Inv-2335

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

UNION PACIFIC RAILROAD

BOSLER, WYO.

FEBRUARY 24, 1939

INVESTIGATION NO. 2335

SUMMARY

Inv-2335

Railroad:	Union Pacific
Date:	February 24, 1939
Location:	Bosler, Wyo.
Kind of accident:	Derailment
Train involved:	Passenger
Train number:	First 37
Engine number:	815
Consist:	14 cars
Speed:	55-60 m.p.h.
Operation:	Timetable, train orders, and automatic block-signal system
Track:	Double; 2° curve; 0.623 percent descending grade
Weather:	Clear
Time:	9:56 p.m.
Casualties:	76 injured
Cause:	Broken rail because of a transverse fissure

To the Commission:

On February 24, 1939, there was a derailment of a passenger train on the Union Pacific Railroad near Bosler, Wyo., which resulted in the injury of 69 passengers, 5 Pullman employees and 2 employees on duty.

Location and Method of Operation

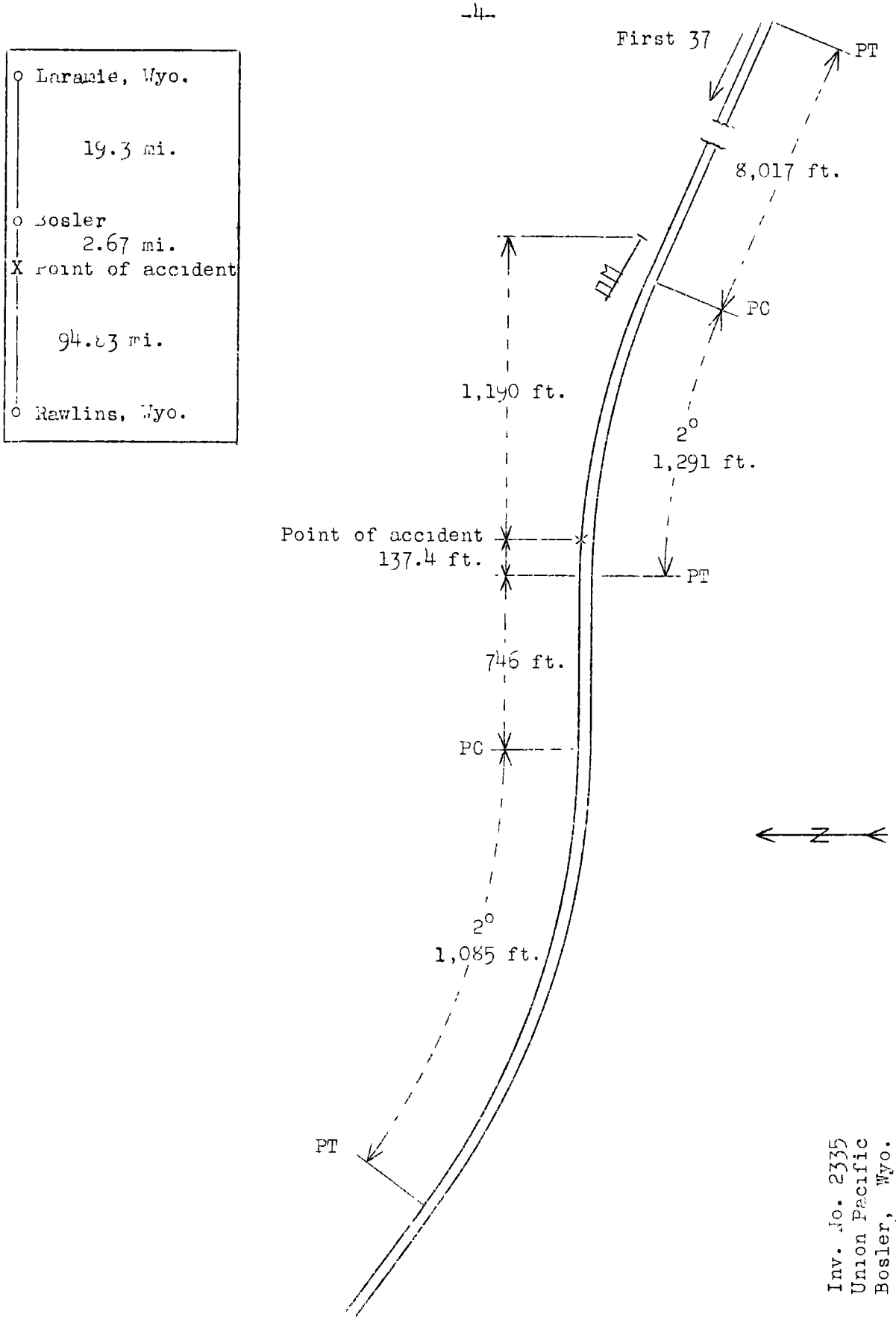
This accident occurred on that part of the Wyoming Division designated as the Sixth Sub-Division which extends between Laramie and Rawlins, Wyo., a distance of 116.8 miles. In the vicinity of the point of accident this is a double-track line over which trains are operated by timetable, train orders, and an automatic block-signal system. The accident occurred on the westward main track at a point 2.67 miles west of Bosler. Approaching this point from the east there is a tangent 8,017 feet long followed by a 2° curve to the left 1,291 feet in length, including spirals each of which is 150 feet in length; the derailment occurred on the leaving spiral of this curve at a point 137.4 feet from its western end. Beyond this curve there is a tangent 746 feet in length followed by a 2° curve to the right 1,085 feet in length and then a tangent 10,303 feet in length. The grade is slightly descending westward, being 0.623 percent at the point of accident.

The track structure is on a 14-foot fill and consists of 100-pound rail, 39 feet in length, laid on an average of 22 treated ties to the rail length; it is fully tie-plated, double-spiked inside, and single-spiked outside the rails, secured with rail anchors, and is ballasted with gravel to a depth of 8 inches below the ties. A maximum and uniform superelevation of 5 inches is maintained on the north, or high, rail of the curve involved; the track is well maintained.

On the curve where the accident occurred the maximum speed limit for train involved was 60 miles per hour.

The last automatic signal governing westward trains is located 1,190 feet east of the point of accident.

The weather was clear and the temperature was about 10 degrees above zero at the time of the accident, which occurred at 9:56 p.m.



Inv. No. 2335
Union Pacific
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Description

First 37, a west-bound passenger train, consisted of one baggage car, three coaches, one Pullman tourist sleeping car, one diner, seven Pullman standard sleeping cars and one observation car, in the order named, all of all-steel construction, hauled by engine 815, a 4-8-4 type locomotive, and was in charge of Conductor Costello and Engineman Palmquist. This train departed from Laramie, 19.3 miles east of Bosler, at 9:33 p.m., according to the train sheet, 13 minutes late, passed Bosler at 9:54 p.m., according to the testimony, 13 minutes late, and was derailed while traveling at a speed variously estimated to have been from 55 to 60 miles per hour.

The locomotive and the first nine cars separated from the rear portion of the train and stopped, coupled, at a point 3,195 feet west of the point of derailment. The locomotive and the first five cars were not derailed. The trailing wheels of the rear truck of the sixth car, U.P. 301, were derailed and stopped inside the rails; the axle of these wheels was broken. All wheels of the seventh car, the rear wheels of the front truck of the eighth car, and all wheels of the ninth car were derailed to the north of the rails; these four cars stopped in upright position on the track structure. The five rear cars were thrown down the north embankment at a point about 1,600 feet east of the rear end of the front portion of the train and stopped end-to-end and parallel to the track; the tenth, eleventh, and fourteenth cars lay on their right sides while the twelfth and thirteenth cars remained upright on their trucks; the rear car was 325 feet west of the point of derailment. Three of the derailed cars were considerably damaged and five were slightly damaged.

Summary of Evidence

Engineman Palmquist stated that the air brakes functioned properly when the running test was made after departure from Laramie. They passed Bosler at 9:54 p.m. Approaching the block signal at the entrance to the curve where the derailment occurred he observed that the signal displayed a proceed indication. The speed was slightly in excess of 60 miles per hour but before entering the curve he reduced it to between 55 and 60 miles per hour by making a 10 or 12-pound brake-pipe reduction. The engine was working a full head of steam and the brakes remained applied while rounding the curve but were released on the tangent immediately west thereof. Shortly after the brakes were released an emergency application occurred, caused by the derailment and separation of the train. The locomotive was in good condition and there were no flat spots on the drivers or wheels of the

tender. When passing over the point where the derailment occurred the locomotive rode smoothly and there was no indication of a broken rail or other abnormal condition. He estimated that the accident occurred about 9:56 p.m.

Fireman Schwab corroborated the testimony of the engineman.

Conductor Costello stated that when rounding the curve involved, at which time the speed was between 58 and 60 miles per hour, he was standing in the aisle of the third car of the train; this coach rode smoothly and there was no indication of passing over a broken rail. Shortly after the coach left the curve an emergency application of the brakes occurred and the train came to a smooth stop. Shortly thereafter when proceeding to the rear of the detached front portion of the train he observed that the rear axle of the rear truck of the sixth car, which was the first derailed unit, was broken off at a point not far from the north wheel.

Brakeman Lund, who was in the same coach with his conductor, did not estimate the speed or observe the broken axle; otherwise, he corroborated the conductor's statement and added that the temperature at the scene of the accident seemed to be near zero.

Flagman Hellon was in the smoking room of the thirteenth car when the accident occurred. His statement added nothing of value.

Division Superintendent Wedge made an inspection before the derailed equipment or damaged track had been disturbed. He stated that the sixth car of the train was the first unit of equipment to be derailed; he found the rear axle of the rear truck of this car broken at a point approximately 11 inches from the hub of its north wheel and both wheels on the ties inside the rails. The exposed fractured surfaces of the axle disclosed a fissure of not more than 10 percent of the cross-sectional area. He was certain that this defect was not sufficient to cause failure of the axle under normal stress and conditions. The appearance of both surfaces at the break in the axle indicated that they had not rubbed together. After observing the derailed rear portion of the train he proceeded eastward to the curve involved where he found the north or high rail broken at several points. The initial fracture occurred at a point 43 inches from the receiving end of the rail; this 43-inch section was still attached to the angle bars. All broken sections were recovered from the snow and matched according to their former positions. The next fracture was located 27 inches west of the initial fracture; this piece was the second broken section, 27 inches in length, and it was found 306 feet west of its original

position at a point 145 feet north of the track. The receiving end of this section, which was at the point of initial fracture of the rail, bore a heavy and distinct flange mark on the outer portion of its fractured surface. It was his conclusion that the north rear wheel of the sixth car struck the receiving end of this section a terrific blow which broke the axle, threw this section of rail to the point where it was found, and the general derailment resulted. An inspection of the track for more than one mile east of the initial rail fracture revealed no marks of defective or dragging equipment or any indication that the axle had failed prior to the time its wheel had struck the broken rail; therefore, it was his opinion that the axle was broken in the derailment caused by the broken rail.

Roadmaster Byrne corroborated the testimony of the division superintendent in regard to the fractured rail, the inspection of the track east thereof, and added that the rail involved was broken into ten pieces, all of which were recovered. He made an examination of the track on the curve where the derailment occurred to determine the gage, elevation, and surface, and he found it to be in good condition. The rail at the point of accident was last inspected on January 5 by a rail inspector with a magnifying mirror; no defects were reported at that time.

Division Engineer Hammond stated that he arrived at the scene the morning after the accident occurred and inspected the ten pieces of rail. The initial fracture was located at a point 43 inches from the receiving end of the rail; this 43-inch section was designated as section 1. Section 2 was 27 inches in length and the remaining eight sections varied from 7¼ inches to 17 feet 7½ inches in length. The exposed fractured surfaces at the leaving end of section 1 and at the receiving end of section 2 disclosed a transverse fissure which covered an area of about 50 percent of the ball of the rail. Other broken sections bore evidence of small transverse fissures but he could not positively identify them as such because a magnifying glass was not available when this inspection was made. The first mark of derailment was that of a wheel inside the north rail at a point between 1 and 3 feet west of the first rail fracture; the track east of that point bore no marks indicating derailment, or either dragging or defective equipment. The second mark of derailment appeared at a point about 23 feet west of the initial mark of derailment; this was a wheel mark outside the rail involved; from this point westward a distance of 2,639 feet numerous ties and rail anchors were marked and a great many joint bolts were broken off. He examined the broken axle and he was of the opinion that it was fractured as a result of the derailment which was caused by failure of the rail at a transverse fissure; there

were no marks of derailment east of the initial rail-fracture, which would have been the case had the axle broken first.

Chief Engineer Prater stated that it was his opinion that the derailment was caused by the broken rail. He thought that the initial fracture occurred at the location of the first transverse fissure, 43 inches from the receiving end of the rail, and that several cars ahead of the diner passed over this fracture before the second break occurred, approximately 27 inches west thereof. He thought that after the second fracture occurred a wheel depressed the west end of the second section thereby raising its east end, and the trailing north wheel of the rear truck of the sixth car then struck the receiving end with sufficient force to break the axle and also throw this piece of rail 306 feet westward. He said the adjacent ends of the broken axle bore no indication that they had rubbed each other.

Vice President Mann, General Manager Williams, and General Superintendent of Motive Power and Machinery Burnett were of the opinion that the initial and the second fractures of the rail occurred during the passage of the locomotive, or other unit ahead of the sixth car, and the displacement of the broken section was the cause of the derailment and the broken axle.

A report of Consulting Chemical and Metallurgical Engineer Barr, who examined the fractured rail and the broken axle, is to the effect that the rail involved was a 39-foot, 100-pound R E section steel rail bearing the following markings: "R E, O H, 10025, ILLINOIS, G, 1111, 1926, U.S.A. Heat 54240, 24-D." This rail was laid in 1926. A transverse fissure, 1-3/8 inches in height, extended from the gage side of the head of the rail a distance of 1-½ inches to the center-line of the web at a point 43 inches from its receiving end; the primary fracture occurred at that point. A similar transverse fissure existed at the point of fracture between sections 2 and 3. The east, or receiving end of section 2, the location of the primary fracture, was mushroomed and beveled to a depth of ½ inch and a width of 3/8 inch entirely across its top surface as a result of the battering received after the fracture occurred. The face of this battered section bore a deep cut extending vertically from the base to the top of the rail through the outer portion of the web and the head. Apparently, after the fracture occurred between sections 2 and 3 the second section was released and probably became lodged in a truck assembly in such manner that the flange of a wheel cut the vertical groove in the receiving face of this section before it was dislodged from the truck. Fissures ranging in size from 3/8 inch to 5/8 inch in the gage side of the head of this rail were also present at the locations of the third, fifth, seventh, and ninth fractures, all being

transverse fissures except the fith. The majority of the secondary fractures occurred at points in the rail where transverse fissures existed. The broken axle was a special 5-½ by 10-inch carbon steel axle having 5 by 9-inch journals; this axle and its wheels were installed new in the rear truck of U.P. 301 July 12, 1938; the wheels were turned December 13, 1938, and the same assembly was again installed in this truck January 11, 1939. The wheels and their flanges were in good condition at the time of the accident. The break in the axle occurred 11 inches from the inside face of the wheel hub. The exposed fractured surfaces disclosed the prior existence of an oval-shaped progressive fracture which had penetrated 1-7/8 inches into the body of the axle with a maximum width of 2-3/4 inches at its surface. The remaining and major portion showed evidence of a clean, new break which was undoubtedly caused by the severe shock when this wheel struck the broken rail.

District Engineer Adamson stated that a rail detector car was operated over the westward track in the vicinity of the point of accident at various intervals prior to the date of the accident. His records established that in the mile of track, within which this rail failure occurred, the detector car disclosed two transverse fissures on May 13, 1935, two on June 30, 1936, one on March 5, 1937, and three on October 12, 1937; these defective rails were immediately removed. The detector car was last operated over this track on March 22, 1938, at which time no transverse fissures were discovered. He was of the opinion that the percentage of rail fractures is increasing because of the increased weight and speed of motive power.

Observations of the Commission's Inspectors

Inspection of the track on the curve involved and examination of the sections of the broken rail and the fractured axle by the Commission's inspectors disclosed the conditions as described by maintenance-of-way and other officials. They observed that the receiving ends of sections 2 and 3 of the broken rail were battered by blows delivered by wheels.

Discussion

According to the evidence the temperature was between zero and 10 degrees above zero at the time of the accident. The derailment occurred on the leaving spiral of a 2° left curve which had a maximum and uniform superelevation of 5 inches and was well maintained. The speed of the train was estimated at 55 or 60 miles per hour, which was in accordance with the speed restriction on the curve involved. Investigation disclosed that the north or high rail at the point of derailment was broken into

10 pieces. The first fracture occurred 43 inches from the receiving end of the rail. Examination disclosed the existence of a transverse fissure in the head of this rail at the location of the primary fracture. This fissure extended from the gage side of the head of the rail a distance of 1-½ inches to the center-line of the web; it was 1-3/8 inches in height and covered approximately 50 percent of the head. A similar transverse fissure existed between sections 2 and 3 at the location of the second fracture which was 27 inches west of the initial fracture. Other fissures varying in size from 3/8 to 5/8 inch were found in the head of the gage side of this rail at the third, fifth, seventh, and ninth fractures; all were transverse fissures except the fifth. It was observed that the receiving ends of sections 2 and 3 were badly battered by wheels and a flange had cut a deep verticial groove in the receiving end of section 2 from the base to the top.

The initial mark of derailment was made by a wheel inside this rail at a point between one and three feet west of the first fracture. There were no marks east of the first fracture to indicate any abnormal condition in either the track or the train.

The first car to be derailed was the sixth car in the train. Both the trailing wheels of the rear truck of this car were inside the rails; the axle was fractured at a point 11 inches from the inside face of the hub of the north wheel. Examination of this fracture disclosed the existence of an old defect which was a small oval-shaped progressive fracture 2-3/4 inches in width at its surface and 1-7/8 inches in depth. The adjacent surfaces of the broken axle indicated that they had not rubbed together; therefore, it appears that the axle was not broken before the derailment occurred. Officials who participated in this investigation were of the opinion that this defect was not sufficient to cause failure of the axle under normal conditions.

The automatic block signal near the entrance to the curve displayed a green aspect which would indicate that the rail was not broken before this train reached that point. The conductor and the head brakeman, who were in the third car, and the engine crew felt no indication of a broken rail as the train passed over the point where the broken rail was later discovered. Maintenance-of-way and other officials were of the opinion that the first and second fractures occurred during the passage of the locomotive or other equipment ahead of the sixth car and that section 2 became dislocated and its receiving end was struck by the wheel of the sixth car with sufficient force to break the axle. The absence of marks indicating any abnormal condition east of the first rail fracture, the location of the initial mark of derailment, the presence of numerous batter marks, the deep

flange mark on the receiving end of section 2 and the evidence of battering on the receiving end of section 3 indicate that the rail was broken prior to the derailment. A rail detector car was last operated over the track involved March 22, 1938, and the rails in that vicinity were last inspected January 5, 1939, with a magnifying mirror by a rail inspector; no defects were discovered in either instance.

Conclusion

This accident was caused by a broken rail, because of the presence of a transverse fissure.

Respectfully submitted,

W. J. PATTERSON,

Director.