

INTERSTATE COMMERCE COMMISSION

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REPORT NO. 3398

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION  
REPORTS UNDER THE LOCOMOTIVE INSPECTION ACT  
OF FEBRUARY 17, 1911, AS AMENDED

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GREAT NORTHERN RAILWAY

June 13, 1951

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Accident (derailment) near Cut Bank, Mont., on April 16, 1951,  
caused by a broken axle on rear unit of a Diesel-electric  
locomotive.

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REPORT OF THE COMMISSION<sup>1</sup>

PATTERSON, Commissioner:

On April 16, 1951, about 10:10 a.m., near Cut Bank, Mont., an axle on Great Northern Railway unit 365-C, the rear unit of a three-unit Diesel-electric locomotive, broke while the locomotive was hauling a passenger train at a tape-recorded speed of 44 miles per hour, resulting in the derailment of the rear two units and the first seven cars of the train. Three passengers were seriously injured.

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<sup>1</sup>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.

## DESCRIPTION OF ACCIDENT

Great Northern Railway Diesel-electric locomotive 365, consisting of units 365-A, 365-B, and 365-C, hauling eastbound passenger train No. 2, departed from Wenatchee, Wash., at 7:34 p.m., April 15, 1951, and proceeded without any known unusual incident to O'Neill spur, 1.7 miles west of Cut Bank, Mont., a distance of 573 miles from Wenatchee, where, about 10:10 a.m., April 16, the left No. 4 driving wheel of the rear unit (365-C), which had previously derailed due to a broken axle, struck the heel block of the frog at O'Neill spur while the train was running at a tape-recorded speed of 44 miles per hour, resulting in the derailment of units 365-B and 365-C, a combination baggage and mail car, four coaches, and a coffee car and partial derailment of a dining car.

Train No. 2, The Empire Builder, consisted of the following equipment in the order named: Diesel-electric locomotive units 365-A, 365-B, and 365-C, a baggage and mail car, four coaches, coffee car, dining car, five sleeping cars, and a club car. The train was shown to have been approximately on time at register stations throughout the trip. The last crew change was made at Whitefish, Mont., 125.5 miles from the point of accident, and the train departed from Whitefish at 6:55 a.m. At time of the accident, the engineer and fireman were in their respective seats in the cab of unit 365-A and other members of the crew were back in the train.

Unit 365-C was being operated in reverse motion; hence the left No. 4 driving wheel, the axle of which broke and caused the accident, was the right No. 1 wheel in the direction of movement. Marks on the track indicated the derailment of this wheel occurred 5226 feet west of O'Neill spur at a point 265 feet east of the center of No. 4 curve, an eastbound curve to the right of 4 degrees 2 minutes 27 seconds. The train continued through this curve, then a stretch of tangent track, No. 3 curve to the left, more tangent track, and into curve No. 2, a curve to the right of 2 degrees 12 minutes, until the derailed wheel struck the heel block of the frog at O'Neill spur, resulting in derailment of the equipment previously named.

The first indication of trouble was found at a point 12,000 feet west of Sundance, Mont., approximately 10-1/2 miles from the point of the accident. Here a crossing plank adjacent to the south rail of the track was freshly marked by a flange at a distance of 3 to 3-1/2 inches from the rail. Numerous other marks were found on the track east of this point to the point of the accident.

From Blackfoot, Mont. to Cut Bank, Mont., a distance of 26 miles, the railroad is double-track and provided with automatic block signals except for gauntlet track over the Cut Bank River which is controlled by interlocking signals operated from Cut Bank station. At and in the vicinity of the point of accident the track was in good condition. From Blackfoot to point of accident, there are both ascending and descending grades, but generally descending. Grades to a maximum of 1 percent and curves to 4 degrees 2 minutes 27 seconds are encountered. The grade at the point of the derailment was 0.92 percent descending.

Locomotive units 365-B and 365-C and the first two cars of the train were derailed and tipped to the left; the remaining three coaches came to rest across the tracks; the coffee car and dining car stopped in upright position over and partly over, respectively, torn out track. From the point of the initial derailment to O'Neill spur, the track was damaged by the derailed wheel. The frog at O'Neill spur was badly damaged and beyond the spur several hundred feet of eastbound and westbound tracks were torn out or damaged by the derailed equipment. The train continued 585 feet after the final derailment.

Three women passengers were seriously injured in the derailment and were taken to a hospital at Cut Bank, Mont.

#### DESCRIPTION OF LOCOMOTIVE

Great Northern Railway Diesel-electric locomotive 365, consisting of units 365-A, 365-B, and 365-C, was built by the Electro-Motive Division, General Motors Corporation, at La Grange, Ill., in October 1950; class F 7, wheel arrangement 3(B-B); total weight on driving wheels 720,960 pounds; tractive effort 180,240 pounds. Units A and C were operating type units and unit B was a non-operating type unit. Each unit was equipped with a 16-cylinder, 2-cycle "V" type Diesel engine; cylinders 8-1/2 x 10 inches; 1500 horsepower at 800 R.P.M. Engines were direct connected to the type D-12 main generators. Operating cabs were provided with Chicago pneumatic speed recorder, calibrated from 10 to 120 miles per hour. The locomotive was designed for speed of 89 miles per hour, however, badge plates in the cabs restricted the maximum speed to 79 miles per hour. The locomotive was equipped with Schedule 24 RL brakes, designed to operate either automatically or by electric straight air.

## DESCRIPTION OF PARTS INVOLVED

Unit 365-C was equipped with two swing bolster type trucks, wheel base 9 feet; each truck had four 40-inch wheels when new, journal size 6-1/2 x 12 inches, Hyatt roller bearing, and two axle hung, type D-17-B, 500 horsepower traction motors having a 19 to 58 gear ratio. The traction motors were supported on the axles between the wheels by two support bearings, one adjacent to a wheel and the second adjacent to the axle ring gear, and were supported on the opposite side by a motor suspension nose through an arrangement of springs mounted on the truck transom.

Each motor support was equipped with an axle bearing cap and oil reservoir which carried an 8 x 12-inch bronze bearing shell with silver babbitt bearing surface. The bearing shell had a lubricating opening, 5-1/2 x 7 inches, and an oil lubricator assembly which consisted of a spring-loaded wick carrier plate, 6-1/8 x 6-1/16 x 3/32 inches, supported by four attached conical coil springs located one adjacent to each corner of the plate with centers 1-1/4 inches from side of plate and 1 inch from the inner edge of the back plate guides. The four springs were also attached to the back plate. The wick carrier back plate was attached to the bearing cap oil box by two 1/2-inch cap screws, one located 3/4 inch above and one 1-1/4 inches below the center line of the axle cap opening. Each assembly had three felt wicks attached to metal back plates. Each of the three back plates had a round lug on the upper rear side which engaged a corresponding hole in the wick carrier pressure plate and thus positioned the wick assembly. The lower end of each wick extended to the bottom of the oil reservoir in the axle bearing cap and carried oil by capillary action to the part of the wick in contact with the axle journal.

## EXAMINATION OF BROKEN AXLE AND BEARINGS

After the accident the No. 4 traction motor and wheels of unit 365-C were moved to Great Northern Railway Diesel shop at Havre, Mont., where they were disassembled and examined. It was found that the traction motor support bearing and support bearing journal on right side had been extremely hot. The axle was broken in the support bearing journal 7 inches from the ring gear wheel hub. The traction motor support bearing was badly broken and crumbled, indicating it had been greatly overheated. Measurements adjacent to fillet indicated the original size of the motor support journal on the axle had been 7-63/64 inches or 1/64 inch below the standard size of 8 inches. The ring gear end of the broken axle indicated that a progressive

fracture started 7 inches from the ring gear hub and developed to approximately 2-1/16 inches in depth. The crack was 7 inches in length through the axle and approximately 10 inches on the circumference of the axle. At the bottom of the fracture, the break progressed approximately 7/8 inch lengthwise from the gear end of the axle where the break was completed through the remaining 5-15/16 inch metal of the axle diameter at a distance of 7-7/8 inches from the hub.

The irregular section broken from the axle, approximately 7 x 2-1/16 x 7/8 inches in size was not found. It probably was ground into small pieces between the ends of the broken axle and became part of the debris removed with a magnet from the parts in the motor suspension bearing cap.

The broken short end of the axle, except that part containing the progressive fracture, was burnished, burned to a permanent blue color, and worn to a convex surface. The mating end of the broken axle was upset from the standard size of 8 inches to 8-5/16 inches in diameter at the end. The end was burnished and worn to a convex surface due to tilting of the axle ends under the weight applied to the outside journal boxes. Due to the burnishing action of the two ends of the axle no evidence remained of the manner in which the opposite side of the axle broke.

The ring gear and pinion gear teeth were badly worn and gouged at their ends due to the right No. 4 wheel tilting out under pressure applied to the outside driving box, thus placing the teeth in misalignment. The upper portion of the outside of the gear case was pushed out and cut by the ring gear.

#### EXAMINATION OF OIL LUBRICATOR WICK ASSEMBLY

The lubricator wick pads and metal wick backs were missing. The wick carrier plate showed signs of heat. The anchored back plate of the oil lubricator wick assembly was broken vertically at the inside edge of the two anchoring cap screws which allowed the inside portion of the back plate to drop approximately 3/16 inch. It also allowed this portion of the back plate to move about, thus destroying its guiding action. The break in the back plate was of long standing.

The two outer springs which connected the wick carrier plate to the part of the back plate that remained anchored to the cap were stretched. Whether this represented a condition existing prior to the accident or was the result of an attempt to remove

the wick carrier plate without first removing the anchor bolts is not known. These springs, although stretched, were lively and did not appear to have been damaged by the heat.

The two inner springs which connected the wick carrier plate to the portion of the back plate that was unanchored had a free height of 5/8 inch. A new spring of this type had a free height of 1-3/8 inches. These two springs were lifeless and did not appear to have the strength needed to carry their share of the wick assembly load. Whether this represented a condition existing before the accident or was the result of overheating could not be determined.

Three outer ends of the wick carrier plate guides were polished. The fourth and right top guide was polished on the end but had been worn at an angle, such as it might have occurred if the wick carrier plate had been cocked against the upper inner surface of the back plate outer vertical arm. The back plate surface showed indications of wear at that point. The combination of weak springs on the inside and distorted springs on the outside, together with broken back plate, could have cocked the wick carrier plate.

#### HISTORY OF TRUCK, MOTOR AND AXLE INVOLVED

During the months of February and March 1951 and for some time prior, truck number L-2584, with traction motors 4400 and 4373, was in service on Diesel-electric locomotive unit 350-A. This truck was the leading truck and motor 4373 was in the No. 2 position. On April 2, 1951, truck L-2584 was removed from unit 350-A due to an open armature on motor 4400. On April 3, 1951, axle 260-241 and 242 MX-1-48 was magnafluxed and inspected at the Jackson Street wheelhouse, St. Paul, Minn., and OK'd. No machining was necessary. New wheels were bored and pressed on axle. Wheels were then spun in a lathe and a maximum runout measured on motor support bearing surface of .004 inch recorded. On April 4, 1951, truck L-2584 with traction motors 4389 and 4373 was applied to Diesel-electric unit 365-C, with the truck in the rear position and motor 4373 assembled together with axle 260-241 and 242 MX-1-48 in No. 4 position. From April 4, 1951, to time of failure on April 16, 1951, this assembly had run a total of 8715 miles.

No record was available which would determine whether the axle in question was new or second hand at the time of application to unit 365-C on April 4th. The date applied, the original diameter, and the kind of material were not stamped on the axle

as required by rule 231(b) of approved rules for inspection and testing of locomotives other than steam.

The record of installation of truck L-2584 on unit 365-C, April 4, 1951, showed the following items signed for:

Check oil in journal boxes, tighten plugs and rewire.  
 Check gear grease.  
 Check oil in support bearings.  
 Remove inspection plates and check the wicks or packing.

Notation on the form states "the above work is to be signed off by Machinist applying the new truck". The form was signed and approved by a foreman.

#### INSPECTION AND REPAIR REPORTS

Locomotive 365, units A, B, and C, received a monthly inspection and an air brake inspection at St. Paul, Minn. on April 4, 1951, since which date the locomotive had worked in a passenger pool between St. Paul, Minn. and Wenatchee, Wash.

Work reports from April 4 to date of the accident, on file at St. Paul, Wenatchee, and Havre, Mont., principal maintenance points, were examined. Work reports from February 1 to April 2, 1951 for Diesel-electric locomotive 350, from which truck L-2584 was removed on April 2, 1951 and applied to unit 365-C on April 4, 1951, were also examined.

"Drain water from support bearing boxes" appeared to be a routine report at St. Paul. Item 32 on Routine Maintenance Work Sheet, reading "Check oil level in motor suspension bearings" was also checked off regularly at St. Paul. No other reports were found which would have any bearing on the accident.

#### SUMMARY OF EVIDENCE

The engineer stated that the train had left Whitefish, Mont., 127 miles from Cut Bank, at 7:00 a.m., and was making a leisurely run. There had been no indication of trouble prior to a jerk and derailment. The brakes were not applied at the time. He reached for the brake valve but emergency application caused by the derailment occurred before he could apply the brakes. Leaving

Blackfoot, Mont., 26 miles from Cut Bank, the maximum speed had been that permitted, 60 miles per hour. Approaching the scene of the derailment he had reduced the speed to observe a 50 mile per hour restriction and was about to reduce further to observe a 30 mile per hour restriction. His last observation of speed was 43 miles per hour. His statement in regard to speed was confirmed by the speed recorder tape.

The fireman had had no occasion to go back in the locomotive since leaving Whitefish. He had heard no alarms or bells. On this type of train he is prohibited from going back except when the train is stationary.

Neither the engineer nor fireman had observed anything unusual in the operation of the train. At and approaching the scene of the derailment they were principally concerned with the signals for the interlocking plant over the Cut Bank River bridge gauntlet track.

The conductor and two brakemen were also interviewed. Each had looked out at various places approaching the scene of the accident but had not seen or smelled anything that would indicate trouble. They could add no further information pertinent to the accident.

#### DISCUSSION

Failure of the axle under Great Northern Railway Diesel-electric locomotive unit 365-C caused a serious accident involving injuries to passengers and large property damage. The progressive fracture of the axle appeared to have been caused by overheating, because of dislocation of the broken back plate and weak and distorted springs of the oil lubricator wick assembly and consequent improper alinement of wicks and insufficient oil supply to the motor support journal bearing. Utmost care in inspection, maintenance, and lubrication of motor support bearings is essential to trouble-free operation. In the present case the accident might have been avoided had the defective oil lubricator assembly been detected when the wheels and motor were assembled 12 days prior to the accident.



## CAUSE OF ACCIDENT

It is found that this accident was caused by a broken axle on rear unit of a three-unit Diesel-electric locomotive, resulting from a progressive fracture in the journal of a motor support bearing.

Dated at Washington, D. C., this 13th day  
of June, 1951.

By the Commission, Commissioner Patterson.

SEAL

W. P. BARTEL,  
Secretary.