INTERSTATE COMMERCE COMMISSION

WASHINGTON

INVESTIGATION NO. 2471

THE SOUTHERN PACIFIC COMPANY

REPORT IN RE ACCIDENT

NEAR VINCENT, CALIF., ON

DECEMBER 20, 1940

SUMMARY

Railroad:	Southern Pacific
Date:	December 20, 1940
Location:	Vincent, Calif.
Kind of accident:	Derailment
Train involved:	Passenger
Train number	56
Engine number:	4109
Consist:	16 cars
Speed:	28-30 m. p. h.
Operation:	Timetable, train orders and automatic block-signal system
Track:	Single; 8°10' left curve; 2.08l percent descending grade eastward
Weather:	Cloudy
Time:	About 5 a. m.
Casualties:	5 injured
Cause:	Accident caused by excessive speed on sharp curve

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 2471

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

THE SOUTHERN PACIFIC COMPANY

February 26, 1941

Accident near Vincent, Calif., on December 20, 1940, caused by excessive speed on sharp curve.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner:

On December 20, 1940, there was a derailment of a passenger train on the line of the Southern Pacific Company near Vincent, Calif., which resulted in the injury of two railway-mail clerks, one express messenger, and two employees. This accident was investigated in conjunction with the Railroad Commission of California.

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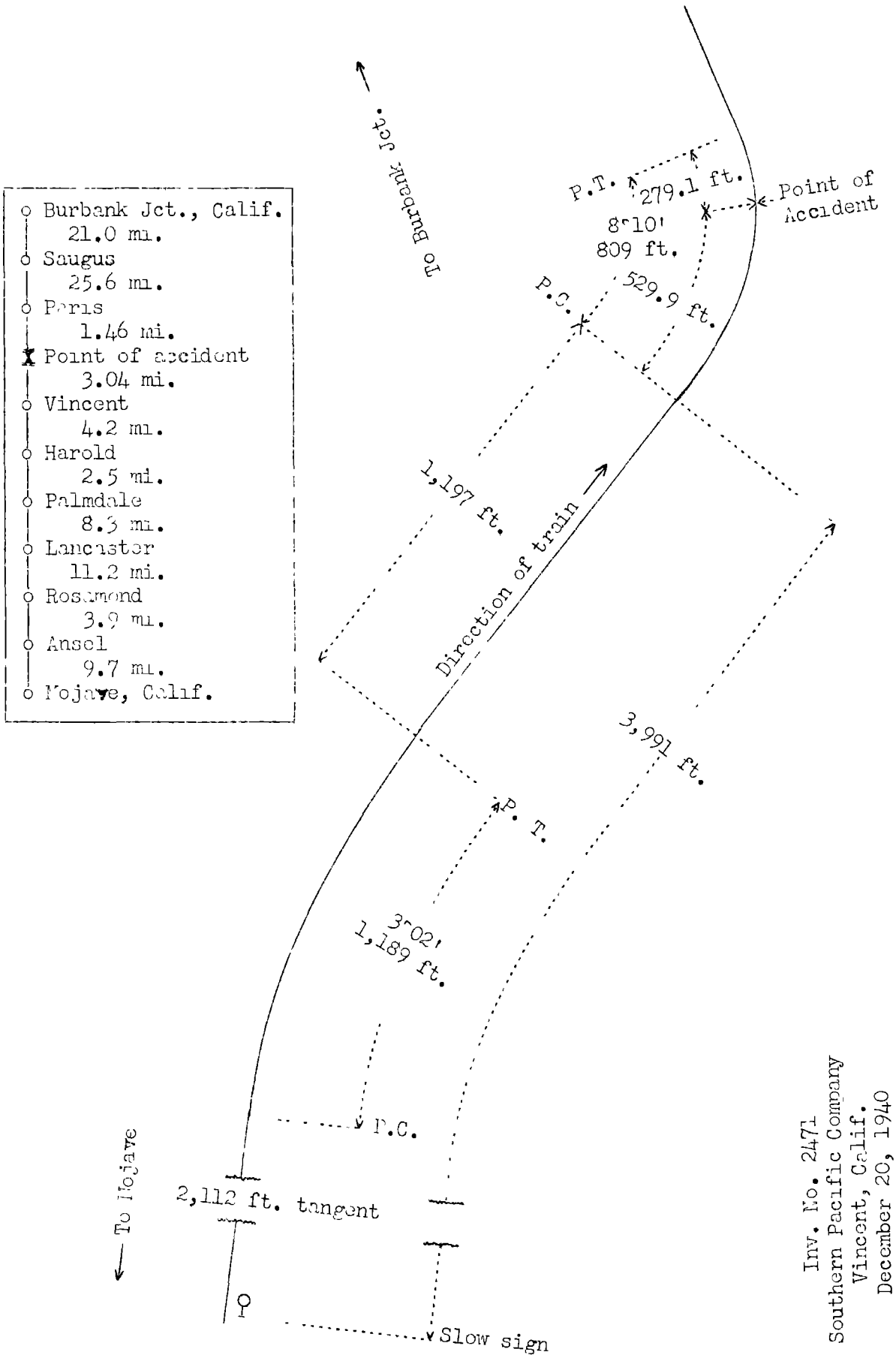
[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.



Inv. No. 2471
Southern Pacific Company
Vincent, Calif.
December 20, 1940

Location and Method of Operation

This accident occurred on that part of the San Joaquin Division designated as the Mojave Subdivision which extends between Mojave and Burbank Junction, Calif., a distance of 90.9 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 system. The accident occurred at a point 3.04 miles east of Vincent. As the point of accident is approached from the west there is a series of curves and tangents followed, in succession, by a tangent 2,112 feet in length, a 3°02' curve to the right 1,189 feet, a tangent 1,197 feet, and an 8°10' curve to the left 809 feet; the derailment occurred on the latter curve, designated as Curve 165, at a point 529.9 feet from its western end. From Vincent to the point of accident the grade for east-bound trains is descending and varies between 1.0 and 2.2 percent; it is 2.081 percent at the point of accident. At the point of accident Curve 165 is laid on a fill about 10 feet in height.

The track structure consists of 131-pound rail, 39 feet in length, laid on an average of 24 treated gum and fir ties to the rail length; it is fully tieplated with double-shoulder canted tieplates, double-spiked, provided with 8 rail anchors per rail length, laid on 3 inches of gravel, and is well maintained. The rails on the curve involved were laid new in July, 1936, and transposed in October, 1940. The west spiral of Curve 165 is 235 feet in length, the 8°10' portion of the curve is 526 feet in length, and the east spiral is 68 feet in length. The maximum superelevation of the outside rail of the curve was 4-1/8 inches; the superelevation was 3-7/8 inches at the point of derailment. The gage varied between 4 feet 8-5/8 inches and 4 feet 8-3/4 inches, and was 4 feet 8-3/4 inches at the point of accident.

Air brake rules and regulations governing the handling of trains read as follows:

> 18. Light Grade Braking:
> "When descending light grades, particularly when retaining valves are not used, build up the braking power by making light brake pipe reductions consistent with grade, speed and weight of train, spacing the reductions so as to have the brake application as heavy as permissible without exceeding a full service by the time a release is necessary or desirable.

In the vicinity of the point of accident the maximum authorized speed for passenger trains is 30 miles per hour. A speed-sign bearing the numerals 50-20 is located 3,991 feet west of Curve 165.

The weather was cloudy at the time of the accident, which occurred about 5 a. m.

Description

No. 56, a first-class east-bound passenger train, with Conductor Paulsen and Engineman Angell in charge, consisted of engine 4109, of the 4-8-8-2 type, one baggage-mail car, one baggage car, five box cars, one baggage car, two express-refrigerator cars, two baggage cars, one express-refrigerator car, one mail car, and two coaches, in the order named; all cars were of steel construction except the ninth and tenth cars, which had steel underframes, steel side and roof framing, and wood sheathing. This train departed from Mojave, 39.8 miles west of Vincent, at 3:30 a. m., according to the train sheet, 1 hour late, departed from Lancaster, 15 miles west of Vincent, at 4:25 a. m., 1 hour 12 minutes late, passed Vincent at 4:52 a. m., 1 hour 7 minutes late, and, while moving at a speed estimated at not less than 28 to 30 miles per hour, became derailed on Curve 165.

Engine 4109 was derailed to the right and stopped on its right side, badly damaged, with the pilot beam 254.8 feet east of the point of derailment and 33 feet south of the center-line of the track; the rear end of the engine was 31.8 feet south of the track. The engine truck became detached. The front corner of the cab was bent inward about 2 feet; the right side of the main boiler-shell was flattened; the main engine-frame of the No. 2 driving unit and the front-end deck were broken. The tender stopped on its right side to the rear of the engine, parallel to it and about 32 feet from the track; both tender trucks were detached and stopped upright at the rear end of the tender and at right angles to the track. The first nine cars stopped east of the engine. The first car stopped bottom up, to the right of the track and parallel to it; its rear end was between the engine pilot-beam and the track; both trucks were detached and the car was destroyed by fire. The second car was derailed to the left and stopped opposite the first car, upright, about 35 feet from the track and at right angles to it; this car was destroyed. The third car was derailed to the left and stopped on its left side, immediately east of the second car, and about 15 feet from the track; both trucks were detached and the car was destroyed. The fourth car was derailed to the right and stopped upright, badly damaged, about 7 feet from the track and at an angle of 15 degrees to it; the front end of this car was 110 feet east of the front end of the engine. The fifth car was derailed to the left and stopped, badly damaged, on its left side, about 20 feet from the track and at an angle of 45 degrees to it; the front end of this car was about 160 feet east of the engine. The sixth car stopped upright, against the fourth car; this car was badly damaged and its east end was about 140 feet east of the engine. The seventh car was derailed to the left and stopped upright, with the front end on the roadbed at a

point about 180 feet east of the engine; this car was badly damaged. The eighth car was derailed to the right and stopped upright, with the rear end on the roadbed and the front end about 10 feet from the track at a point about 200 feet east of the engine; this car was badly damaged. The front truck of the ninth car was derailed; this car stopped upright on the track immediately to the rear of the eighth car. The remaining cars in the train were not derailed; however, the tenth car was slightly damaged and the eleventh car was badly damaged by fire.

The employees injured were the engineman and the fireman.

Summary of Evidence

Engineman Angell stated that at the roundhouse at Bakersfield, 107.3 miles west of Vincent, he inspected engine 4109 and found it in suitable condition for service. At the station a terminal air-brake test was made and the car inspector informed him of the number of cars and the types of brakes in the train. After the train departed a running test was made, various stops were made en route, and in each instance the brakes functioned properly. Brake-pipe pressure of 90 pounds and main-reservoir pressure of 110 pounds were maintained. At Mojave the first car in the train was set out and two cars were added to the train; the air brakes were tested and found to be operative. As the train approached Vincent, he made a running test of the brakes as required by the rules, by making a 12-pound brake-pipe reduction, and after the speed had been reduced to about 24 miles per hour, he released the brakes. He received a signal from the rear that the brakes were functioning properly. When the train passed the station at Vincent the speed was about 25 miles per hour and he closed the throttle gradually to drifting position. The speed increased on the descending grade to about 30 miles per hour and, at a point about 2.7 miles west of Curve 165, he made a brake-pipe reduction of 7 or 8 pounds, then at intervals made further brake-pipe reductions until the total reduction was about 20 pounds. At signal 421.8, located 1.67 miles west of the point where the accident occurred, the speed was 18 or 19 miles per hour and he placed the automatic brake-valve in release position, where it remained about 1-1/2 or 2 minutes; the brake-pipe pressure was fully restored to 90 pounds but was not overcharged; however, in a later statement he said that he held the brake valve in release position from 25 to 40 seconds only. When the engine was near the slow sign, located 4,521 feet west of the point where the accident occurred, the speed increased to about 30 miles per hour; he made a brake-pipe reduction of 7 or 8 pounds, then soon afterward made an additional reduction of 12 pounds; the two reductions totaled 20 pounds. He did not release the train brakes but he did release the brakes of the engine and the tender. When the engine entered Curve 165 the speed was about 28 or 30 miles per hour, the brake valve was in

lap position, the throttle was in drifting position, and he was on his seatbox with his hand on the brake-valve handle. The first he knew of anything being wrong was when the right front corner of the engine-cab appeared to drop and the left front corner to rise; he immediately moved the brake valve to emergency position. Prior to the overturning of the engine he did not feel the engine encounter any obstruction or strike ties. Throughout the descending grade the speed was practically uniform and did not exceed 30 miles per hour; he felt no run-in of slack. He thought he manipulated the automatic brake valve in accordance with the requirements of air brake rule No. 18. He said that he was familiar with the physical characteristics of the territory involved, as he had performed considerable service as fireman on passenger trains. Since the date of his promotion he has made a sufficient number of trips to remain qualified; he had made 4 or 5 trips over this territory during the past 30 days. He was qualified to perform service as an engineman on passenger trains; however, this was the first instance he had been in charge of No. 56. In his opinion the accident was caused either by something fouling the articulated joint between the Nos. 1 and 2 driving units in such manner as to result in the engine suddenly becoming rigid, or by some object being on the rail. It was dark, the weather was clear and the engine headlight was lighted.

Fireman Koenig stated that he was assigned regularly to trains operating on the schedule of No. 56. Terminal air-brake tests were made at Bakersfield and at Mojave, stops were made en route, and the brakes functioned properly. The engine was in excellent condition. As the train passed the station at Vincent the engineman made a running air-brake test. The fireman became occupied in adjusting the oil supply to the fire and did not observe the manner in which the engineman applied and released the brakes. Although the fireman could not see the air gauges, he could hear the brake-pipe exhaust. The fireman said that his train did not attain a speed of more than 30 miles per hour between Vincent and the point where the accident occurred; however, in a later statement he said that the speed could have been in excess of 30 miles per hour. The train was operated down the grade east of Vincent similar to the manner in which the regular engineman had operated; therefore, the fireman was not alarmed until the engine started to rock as it entered Curve 165. At that point he became alarmed concerning the action of the engine. About 375 feet west of the point where the derailment occurred, it started to thrust from side to side, then rose on the left side, settled back, then again rose on the left side and overturned. He said that an engine of the type involved could round Curve 165 safely at a speed of 55 miles per hour. He thought the speed of the train entering the curve was greater in this instance than any previous instance in which he had been on an engine on the curve involved.

Conductor Paulsen stated that at Bakersfield a terminal air-brake test was made, numerous stops were made en route and the brakes functioned properly. The train passed the station at Vincent at 4:53 a. m., at which time the speed was 28 or 30 miles per hour. The engineman made a running air-brake test, which was acknowledged by means of the train air-signal. The conductor was in the fifteenth car as his train proceeded down the grade east of Vincent. He said the speed did not exceed 30 miles per hour. The train rode smoothly and at intervals he felt the brakes apply and release. He thought the speed was about 26 or 27 miles per hour as the train rounded the first curve west of Curve 165, then it increased to about 30 miles per hour, and the speed was higher when the train was near Curve 165 than when it was just east of Vincent; however, because it was dark he could not see clearly enough to judge the speed accurately. Had the speed been excessive he would have been warned by the motion of the train. The first he knew of anything being wrong was when the car in which he was riding lurched violently four or five times, then stopped abruptly. He could not state definitely the time the accident occurred. Immediately after the accident he observed under the rear car a mark on the high rail of the curve such as might have been made by dragging equipment. He did not know whether the air brakes were applied at the time of the accident. At Bakersfield he had compared watches with Engineman Angell. In the vicinity of the point of accident the use of retainers is not required on east-bound passenger trains.

Front Brakeman High stated that when his train approached the point where the accident occurred he was in the fifteenth car, maintaining a lookout on curves. He saw sparks fly from the wheels when the brakes were applied, and felt the brake on the fifteenth car apply and release. The first he knew of anything being wrong was when the train lurched several times and stopped abruptly. He did not know whether the brakes were applied immediately prior to the accident. He said speed was not excessive and the train was operated in the usual manner.

Flagman Eaton stated that when the train passed Vincent a running test of the brakes was made. He estimated the speed of the train when it reached the top of the descending grade to have been about 25 miles per hour. When his train approached the point where the accident occurred he was in the last car and the train was operated in the usual manner. The first he knew of anything being wrong was when the train lurched badly; he immediately opened the conductor's valve but the brakes had already been applied in emergency. He said the speed was not excessive; however, it might have been somewhat higher than 30 miles per hour. Immediately after the accident occurred he proceeded back to provide flag protection and found no indication of dragging equipment.

Telegrapher Lary, at Vincent, stated that when No. 56 approached he was on the station platform. The headlight was lighted, the engine whistle was sounded, and the engineman was in his usual position. The rear end of the train passed the station at 4:52 a. m., and the speed of the train was 25 or 30 miles per hour. He observed no dragging equipment. When the brakes were applied about 1,200 to 1,500 feet west of the station he observed sparks flying from the wheels.

Division Engineer Peterson stated that he arrived at the scene of the accident at 9:32 a. m., December 20, and examined the track throughout a distance of 1 mile west of Curve 165; he found no indication of dragging equipment or defective track. The first indication of derailment was a distinct flange mark on the head of the high rail of the curve, beginning at a point 529.9 feet east of the western end of the curve and extending diagonally outward across the top of the rail a distance of 29 feet, at which point the wheel dropped off the rail and marked the tops of four ties about 8-1/2 inches outside the rail. As there were no parallel marks between the rails, it appeared that certain wheels were raised above the track structure. At a point 45 feet east of the point of derailment and 1 foot 1-1/4 inches inside the low rail, wheels had marked the ties; these marks extended diagonally throughout a distance of 58.5 feet to the high rail, then crossed to the outside and furrowed the embankment; apparently these latter marks were made by the rear rigid-wheel truck of the tender. After this truck crossed the outside rail it made distinct marks and the right three wheels made a deep furrow, as if the truck was tipped outwardly. All marks west of these marks were a result of the cars in the train becoming derailed after the cars passed the point where the engine stopped. There was no track damage west of the point of derailment. The actual point where the engine left the rails could not be determined definitely. There was no defective flange or wheel that could have caused the accident. No storm had occurred in this vicinity for several days prior to the accident, and the drainage at this location was good. The rails on Curve 165 were laid new in 1936, and during October, 1940, they were transposed to prevent excessive curve-wear; at this time the track was surfaced and ties were spaced. The rails were not curve worn nor were the joints battered. No trouble had been experienced in keeping proper alinement on Curve 165. On December 17 and 18, he rode over this curve and did not observe anything wrong; had there been any track irregularity he would have detected it. He said that the center of gravity of engine 4109, with water in the boiler at working height, is 77 inches; the center of gravity of a tender having a capacity of 13,000 gallons is 56 inches when empty, 70 inches when half-full, and 82-1/2 inches when full. Based on accepted calculation the safe speed on Curve 165 was 35 miles per hour for passenger trains hauled by engines of the type involved,

and the overturning speed was 56 miles per hour. Because of the absence of marks which could be traced to the engine, either in the track or in the embankment, it was his opinion that engine 4109 tipped over and moved through space forward and sidewise until it stopped to the right of the track, 89 feet east of the point where it overturned, 38 feet at the front end and 51 feet at the rear end. This was calculated by the fact that the engine and tender were 120 feet long, the front end of the engine stopped 89 feet south of the first mark of derailment, and the first mark of derailment and succeeding marks made west of the point where the engine stopped were made by the rear truck of the tender. He estimated that the engine moved through space during 0.8 second while it was falling from the plane of the track to the plane of the bottom of the embankment. There was no evidence that any part of the engine touched the track structure or the ground during the process of overturning. If the engine had been derailed because of either defective track or defective parts of the equipment there would have been marks on the ties and the rails. In his opinion the derailment was caused by the engine overturning as a result of excessive speed on the curve. The heads of the rails bore no mark such as would be made if an engine made severe lateral thrusts. The gage and superelevation of Curve 185 throughout a distance of 182.3 feet immediately west of the point of derailment were as follows:

Distance west of point of derailment		Gage	Superelevation
Left rail	Right rail		
	182.3'	4' 8-5/8"	3-7/8"
159.7'		4' 8-1/2"	3-3/4"
	145.1'	4' 8-3/8"	3-3/4"
120.7'		4' 8-7/16"	4"
	103.9'	4' 8-7/16"	4"
81.7'		4' 8-1/2"	3-7/8"
	64.6'	4' 8-7/16"	4"
42.7'		4' 8-3/8"	3-7/8"
	25.2'	4' 8-7/16"	4"
3.6'		4' 8-11/16"	3-3/4"
	(P. of D.)	4' 8-3/4"	3-7/8"

Note. Within this distance the maximum deflection of either rail under traffic was 1/8 inch and at the point of accident the deflection under each rail was 1/16 inch.

Roadmaster Markley stated that about 9 a. m., December 19, he passed over Curve 165 westward on his motor-car and returned eastward about 3:30 p. m.; he observed nothing unusual in the condition of the track. He corroborated the statement of Division Engineer Peterson concerning the condition of the track subsequent to the accident.

Section Foreman Freese stated that he last performed work of spotting joints on Curve 165 during October, 1940. No difficulty had been experienced in maintaining this curve in proper condition. On December 19 he inspected the curve from a motor-car and did not observe any defective condition. He said that from a track maintenance standpoint engines of the type involved caused little difficulty.

Master Mechanic Hinchman stated that he arrived at the scene about 4-1/2 hours after the accident occurred and examined engine 410. The radial buffer between the engine and the tender, the articulated casting between driving units Nos. 1 and 2, the driving boxes and wedges, and the boiler-bearing sliding-plate were well lubricated and in suitable condition for service. The spring rigging and equalizers, the engine truck and center castings, the trailer truck and resistance rocker, the lateral motion device on the Nos. 4 and 5 pairs of driving wheels, and all working parts of the engine were in excellent condition, and there was no evidence of binding. There was no indication of binding between the engine and the tender. The tender splash-plates were in position and were securely fastened. This engine was released from the Los Angeles general shops on November 19, 1940, after it received Class 2 repairs. On December 18 it received the regular monthly inspection required by the Interstate Commerce Commission. Between the time this engine left the shops and the time the accident occurred it had traveled 4,939 miles. He examined the track and formed the opinion that the marks of derailment were made by a six-wheel truck having wheels 56 inches in diameter. There was no condition of the track or the engine which could have contributed to the cause of the accident. Based on the absence of marks on either the track or the roadbed, or on the working parts of the engine, it was his opinion that the engine overturned when the center of gravity passed to the outside of the rail as a result of excessive speed. Had the engine been derailed at less than overturning speed the track and roadbed would have been marked. Subsequent to the accident the engine and the tender were examined at the Los Angeles shops. All wheels were placed in a wheel lathe and the wheels ran true. There was no mark on the treads or faces of the wheels such as would be made if the wheels had struck some object on the track. Measurements of the tires, wheels and driving boxes were as follows:

Wheel	Lateral	Tread Wear Left	Tread Wear Right	Tire Thickness Left	Tire Thickness Right
Engine truck					
front wheels	5/8"	1/16"	5/64"		
rear wheels	23/32"	5/64"	1/16"		
No. 1 driving wheels	3/8"	7/64"	3/32"	2-45/64"	2-23/32"
No. 2 driving wheels	11/32"	1/16"	1/16"	2-3/4"	2-3/4"
No. 3 driving wheels	3/8"	3/32"	3/32"	2-23/32"	2-23/32"
*No. 4 driving wheels	1-5/16"	3/32"	3/32"	2-23/32"	2-23/32"
*No. 5 driving wheels	1-11/32"	3/32"	1/8"	2-23/32"	2-11/16"
No. 6 driving wheels	7/16"	3/32"	5/64"	2-23/32"	2-23/32"
No. 7 driving wheels	3/8	5/64	5/64	2-23/32"	2-23/32"
No. 8 driving wheels	9/16"	1/16"	3/32"	2-3/4"	2-23/32"
Trailer truck wheels	9/16"	1/16"	1/16"		
Tender truck (front)					
No. 1 pair wheels	13/16"	1/16"	1/16"		
No. 2 pair wheels	11/16"	1/16"	5/32"		
No. 3 pair wheels	13/16"	1/16"	1/16"		
Tender truck (rear)					
No. 4 pair wheels	11/16"	1/16"	1/16"		
No. 5 pair wheels	15/16"	1/16"	1/16"		
No. 6 pair wheels	13/16"	3/64"	3/64"		

Wheel	Wheel spacing back-to-back	Diameter Left	Diameter Right
Engine truck			
front wheels	53-3/8"	31-7/16"	31-7/16"
rear wheels	53-11/32"	31-5/16"	31-5/16"
No. 1 driving wheels	53-15/64"	61-15/32"	61-15/32"
No. 2 driving wheels	53-15/64"	61-1/2"	61-1/2"
No. 3 driving wheels	53-1/4"	61-31/64"	61-31/64"
No. 4 driving wheels	53-15/64"	61-31/64"	61-31/64"
No. 5 driving wheels	53-1/4"	61-31/64"	61-13/32"
No. 6 driving wheels	53-1/4"	61-7/16"	61-29/64"
No. 7 driving wheels	53-9/32"	61-29/64"	61-29/64"
No. 8 driving wheels	53-5/32"	61-1/2"	61-31/64"
Trailer truck wheels	53-3/8"	34-1/2"	34-1/2"
Tender truck (front)			
No. 1 pair wheels	53-1/4"	34-7/16"	34-7/16"
No. 2 pair wheels	53-5/16"	34-11/16"	34-5/8"
No. 3 pair wheels	53-5/16"	34-1/16"	34-1/16"
Tender truck (rear)			
No. 4 pair wheels	53-5/16"	34-5/8"	34-5/8"
No. 5 pair wheels	53-5/16"	34-23/32"	34-23/32"
No. 6 pair wheels	53-5/16"	34-3/4"	34-3/4"

Note: There was no throat wear of consequence on any of the wheels. Nos. 4 and 5 pairs of driving wheels are equipped with lateral motion device.

Road Foreman of Engines Hoffman stated that during the afternoon of December 20 he entered the cab of engine 4109 at the scene of the accident and found the independent brake-valve in running position, the automatic brake-valve in service position, and the throttle in drifting position. He inspected the engine but found no condition that might have caused the derailment.

According to data furnished by the railroad, engine 4109 is a single-expansion, articulated engine of the 4-8-8-2 type, equipped to operate with the cab at the front end. The total loaded weight is 614,600 pounds, distributed as follows: Engine truck, front pair of wheels, [illegible],500 pounds, and the rear pair of wheels, 43,500 pounds; first pair of driving-wheels, 60,300 pounds; second pair of driving-wheels, 59,100 pounds; third pair of driving-wheels, 58,600 pounds; fourth pair of driving-wheels, 58,600 pounds; fifth pair of driving-wheels, 58,500 pounds; sixth pair of driving-wheels, 60,700 pounds; seventh pair of driving-wheels, 60,300 pounds; eighth pair of driving-wheels, 60,100 pounds; and the trailer truck, 52,400 pounds. The engine-truck wheels are 33 inches, the driving wheels 63 inches, and the trailer-truck wheels 36 inches in diameter. The tender has two six-wheel trucks; the diameters of these wheels are 36 inches. The capacity of the tender is 16,152 gallons of water and 4,889 gallons of oil. The weight of the tender loaded is 292,100 pounds. The total weight of the engine and tender is 906,700 pounds. The rigid wheel-base of each driving unit is 16 feet 11 inches and the distance between the front driving unit and the rear driving unit is 10 feet 9 inches; the total engine wheel-base is 63 feet 11 inches, and the total length of the engine and tender is 119 feet 6 inches. The two driving units are connected by an articulated casting. The main pairs of driving wheels are cross-counter-balanced. Oil lubrication is provided for the engine-truck and trailer-truck wheel-hubs, and for the driving-wheel boxes and wedges.

The air-brake equipment is No. 6-ET, M3-A feed valve, M3 reducing valve, H-6 automatic brake-valve, and an S-6 independent brake-valve; the engine is provided with two 8-1/2-inch cross-compound compressors, and an AD-6 compressor governor.

Discussion

According to the evidence, No. 56 was moving at an estimated speed of 28 to 30 miles per hour on an 8°10' curve to the left when the engine became derailed to the right. The maximum authorized speed was 30 miles per hour for passenger trains. The rails were in good condition. The gage was good and the superelevation was evenly maintained. The authorized superelevation was 4 inches and the actual superelevation was 3-7/8

inches at the point of derailment. There was no indication in the ballast of ties having shifted, of any obstruction on the track, or of dragging or defective equipment.

The equipment and the air brakes had been inspected prior to the time that No. 56 left Bakersfield and no defective condition was disclosed. The air brakes functioned properly at all points where used en route. Subsequent to the accident inspection of the equipment failed to disclose any defective condition which might have existed prior to the accident and contributed to the cause of the derailment.

The track for a considerable distance was on a descending grade slightly in excess of 2 percent; frequent application and release of the train brakes was necessary in order to maintain a uniform speed of 30 miles per hour. According to the statement of the engineman, he manipulated the automatic brake-valve in the approved manner, and, when the engine was approaching the slow-sign located 5,991 feet west of Curve 165, he made a brake-pipe reduction of 7 or 8 pounds, which was followed soon afterward by a further reduction of 12 pounds; this application remained applied throughout a distance of 4,091 feet to the point of derailment. When he felt the engine start to overturn he moved the brake valve to emergency position. The speed was estimated to be about 30 miles per hour when the application was made and was 28 or 30 miles per hour when the accident occurred, although a brake application from a total brake-pipe reduction of 20 pounds remained applied throughout a distance of more than 4,000 feet. Since the brakes were functioning properly and the grade was slightly more than 2 percent descending, it appears that the speed should have been reduced considerably within the distance the brakes remained applied. According to the statement of the fireman, the speed at the time of the accident might have been somewhat higher than 30 miles per hour. The engineman did not realize that anything was wrong until the left corner of the cab rose and the engine overturned; however, the fireman observed that the engine started to rock laterally as it entered the curve, rose on its left side, settled back, then rose again on its left side and overturned. The fireman thought the speed in his first case was greater than that on any previous trip he had made on the curve involved. The other members of the crew, who were near the rear end of the train, thought the speed was not excessive; however, on account of darkness they were unable to estimate the speed definitely.

Subsequent to the accident, examination of the marks of derailment disclosed that the engine overturned without marking the rails, roadbed or any working part of the engine. The rear truck of the tender was the first unit of the equipment to mark either the rails or the ties; the nine derailed cars stopped

ahead of the engine; the eighth car stopped 472 feet east of the point of derailment. According to A. R. E. A. superelevation tables and data furnished by the carrier, the overturning speed, based on the superelevation and curvature at the point of derailment, was 56 miles per hour, and the maximum safe speed was 35 miles per hour. The division engineer and the master mechanic expressed the opinion that the engine was moving at a rate of speed sufficient to raise the left wheels clear of the rail and when the center of gravity passed outside the high rail the engine overturned without marking either the rail or the roadbed. Since all factors that could cause or contribute to the cause of the derailment apparently are eliminated except the factor of speed, it appears that the estimates of the speed given by the members of the crew were considerably lower than the actual speed of the train, because of the conclusive evidence that no part of the engine was in contact with the ground between the high rail and a point about 81 feet to the right of that 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 February, 1941.

By the Commission, Commissioner Patterson.

W. P. BARTEL,

(SEAL) Secretary.