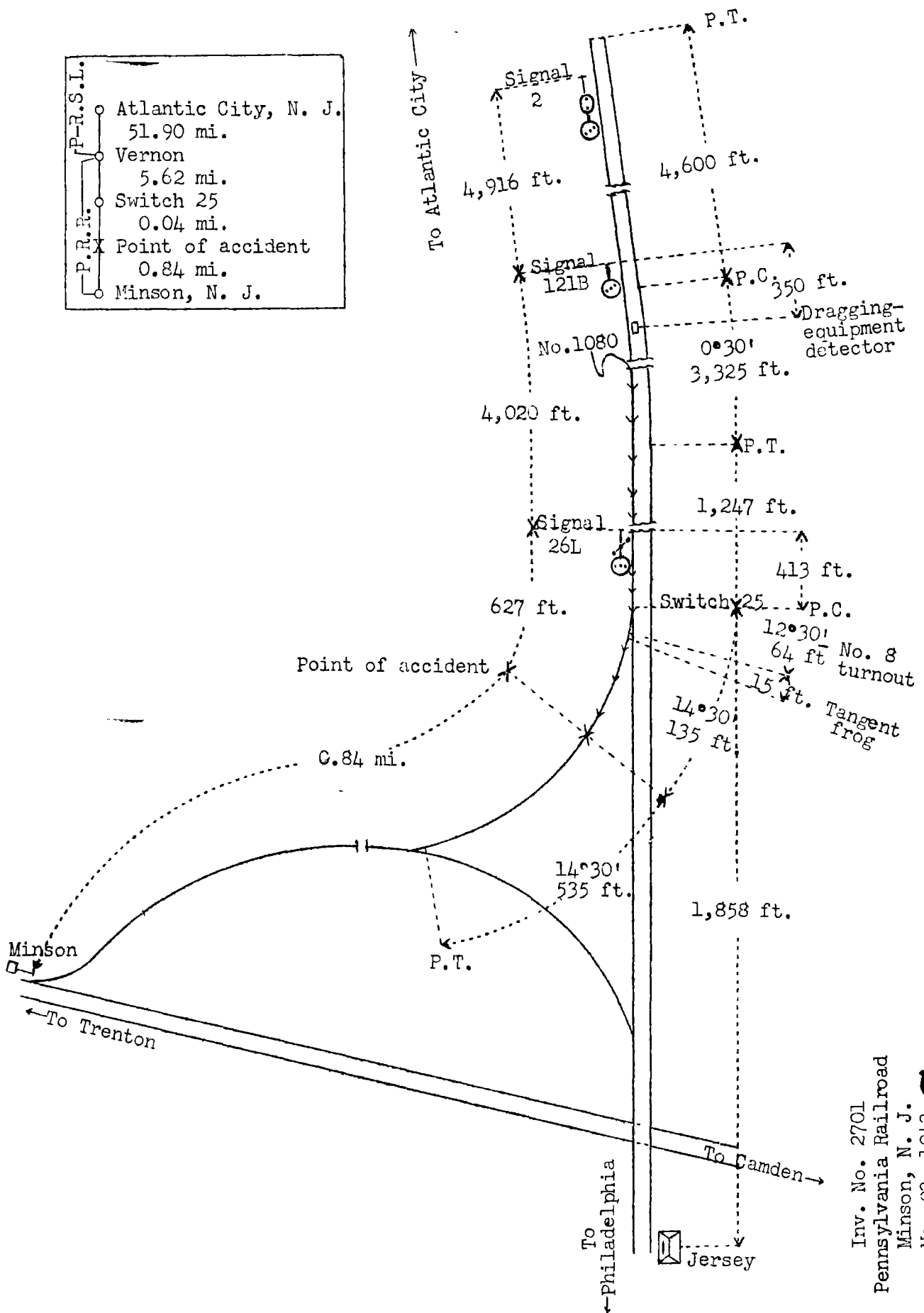
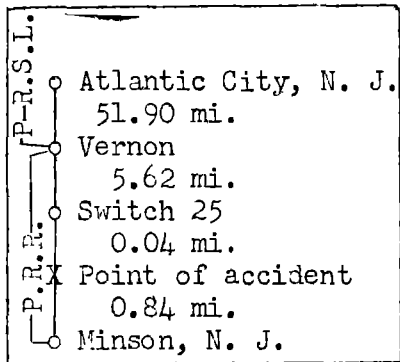
Accident near Minson, N. J., on May 23, 1943, caused by
excessive speed on sharp curve.

REPORT OF THE COMMISSION¹

PATTERSON, Commissioner:

On May 23, 1943, there was a derailment of a passenger train on the Pennsylvania Railroad near Minson, N. J., which resulted in the death of 12 passengers and 2 train-service employees, and the injury of 80 passengers and 1 train-service employee. This accident was investigated in conjunction with representatives of the New Jersey Board of Public Utility Commissioners.

¹Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.



Inv. No. 2701
 Pennsylvania Railroad
 Minson, N. J.
 May 23, 1943

Location of Accident and Method of Operation

This accident occurred on that part of the Atlantic Division which extends between Vernon and Minson, N. J., 6.5 miles. Between Vernon and switch 25, located 5.6 miles west of Vernon, this is a double-track line over which trains moving with the current of traffic are operated by an automatic block and cab-signal system, the indications of which supersede time-table superiority. This double-track line extends westward from switch 25 to Philadelphia. At switch 25 a single-track line connects with the westward main track and extends 0.84 mile to Minson where it connects with the eastward main track of a double-track line extending between Camden and Trenton. The single-track line between switch 25 and Minson is within interlocking limits. The interlocking is controlled from the tower at Jersey, located adjacent to the first-mentioned double-track line at a point 1,858 feet west of switch 25. The accident occurred on the single-track line about 4,215 feet east of Minson and about 214 feet west of switch 25. Approaching from the east there are, in succession, a tangent 4,600 feet in length, a $0^{\circ}30'$ curve to the left 3,325 feet, a tangent 1,247 feet to switch 25, a No. 9 turnout to the right 64 feet in length, the curvature of which is $12^{\circ}30'$, a 15-foot tangent frog, and a $14^{\circ}30'$ curve to the right 670 feet. The accident occurred on the latter-mentioned curve at a point about 135 feet west of its eastern end. The grade for west-bound trains is, successively, level 1,285 feet, 0.4 percent descending 2,635 feet and 0.8 percent descending 159 feet to the point of accident and about 500 feet beyond.

On the curve involved the track is laid on a cinder and clay fill, the maximum height of which is about 5 feet. The track structure consists of 130-pound rail, 39 feet in length, relaid in 1938 on 22 treated hardwood ties to the rail length; it is fully tieplated, double-spiked, provided with an average of 20 rail anchors per rail length, and is ballasted with cinders to a depth of about 12 inches. Throughout the curve 130-pound guard rails are located inside the south rail and outside the north rail. A flangeway of 3-1/2 inches is maintained between the guard rails and the running rails by filler blocks located 10 feet apart. The rails and the filler blocks are fastened by 1-1/8-inch by 13-inch bolts. The maximum super-elevation on the curve was 3 inches and the gage varied between 4 feet 8-1/2 inches and 4 feet 9-1/8 inches. The super-elevation at the point of derailment was 2-1/4 inches and the gage was 4 feet 9 inches.

Semi-automatic signal 2 and automatic signal 121-B, governing west-bound movements on the westward main track, and home signal 26L, governing west-bound movements through the interlocking, are located, respectively, 9,557 feet, 4,641 feet and 621 feet east of the point of accident. A dragging-equipment detector is located 350 feet west of signal 121-B. These signals are of the position-light type and are continuously

lighted. The involved aspects and corresponding indications and names of these signals are as follows:

	<u>Aspect</u>	<u>Indication</u>	<u>Name</u>
Signal 2	Three white lights in diagonal position above three white lights in vertical position	Proceed approaching next signal at medium speed.	Approach-medium.
Signal 121-B	Three white lights in diagonal position	Proceed prepared to stop at next signal. Train exceeding medium speed must at once reduce to that speed.	Approach.
Signal 26L	Three white lights in horizontal position above three white lights in diagonal position	Proceed prepared to stop at next signal. Slow speed within interlocking limits.	Slow-approach.

The interlocking machine is of the electro-pneumatic type and consists of 38 working levers in a 56-lever frame. Approach locking and electric switch-locking are provided throughout the interlocking. Time releases in connection with approach locking are provided. The time release for the approach locking on the westward main track at signal 26L is set for 3 minutes 36 seconds.

Definitions

* * *

Speeds

Medium Speed--Not exceeding one-half the speed authorized for passenger trains but not exceeding 30 miles per hour.

* * *

Slow Speed--Not exceeding 15 miles per hour.

* * *

The maximum authorized speed for passenger trains between Vernon and Jordan, 3.8 miles, is 70 miles per hour, and between Jordan and switch 25, 1.8 miles, 60 miles per hour. On the curve involved the maximum speed for trains moving under a slow-approach indication is 15 miles per hour.

Description of Accident

No. 1080, a west-bound first-class passenger train, consisted of engine 3806, of the 4-6-2 type, and 15 coaches, in the order named. The cars, which had been converted from Pullman parlor cars to coaches, were of steel construction. After a terminal air-brake test was made this train departed from Atlantic City, 51.9 miles east of Vernon, on the Pennsylvania-Reading Seashore Lines, at 9 p. m., according to the dispatcher's record of movement of trains, on time, passed Vernon, the last open office, at 10:01 p. m., 8 minutes late, passed signal 2, which displayed approach-medium, passed signal 121-B, which displayed approach, passed home signal 26L, which displayed slow-approach, entered the single-track line at switch 25 and while moving at a speed estimated by the crew as 15 to 30 miles per hour the engine and the first seven cars were derailed.

Engine 3806 was derailed to the south and stopped on its left side down the embankment, with the front end about 175 feet west of the point of derailment and about 20 feet south of the track. The engine truck was detached, the cab was demolished, the steam and the water connections to the left water glass and to the right water column were broken, and the left wrapper sheet of the firebox was bent inward about 3 inches. The cistern of the tender was badly damaged and the rear-end sheet was pushed inward about 2 feet. The tender, remaining coupled to the engine, stopped upright, badly damaged, and at an angle of about 45 degrees to the engine. The first car became separated from the tender and the second car and stopped on its left side between the engine and the track, with the front end about 25 feet west of the front end of the engine. The second car stopped on its left side at an angle of about 80 degrees to the track, with the left front corner against the cistern of the tender. The third car stopped upright, practically parallel to the second car, and against it. The fourth car stopped upright, across the track and at an angle of about 20 degrees to it. The fifth car stopped upright, across the track and at an angle of about 45 degrees to it, with the front end against the right side of the third car. The sixth car stopped upright, north of the track and with the front left corner against the left back corner of the fifth car. The seventh car stopped upright, on the roadbed and in line with the track. The second, third, fourth and fifth cars were badly damaged and the first, sixth and seventh cars were considerably damaged.

It was clear at the time of the accident, which occurred about 10:03 p. m.

The train-service employees killed were the conductor and the fireman. The train-service employee injured was the engineer.

After the accident, an inspection of engine 3806 disclosed that the throttle valve was closed, the reverse lever was in position for full cut-off in forward motion, and the independent and the automatic brake valves were in running position. The engine-truck frame, springs, swing links, transom, bolster, transverse braces and center casting were in good condition and conformed to the prescribed requirements. The driving-box springs, spring-saddles, spring hangers, equalizers, fulcrums and pins were in suitable condition for service and there was no indication of fouling. The driving-box shoes and wedges, the radial buffer castings, the trailer-truck side-bearings and the wirebox expansion shoes were well lubricated. The driving boxes moved freely and there was no indication of any box striking at the top or bottom. The springs of the buffer castings were under proper compression. The engine-truck wheels and the driving-wheel assembly were trammed and found to be spaced according to specifications. The male center-casting entered the engine-truck female casting 2 inches and there was no indication of binding. The main rods and the parallel rods were in alignment and there was no indication of fouling. The main engine-frame was in true alignment except that the tail-piece member was slightly twisted as a result of the derailment. The drawbars between the engine and the tender were in place and intact, but were twisted to the left about 70 degrees as a result of the derailment. The trailer-truck side-bearings were displaced during the derailment; however, there was no indication of any defective condition having existed prior to the accident. There was no slid-flat spot on any wheel, nor any pressure burn in the throat of any flange. Measurements of the wheels were as follows:

Wheel	Lateral	Height	Flange Thickness	Flange Wear	Tire Thickness	Tire Diameter
<u>Engine truck</u>						
Left No. 1	0.250"	1"	1.250"	0.031"		35.750"
Right No. 1		1"	1.250"	0.031"		35.750"
Left No. 2	0.250"	1"	1.250"	0.031"		35.750"
Right No. 2		1"	1.250"	0.03"		35.750"
<u>Driving wheels</u>						
Left No. 1	0.431"	1.250"	1"	0.062"	3.500"	78.572"
Right No. 1		1.250"	1.062"	0.062"	3.500"	78.558"
Left No. 2	0.312"	1.125"	1.125"	0.062"	3.500"	78.404"
Right No. 2		1.062"	1.187"	0.093"	3.500"	78.368"
Left No. 3	0.375"	1.125"	1.187"	0.031"	3.500"	78.401"
Right No. 3		1.062"	1.250"	0.062"	3.500"	78.397"
<u>Trailer wheels</u>						
Left	0.500"	1.134"	1.192"	0.093"		49.019"
Right		1.125"	1.200"	0.093"		49.000"

The back-to-back measurements of all pairs of wheels of the engine and the tender were taken in four positions and the greatest variation of the spacing between any pair of wheels was 0.037 inch. All wheels were tight on the axles and all driving-wheel tires were tight on the wheel-centers. All pairs of wheels met the requirements of the gage of the track.

The total weight of engine 3806 in working order is 308,890 pounds, distributed as follows: Engine truck, 53,640 pounds; driving wheels, 201,830 pounds; and trailer truck, 53,420 pounds. The specified diameter of the engine-truck wheels, the driving wheels and the trailer-truck wheels are, respectively, 36, 80, and 50 inches. The tender is rectangular in shape and is equipped with two 4-wheel trucks. Its capacity is 7,850 gallons of water and 27,100 pounds of coal. The weight of the tender loaded is 171,400 pounds. The length of the rigid wheelbase of the engine is 13 feet 10 inches, and the total length of the wheelbase is 36 feet 2 inches. The total length of the engine and tender is 80 feet 6-3/4 inches. The engine was built in 1923. The last class 3 repairs were completed on November 9, 1939, and the last heavy running repairs were completed on July 9, 1942. The center of gravity is 80 inches above the top of the rails.

After the accident, measurements of the track between points 167 feet and 13 feet east of the point of accident were found to be as follows:

<u>Distance east of point of accident</u>	<u>Superelevation</u>	<u>Gage</u>	<u>Curvature</u>
<u>Feet</u>	<u>Inches</u>	<u>Feet</u> <u>Inches</u>	<u>Degrees</u>
167	1/4	4 8-3/4	13
156	1/4	4 8-5/8	7
145	1/2	4 8-1/2	10
134	1/2	4 9	12
123	3/4	4 9	14
112	3/4	4 9-1/16	15
101	1-1/8	4 9-1/8	17
90	1-1/4	4 9	14
79	1-1/2	4 9	16
68	1-5/8	4 9	16
57	1-3/4	4 9	19
46	1-7/8	4 9-1/8	16
35	2	4 9	9
24	2-3/8	4 8-7/8	17
13	2-3/8	4 9	18

According to data furnished by the carrier the equilibrium, comfortable, safe and overturning speeds on a 14°30' curve having a 3-inch superelevation are, respectively, 13-1/2, 22-1/2, 27-1/2 and 47 miles per hour.

Discussion

No. 1080 entered the turnout at switch 25 and was moving at a speed estimated by the crew as 15 to 30 miles per hour on a $14^{\circ}30'$ curve to the right, having a maximum superelevation of 3 inches, when the engine and the first seven cars were derailed. The curve is within interlocking limits, and the speed of trains moving on the curve is governed by signal indication. Home signal 26L, located at the eastern limit of the interlocking, displayed slow-approach for No. 1080. This indication required No. 1080 to proceed within the interlocking limits at a speed not exceeding 15 miles per hour.

The engine became derailed at a point about 214 feet west of switch 25. The turnout at switch 25 is 64 feet in length and the curvature is specified as $12^{\circ}30'$. At the frog there is a section of tangent track 15 feet long, which is followed by the $14^{\circ}30'$ curve. According to data furnished by the carrier, the maximum safe speed for engine 3806 on a $14^{\circ}30'$ curve with a superelevation of 3 inches is about 27-1/2 miles per hour and the overturning speed is about 47 miles per hour; however, at the point of derailment the superelevation was only 2-1/4 inches. There was no defective condition of the engine prior to the accident, and there was no indication of dragging equipment, defective track, or of any obstruction having been on the track. Starting at a point approximately 214 feet west of switch 25, a flange mark appeared on the inside of the high rail and it extended diagonally across the head of the rail a distance of about 6 feet. From this point westward the shoulder of the fill was gouged to the point where the engine stopped.

According to the statement of the engineer, as No. 1080 was approaching signal 2, located 9,557 feet west of the point of accident and which displayed approach-medium, the speed was about 65 miles per hour. The engineer and the fireman were maintaining a lookout ahead. The air brakes had functioned properly en route, the headlight was lighted and the engine had been riding smoothly. As the engine passed signal 2, the engineer closed the throttle and made an 8-pound brake-pipe reduction. When the engine was about 1/4 mile west of signal 2 he made a 4 or 5-pound reduction. At a point about 1/4 mile east of signal 121-B, which displayed approach, the brakes were released and the speed was about 30 miles per hour when the engine passed that signal. When the engine was about 1/2 mile east of signal 26L, the fireman called the slow-approach indication displayed by that signal and the engineer made an 8-pound brake-pipe reduction, and then a 4 or 5-pound reduction. At a point about 2,200 feet east of signal 26L, the brakes were released and the speed was about 22 miles per hour. The

engine passed signal 26L at a speed of about 15 miles per hour. He said that soon after the engine entered the turnout at switch 25 it lurched to the left and overturned.

It could not be determined when the fireman and the conductor first became aware of anything being wrong, as they were killed in the accident. The flagman, who was in the fourteenth car, estimated the speed as about 50 miles per hour when the brakes were applied about 40 or 50 seconds before he felt two sudden lurches, and then the derailment occurred. The speed was about 25 or 30 miles per hour at the time of the accident. The front brakeman, who was in the sixth car, and the swing brakeman, who was in the eleventh car, were unable to estimate the speed, as they were engaged in collecting tickets and the cars were being moved under black-out regulations.

The last west-bound train to pass the point where the derailment occurred was Passenger Extra 3728, which passed about 2 hours 35 minutes prior to the time the accident occurred. The members of the crew of that train did not observe any unusual condition. The track foreman last inspected switch 25 and the track in this vicinity on the day previous to the occurrence of the accident and no unusual condition was observed.

In a test made after the accident, a train similar to that of No. 1080 passed signal 2 at a speed of 53 miles per hour, or 12 miles per hour less than the speed the engineer of No. 1080 estimated his train was moving when it passed that signal. The throttle was closed and brake applications were made in the same manner as the engineer of No. 1080 said he made them. The test train passed signal 121-B at a speed of 38 miles per hour and signal 26L at a speed of 34 miles per hour, or, respectively, 8 and 19 miles per hour greater than the speeds the engineer of No. 1080 estimated his train was moving as it passed those signals. The test train was operated west of switch 25 on the westward main track.

Considering the movement of the test train compared with the movement of No. 1080, as described by the engineer, and the manner in which the engine became derailed, it appears that No. 1080 entered the curve at a higher speed than that estimated by the engineer. At a point about 160 feet east of the point of derailment the alignment changed from a curvature of 13° to a tangent 15 feet long, which was followed by a curvature of $14^{\circ}30'$. These variations would cause the engine to pivot and to roll laterally. Evidently excessive

speed increased the pivoting and rolling of the engine to such an extent that the flange of a wheel on the left side of the engine mounted the high rail.

Cause

It is found that this accident was caused by excessive speed on a sharp curve.

Dated at Washington, D. C., this twenty-sixth day of June, 1943.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL,
Secretary.