

INTERSTATE COMMERCE COMMISSION
WASHINGTON

INVESTIGATION NO. 3094
THE ATCHISON, TOPEKA AND SANTA FE
RAILWAY COMPANY
REPORT IN RE ACCIDENT
AT OTERO, N. MEX., ON
APRIL 9, 1947

SUMMARY

Railroad: Atchison, Topeka and Santa Fe
Date: April 9, 1947
Location: Otero, N. Mex.
Kind of accident: Derailment
Train involved: Passenger
Train number: 18
Engine numbers: Diesel-electric units
16-16A-16B-16C
Consist: 13 cars
Speed: 73 m. p. h.
Operation: Timetable, train orders and
automatic block-signal system
Track: Single; 1°30' curve; 1.367 percent
ascending grade eastward
Weather: Clear and dusk
Time: 6:53 p. m.
Casualties: 39 injured
Cause: Defective traction-truck gear-
housing

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 3094

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

THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

May 26, 1947

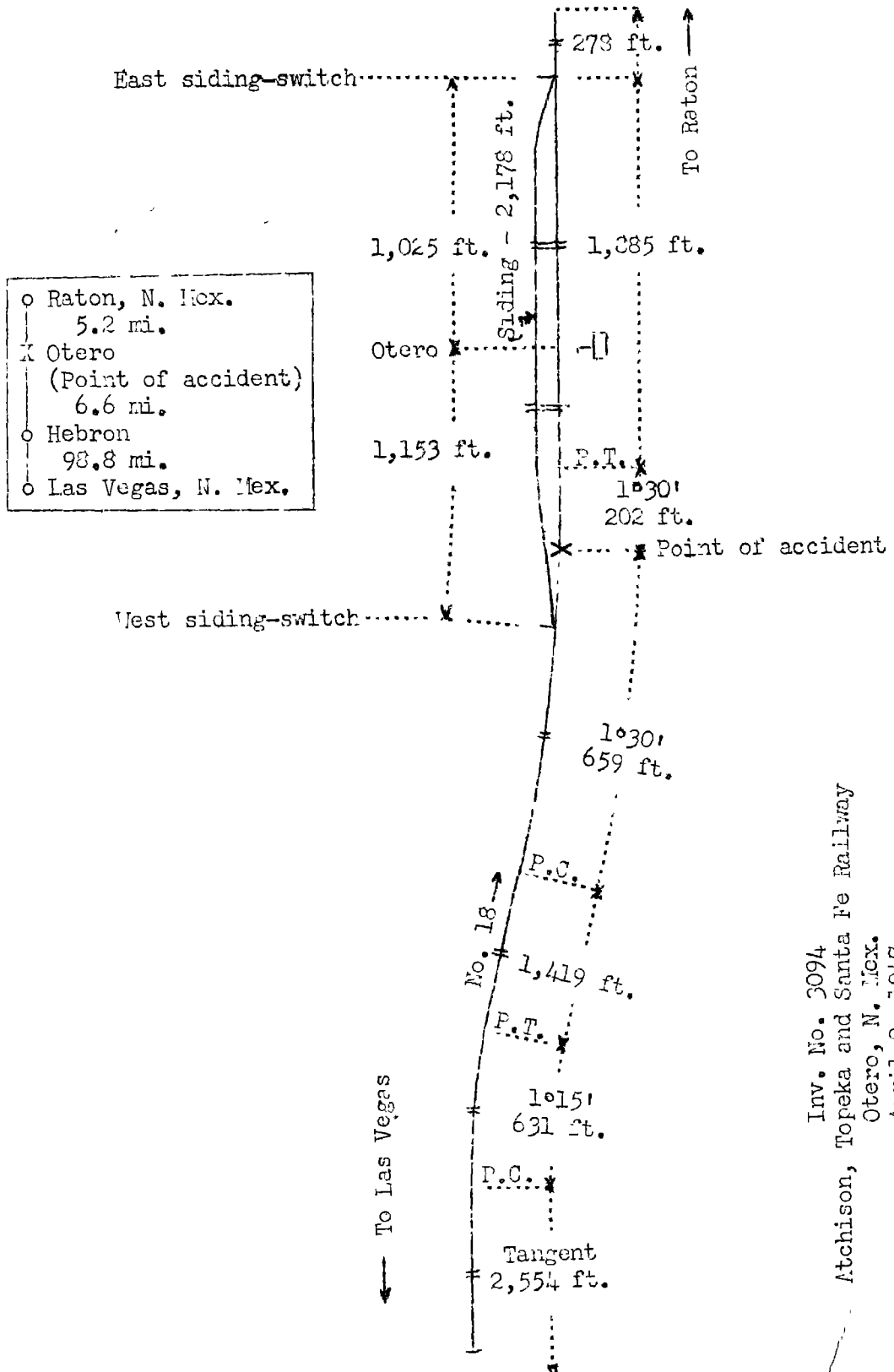
Accident at Otero, N. Mex., on April 9, 1947, caused
by a defective traction-truck gear-housing.

REPORT OF THE COMMISSION¹

PATTERSON, Commissioner.

On April 9, 1947, there was a derailment of a passenger train on the Atchison, Topeka and Santa Fe Railway at Otero, N. Mex., which resulted in the injury of 38 passengers and 1 dining-car employee.

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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.



Location of Accident and Method of Operation

This accident occurred on that part of the New Mexico Division extending between Las Vegas and Raton, N. Mex., 110.6 miles, a single-track line, over which trains are operated by timetable, train orders and an automatic block-signal system. At Otero, 105.4 miles east of Las Vegas, a siding 2,178 feet in length parallels the main track on the north. The west and the east switches of this siding are, respectively, 1,153 feet west and 1,025 feet east of the station. The accident occurred on the main track at the frog of the west siding-switch, and the general derailment occurred at the east siding-switch. From the west there are, in succession, a tangent 2,554 feet in length, a 1°15' curve to the right 631 feet, a tangent 1,419 feet and a 1°30' curve to the left 659 feet to the point of accident and 202 feet eastward, then there is a tangent 1,885 feet to the east siding-switch and 278 feet eastward. At the point of accident the grade is 1.367 percent ascending eastward.

Between the clearance points of the main track and the siding the distance between the centerlines is 15 feet. The structure of the main track consists of 110-pound rail, 39 feet in length, laid new during 1928, on an average of 24 treated ties to the rail length. It is fully tieplated, single-spiked, provided with 4-hole angle bars and an average of 4 rail anchors per rail length. It is ballasted with slag to a depth of 10 inches. The turnouts of the siding switches consist of 110-pound switch-points, 13.5 feet in length, 110-pound rails and No. 10 spring-rail type frogs. Guard rails are provided at frog locations.

Operating rules read in part as follows:

ENGINEMEN.

* * *

457. They must look back frequently, and especially while rounding curves and passing over track covered by slow orders, to detect any defects in their train and for signals, and must require fireman and brakeman to do likewise.

* * *

The maximum authorized speed for this train was 100 miles per hour on tangent track, and 85 miles per hour on the curve at the point of accident.

Description of Accident

No. 18, an east-bound first-class passenger train, consisted of Diesel-electric units 16, 16A, 16B and 16C,

coupled in multiple-unit control, one baggage car, one club car, five sleeping cars, one lounge car, one dining car and four sleeping cars, in the order named. All cars were of lightweight-steel construction. This train passed Hebron, the last open office, 6.6 miles west of Otero, at 6:47 p. m., 16 minutes late, and while it was moving at a speed of 73 miles per hour the front wheels of the front truck of the second Diesel-electric unit were derailed at the frog of the turnout of the west siding-switch at Otero. These wheels continued in line with the main track a distance of 2,000 feet to the turnout of the east siding-switch, where all wheels of the second, third and fourth Diesel-electric units, and the first to eleventh cars were derailed.

Separations occurred between the third and fourth Diesel-electric units, between the fifth and sixth cars, between the sixth and seventh cars, between the seventh and eighth cars, and between the eighth and ninth cars. The first three Diesel-electric units stopped with the front end of the first unit 1,128 feet east of the point where the general derailment occurred. The second and third units remained upright and in line with the track. The fourth unit stopped on its right side about 10 feet south of the main track and parallel to it, and about 90 feet west of the west end of the third unit. The second and third units were slightly damaged, and the fourth unit was badly damaged. The first car stopped on its right side about 12 feet south of the main track and parallel to it. The second car stopped in line with the first car and leaned to the south at an angle of about 45 degrees. The third and fourth cars stopped upright and in line with the second car. The fifth car stopped in line with the fourth car and leaned to the south at an angle of about 45 degrees. The sixth car stopped on its left side, about 75 feet west of the fifth car, across the track and at an angle of 70 degrees to it. The seventh car stopped upright, immediately west of the sixth car, across the track and at right angles to it. The eighth car stopped upright, across the track and at an angle of 45 degrees to it, with its front end against the front end of the seventh car, and its rear end about 40 feet north of the track. The ninth, tenth and eleventh cars stopped upright and in line with each other, with the front end of the ninth car about 40 feet north of the track and against the rear end of the eighth car, and the rear end of the eleventh car on the roadbed. The first to ninth cars, inclusive, were badly damaged. One side of the sixth car was crushed inward, and the entire superstructure was out of square. The remainder of the derailed cars were slightly damaged. The Diesel-electric units and the cars were equipped with tightlock couplers. The separations occurred as a result of broken couplers.

The weather was clear and it was dusk at the time of the accident, which occurred about 6:53 p. m.

Unit 16A, the second Diesel-electric unit of No. 18, is a booster unit of the 4-0-4 type, and was built in 1946. It is 50 feet long over the pulling faces of the couplers, and its total weight in working order is 232,910 pounds. This unit is provided with two 4-wheel traction trucks of the swing-motion equalized type. The wheelbase of each truck is 9 feet long, and the trucks are spaced 30 feet between centers. The diameter of the front wheels of the front truck is 39-1/2 inches. A traction motor is mounted between the wheels on each axle of each truck, and power is transmitted to each axle by a pinion on the armature shafting engaging a gear on the axle. One set of gearing per axle is used, and the gears are mounted parallel with the inner surface of a driving wheel and adjacent to it. Each set of gears is encased in a gear housing. Each housing is constructed in two parts. The outer dimensions of each housing are about 49 inches long, 6-1/8 inches wide and 20.5 inches high, and is of a general irregular polyhedron-shape. The lower half varies from 3/16 to 3/8 inch in thickness, and weighs 80 pounds. The lower and the upper half of each housing are connected at the centerline at each end by a heat-treated bolt, machined to 1 inch in diameter. The bolts are 7-1/2 inches long below the head, and are inserted through 1-inch holes in bolting brackets. According to specifications of the carrier, these bolts are applied with the heads upward, and are held in place by a lock-washer, a nut and a 3/16-inch cotter key applied below the lower edge of the housing. In addition, a safety strap, constructed of strip steel 3/8-inch thick by 3 inches wide and bored for the insertion of a 1-inch bolt, is so designed that it fits over the bolting brackets of each half of the housing. One leg of the safety strap fits between the head of the bolt and the bolting bracket of the top half of the housing, and the other leg fits between the lock-washer and the bolting bracket of the bottom half of the housing. The upper leg of the safety strap is provided with a U-shape arrangement fitted on the head of the bolt to prevent rotation of the bolt, and a cotter key is inserted above the head of the bolt to prevent upward movement of the bolt. If the cotter key, the nut and the lock-washer are missing from the lower end of the bolt, the safety strap prevents the two members of the housing from becoming separated. When the housing is secured in place and 39-1/2-inch wheels are used, the maximum clearance between the lower surface of the gear-housing and the tops of the rails is 5-1/2 inches. During

the trip involved unit 16A was assembled in the train so that the gears of the front traction-motor of the front truck were on the north side, and the pinion end of the gear-housing was trailing. According to data submitted by the carrier, the front wheels of the front truck of unit 16A were turned to full contour on February 18, 1947. The last inspection and repairs of this unit were completed at Barstow, Calif., on April 8, 1947. At that time there were flat spots on the front wheels of the front truck of this unit varying between 2-1/4 and 3 inches in length. These flat spots were reduced to about 2 inches in length by grinding the surface of the tread.

Discussion

No. 18 was moving at a speed of 73 miles per hour, as indicated by the tape of the speed-recorder with which the first Diesel-electric unit was equipped, on a 1°30' curve to the left, where the maximum authorized speed was 85 miles per hour, when the No. 1 pair of wheels of the second unit were derailed to the left in the immediate vicinity of the frog of the west siding-switch at Otero. At this point the superelevation of the curve was 4 inches. The derailed wheels continued in line with the main track to the east siding-switch, where the general derailment occurred. Prior to the time of the derailment, the Diesel-electric units and the cars were riding smoothly, and there was no indication of defective track, nor of any obstruction having been on the track. The track was well maintained.

As No. 18 was approaching Otero, the enginemen, and a roadmaster who was in the control compartment, were maintaining a lookout ahead from the front control compartment of the first unit. The members of the train crew were in various locations throughout the cars of the train. The first these employees knew of anything being wrong was when they felt several severe surges of the train, then the brakes became applied in emergency as a result of the derailment.

The first mark on the track structure was a scraping mark on the planking inside the north rail of the main track at a track motor-car set-off, located 4.75 miles west of the west siding-switch at Otero. This mark was about 6 inches wide and its outer edge was about 3 inches inside the gage side of the north rail. Similar marks appeared on the north inner guard rail of a bridge and on the planking of several track motor-car set-offs east of the first mark. The last mark appearing at a set-off was 149 feet west of the point of

accident. There were scraping marks on the north side of the rigid wing-rail and the foot guards of the frog of the turnout of the west siding-switch. This frog is of the spring-rail type. The frog point was open $7/8$ -inch, and there was a flange mark on the left side of the frog and 6 inches east of the frog point. Opposite the marks on the frog heavy abrasive marks appeared on the south edge of the guard rail located inside the south stock rail of the main track, and the spikes on the south side of these rails were raised from $1/4$ -inch to 1 inch. Eastward from the flange mark on the frog point, there was a flange mark extending outward diagonally 47 feet 8 inches across the top of the head of the north rail. At a point 3 feet 3 inches eastward a single flange mark appeared on the top of a tie inside the south rail. Then single flange marks appeared on the tops of ties at points varying from 8 to 10 inches outside the north rail and inside the south rail throughout a distance of 2,018 feet to the heel of the frog of the turnout of the east siding-switch. The long-point rail of this frog was broken, the switch points were torn out, and the stock rail was overturned. The track was torn up from this point eastward to the point where the second Diesel-electric unit stopped.

Examination of the second Diesel-electric unit disclosed that the lower half of the gear-housing, located inside the left front wheel of the front truck, had become disconnected at the front connection and had dropped downward from its normal position. The specifications require that this type of gear-housing must be secured by bolting the upper and lower halves together at each end by 1-inch fitted bolts held in place by safety straps, lock washers and nuts. A cotter key must be used at the top to prevent the bolt from rising, and a cotter key must be used at the lower end of the bolt to insure that the nut and lock-washer will not drop off. After the accident, the bolt, safety strap, lock-washer, nut and cotter keys were missing at the front bolting location. The bolt at the rear bolting location was in place, together with its safety strap, upper cotter key, lock-washer and nut, but the lower cotter key was missing and the lower portion of the bolt was bent backward at an angle of 30 degrees. The degree of angularity to which the rear bolt was bent indicated that the lower half of the gear housing had dropped 11.5 inches, or 6 inches below the tops of the rails. The rails in this territory are $6-1/4$ inches high and are laid on tieplates $3/4$ -inch thick, a total of 7 inches; therefore, the bottom surface of the gear-housing would clear the tops of the ties

1 inch, but would strike any object between the rails that was more than 1 inch above the tops of the ties. The marks on the track structure indicate that when the gear housing struck the rigid wing-rail of the frog the gear housing was deflected against the left front wheel of the front truck with sufficient force to compress the wheel flange against the spring wing-rail, and the wing-rail was moved northward a sufficient distance for the wheel flange to pass to the left of the frog point and to mount the frog. During this movement, the back of the flange of the right front wheel bore against the inside face of the guard rail with such force that the spikes were raised and the guard rail tilted sufficiently to permit this action. The back-to-back measurement of the wheels involved was 53-5/16 inches. The flange of the left wheel struck the movable frog point with such force that the hold-down horn and housing were bent out of proper alinement and the frog point remained slightly open.

The housing involved had been dragging throughout a distance of not less than 4.75 miles immediately west of the west siding-switch at Otero. Under the rules, enginemen are required to inspect their trains rounding curves. The engineer said that he had inspected the train as it rounded curves to the right, and the fireman said that he had inspected the train as it moved on curves to the left, including the curve on which the accident occurred. Neither of these employees had observed any indication of dragging equipment prior to the accident.

The front wheels of the front truck of the second Diesel-electric unit had been turned on a lathe to proper contour and were placed in the truck on February 18, 1947. At this time the gear-housing was bolted into place. The Diesel-electric unit involved received periodic inspection and repairs at Barstow, Calif., on April 3, 1947, and the last trip inspection and repairs were completed at that point on April 8.

After the accident examination disclosed that the bolt hole in the bolting bracket at the front end of the upper half of the gear housing was elongated 1/8-inch by wear and the upper surface of the bracket was worn around the bolt hole in an area equivalent to the maximum diameter of the head of a 1-inch bolt. This area was slightly cupped, which condition indicated that the bolt had been loose and had rotated throughout a considerable period prior to the accident. Inspection of other Diesel-electric units equipped with similar gear housing disclosed that some of the safety straps on the units were broken at bend locations, because fillets were not

provided. The assistant general mechanical officer said that in his opinion the safety strap involved broke at the upper bolt hole and that the bolt was sufficiently loose to rotate. The loose condition of the bolt was further aggravated by vibration caused by the presence of flat spots on the wheels involved. He could assign no reason why the lock-washer and the nut became lost from the lower portion of the bolt.

Since the investigation of this accident, the carrier has revised the specifications of gear housings so as to increase the thickness of the safety straps, to provide fillets at bend locations on the safety straps, and to use 1-1/4-inch bolts instead of 1-inch bolts. These bolts will be secured at the lower end by lock-washers and castellated nuts held in place by cotter keys placed through notches of the nuts.

Cause

It is found that this accident was caused by a defective traction-truck gear-housing.

Dated at Washington, D. C., this twenty-sixth day of May, 1947.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL,
Secretary.