

INTERSTATE COMMERCE COMMISSION

Ex Parte No. 183

ACCIDENT NEAR UTICA, ILL.

Submitted July 17, 1951

Decided August 13, 1951

Accident near Utica, Ill., on July 7, 1951, caused by a defective spring-rail-frog assembly.

R. S. Outlaw for the Atchison, Topeka and Santa Fe Railway Company.

Bruce Drinnell for the Chicago, Rock Island and Pacific Railroad Company.

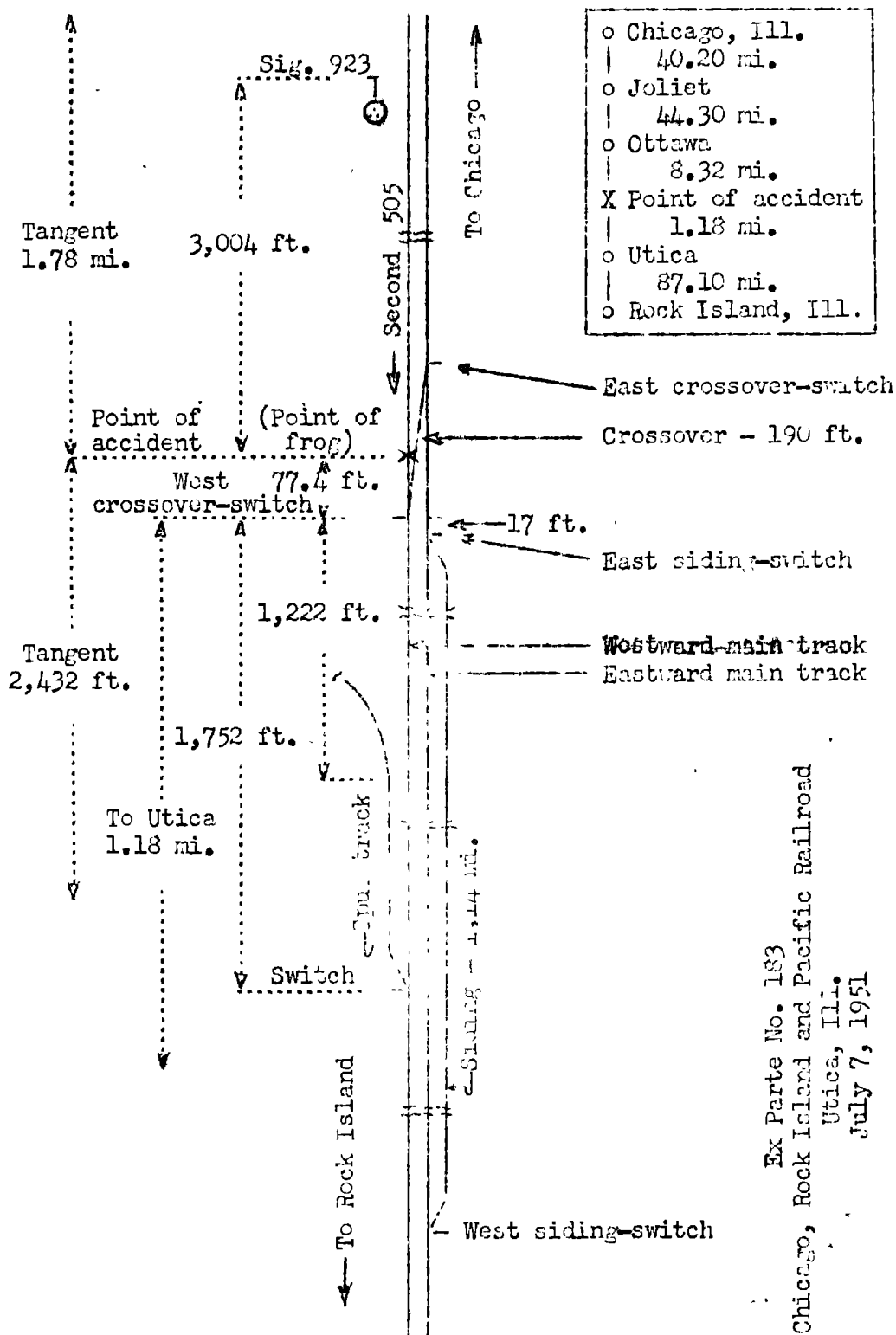
C. R. McEvoy for the Illinois Commerce Commission.

REPORT OF THE COMMISSION

DIVISION 3, COMMISSIONERS PATTERSON, JOHNSON, AND KNUDSON

PATTERSON, Commissioner:

This is an investigation by the Commission on its own motion with respect to the facts, conditions and circumstances connected with an accident which occurred on the line of the Chicago, Rock Island and Pacific Railroad, hereinafter referred to as the Rock Island, near Utica, Ill., on July 7, 1951. Hearing was had at Chicago, Ill., on July 16 and 17, 1951. The accident was the derailment of a passenger train and resulted in the injury of 130 passengers, 16 dining car employees, and 1 train-service employee.



Ex Parte No. 183
Chicago, Rock Island and Pacific Railroad
Utica, Ill.
July 7, 1951

Location of Accident and Method of Operation

This accident occurred on that part of the Rock Island Division extending between Chicago and Rock Island, Ill., 181.1 miles. In the vicinity of the point of accident this is a double-track line over which trains moving with the current of traffic are operated by automatic block-signal and cab-signal indications. A trailing-point crossover 190 feet in length connects the two main tracks at a point 92.82 miles west of Chicago and 1.18 miles east of the station at Utica. A siding parallels the eastward main track on the south throughout a distance of 1.14 miles immediately west of the crossover, and a spur track parallels the westward main track on the north between points 1,222 feet and 1,752 feet west of the crossover. The spur-track switch is trailing point for west-bound movements. The accident occurred on the westward main track at the frog of the west crossover-switch. The main tracks are tangent throughout a distance of 1.78 miles immediately east of the point of accident and 2,432 feet westward. The grade is 0.28 percent ascending westward.

The structure of the westward main track consists of 112-pound rail, 39 feet in length, laid new in 1938 on an average of 22 treated ties to the rail length. It is fully tieplated with double-shoulder tieplates, single-spiked, and is provided with 24-inch 4-hole joint bars and an average of 6 rail anchors per rail. It is ballasted with slag to a depth of 6 inches below the bottoms of the ties on a gravel sub-ballast of 8 inches. Rail ends were built up by field welding during 1944. At the point of derailment the gage was 4 feet 8-1/2 inches, the alinement was tangent, and the south rail was 1/8 inch higher than the north rail.

When the accident occurred the structure of the turnout of the west crossover-switch consisted of a No. 10 spring-rail frog, the angle of which was 5°43'29", 112-pound rails and switch rails, and two manganese 1-piece guard rails 8 feet 4-1/2 inches in length. The frog was 17 feet 10-1/2 inches in length. It was laid new during April, 1947, on 11 treated hardwood switch ties and was provided with bearing plates and a 1-piece base plate. For through movements on the main track, the carrier's specifications require that a 2-inch flangeway be provided between the rigid wing-rail and the frog point. For movements through the turnout, they require that the spring wing-rail be adjusted for a 2-inch flangeway when fully open.

The spring wing-rail was 13 feet 3 inches long. It was held in normal position by a double coil spring. The spring housing was bolted to the base plate at a point 23-1/2 inches east of the actual point of frog. Normally, excessive vertical movement of the spring wing-rail was prevented by two hold-downs, which consisted of horns projecting approximately at right angles from the spring wing-rail into inverted U-shape housings at points, respectively, 4 inches and 43 inches east of the point of frog. These hold-down horns were constructed of 3/4-inch by 3-inch steel, bent double a distance of 8 inches to form the horn, and with a leg in each direction approximately at right angles to the horn. Both legs of the west horn and the east leg of the east horn were bolted to the rail with two bolts, but the west leg of the east horn was bolted with only one bolt. To prevent the spring wing-rail from rising excessively, the specifications required that the hold-downs be adjusted for a maximum clearance of 1/8 inch between the horns and the tops of the housings. Flanges on each side of each hold-down housing rested on the base plate. A square spike-hole extended through each flange and through the base plate underneath. The flanges were welded to the base plate when the frog was installed, but during the fall of 1948 the welds on the flanges of the west housing were broken. Bolts then were inserted into the spike holes to rigidly secure the housings to the base plate. In January, 1949, the flanges were re-welded to the base plate, and the bolts were not removed. Horizontal movement of the spring wing-rail was controlled by the hold-down housings and by stops attached to the base plate. The housings and the stops were so placed that they prevented farther outward movement of the rail after it was fully open. The spring wing-rail was 7 inches longer than the rigid wing-rail, and the free end was flared throughout a distance of 24 inches to permit wheels to open the rail during movement on the turnout. A triangular section, 1/2 inch deep at the apex, 49-1/2 inches east of the point of frog, and tapered to the top of the rail at a point 17-1/2 inches east of the point of frog, where a wheel tread would fully cover both rails, was planed from the top of the spring wing-rail. This channeling was provided so that the treads of wheels moving on the main track during a trailing movement would be over the spring wing-rail before they came in contact with it. The toe joint consisted of a channel toe block of 3/4-inch steel plate 24 inches in length, and two 24-inch 4-hole outside joint bars. The toe block and each joint bar were bolted by four 1-inch joint bolts.

Automatic signal 923, governing west-bound movements on the westward main track, is located 3,004 feet east of the point of accident.

This carrier's Rules and Regulations for Maintenance of Way and Structures read in part as follows:

RAIL AND FASTENINGS AND SHIMMING

383. Frogs * * *

(A) Turnouts must be installed and maintained according to Standard Plan. * * *

* * *

(C) All ties throughout the turnout must be kept firmly tamped. * * *

(D) All bolts in * * * frogs * * * must be kept tight.
* * *

(E) A thorough inspection must be made each working day by track foremen of all turnouts on main line * * * testing and examining switch and switch stand for lost motion, throw, gauge and line through turnout, condition of plates, joint bars at heel of points, switch locks, connecting rod bolts, cotter keys, loose bolts, rivets, point and throat wear of frog, movement of wing rail and its connections, spring bolts, spring housing, hold-down devices; examine guard rails for wear, condition of clamps, gage and bearing on ties.

(F) The proper elevation of stock rail and wing rail of frog must be maintained.

* * *

The maximum authorized speed for the train in this accident was 79 miles per hour.

Description of Accident

No. 21, a west-bound first-class passenger train of the Atchison, Topeka and Santa Fe Railway, hereinafter referred to as the Santa Fe, consisted of Diesel-electric units 21C, 21B, 21A, and 21, coupled in multiple-unit control, one baggage car, one baggage-dormitory car, three chair cars, one dining car, two chair cars, one lounge car, two chair cars, one dining car, one chair car, and one chair-observation car, in the order named. All cars were of light-weight steel construction, and all units were equipped with controlled-slack type E couplers. Because of flood conditions on the line of the Santa Fe, this train was being detoured over the Rock Island and was operating as Second 505, a west-bound first-class train, while on that line. It departed from Joliet, 40.2 miles west of Chicago and its initial station on the Rock Island, at 7:53 p. m., 2 hours 11 minutes late, departed from Ottowa, 84.5 miles west of Chicago and the last open office, at 8:41 p. m., 2 hours 23 minutes late, passed signal 923, which indicated Proceed, and while moving at a speed of 79 miles per hour the left rear wheel of the fourth Diesel-electric unit, the left wheels of the front truck of the first car, the rear truck of the first car, the second to the thirteenth cars, inclusive, and the front truck of the fourteenth car were derailed at or in the vicinity of the frog of the west crossover-switch 1.18 miles east of the station at Utica.

The fourth Diesel-electric unit and the front truck of the first car were re-railled on the closure rail. The Diesel-electric units and the first two cars remained coupled and stopped 2,884 feet west of the point of derailment. Separations occurred between the second and third, the third and fourth, and the fourth and fifth cars. The trucks and the appurtenances below the floor level of each of the derailed cars were damaged. The first car stopped upright and in line with the track. The second car was derailed to the north, and the rear end of the car scraped the sides of several freight cars which were standing on the spur track west of the crossover. The car was deflected toward the main track at the spur-track switch, and it stopped upright and in line with the track. The north side of the car was badly damaged. The third car stopped on its right side 840 feet west of the point of derailment, with its front end on the track structure, and its rear end 25 feet north of the track. Both sides and one end of the car were badly damaged. The fourth car stopped on its right side, across the track and at right angles to it, with its front end against the rear end of the third car. The sides, roof, and ends were badly damaged. The fifth car stopped upright, with its front end against a freight

car which was standing on the siding south of the eastward main track and its rear end on the westward main track. The other derailed cars stopped upright and approximately in line with the track. The ends of the fifth, seventh, eighth, and ninth cars were considerably damaged.

The train baggageman was injured.

The weather was clear at the time of the accident, which occurred at 8:50 p. m.

The Diesel-electric units of Second 505 were of the O-4-4-0 classification. The first and the fourth units were 50 feet 8 inches in length, and were provided with control compartments. The second and the third units were of the booster class, and were 50 feet in length. The total length of the four units coupled was 201 feet 4 inches. The trucks upon which the traction motors were mounted were of the swing-motion type, and their wheelbase was 9 feet. The truck centers of each unit were spaced 30 feet apart. The total weight of the four units in working order was 987,800 pounds. The specified diameter of the driving wheels was 40 inches. All driving-wheel journals were equipped with roller bearings.

Discussion

Because of flood conditions on the Santa Fe, Second 505 was being detoured westward from Joliet over the Rock Island. The cab-signal equipment on the Diesel-electric units was not operative after the train departed from Joliet because the cab-signal equipment in use on the Santa Fe differs from that in use on the Rock Island. For this reason an absolute block was maintained ahead of the train, and the speed was restricted by train order to 79 miles per hour. As Second 505 was approaching the point where the accident occurred the enginemen and the engineer-pilot were maintaining a lookout ahead from the control compartment at the front of the first Diesel-electric unit, and the members of the train crew were in various locations in the cars of the train. The speed was 79 miles per hour, as indicated by the tape of the speed recording device. The brakes of the train had been tested and had functioned properly when used en route. Automatic signal 923 indicated Proceed. Before the accident occurred the Diesel-

electric units and the cars were riding smoothly. Soon after the Diesel-electric units passed over the frog where the accident occurred, the brakes of the train were applied in emergency as a result of the accident.

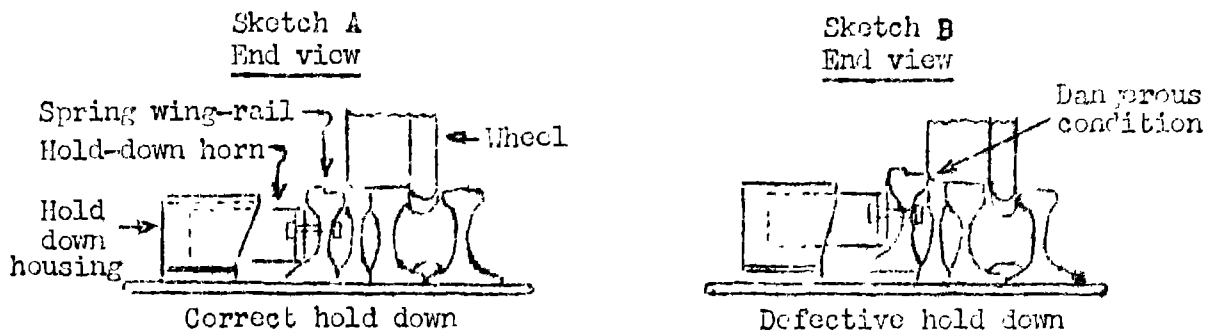
Examination of the equipment after the accident occurred disclosed no defective condition which could have contributed to the cause of the derailment. The left rear wheel of the fourth Diesel-electric unit had a circular band on the rim $3/8$ inch to $7/16$ inch wide with its outside edge starting $5/8$ inch from the tread. The mark apparently was caused by rubbing action. The two left wheels of the front truck of the first car each bore a circular mark approximately $1/8$ inch wide on the radius of the rim.

Examination of the track throughout a considerable distance eastward from the frog involved disclosed no indication of defective track, dragging equipment, or of an obstruction having been on the track. The surface, gage, and alinement were well maintained. Westward from the frog the track was destroyed throughout a distance of 841 feet. The turnout of the spur track was destroyed, and the main track throughout a distance of 771 feet west of the spur-track switch was damaged.

Examination of the frog assembly disclosed that at a point in the channeling of the spring wing-rail where the rim of a wheel moving in a trailing direction on the main track normally would first pass over the inside of the rail, the top of the rail was battered in a manner which indicated that it had been struck by wheels during a considerable period of time. The battering continued westward on top of the rail and parallel to the main track and increased in depth toward the inside of the rail until at a point opposite the spring housing it was $3/4$ inch deep. At a point between the spring housing and the point of frog, the inside of the spring wing-rail was marked throughout a distance of about $1/2$ inch from the top of the rail. This mark continued westward on the gage side of the rail a distance of about 9 feet. The surface of the mark was smooth and indicated a heavy rubbing action which diminished in intensity west of the point of frog. The welds on the flanges of the west hold-down housing were broken, and the heads of both bolts had been pulled through the holes in the base plate. The fractures of the welds were worn smooth which indicated that they had been broken for some time. The weld on the west flange of the east hold-down housing was recently broken, and the bolt was missing from this flange. The weld on the east flange was cracked, but the bolt was in place. The east leg of the east

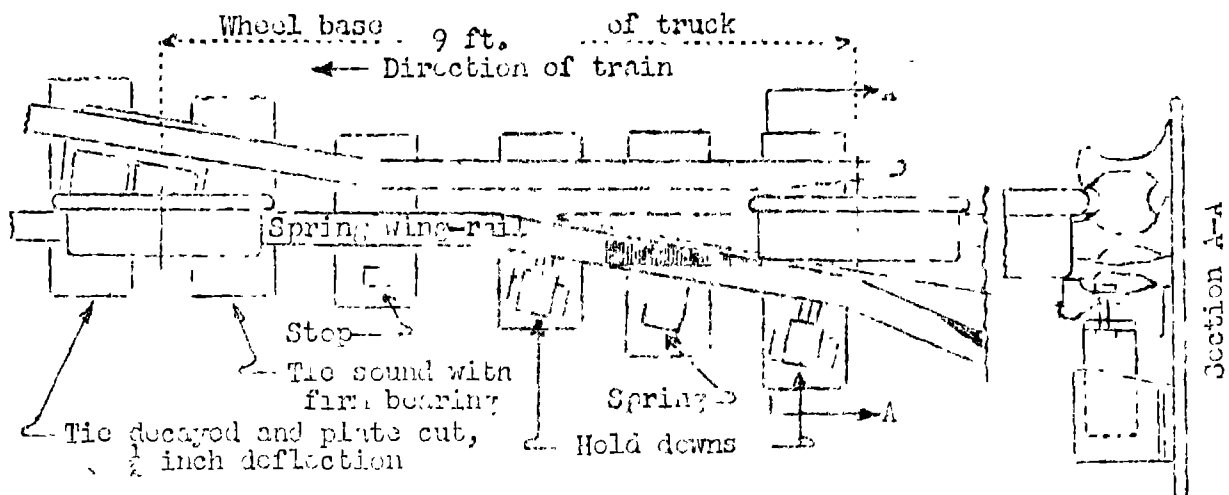
hold-down horn was broken. As a result, the horn was secured to the rail by only the one bolt through the west leg. It was an old fracture. When the housings were placed in normal position after the accident occurred it was found that the vertical clearance between the horns and the tops of the housings of the east and the west hold-downs were, respectively, 11/16 inch and 1/8 inch. The left side of the channel toe block was bent outward and the metal reinforcing strip on the left side of the channel was crushed downward. The four joint bolts which secured the left side of the channel toe block to the rail had been broken in tension. Fractures existed in three of the bolts before they were broken which covered, respectively, 55, 75 and 95 percent of the cross-sectional area. The head of each joint bolt was worn smooth, and each bolt was bent and worn which indicated that the joint had been loose a considerable time before the accident occurred. The switch tie under the east end of the toe joint of the frog was sound and provided a good bearing for the tie plate, but the switch tie under the west end of the toe joint and the next tie westward were decayed and plate cut and there had been a vertical movement of the toe joint of at least 1/2 inch. The top of the receiving end of the next rail was battered by wheel treads and at least one flange had struck the end of the rail. The north main-track rail opposite the frog was canted outward, and the bottom of the guard rail was marked by the base of the main-track rail.

The worn condition of the top of the spring wing-rail indicated that the top of the rail had been rising sufficiently above the frog point-rails to come in contact with the rims of wheels. Sketch A below illustrates the correct position of the spring wing-rail when the channeling is below the tops of the frog point-rails. Sketch B illustrates a defective condition of the frog assembly when the spring wing-rail is raised sufficiently to permit a wheel rim to engage the inside of the rail.

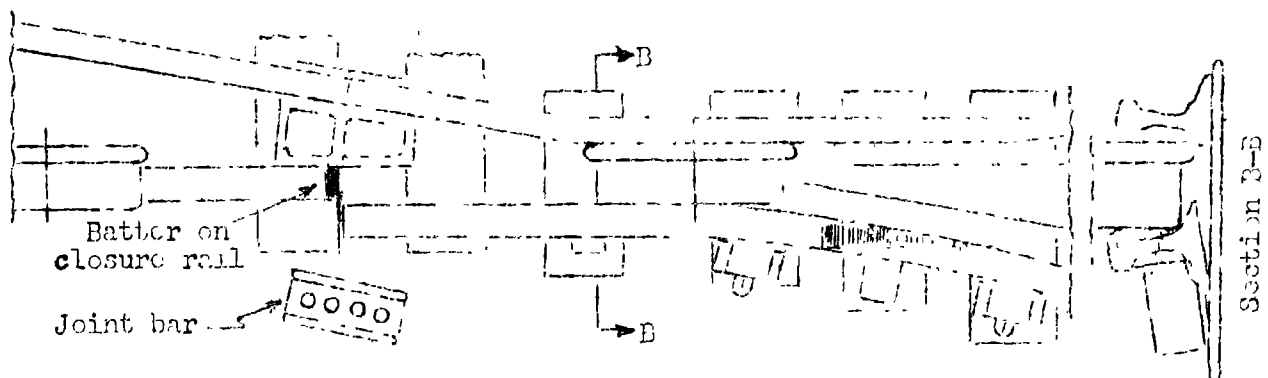


The wheelbase of each truck of the Diesel-electric units was 9 feet, and the distance between the leaving end of the spring

wing-rail and the worn location of the rail was approximately 9 feet. When the Diesel-electric units of Second 505 passed over the frog there was sufficient deflection at the leaving end of the spring wing-rail, combined with excessive vertical clearance in the east hold-down and the defective condition of the west hold-down, to permit the flared end of the rail to rise high enough for the outer edge of the rim of the left rear wheel of the rear truck of the fourth Diesel-electric unit to engage the inside surface of the rail as shown in the following sketch.



The rail was then forced outward and canted, and the wheel dropped inside the rail immediately west of the frog point as shown in the following sketch.



The spring wing-rail was separated from the closure rail when the bolts in the toe joint were broken. The battered condition of the head of the receiving end of the closure rail indicates that the left rear wheel of the rear truck of the Diesel-electric unit and the left wheels of the front truck of the first car were re-railed at this point.

In 1948, investigations were made of two accidents on the line of another carrier, Investigation Nos. 3194 and 3199, each of which was a derailment of a passenger train. Each of these accidents was caused by a defective spring-rail frog assembly and together resulted in the injury of 129 persons. In each case a firm bearing under the toe joint was not provided, which resulted in excessive deflection of the joint under load, the clearance between the hold-down horns and their respective housings was excessive, which permitted the flared end of the wing rail to rise above the frog point-rails when the leading end was under load, and the wheelbase of the trucks of the Diesel-electric units were of the proper length for the leading wheel to deflect the toe joint and permit the wheel face to contact the inside of the elevated wing rail. Instructions were issued on the Rock Island immediately after each of the reports was released to inspect spring-rail frogs, but attention was not directed to a maximum clearance between the hold-down horns and their housings. The section foreman on whose section the accident occurred, a maintenance-of-way foreman who had been working in the immediate vicinity of the point of accident, the roadmaster and the division engineer all testified that before the accident occurred they had never checked the clearance between the hold-down horns and their housings. However, since the accident occurred, the carrier has issued detailed instructions to maintenance-of-way forces which require, among other things, that switch ties be maintained to provide a uniform bearing throughout the length of spring-rail frogs, and that a clearance of not more than 1/8 inch must be maintained between hold-down horns and their housings. If the frog in question had been maintained in accordance with these instructions, this accident would not have occurred.

Cause

It is found that this accident was caused by a defective spring-rail frog assembly.

By the Commission, Division 3.

(SEAL)

W. P. BARTEL,
Secretary.