INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE ST.LOUIS,BROWNSVILLE & MEXICO RAILWAY, MISSOURI PACIFIC SYSTEM, AT RICARDO,TEXAS, ON JANUARY 7, 1929.

March 6, 1929.

To the Commission:

On January 7, 1929, there was a derailment of a passenger train on the St. Louis, Brownsville and Mexico Railway, Missouri Pacific System, at Ricardo, Texas, resulting in the death of one employee, and the injury of one person carried under contract and one employee.

Location and method of operation.

This accident occurred on the Brownsville District of the Kingsville Division extending between Brownsville and Kingsville, Texas, a distance of 118.6 miles. This is a single-track line over which trains are operated by timetable and train orders, no block-signal system being in use. The accident occurred at a point 712 feet north of the station at Ricardo; approaching this point in either direction the track is tangent for a distance of several miles and the grade is practically level. The maximum speed permitted for passenger trains is 45 miles per hour. The track is laid with 75-pound rails, 33 feet in length with an average of about 20 ties to the rail-length, single-spiked, about 50 per cent tie-plated, and ballasted with gravel; the track is maintained in fair condition.

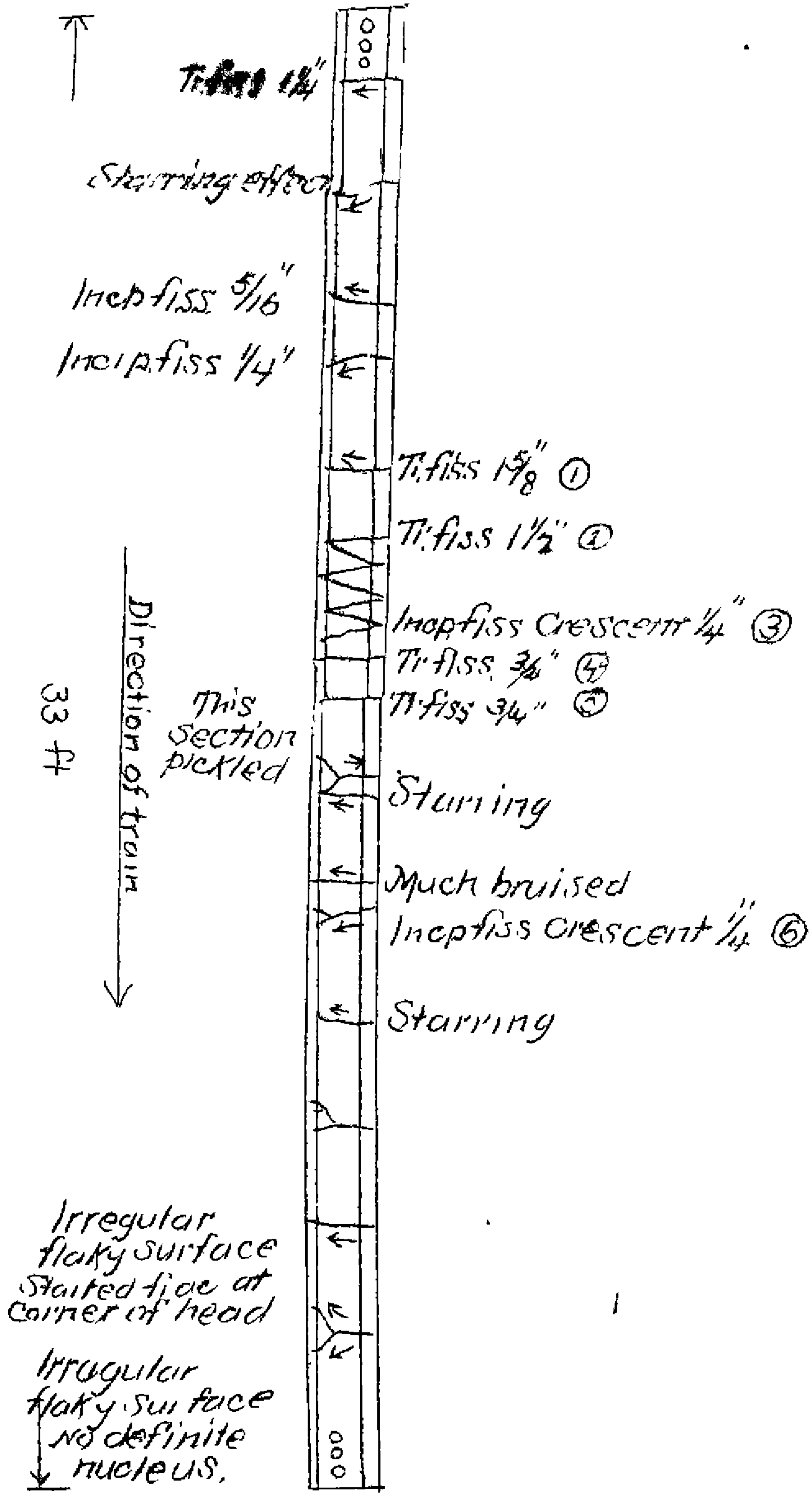
The weather was clear at the time of the accident, which occurred at about 12.35 a.m.

Northbound passenger train No. 14 consisted of one express car, two baggage cars, two coaches and one Pullman sleeping car, all of steel construction except the express car which was of wooden construction, hauled by engine 372, and was in charge of Conductor Brown and Engineman Perrenot. At Harlingen, 87.3 miles south of Ricardo, the crew received a copy of a slow order on Form 19, a part of which restricted the speed of passenger trains to 30 miles per hour between bridge 95-5 and Kingsville, within which territory the accident occurred. This train departed from Harlingen at 10.05 p.m., 1 hour and 20 minutes late, passed Armstrong, the last open office, 52.2 miles beyond, at 11.42 p.m., 1 hour and 21 minutes late, and had just passed Ricardo when it was derailed by a broken rail on the east side of the track while traveling at a speed estimated to have been from 25 to 35 miles per hour.

Broken rail 75 lbs A.S.C.E. Maryland 11111111-06 Heat 34777

Accident on the Gulf Coast Lines, near Ricardo, Texas

January 7, 1929



The engine, tender, the first four cars and the forward truck of the fifth car were derailed to the right, the engine and tender coming to rest on their right sides with the front end of the engine 339 feet north of the point of derailment. All of the cars entirely derailed were partly overturned, the forward end of the leading car being 71 feet and the rear end 21 feet from the track; the other cars remained more nearly in line with the track. The employee killed was the engineman.

Summary of evidence.

Fireman Cogdill stated that approaching the point of accident the engine was riding smoothly and then suddenly dropped to the ground, traveled a distance of about four carlengths and turned over. As soon as the derailment occurred the engineman applied the brakes in emergency and started to close the throttle. Fireman Cogdill estimated the speed at the time of the derailment at not more than 25 miles per hour and thought it had been reduced to about 15 miles per hour when the engine overturned.

Conductor Brown stated that he was in the fourth car approaching the point of accident and his first knowledge of anything wrong was when the brakes applied in emergency, which was followed by the derailment of the car in which he was riding. He had noticed no unusual rocking of the train prior to the accident and estimated the speed at the time to have been between 25 and 30 miles per hour.

The only facts of importance brought out by the statements of Express Messenger Ezell, Brakeman Wilson and Flagman Gale were their estimates of the speed at the time of the accident, which varied from 25 to 35 miles per hour; they also stated that they noticed nothing unusual before the derailment occurred.

The statements of Engineman Ferguson and Fireman Shanks, of train No. 16, the last train to pass the point of accident, at about 12.10 a.m., were to the effect that their train was traveling at a speed of between 25 and 33 miles per hour and that there was nothing about the track conditions to lead them to believe there was a broken rail in that vicinity, although they did notice a few rough spots north of Ricardo. They considered the track safe for a speed of 30 miles per hour or more. Engineman Ferguson said that after arriving at Kingsville he heard his flagman remark about a bad place in the track south of Riviera, which is 8.1 miles south of Ricardo; he did not remember whether the flagman mentioned the exact location.

Flagman Cobb, of train No. 16, stated that when his train reached a point near the north switch at Ricardo he was riding in the rear end of the last car and felt a slight jolt, which appeared to be a low joint on the right or east side of the track. He then went forward and notified the conductor, who was in the next car ahead, of what had occurred, the conductor replying that he felt it but did not think it was serious. After the train arrived at Kingsville the engineman asked him how the train was riding; he informed the engineman that it had been riding smoothly, except there was a little rough place at the north switch at Ricardo and the engineman said there were so many he could not tell that one from the rest of them.

Conductor Sparks, of train No. 16, stated that he noticed nothing out of the ordinary in the vicinity of Ricardo but after passing that point the flagman came forward and inquired whether he had felt or heard anything unusual, the flagman remarking that it made a funny noise and might have been a broken rail. Conductor Sparks said he thought from the way the flagman acted he was excited and did not know what he was talking about, therefore no confidence was placed in what had been said. He knew that the flagman was an experienced man and it occurred to him that if there had been anything wrong the flagman would have stopped the train without consulting him.

Section Foreman Fowler, on whose section the derailment occurred, stated that he passed over the track in the vicinity of the point of accident at about 4.30 p.m., January 6, and noticed no unusual conditions. He has had some trouble from joints churning during wet weather, but said he is allowed an average of six men, which is sufficient to maintain the track in safe condition for traffic at the rates of speed permitted. He arrived at the scene of accident about 10 minutes after its occurrence and after examining the track he concluded the accident was caused by a broken rail.

Roadmaster Scott stated that he arrived at the point of accident at about 4 a.m. and immediately inspected the track in advance of the point of derailment. He found conditions generally fair, with some soft joints about 500 feet south of the point of accident; these joints were not very low. His examination revealed that the accident was evidently due to a broken rail. He further stated that more trouble is experienced in maintaining the track in this locality than on other sections, which condition he attributed to the fact that the rails were rather old and to the kind of ballast in use, as well as to the fact that the soil was different from that at other points; for these reasons it is necessary to place slow orders covering the territory during wet weather. He was of the opinion that the track is safe for a speed greater than 30 miles per hour.

Division Engineer McCord stated that he arrived at the scene of accident at 1.30 a.m. and about 15 minutes later he inspected the rail which caused the accident. This rail was broken into 27 pieces as near as he could determine, the first fracture being 10 feet and 4 inches from the receiving end of the rail. His examination of some of the fractured surfaces disclosed the presence of transverse fissures. Mr. McCord also said that the rail was rolled in 1906 and was laid on another division in 1907; in 1917 it was taken up and relaid on the division on which this accident occurred. He did not think the track was safe for a speed higher than 30 miles per hour.

An examination of the track in the vicinity of the point of accident was made by the Commission's inspectors on January 9 and the gauge and alignment was found to be good but the rails were more or less surface and line bent. Practically all the joints were either swinging or churning, due to the nature of the soil and ballast and the excessive rainy weather which had prevailed in that section for some time. As a result of this condition a slow order had been in effect over this track since about October 1 which restricted the speed of passenger trains to 30 miles per hour and freight trains to 25 miles per hour; it appeared that the track was fairly safe for these speeds.

This accident was caused by a broken rail. An investigation into the reason for the failure of this rail was conducted by Mr. James E. Howard, engineer-physicist, whose report immediately follows:

Report of the Engineer-Physicist.

The rail which broke causing this accident, displayed a number of transverse fissures; the presence of which led to its fracture. It was 33 feet long, weighing 75 pounds per yard, Bessemer steel, and rolled by the Maryland Steel Company, August, 1906, heat number 34777.

The initial point of fracture made in the track was at a transverse fissure located 10 feet 4 inches from the receiving end. This fissure had a diameter of 1 5/8 inches. Five other transverse fissures were displayed in the fragmentation of the rail as it occurred at the time of the accident. They ranged in diameters from 1 1/2 inches down to 1/4 inch. The smallest fissure represented one in its early stage of development. Its nucleus was concentric with a small crescent shaped surface of silvery lustre.

Bright faces, of silvery lustre, are characteristic of tranverse fissures during their incipient stages, until they are developed and air is admitted to the faces of the fracture.

This rail, beyond the first complete fracture, was broken successively into a number of small fragments by the action of the wheels of the engine of the derailed train.

It is probable that the initial fracture of the rail, at the transverse fissure 10 feet 4 inches from the receiving end, occurred and was completed under an earlier train.

The derailment of the engine and perchance some of the forward cars of the train is commonly the case when a rail is broken with a transverse fissure. Depending upon the location of the fissure, with respect to the length of the rail, and the strength of the track structure, speeds as well, the engine or car under which the fracture actually occurs usually remains on the rails, those next following encountering a gap in the track are derailed.

That this unusual derailment was due to the presence of a broken rail when the engine of train No. 14 came upon it appears to be substantiated by the observations of Floyd Cobb, brakeman of train No. 16, which passed over this track a short time before the derailment. Unusual sounds were heard when train No. 16 was in the vicinity of the point of accident, and which a few minutes later occurred. The unusual sounds alarmed Mr. Cobb but his feelings were not shared by others of the train. It is highly probable that the actual rupture of the rail at its initial point occurred under the forward end of train No. 16 and was heard by the brakeman at the rear end of it.

In this connection it may be remarked that common experience of those familiar with the sounds of running machinery pay no attention to ordinary sounds, however noisy the machines may be, but an unusual sound immediately attracts notice and directs attention to the place from whence it issues. Credence is given the impression received by Mr. Cobb. It tallies with other circumstances of the case.

The portion of the rail in advance of the initial point of rupture is commonly exposed to severe blows by succeeding wheels and is broken into small fragments. If incipient transverse fissures are present in this portion of the rail they are or may be displayed on several of the short fragments.

On this occasion there were five additional fissures displayed as previously remarked. Subsequent examination revealed three more fissures in the 10-foot 4-inch piece of rail at the receiving end. In all this rail contained nine transverse fissures in different stages of development. All were located on the gauge side of the head with nuclei 1/2 inch below the running surface. This is nearer the running surface than generally the case. Track conditions are such that 5/8 inch or a little deeper is the more common depth below the top of the head at which transverse fissures have their loci. The influence of track conditions is shown by the fissures generally originating on the gauge side of the head.

A short fragment of this rail, each end of which displayed a transverse fissure, was examined by planing off the top of the head to the depth of the nuclei of the transverse fissures and pickling the exposed surface in hot hydrochloric acid. A zone of metal along the middle of the width of the head displayed a generally shattered state of the metal. This shattered zone had a width about four-tenths that of the head of the rail. It was defined at each boundary by a pronounced longitudinal seam. A zone so completely shattered as this is seldom seen in the interior core of the head of a rail.

Some special remarks are called for by reason of this manifestation. It will be noted that this rail was of Bessemer steel and that it had been in service in the track for an interval of 22 years--a long period. Transverse fissures in Bessemer rails are by no means unique. Data are not at hand whereby a direct comparison can be made between open hearth and Bessemer rails. However, there is no known specific reason structural or chemical why transverse fissures should not appear in rails rolled from either of these processes.

In the present example attention centers on the decidedly shattered state of the metal in the central core of the head of the rail. The several transverse fissures had their nuclei at one edge, gauge side, of this shattered zone. It should be remarked in passing that the shattered zone or core of the head is believed to represent a condition which existed at the time of fabrication and remained during its entire period in service.

Other examples of transverse fissured rails have been witnessed where the nuclei were within the shattered zone; those in which the fissures originated in the sound metal between the shattered core and periphery of the head; and also examples have been shown of transverse fissures in rails in which no shattered metal was found. Three sets of conditions are thus presented: transverse fissures where no shattered metal existed; where there was a shattered core the fissure occurring within the limits of the shattered metal; and where it occurred beyond the limits of the shattered steel.

Whatever the relation of the shattered metal may be, its influence for or against longevity should be reasonably established. Shattered zones represent the results of shrinkage conditions. Modified cooling conditions modify the development of cooling strains.

Shrinkage cracks indicate the relief of internal cooling strains. The development of a transverse fissure is explained as the results of two definite causes, strains set up by the cold rolling action of wheels on the head of the rail and cooling strains acquired at the time of fabrication. Cooling strains are relieved when the metal yields by the formation of cracks. One component affecting the metal at the interior of the head is thus eliminated. Is the elimination of one of the two components an advantage, is an important query. Is the relief of one of these strains beneficial as a whole, or is the formation of shattering cracks a disadvantage offsetting the elimination of one component which has a tendency to result in transverse fissures. This is a question affecting the durability of rails against the formation of this dangerous type of fracture.

Information upon this feature must come from the examination of a larger number of fissured rails. Efforts to correct an error must be preceded by a demonstration that it is an error which is under consideration.

Ample material is available to throw light upon this matter. Between four thousand and five thousand transverse fissured rails per year have been reported. These examples are reported by the users of the rails, by the railroads. The rails are in the possession of the railroads and available for examination whenever the railroads are in readiness to inaugurate these tests.

These remarks indicate one of the lines of investigation which give promise of furnishing information of value. It is not considered commendable that active efforts are deferred by those who are in position to advance knowledge upon this type of rail fracture, regarded by all as one of the most disquieting dangerous types that is experienced. The problem is a general one, too widely distributed for an individual road to undertake, but a joint problem for united effort. Some at least of the elements involved in the display of transverse fissures are not clouded in obscurity but admit of well directed efforts in their solution.

Summary

The report of the engineer-physicist is that this accident was due to a broken rail, one which probably broke under some other train, and it is also stated that the cause of its breaking may be traced to the presence of transverse fissures.

It is pointed out that transverse fissures are developed as a result of cooling strains acquired at the time of fabrication, and strains set up by the cold rolling action of wheels. In the present case there was a shattered state of the metal in the central core of the head of the rail, the transverse fissures having their nuclei at one edge of this shattered zone. The cooling strains were relieved when the metal yielded by the formation of cracks, but the important question is whether the relief of one of the two strains is beneficial as a whole, or is the formation of shattering cracks a disadvantage offsetting the elimination of one of the components, the cooling strains, which have a tendency to result in these fissures.

Attention is directed to the fact that there is ample material available in the hands of the railroads to throw light on the subject whenever the railroads are in readiness to proceed, and that the problem is too widely distributed for one railroad to undertake, being a problem calling for united effort.

Respectfully submitted,

W. P. BORLAND,

Director.