INTERSTATE COMMERCE COMMISSION

JOINT REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY AND THE CHIEF INSPECTOR OF THE BUREAU OF LOCOMOTIVE INSPECTION IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE PENNSYLVANIA RAILROAD NEAR ST GEORGE, PA, ON JANUARY 30, 1924

MARCH 17, 1924

To the Commission

On January 30, 1924, there was a derailment of a passenger train on the Pennsylvania Railroad near St George, Pa, resulting in the death of 2 employees and 1 person carried under contract, and the injury of 26 passengers, 4 employees, and 3 persons carried under contract

LOCATION AND METHOD OF OPERATION

This accident occurred on that part of the Allegheny division extending between Kiskiminetas Junction and Oil City, Pa, a distance of 92 2 miles, in the vicinity of the point of accident this is a single-track line over which trains are operated by time-table, train orders, and a manual block-signal system The accident occurred about 1½ miles south of ST block station Approaching this point from the north the track is tangent for 1,203 feet, followed by a compound curve to the right 1,005 7 feet in length, then tangent for a considerable distance Both easements of this curve have a curvature of 1°10′, the north easement being 235 7 feet in length and the south easement 250 feet, while the curve proper is 520 feet in length and has a curvature of 5° 30′ The grade is practically level In this vicinity the track is located on the east bank of the Allegheny River east of the track there is a hillside The track is constructed with 100-pound rails, 33 feet in length, laid in April 1921, with 16 to 18 oak ties to the rail length, tie-plates under both rails secured with four spikes to each tie-plate, and ballasted with cinders, there were four antirail creepers per rail length The rail joints were of the supported type, with four-hole angle bars, slotted for spikes, and three or four spikes per tie being used At the time of this accident the roadbed was frozen to a depth of about 12 inches At the point where this accident occurred the speed of passenger trains is limited by time-table rule to 50 miles an hour The weather was clear at the time of the accident, which occurred at about 2 52 p m

DESCRIPTION

Southbound passenger train No 900 consisted of 1 express car, 1 combination baggage and mail car, 1 Pullman chair car, and 2 coaches, in the order named, hauled by engine 397, and was in charge of Conductor Anderson and Engineman Hulings The cars were of all-steel construction, with the exception of the express car, which was of wooden construction According to the train sheet, this train left Oil City, 27 miles from St George, at 2 06 p m , eight minutes late, and was derailed while traveling at a speed variously estimated to have been from 55 to 70 miles an hour

Examination of the track disclosed that the first indication of the derailment was a mark on the top of the high rail at a point about 200 feet south of the north end of the 5° 30′ curve the first pronounced flange mark was nearly 250 feet farther south Between these points, joints of the outside rail were kinked inward, outside splice bars were battered on the north or receiving ends, ribbons were shaved off tops of splice bars, and some of the bolts were broken, spike heads on the outside of the high rail had indentations on them, and many spikes on the inside of the high rail were broken off and bent inward Between these points the high rail was not turned over but had been forced back against the outside spikes, there were no marks on the ties near the low rail nor was the low rail disturbed

Beyond the point where the first pronounced flange mark was found there were flange marks between the rails and beginning at a point approximately 215 feet south of the first pronounced flange mark the track was entirely destroyed

The entire train was derailed Engine 397 came to rest on its left side east of the track, its head end being on the east rail about 275 feet south of the first pronounced flange mark The engine truck was torn from the engine and almost entirely demolished the two pairs of wheels were found separated by considerable distances from each other and from the truck frame The tender and first car were derailed to the right and went down the embankment into the river, the head end of the tender being about 170 feet beyond the engine, the second and third cars were also derailed to the right or west side of the track, the rear end of the third car being opposite the rear end of the engine The last two cars remained upright and behind the engine The first car was practically demolished, the left side of the second car was torn out, and the left side of the third car torn out about half its length The persons killed were the engineman, fireman, and Pullman porter

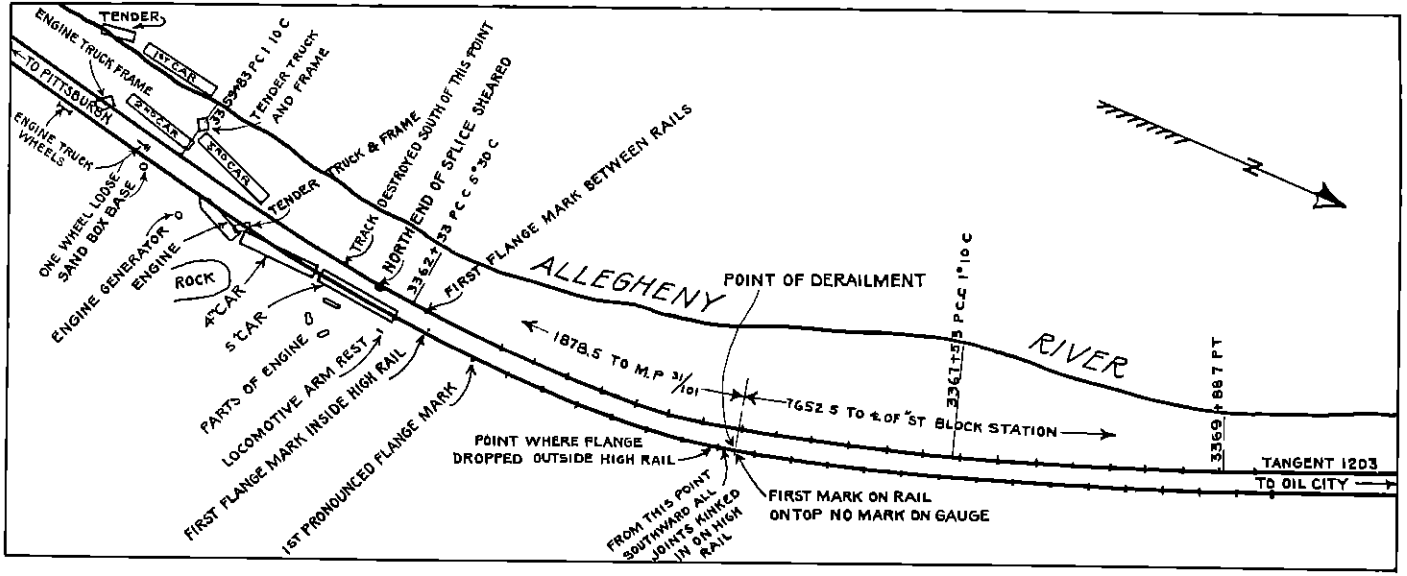

Diagram showing position of equipment after derailment and other information referred to in body of report

SUMMARY OF EVIDENCE

Conductor Anderson, Flagman Hill, Baggagemaster Winslow, Express Messenger Crouch, and a number of employees who were deadheading on train No 900, all stated that they noticed nothing unusual in the operation of the train prior to the accident, and while they estimated that the speed at the time of the accident was from 50 to 60 miles an hour none of them considered the speed excessive or dangerous Conductor Anderson said he was collecting transportation in the Pullman car and the first intimation he had of danger was when dishes fell from a table which the porter had set for some passengers Just prior to the accident he heard an unusual sound, as though something was dragging A few seconds after the accident both the conductor and the flagman looked at their watches and it was then 2 52 p m Although Conductor Anderson had worked with Engineman Hulings for a considerable length of time he had never called the engineman s attention to exceeding the speed limit and at no time during the month of January, 1924, had his own attention been called to exceeding the speed limit on this run Baggagemaster Winslow stated that just prior to the accident he heard something strike the bottom of the baggage car, probably part of the brake rigging, and he started toward the emergency cord, but the accident occurred before he could reach it

Train Dispatcher Burns stated that, according to reports he received from operators, train No 900 covered the distance between KM and ST block stations in two minutes, whereas the usual time is three minutes, as this indicated high speed he checked the clocks at these stations simultaneously and both clocks were five seconds fast Shortly afterwards, at about 2 53 p m, the wires failed He further stated he had not calculated the rate of speed, he made no report of trains exceeding the speed limit, and he had not received instructions to do so, he had not called the attention of Conductor Anderson or Engineman Hulings to exceeding the speed limit on this division, and if the derailment had not occurred he would not have thought anything more about the speed of train No 900 on this occasion after checking the clocks at KM and ST block stations

Operator Hillard, on duty at St George at the time of the accident, stated he reported train No 900 by at 2 51 p m, but that he judged it passed about 10 seconds sooner He stated the train was running very fast, faster, he thought, than he had ever observed it before, and he spoke about the high rate of speed to the operator at KM block station He estimated the speed to have been at least 70 miles an hour when passing his station

Operators Steele, Alex, and Latshaw, stationed at River Ridge, RL block station, and KM block station, respectively, stated that in their

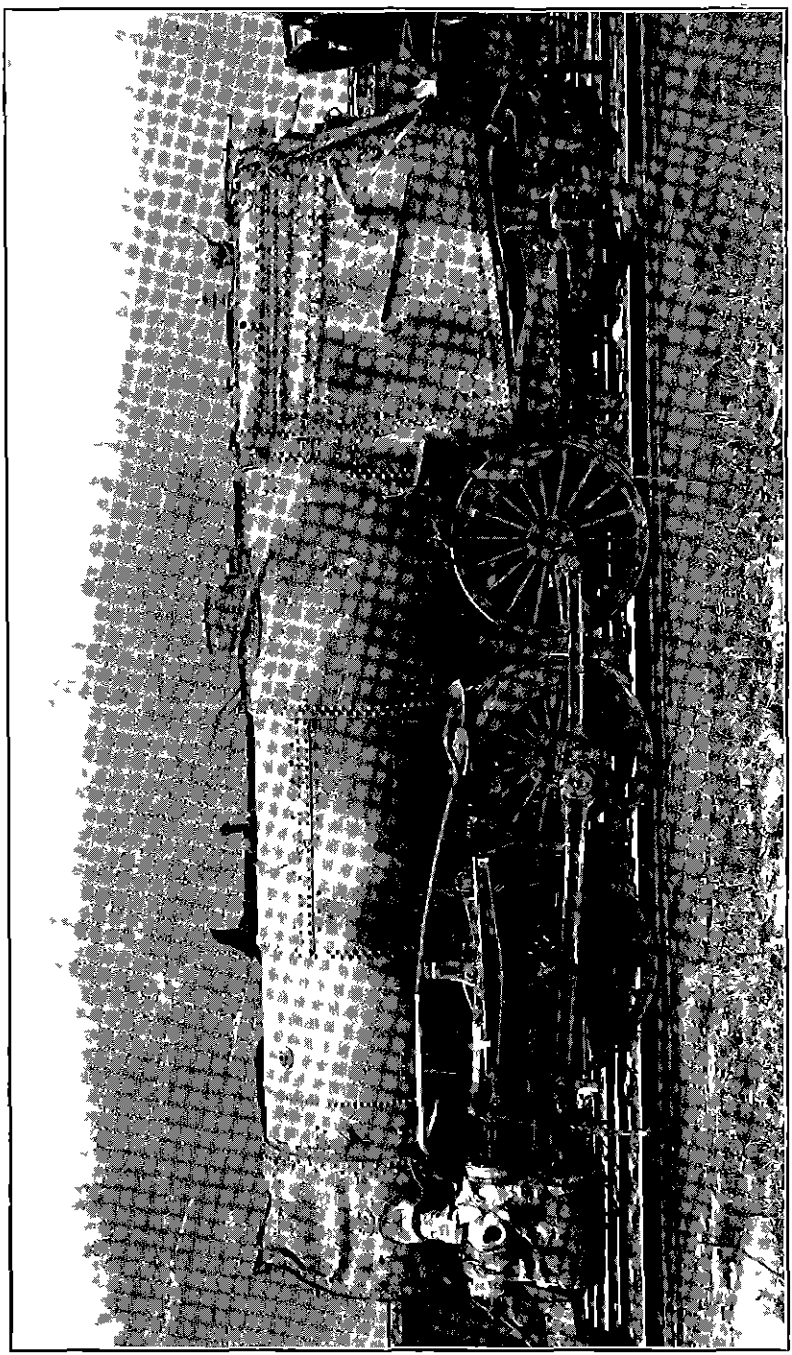

Plate 1 shows locomotive 397 after being picked up and placed on the track

Plate 2 shows left side of combination baggage and mail car as damaged by derailment

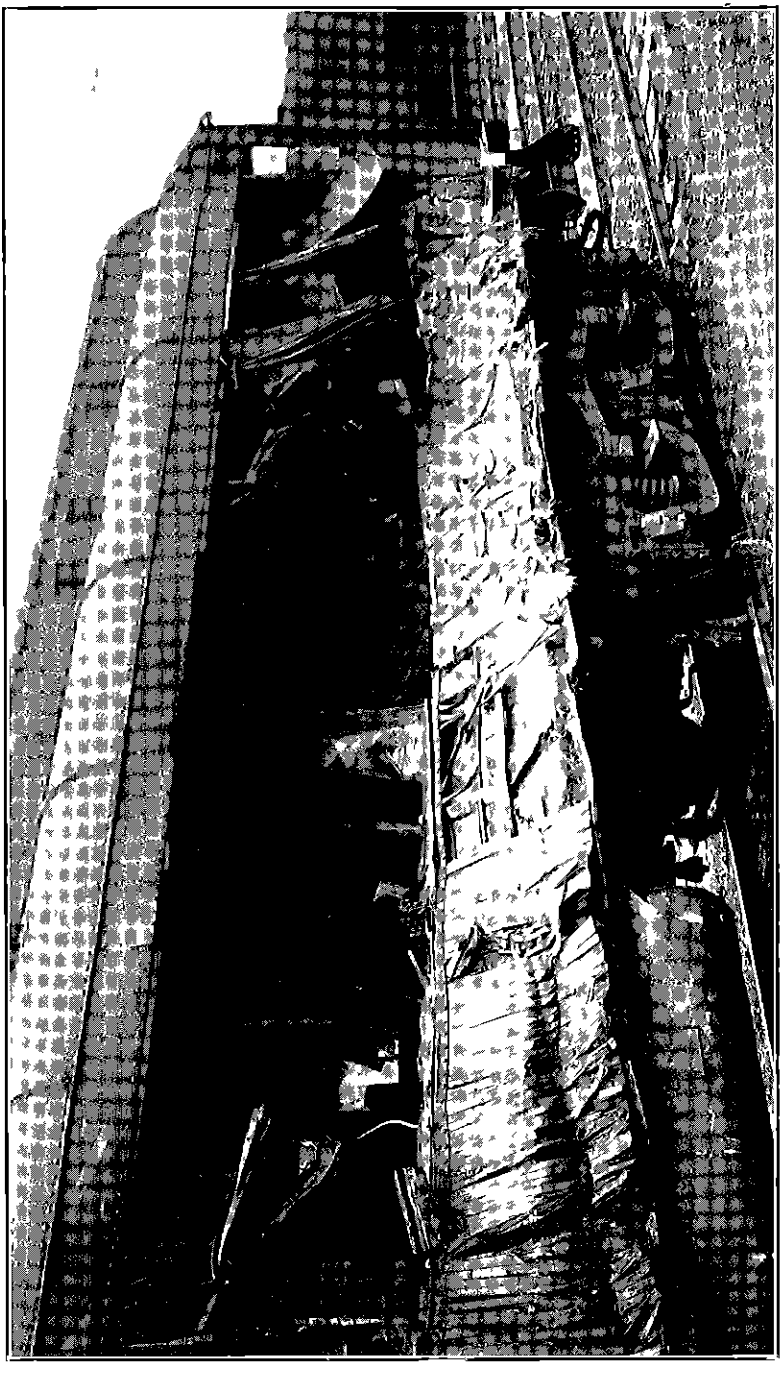

Plate 3 shows left side of Pullman chair car as damaged by derailment

estimation the speed of train No 900 was higher than usual Operator Steele estimated the speed to have been 60 miles an hour when passing his office Operator Alex said that passenger trains usually shut off for a curve north of his station but he noted that this was not done on train No 900 on that day

Operator George, stationed at Big Rock, stated that Operator Steele remarked about the high speed of train No 900 when reporting it by He first reported it by at 2 19 p m , but later instructed him to change this to 2 20 p m so as to show more running time between RH and UN block stations

Section Foreman Alex stated that he was at a point about 1 mile north of St George when train No 900 passed, traveling at an unusually high rate of speed, so fast that it frightened him and he ran toward the river , he said he thought then the speed was so great the train would not run very far He arrived at the scene of the accident shortly after its occurrence and saw the joint where the train left the track, he stated that south of this point the spikes were cut off on the gauge side of the high rail, and nuts were also sheared off the rail-joint bolts He was of the opinion the accident was caused by excessive speed, track conditions not contributing to the derailment in any manner

Conductor Silves, of extra 1319 south, stated that train No 900 passed him at St George, his attention was attracted by its high rate of speed and he remarked to the flagman that it must be making up time He waved to Engineman Hulings, who responded in a similar manner, and shortly after the train passed he heard the crash of the derailment Engineman Sallade, of train 1319, stated Engineman Hulings was using steam as train No 900 passed him at a speed which he thought was between 55 and 60 miles an hour Engineman Hulings waved his hand as he passed Shortly afterwards he heard the crash and immediately reported the accident He assisted in caring for the fireman of train No 900, but the latter made no statement concerning the accident before his death

Track Foreman Evans stated he arrived at the scene of the accident at 3 45 p m He made an examination of the track and considered it to be in good condition in both directions from this point He noted the joint where the train evidently left the track, south of that point for a distance of 6 or 8 rail lengths spikes were sheared off on the inside of the high rail and the rail had been pushed inward toward the center of the track The outside spikes were all good There were many marks on the outside of the high rail and rail-joint bolts were sheared off in places He was unable to determine definitely what caused this but thought it might have been an engine truck wheel or a brake beam

Master Mechanic Rhoads thought, in view of the position of the engine, the markings on the track, and the manner in which the ground adjacent to the track was dug up, that the engine overturned due to centrifugal force caused by high speed He was doubtful as to whether the engine truck was derailed first, owing to its position south of the engine presumably having been carried forward with the tender which passed the engine after it had cleared the track He stated that after the accident the brake valve was found undamaged and in running position, the throttle lever and latch were damaged to such an extent that the position of the throttle at the time of the accident could not be determined

Road Foreman of Engines Glass was of the opinion the accident was caused by excessive speed He stated that apparently there was a severe thrust exerted against the gauge side of the high rail on the curve, which caused the spikes to break off in the tie-plates, a number of them also being pulled, allowing this rail to tilt outward, the lead wheel of the engine truck being derailed and running some distance, being held in that position by the safety chains, which finally gave way and permitted these wheels to drop, then cross to the east side of the track and leave the ties, the momentum of the train shoving the wheels at an angle for a distance of possibly 70 feet, at which point they led into a depression near the track Road Foreman of Engines Glass's further testimony corroborated that of Master Mechanic Rhoads in connection with the brake valve and condition of the engine after the accident

Division Engineer Wilson stated the spikes on the gauge side of the high rail were partly pulled, some broken and other sheared off The spikes on the outside were not disturbed He was of the opinion that a pair of wheels on the engine or tender climbed the high rail and caused the spikes to shear off, also that the excessive speed caused the rail to cant

Trainmaster Kinney was of the opinion that the accident was caused by excessive speed, and that there was no defective condition of track or equipment that would have caused the derailment

According to the train sheets for the month of January, 1924, it was noted that train No 900 had exceeded the speed limit of 50 miles an hour between various stations on this division on numerous occasions, on two of which, the day prior to and the day of the accident, the train was hauled by engine 397 According to the train sheet, on the day of the accident the running time of train No 900, between Sedgwick and River Ridge, 3 7 miles, was 4 minutes, indicating an average speed of 55 5 miles an hour , between Big Rock and FI block station, 5 1 miles in six minutes, an average speed of 51 miles an hour , between RL block station and KM block station 3

miles in 3 minutes, an average speed of 60 miles an hour, and between KM block station and St George, 2 3 miles in 2 minutes, an average speed of 69 miles an hour

Measurements made of the track beginning at a point about 435 feet north of the first mark of derailment, at intervals of 11 feet, showed the gauge to be practically standard, while the elevation was well maintained The maximum elevation was $5\frac{9}{16}$ inches, while the gauge at the first mark on top of the east or high rail was 4 feet $8\frac{3}{4}$ inches The alignment was also good The rails were somewhat flange worn, but there was no condition of the track which was thought to have contributed to the cause of this accident When the commission's inspectors arrived at the scene of the accident the track had been opened to traffic

Engine 397 is of the 4–6–2 type, class K2S, having a total weight, engine and tender loaded, of 442,000 pounds, the weight of the engine is distributed as follows Engine truck 42,500 pounds, front driving wheels, 62,000 pounds, main driving wheels, blind tires, 64,000 pounds, rear driving wheels, 62,000 pounds, trailing truck, 52,500 pounds Its driving-wheel base is 13 feet 10 inches, and total wheel base, engine and tender, 70 feet 3 inches This engine received class 3 repairs at Altoona on October 19, 1923, and the boiler was washed at Oil City on January 20, 1924 Engines of this class had been used on this division for a period of three or four months

Owing to the badly damaged condition of the engine and tender, various measurements could not be obtained The engine truck was almost completely demolished and the frame badly distorted, there were numerous marks and indentations on the frame, axles, and wheels, evidently caused by the accident Both axles of the engine truck were bent One wheel of the leading pair of engine truck wheels was found against its mate on the opposite end of the axle Owing to the absence of identification marks, however, it was not determined whether the wheel found off its seat was the right or left wheel The commission's inspectors were of the opinion that the marks and indentations on this wheel did not show evidence of a blow sufficient to have loosened it Micrometer measurements of the wheel seat indicated slight distortion, and close examination disclosed that apparently a perfect bearing was not obtained at the time of original application Measurements of the wheel seat and bore showed the dimensions of the axle wheel seat to average 0 004 inch larger than the bore On February 12, at Buffalo shops, the loose wheel was pressed back on its seat, requiring a pressure of 45 tons for the first 2 inches and 80 tons for the other 4 inches

The engine truck was equipped with two semielliptical springs, each having 24 leaves, the longest leaf being 39 inches in length

Plate 4 shows front engine truck axle on which one wheel was found against its mate on the opposite end of the axle indicating that a proper bearing was not obtained on the wheel fit at the time of the original application of the wheel

Plate 5 shows bore of engine truck wheel of the leading pair which was found off its seat and on the opposite end of the axle The tool marks in the bore indicate that a proper fit was not obtained at the time the wheel was originally applied to the axle

These springs are located betwen the equalizers and can only be properly inspected from underneath One of these springs was found to have nine short and five long leaves broken, and the other spring had six short leaves broken at the band, the ends of all broken leaves except one being missing There was nothing to indicate that they had been broken in the derailment On February 12 the engine truck springs were dismantled and the leaves referred to showed evidence of having been broken for some time

The engine was badly damaged The tires and flanges on all engine wheels were in good condition Measurements of the driving wheels, back to back, were as follows No 1 wheels, 53 inches at three points, No 2 wheels, 53⅛ inches at three points, No 3 wheels, 52¾ inches at one point, 52 13-16 inches at two points There were some marks and slight indentations on the backs of the left Nos 2 and 3 driving-wheel tires, but they did not, in the judgment of the commission's inspectors, indicate that these wheels crowded the rails to any extent

The trailing-truck frame was practically destroyed, being broken at several points, and the axle was bent, the previous condition of this truck could not therefore be determined

Nothing about the tender was found that could have contributed to the accident

Rule No 104 established by the commission under the locomotive inspection law provides as follows

> Each locomotive and tender shall be inspected after each trip, or day's work, and the defects found reported on an approved form to the proper representative of the company This form shall show the name of the railroad, the initials and number of the locomotive, the place, date and time of the inspection, the defects found, and the signature of the employee making the inspection The report shall be approved by the foreman, with proper written explanation made thereon for defects reported which were not repaired before the locomotive is returned to service The report shall then be filed in the office of the railroad company at the place where the inspection is made

A check of the reports of inspection of engine 397 shows that on a number of days prior to the occurrence of this accident defects were reported which evidently existed at the time of the derailment and which may have been contributing causes of the accident Lateral motion between hubs and boxes on the No 2 engine-truck wheels was reported on 17 days between December 20, 1923, and January 30, 1924, as follows

> 1¾ lateral motion in back engine truck boxes
> Examine lateral motion in #2 eng truck
> Too much lateral motion in #2 eng truck boxes

Some of these reports indicated that repairs had been made, while others bore notations "passed," "serviceable," and "will rep at B W period," the last notation indicating that the defect reported

Plate 6 shows one of the engine truck springs with 9 short leaves and 5 long leaves broken, which evidently had been broken for some time prior to the accident

Plate 7 shows the other engine truck spring with 6 leaves broken, which evidently had been broken for some time prior to the accident. The pieces of broken springs were all missing at the time of the investigation except one

would be repaired at the next boiler-washing period A number of these reports indicated that lateral motion existed beyond the maximum of 1 inch allowed by the rules of the commission

Other defects which may have had some bearing on this accident were reported as follows

January 9, engine spring out of set LS
January 13, front lower spring leaf broken LS
January 19 R No 1, engine truck box tipped
January 30, L & R front engine truck pedestal brace bolts loose

CONCLUSIONS

The primary cause of this accident was the defective condition of the engine truck, a contributing cause was excessive speed

The investigation disclosed that both engine-truck springs had a number of broken leaves which had evidently been broken some time prior to the accident, and this condition no doubt resulted in the normal position of the engine-truck frame over the journal boxes being changed, the frame probably being down on top of the boxes and the spring seats riding the equalizers, thus creating a relatively rigid condition of the engine truck, changing the distribution of weight on the engine-truck wheels and retarding the proper movement of the truck when rounding curves Excessive lateral had been reported so frequently that it is apparent proper correction was not made, and while on account of damage resulting from the accident accurate measurements could not be taken so as to determine the lateral which existed at the time, it is believed that this and others of the defective conditions mentioned existed at the time of the derailment and were primarily responsible for the accident

As a result of this investigation it is believed that when the locomotive entered upon the $5\frac{1}{2}°$ curve, because of the defects noted and the rate of speed, the thrust to which the left leading engine-truck wheel was subjected caused it to move inward on its axle, the left rear engine truck wheel was forced over the rail where the first mark of derailment was found, continuing along against the outside of the rail until the leading wheel had been forced inward far enough to allow the leading wheel to drop to the ties between the rails and the rear wheel to drop to the ties outside the high rail, thus precipitating the derailment of the train The belief that an engine-truck wheel was the first wheel to be derailed is supported by the character of the marks on the track, and by the fact that although the train traveled a considerable distance beyond the point where this wheel first left the rail before complete derailment of the train occurred, the engineman was evidently unaware of this condition as the evidence indicates no brake application was made While it could not be determined by identification of the

wheel itself that it was the left leading engine-truck wheel which after the accident was found off its seat, this conclusion is warranted by the fact that this wheel would be subjected to the severe thrust incident to guiding the engine, running at high speed, when rounding this curve

The railroad company's committee which investigated this accident stated as part of its conclusions that—

> The speed at which the locomotive attempted to negotiate the curve, resulted in an excessive surging motion, which forced the left No 3 driver across the east or high rail, resulting in the upsetting of the locomotive and wrecking the train

However, in view of the weight on the driving wheels, and the fact that the wheel first derailed ran in a practically suspended position for a distance of about 250 feet, the theory that one of the driving wheels was derailed first does not appear tenable, and is not borne out by the marks on the backs of the driving wheel tires or on the track

It is obvious that adequate maintenance of engines is one of the essentials for safe operation Had the defects noted not existed on this engine, it is probable it would have successfully rounded this curve notwithstanding the excessive speed at which it was being operated Measures should at once be taken by responsible officials to the end that proper inspection and repairs of engines shall be made

Estimates vary as to the actual rate of speed at which the train was running at the time of the accident, but beyond doubt it was in excess of 50 miles an hour, the maximum prescribed for passenger trains on that portion of the road, as established by testimony of a number of employees

The investigation disclosed several recent cases of excessive speed on this division and indicated that measures are not being taken by operating officers to enforce speed regulations and check violations thereof Proper regulation of speed on sharp curves is essential to safe operation, and measures should at once be taken by responsible operating officers of this railroad to enforce adequate speed restrictions

All of the employees involved were experienced men At the time of this accident none of them had been on duty in violation of any of the provisions of the hours of service law

Respectfully submitted

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Director, Bureau of Safety
A G Pack,
Chief Inspector, Bureau of Locomotive Inspection

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