

INTERSTATE COMMERCE COMMISSION
WASHINGTON

REPORT OF THE DIRECTOR
BUREAU OF SAFETY

ACCIDENT OF THE
CHICAGO, ROCK ISLAND & PACIFIC RAILWAY

OAK FOREST, ILL.

APRIL 20, 1938.

INVESTIGATION NO. 2269

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SUMMARY

Inv-2269

Railroad: Chicago, Rock Island & Pacific
Date: April 20, 1930.
Location: Oak Forest, Ill.
Kind of accident: Derailment
Train involved: Freight
Train number: Extra 2594
Engine number: 2594
Consist: 37 loads, 41 empties, dead engine, caboose
Speed: 25 m.p.h.
Operation: Timetable, train orders, automatic block-signal system, automatic train-stop system.
Track: Double-track; tangent, descending grade 0.51 percent.
Weather: Clear
Time: 11:45 p.m.
Casualties: 2 killed; 3 injured
Cause: Broken journal due to overheating.

June 17, 1938.

To the Commission:

On April 20, 1938, there was a derailment of a freight train on the Chicago, Rock Island & Pacific Railway at Oak Forest, Ill., which resulted in the death of two trespassers, and the injury of three trespassers. This accident was investigated in conjunction with the Illinois Commerce Commission.

Location and method of operation

This accident occurred on the Chicago Division of the First District, Subdivision 10, extending between Joliet and Blue Island, Ill., a distance of 24.5 miles; in the immediate vicinity of the point of accident this is a double-track line over which trains are operated by timetable, train orders, an automatic block-signal system and an automatic train-stop system. The derailment occurred on the eastward main track at a point 436 feet east of the depot at Oak Forest. Approaching from the west the track is tangent for $1\frac{3}{4}$ miles to the point of accident, and for a considerable distance beyond. The grade for east-bound trains is descending, varying from 0.35 to 0.63 percent, and is 0.51 percent at the point of accident.

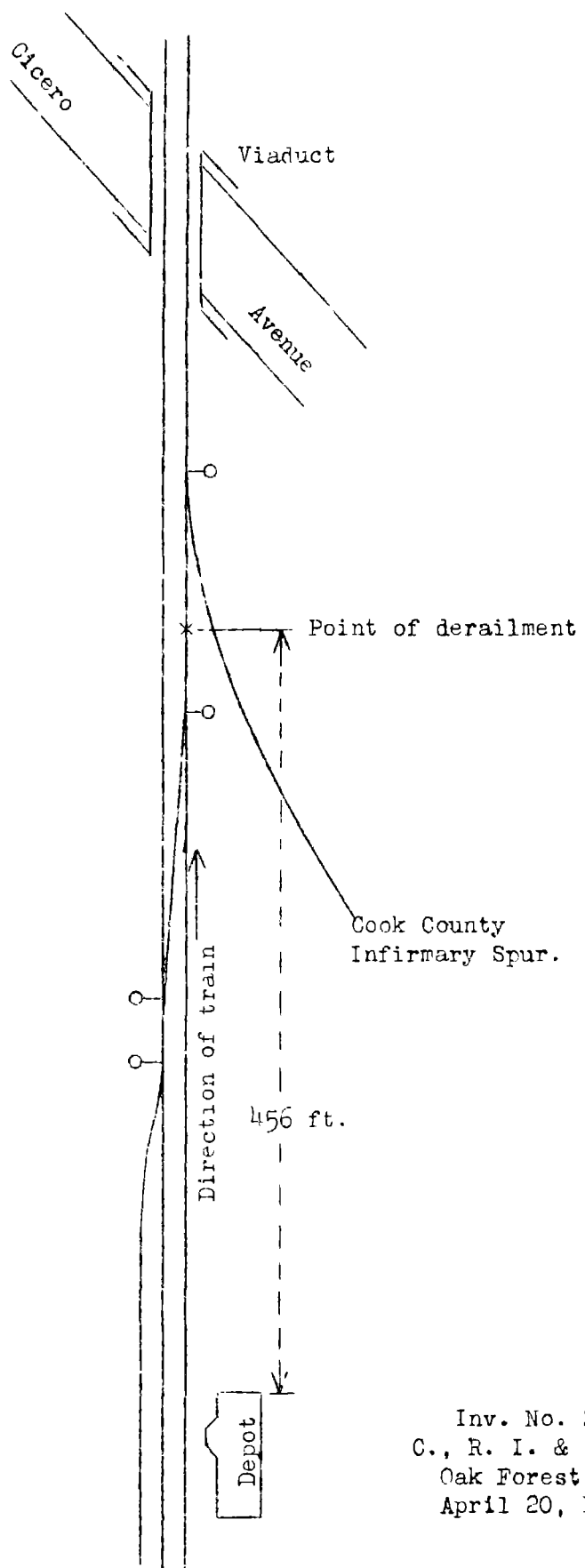
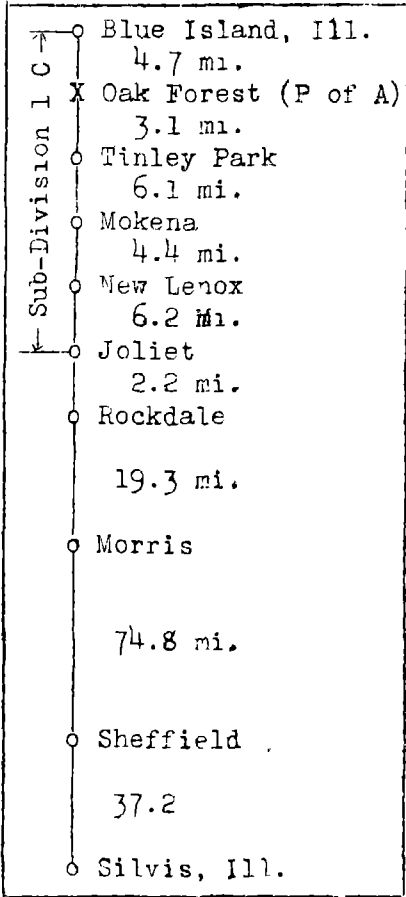
A trailing-point cross-over switch is located 44 feet west of the point of derailment, and a trailing-point switch, leading to the Cook County Infirmary spur, is located $1\frac{1}{2}$ feet east of the point of derailment. At Cicero Avenue, 259 feet east of the point of derailment, the tracks are on a viaduct about 17 feet above the street.

A dead engine was included in the consist of the train involved in this derailment and the maximum authorized speed for a train hauling such equipment is 25 miles per hour.

The weather was clear at the time of the accident, which occurred about 11:45 p.m.

Description

Extra 2594, an east-bound freight train, consisted of 37 loaded cars, 41 empty cars, a dead engine and a caboose, hauled by engine 2594, and was in charge of Conductor Yackey and Engineer Gallagher. This train originated at Silvis, Ill., 133.5 miles west of Joliet, on the adjacent Rock Island Division, and departed from that point at 11:45 a.m. At various points en route cars were picked up and set out, and at Morris, 21.5 miles west of Joliet, among others R.I. box car 157356 loaded with



Inv. No. 2269
 C., R. I. & P. Ry.,
 Oak Forest, Ill.,
 April 20, 1938

88,000 pounds of shelled corn, was picked up. This train passed Mokena, the last open office, 10.6 miles east of Joliet, at 11:23 p.m., according to the train sheet, and was derailed while passing Oak Forest, 9.2 miles beyond, at a speed estimated to have been about 25 miles per hour.

The engine and first six cars were not derailed. The rear truck of the seventh car and the following 19 cars were derailed. The seventh to tenth cars, inclusive, stopped east of Cicero Avenue; the next 11 cars went over the viaduct and 9 of them were piled up on the street; the following 5 cars were derailed west of the viaduct. The L-3 journal of the seventh car in the train, R.I. 157356, was broken off; this journal was on the right side of the train.

Summary of evidence

General Superintendent Dick stated that the end of the journal that broke off was found about 50 feet down the fill, opposite the point where the car broke down. The grass around it was burned as well as a piece of rope and a piece of paper.

Engineman Gallagher stated that the air brakes were tested at Silvis and worked properly en route. Before departing from Silvis he had been advised that there was a dead engine in the train; this fact restricted the speed to a maximum of 25 miles per hour. Cars were picked up at Morris and at Rockdale, and at the latter point the conductor and flagman inspected the train. Cars were set out at East Joliet and the train left that point about 10:35 p.m. Between East Joliet and the point of accident the train did not exceed a speed of 25 miles per hour. The fireman and head brakeman inspected the train while rounding all left curves, and he made a similar inspection while rounding all right curves. The last right curve was at Tinley Park Station, 3.1 miles west of Oak Forest, and at that point he did not see anything unusual. The first intimation he had of trouble was an emergency application of the air brakes which caused the engine to lunge; at the time the speed was not over 25 miles per hour. After the train stopped he walked back toward the rear end about three car lengths from the engine he met the head brakeman who informed him of the derailment. In inspecting the wreckage they observed that the L-3 journal box was missing from the first derailed car and the journal was broken off. Engineman Gallagher touched the journal with his bare hand and found that although it was slightly warm, it was not hot enough to burn his hand, even though he held his hand on it for a short period of time. There was no burning waste around the hub end of the journal, nor was there anything else to indicate that rope had been burning. He called Brakeman Frey's attention to the fact that the journal hub

was cool enough to put his hand on it, and later he informed Conductor Yackey and Flagman Mailhiot of that fact.

Fireman Williamson stated that at no time during the trip did the speed of his train exceed 25 miles per hour. When the train stopped at Oak Forest he immediately went out with flagging equipment to protect westward movements. When he had been relieved by the head brakeman he returned to the train and saw the car with the journal broken off; he felt the stub end of it and it was barely warm. He did not see any burning dope, and he thought the journal had not been burnt off but had broken off. He had noticed the engineman looking back while going around curves.

Head Brakeman Frey was on the seat box in front of the fireman while the train was en route; his statements corroborated those of the engineman and the fireman. He did not see any indication of hot box or other trouble en route, neither did he smell any odor such as is given off by an overheated journal. Shortly after the accident, he saw both the engineman and the conductor feel the broken journal with their bare hands, but did not do so himself. There was no fire around the broken journal, and he did not see any burning waste. He was alongside of R.I. 157356 when it was picked up at Morris and at that time he did not notice anything wrong with it.

Conductor Yackey stated that 21 cars, including R.I. 157356, billed at 83,000 pounds of corn, were picked up at Morris. He checked all of these cars with the bills, and took no exception to the condition of any of them. At Rockdale the entire train was inspected but no hot box was found; he inspected the south side, and Flagman Mailhiot the north side, of the train. The flagman rode the head end from Rockdale to Joliet, and inspected the left, or north, side of the train as it pulled by him into the east end of Joliet yard. In addition to these inspections both he and the flagman made running inspections while moving around curves en route. Passing Mokena everything was all right. Conductor Yackey was on the left side of the caboose cupola, and the flagman, who had just come in from the rear end, was on the right side of the cupola when the air brakes became applied in emergency at Oak Forest. At that time the speed was about 25 miles per hour, but for about 10 miles after leaving East Joliet it had been between 15 and 20 miles per hour. The conductor went forward and found that the train had been derailed, and that a journal had been broken off R.I. 157356. This was about 15 minutes after the accident and at that time both he and the engineman, who was already at the car involved, could put their bare hands on the broken hub. The journal box was missing and there was no burning dope in the vicinity. Between Joliet and the point of derailment three west-bound trains passed his train.

The first was met between Joliet and New Lenox, the second near Mokena, and the third near the west end of Oak Forest. On each of these trains members of the crew were visible at the rear end of their train, but no signal was given by any of them until the third train passed and a member of its crew gave a stop signal; he later learned this signal was given by a brakeman who saw flying sparks and thought a brake beam was down or a brake was sticking. At that time it was too late to take any action toward stopping his train as the accident happened almost immediately afterward. Conductor Yackey did not think it possible to burn off a properly packed journal in a distance of 40 miles while traveling at a speed of 25 miles per hour. He also expressed the opinion that if the journal had burned off it would have been impossible for him to place his hand on the hub 15 minutes after the accident. At Oak Forest the tracks are adjacent to an infirmary and it is possible that the burned grass, rope and paper at the point where the broken-off end of the journal was found were the remains of a fire started by one of the inmates of the infirmary.

Flagman Mailhot made a statement similar to that of other members of the crew with respect to speed and events en route. When he inspected the cars at Rockdale he felt all the boxes. At Joliet he made a running inspection on the north side of the train, and did not hear any journals squealing as the cars passed, nor did he see any evidence of fire around any of the trucks. Between Joliet and the point of accident they met three trains. From the rear of the second train they received a proceed signal, and from the rear of the third they received a stop signal. After the train stopped at Oak Forest he immediately went back to protect the rear end. He flagged a following extra at 11:52 p.m., and rode on it to his caboose, and then went forward to learn what had happened. He placed his bare hand on the broken hub of the journal and found it warm, but not hot; there was no burning dope around. Between East Joliet and the point of accident he was on the left, or south, side of the caboose cupola, and in that distance he did not see anything to indicate that a car was defective. The last curve upon which he had a chance to scan the train was east of New Lenox. In his opinion the journal had broken off, and had not burned off.

Operator Milbourne, at Mokena, 9.2 miles from Oak Forest, stated that he was out on the platform with a white light just after the engine of Extra 2594 passed the station. He inspected the passing train, but did not see anything to indicate any trouble with the cars. The train ascended the grade at that point at a speed of about 15 miles per hour, and passed at 11:23 p.m.

Car Inspector Gwarney, at Morris, stated that R.I. 157356 arrived empty on April 19 to be loaded with grain. His inspection of the car prior to the time it was loaded included draft gears, journals, brasses, wheels, and he found no defects. The car was rebuilt complete in 1936, and all brasses and packing in good order. On April 20, 1938, after the car was loaded, he gave it another inspection, and it was all right at the time he went off duty at 4:45 p.m. The boxes were in proper condition for movement, properly packed and lubricated. The journal was not cut. In his opinion the journal had not burnt off, but had crystallized and broken.

General Car Foreman Hanson inspected the truck involved; in his opinion the journal which failed had been crystallized a long time and had broken off, when the train was moving into Oak Forest. There was no evidence of cutting on the journal; the smoke around this part of the journal came after the journal broke. The wheels were damaged as a result of the derailment.

Engineer of Tests Sedwick made laboratory tests of the lead pair of wheels from the rear truck of box car R.I. 157356, together with the axle, broken journal, wedge and a small side wall section of box L-3, in which box the journal failed. From the results of these tests it did not appear that the wheels were unduly hard or brittle, nor could the failure of the axle or wheels be attributed to the quality of the material composing them. The manufacture of the axle was not known; identification markings were not legible. Judging by the extent of corrosion and pitting present on midsection, it was evidently an extremely old axle.

The tests of the journal, wedge and journal box developed the following information:

Dimension of failed journal:

Diameter adjacent to collar 4.77"
Diameter middle length of journal 4.75"
Diameter adjacent to fracture 4.18"

Location of fracture:

Distance from inside face of collar ... 6.25" to 7.70"

Collar:

Diameter 6.14"; thickness - varied around diameter from .520" up to .590" and back to .520".
Condition of collar - smooth.

Condition of bearing surface of failed journal:

Surface is smooth and comparatively free of scores or unusual bruises. The surface is covered with a film of oxide, result of heat. No beads of melted brass or babbitt. The elongated central area has a heavy oxide scale, result of heat.

Character of fracture:

The break took place in two stages; i.e., first, rupture occurred angularly for a depth of about 5/8", when while rotating under load the remaining central area elongated and twisted off. The stub end left on the axle was then further elongated and distorted as a result of riding on wedge and box after major failure. There were numerous cracks, and surface is covered with a thick coat of scale, result of heat.

Kind of material in journal:

Forging grade plain carbon steel.

Chemical Analysis

	<u>Failed Journal</u>	<u>Former A.A.R. Limits</u>	<u>Present A.A.R. Specification Limits</u>
Carbon.....	.44%	.38-.52%	.40-.55%
Manganese..	.41	.40-.60	.50-.90
Phosphorus.	.010	.05 maximum	.05 maximum
Sulphur....	.028	.05 "	.05 "
Silicon....	.009		

Etch of longitudinal section through length of journal:

Shows normal macrostructure for this grade of steel and no indication of segregation. Further, as indicated by the two lines extending across the section, one at the collar, and the other at the junction of the surface of journal with fillet at dust guard fit, the journal had been heated to a sufficiently high temperature and for a sufficiently long period that by conduction the entire cross section and length of journal was heat affected. Numerous cracks extending inward from the surface are present adjacent to the fracture, and most of these cracks are filled with brass. The cracks in question are not true ruptures

but are due to intergranular penetration of brass, at some points to extent of bringing about complete disintegration of the metal structure. The condition present is characteristic result of critically heated steel while under critical tension stress coming in contact with molten brass.

Wedge:

The wedge was distorted when received. This is a cast malleable iron wedge of a cored box type. There were 14 vertical supporting lugs. As received for examination none of these lugs were joined to both walls, indications being that in casting complete union did not take place or due to shrinkage they pulled away from the top surface. There are imprints of the ends of the lugs on the surface of the top wall. Also, as received, two cracks were present, one the length of the wedge on inner face at the juncture of the shoulder and inner wall. The face of this fracture showed heat discoloration, indicating if not present prior to accident at least rupture took place during the accident. The other crack was at the top corner, at the junction of the shoulder top wall, sections between openings being broken. Fractures were bruised, and it is not possible to state if same were of recent origin. The wedge does not conform to present A.A.R. standard which requires that "Wedge shall be of forged or cast steel and solid throughout without lightening cores or recesses." The above is shown in revision of 1934. The records would indicate reference permitting use of malleable iron was dropped in 1909.

Section of box:

This consisted of a piece of the side wall. This piece was so badly distorted and bruised no information was obtainable.

Concerning the foregoing information Engineer Sedwick made the following comment: The material in the malleable iron wedge, together with design of same, may have been a factor in initiating the failure as outlined below. The investigation shows the journal failed primarily due to being overheated. It is not possible to state from the evidence at hand the initial cause of overheating. However, in view of the design and kind of material in the wedge, under heavy loading and shock this wedge may have become distorted, resulting in highly localized loading on the journal and bringing about overheating. The head discoloration on the face of the crack in the wedge and the heavy imprints of

the interior supporting lugs on the top wall of the wedge, justifies to a certain extent the above statement. Or, in view of no evidence of melted babbitt on the failed journal, there is a possibility of this lining having been initially loose, or loosened due to distortion of brass by the wedge, or loosened due to break down of lubrication, and as a result the lining "slipped out", permitting brass back of the bearing to contact the steel journal. When the brass contacting the journal became molten, it penetrated the stressed and heated steel, bringing about disintegration and cracks. Evidence indicates this intergranular penetration brought about a transverse angular break around the axle, 5/8" deep, when the central area being no longer able to withstand existing loading failed by elongating and twisting off. When this journal failed, a heavy thrust load toward the opposite side may have taken place, resulting in failure of the wheel at that side.

Observations of the Commission's Inspectors

R.I. 157356 was a wood superstructure box car with steel center sill. Stencilling on the car showed: date built, 10-19; light weight, 45,400 pounds; load limit, 90,600 pounds; air brake cleaned by C.R.I. & P. at SV, 3-10-38; journal boxes repacked by C.R.I. & P. at SV, 4-27-37. The 5x9 inch journal which failed was located at L-3 position, which was the lead wheel of the rear truck, right, or south, side, in the east-bound train.

The Commission's inspectors made an examination of the truck that failed. At that time the journal box and brass from the L-3 location were missing, but a part of the box housing, the wedge and the outer end of the journal were available. All of the brake hangers and brake beams were in place, except that the brake shoe key at the L-3 position had been bent and had permitted the brake hanger to become disconnected at that point. All box bolts and nuts were in place except at the L-3 location where the box and box-bolt nuts were missing; the box bolts were still in place but were badly bent. The wheel opposite the one at the L-3 location was badly damaged with all of the flange and part of the tread missing, evidently a result, and not the cause, of the accident. The truck had Andrews solid steel truck sides. The three remaining journal boxes were equipped with Symington covers, and were in good condition. The track from Tinley Park to Oak Forest was inspected, but no indication of anything wrong could be found.

Discussion

It was apparent that the rear truck of the seventh car in the train, R.I. 157356, was the first to be derailed, and an examination of this truck showed that the journal at the L-3 location

had failed and only a blunt conic stub remained outside of the wheel. The evidence is to the effect that immediately after the derailment this stub was warm but it was possible to hold the bare hand upon it for a short space of time.

The lading of the car was well within the load limit marked on the car. The car had been picked up at Morris, Ill., 41.3 miles west of the point of accident, where it had been inspected by an inspector who considered the journals, bearings and boxes in good condition. A complete inspection of the train was made by the members of the crew at a point 19.3 miles east of Morris, and at Joliet, 2.2 miles farther east, a brakeman stationed on the side of the train opposite to that on which the bearing failed, inspected the train as it passed by him and saw nothing wrong with it. In addition, the members of the crew made observations along the train at curves and saw no indication of a hot box. At Mokena, 10.6 miles east of Joliet, the operator watched the passage of the train and saw nothing wrong. Between Joliet and the scene of the accident, three trains were met by Extra 2594. On each of these trains members of its crew were on the rear platform of the caboose. No signal was received from the first train which was met, a proceed signal was received from the second train, which was met near Mokena, and a stop signal was received from the third train just prior to the emergency application of the brakes which resulted from the derailment. All of the above evidence indicates that there was no sign of a hot box in the train after it left Morris.

On the other hand, the broken-off end of the journal was found at the scene of the derailment; the grass around it was burned, and, in addition, a burnt piece of rope and a burnt piece of paper lay under it. The failed journal was elongated and showed evidence of having been overheated. It also was tapered on both ends of the fracture in a manner typical of burned-off journals, and the taper at the core of the broken-off end was twisted.

It is difficult to reconcile the apparently conflicting evidence. Apparently the only explanation that can be fitted to both sets of circumstances is that the journal was overheated on a previous occasion, but that complete fracture did not take place until shortly before the derailment occurred.

Conclusion

This accident was caused by a broken journal, due to having been overheated.

Respectfully submitted,

W. J. PATTERSON,

Director.