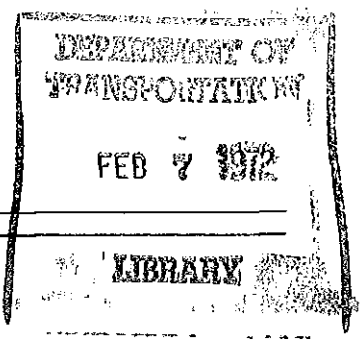


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RAILROAD ACCIDENT INVESTIGATION

REPORT NO. 4159



PENN CENTRAL COMPANY

GERMANTOWN, IND.

APRIL 25, 1969



FEDERAL RAILROAD ADMINISTRATION

BUREAU OF RAILROAD SAFETY

Washington, D C 20591

Summary

DATE: April 25, 1969

RAILROAD: Penn Central

LOCATION: Germantown, Ind

ACCIDENT TYPE: Derailment

TRAIN INVOLVED: Freight

TRAIN NUMBER: Extra 6075 East

LOCOMOTIVE NUMBERS: Diesel-electric units  
6075, 7394, 7408

CONSIST: 110 cars, caboose

SPEED: 61 m p h

OPERATION: Signal indications

TRACK: Double; tangent; 0 10% de-  
scending grade westward

WEATHER: Clear

TIME: 6:10 a m

CASUALTIES: None

CAUSE: Broken truck side frame, result-  
ing from casting defect and metal  
fatigue

DEPARTMENT OF TRANSPORTATION  
 FEDERAL RAILROAD ADMINISTRATION  
 BUREAU OF RAILROAD SAFETY

RAILROAD ACCIDENT INVESTIGATION  
 REPORT NO. 4159

PENN CENTRAL COMPANY

APRIL 25, 1969

Synopsis

On April 25, 1969, a Penn Central freight train derailed at Germantown, Ind, resulting in evacuation of about 400 townspeople due to fire spreading through wreckage that included cars loaded with hazardous materials. No casualties resulted from the derailment or subsequent fire.

The accident was caused by a broken truck side frame, resulting from a casting defect and metal fatigue.

Location and Method of Operation

The accident occurred on that part of the railroad extending eastward from Cumberland to Richmond, Ind, a distance of 57.2 miles. In the accident area the railroad is a double-track line over which trains moving with the current of traffic operate by signal indications of an automatic block signal system, supplemented by a cab-signal system. From the north, the main tracks are designated as No. 2 westward and No. 1 eastward.

At Germantown, 43.7 miles east of Cumberland, a spur track parallels track No. 1 on the south in the immediate vicinity of the station point. Its switch is trailing point for eastbound movements on track No. 1.

The initial derailment occurred on track No. 1, 5170 feet west of the spur-track switch at Germantown. The general derailment occurred 1420 feet east of that switch.

### Track No. 1

From the west on track No 1 there are, successively, a long tangent to the initial derailment point and 1910 feet eastward; a 0°20' curve to the right 690 feet, and a tangent 3390 feet to the general derailment point and a considerable distance eastward

The grade for eastbound trains is practically level 3100 feet west and 1 2 miles east of the initial derailment point and then 0 32% ascending 90 feet to the general derailment point and 1,100 feet beyond

The structure of track No 1 in the Germantown area consists of 131-pound rail, 39 feet in length, laid new in 1941 on an average of 22 treated ties per rail length. It is fully tie-plated with 2 rail-holding and 2 plate-holding spikes per tie plate, and is provided with 6-hole, 36-inch joint bars and an average of 8 rail anchors per rail. It is ballasted with slag to a depth of 12 inches below the ties

### Time and Weather

The derailment took place at 6:10 a m., in clear weather.

### Authorized Speed

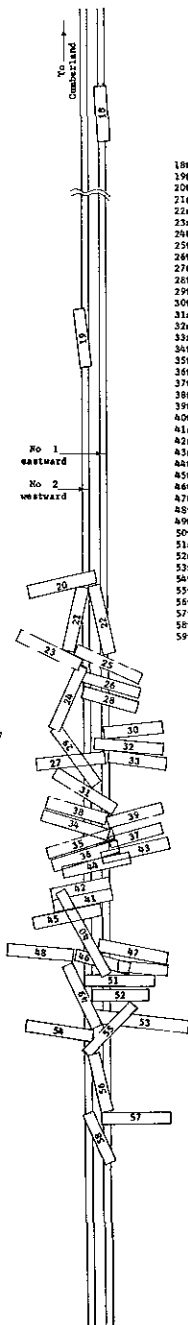
The maximum authorized speed for freight trains in the Germantown area is 50 m p h

### The Accident

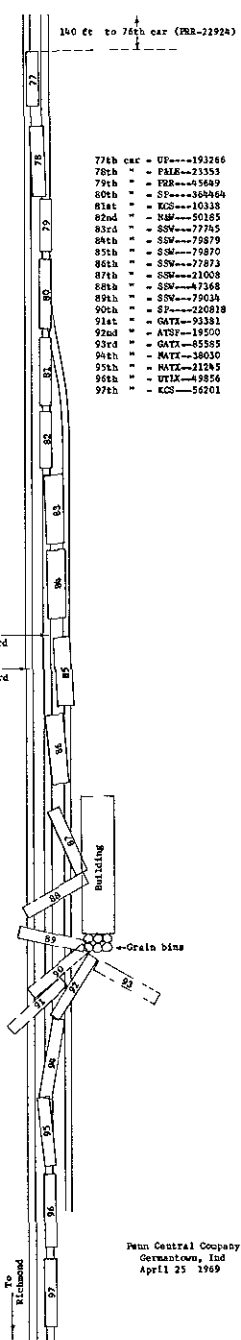
Extra 6075 East, an eastbound freight train consisting of 3 diesel-electric units, 110 cars and a caboose (8523 tons), left Indianapolis, Ind., 12 miles west of Cumberland, at 10:30 p.m. the day before the accident. About 1 hour 45 minutes later, it entered the siding at Riley, 12 miles east of Cumberland, to permit three eastbound trains to pass on track No. 1. At 5:01 a m., it reentered track No 1 and resumed its trip eastward. The engineer and fireman were in the control compartment of the first diesel-electric unit; the front and swing brakemen were in the control compartment of the third unit, and the conductor and flagman were in the caboose. The crew members stated they had made frequent observations of the train while en route toward Germantown and had observed nothing unusual.

At 6:10 a.m., as the train moved eastward on track No.1 at 61 m p h, or 11 m p h over its maximum authorized speed, as indicated by the speed-recording tape, the front pair of wheels of the rear truck of the 18th car derailed to the south, 5170 feet west of the spur-track switch at Germantown. A few moments later, without the crew members being aware of the derailment, the train entered a practically level grade and decreased speed. As it moved at 54 m p h in the vicinity of the Germantown station point, the derailed pair of wheels of the 18th car apparently struck the frog of the spur-track turnout, causing the rear pair of wheels of the same





- 18th car - PRR---608973
- 19th " " GF---52774
- 20th " " UF---53556
- 21st " " WF---14509
- 22nd " " PRR---608974
- 23rd " " PRR---112755
- 24th " " T&F---360338
- 25th " " CG---43246
- 26th " " PRR---609287
- 27th " " PRR---609285
- 28th " " ACIX---59129
- 29th " " UF---498938
- 30th " " SLEX---1530
- 31st " " DWCO---51123
- 32nd " " T&F---17890
- 33rd " " SOO---46186
- 34th " " SAL---21486
- 35th " " UF---497419
- 36th " " GATX---84159
- 37th " " ARGX---121
- 38th " " ARGX---107
- 39th " " GATX---36980
- 40th " " RTTX---100369
- 41st " " NYC---886376
- 42nd " " NYC---88762
- 43rd " " NYC---87313
- 44th " " ATSF---241151
- 45th " " PRR---112597
- 46th " " PRR---112626
- 47th " " SP---651097
- 48th " " PRR---113329
- 49th " " ATSF---521236
- 50th " " NKP---25509
- 51st " " NYC---852317
- 52nd " " GKO---59789
- 53rd " " QTTX---90170
- 54th " " UF---115235
- 55th " " GATX---16171
- 56th " " SAL---23254
- 57th " " OO---474
- 58th " " RMW---164992
- 59th " " CNW---76825



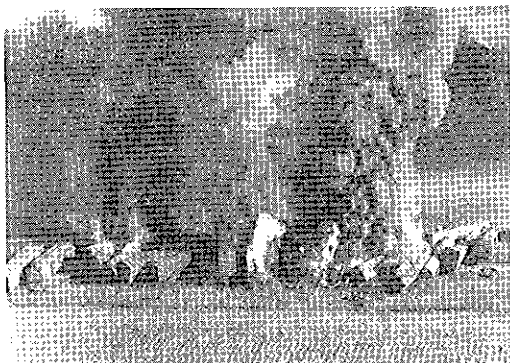
- 77th car - UF---193286
- 78th " " FLEB---23355
- 79th " " PRR---65689
- 80th " " SP---364464
- 81st " " KCS---10338
- 82nd " " RMW---50185
- 83rd " " SSW---77745
- 84th " " SSW---79879
- 85th " " SSW---79870
- 86th " " SSW---77873
- 87th " " SSW---21008
- 88th " " SSW---47168
- 89th " " SSW---79034
- 90th " " SP---220818
- 91st " " GATX---93381
- 92nd " " ATSF---19550
- 93rd " " GATX---85585
- 94th " " MATX---38030
- 95th " " MATX---21245
- 96th " " UTKL---49856
- 97th " " KCS---56201

Penn Central Company  
 Germantown, Ind  
 April 23 1969

truck to derail to the north. Seconds later, the 19th to 58th cars, inclusive, derailed at a point (general derailment) approximately 1420 feet east of the spur-track switch, causing the train brakes to apply in emergency. As a result of forces created by the derailment and emergency brake application, the 76th to 97th cars, inclusive, derailed in the general vicinity of the spur track and some of those cars struck grain bins and a building along the south side of track No. 1.

The derailed cars stopped in two groups on or near the track structures, as indicated in Plate No. 2. The easterly group included the 36th car, a tank car loaded with butadiene, inhibited, a liquefied flammable compressed gas, and the 37th and 38th cars, box cars containing tanks loaded with liquefied ethylene, a flammable colorless gas. Due to punctures and loosened fittings, the contents of these three cars escaped and caught on fire, resulting in fire spreading to several other cars in the easterly group of derailed equipment (see Plate No. 3).

PLATE No. 3



Easterly group of derailed cars.

None of the cars in the westerly group caught on fire. This group contained one tank car loaded with vinyl chloride, and three or four others loaded with combustible liquids or gases not classified as hazardous materials. The tank of one of the latter cars received a puncture, which resulted in loss of its contents. The tanks of the other cars remained intact.

#### Emergency Measures

A few minutes after the accident, a police officer smelled fumes emanating from fire to the derailed cars loaded with butadiene and ethylene. He immediately took action which resulted in the prompt evacuation, as a precautionary

measure, of about 400 Germantown residents living within one-half to one mile of the derailment scene. The evacuation was lifted about 28 hours later.

Fire department forces from several communities in the Germantown area promptly responded to the emergency under a mutual-aid program.

During the evacuation period, emergency shelters were set-up in nearby communities for the Germantown evacuees, with aid and cooperation from the Salvation Army and American Red Cross.

#### Damages

The locomotive with the first 18 cars stopped 4715 feet east of the easterly group of derailed equipment. The 18th car, with all wheels of its rear truck derailed, remained coupled to the 17th car and stopped upright on and in line with the structure of track No. 1. The 19th car stopped on track No. 2 at a point a considerable distance to the rear of the 18th car and about 180 feet east of the easterly group of derailed equipment. The cars in this group (20th through 58th) stopped in various positions on or near the track structures and within a distance of about 485 feet. The 59th to 75th cars, inclusive, remained on the rails and stopped between the two groups of derailed equipment. The westerly group contained the 76th to 97th cars, inclusive.

Of the 63 derailed cars, 29 were destroyed, 26 considerably damaged, and 8 slightly damaged by the derailment impacts and/or subsequent fire.

According to the carrier's estimate, the cost of damages to train equipment and track structures was \$423,000.

#### Casualties

There was no report of injury to any member of the train crew, resident of Germantown, or member of the fire-fighting forces.

#### Train Crew's Hours of Service

All the crew members had been on duty 9 hours 10 minutes at the time of the accident, after having been off duty 17 hours or more.

#### Car PRR 608973

This was the 18th car in the train and was the first to derail. It was an all-steel box car, rebuilt in October 1959, with a length of 51 feet 11 inches over strikers. Its stencilled light-weight, load limit and nominal capacity were 60,700, 150,300 and 140,000 pounds, respectively. The trucks were of the 4-wheel, spring-plank, freight type with 33-inch wheels, 6-inch by 11-inch friction journals, cast bolsters, and cast-steel side frames having non-integral journal boxes. The trucks had a wheel base of 5 feet 10 inches and were spaced 40 feet 11 inches between their centers.



The car was transporting a cargo of 79 lead ingots having a total weight of 149,675 pounds

#### Post-Accident Examinations

##### Track No. 1

Examination of this track throughout a considerable distance west of the initial derailment point disclosed no evidence of an obstruction on the track or a defective track condition having been a causal factor in the accident

Evidence of dragging equipment first appeared 417 feet west of the initial derailment point. It consisted of a scrape mark, 5 inches wide, on a tie and on the field side of the south rail. Similar marks appeared intermittently on ties for a distance of 88 feet eastward, then on every tie to the initial derailment point. At that point flange marks appeared on a tie on the gage side of the north rail and the field side of the south rail, indicating that a pair of wheels, apparently the front wheels of the rear truck of the 18th car, had derailed to the south. The aforesaid scrape and flange marks extended eastward to the area where the structure of track No. 1 was heavily damaged or destroyed throughout a distance of 1140 feet farther eastward by the derailment of the 76th through 97th cars. The track structure was relatively undamaged for 1080 feet east of this area, then was destroyed for 440 feet farther eastward by derailment of the 19th through 58th cars.

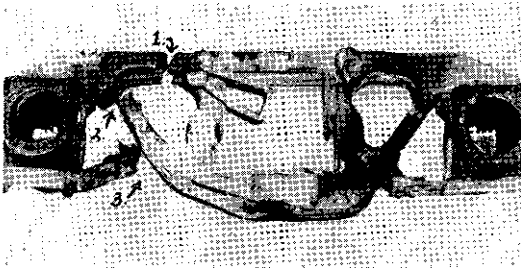
Between the two destroyed-track areas, flange marks caused by the derailed rear truck of the 18th car appeared on the ties, along each side of both rails, with scrape and/or gouge marks appearing on the south ends of the ties and the adjacent ballast shoulder. The head of the south rail also bore evidence of dragging equipment.

##### 18th Car - PRR 608973

The lead-ingot lading of this car was found to be evenly distributed. The car stopped upright with its front end coupled to the 17th car; the front pair of wheels of the rear truck derailed to the south, and the rear pair of wheels derailed to the north.

The side frame on the south side of the rear truck was found broken through at tension and compression members of the casting (see figures 1 and 2 of Plate No. 4).

From all indications, the side frame broke through when the car was moving 5587 feet west of the spur-track switch at Germantown, resulting in the bottom portion dropping sufficiently to contact the south ends of the ties, derailment of the associated front pair of wheels 417 feet farther eastward, and the subsequent general derailment.

PLATE NO. 4

Broken truck side frame of 13th car.  
 Fig. 1 - Broken compression member.  
 Fig. 2 - Broken tension member.  
 Fig. 3 - Broken journal box tie bar  
 bracket.

Derailed Hazardous Material Cars

The 36th car was GATX 84159, a 200,000-pound nominal capacity tank car loaded with 156,130 pounds of Butadeine, inhibited, a liquefied compressed gas. Butadeine, inhibited, is highly flammable and has a flash point of  $-105^{\circ}\text{F}$ . It is a colorless liquid with a mild aromatic odor. In high concentrations, it has an irritating effect upon the skin, eyes, lungs and nasal passages, and can cause unconsciousness or death. The tank head at the "A" end of the car was punctured, apparently by the coupler of another car, in its lower "AR" quadrant. The punctured area, measuring about two by four feet, permitted butadeine to escape and ignite, destroying the car and abetting the spread of fire to other cars in the easterly group of derailed equipment.

The 37th and 38th cars were AROX 121 and AROX 107, all-steel box cars containing one fixed tank each. At the time of the accident the tank of the 37th car contained 43,680 pounds, and the tank of the 38th car 41,850 pounds of

liquefied ethylene This material is a colorless gas with a faint sweet odor. It is non-toxic and non-irritating, but is highly flammable, having a flash point of  $-213^{\circ}\text{F}$ . The derailment caused the tank of the 37th car to be punctured near the center of one side, and loosening of fittings on the tank of the 38th car. The puncture and loose fittings permitted the contents of both cars to escape and ignite, adding to the fire from the 36th car.

The 36th, 37th and 38th cars stopped parallel to and against other cars in the midst of the easterly group of derailed equipment, and all three were destroyed by the fire.

The 94th car was NATX 38030, a tank car loaded with vinyl chloride, a flammable compressed gas. It stopped on one side in the westerly group of derailed equipment. Its tank remained intact.

#### Broken Truck Side Frame - 18th Car

##### Manufacturer

The frame was cast of Grade B steel by American Steel Foundries on June 22, 1923, under Pattern No. 6656 and AAR Code No. 7363.

##### Laboratory Analysis

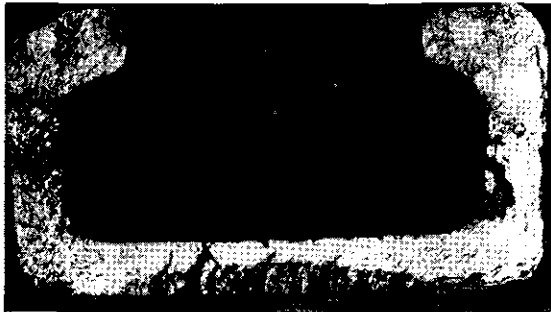
The frame met chemical composition requirements of AAR Specification M-201 for Grade B steel castings. It was found with a compression member and a tension member broken through at points about 16 and 28 inches from the frame center, respectively, and with a bracket for a journal box tie bar broken through at the point where it was attached to the tension member. See Plate No. 4 for fracture areas.

Metallographic, fractographic, and electron-microscopy studies revealed evidence to indicate that the tension member broke as a result of casting defects and metal fatigue. The fracture surfaces showed a heavily oxidized area, about 4 inches wide, along 58% of the bottom surface of the channel cross section (see Photo 1, Plate 5). The metal adjacent to the oxidized area was completely decarbonized, indicating a casting defect resulting from an external hot tear. Secondary cracks were in the hot tear area. A thin zone of minute fracture features typical of fatigue propagation was along the entire edge of the decarbonized metal area. The tension-member break was a typical striate fracture, a characteristic of fatigue fractures. The striation pattern was not uniformly spaced, but was rather complex. Coarsely spaced striations were interspersed with many finer-spaced striations, indicating that both high and low stresses were involved in propagation of the crack.

Planimeter analysis of the tension-member fracture found that approximately 15% of the fracture consisted of casting defects and fatigue cracks. The remaining 85% was new break.

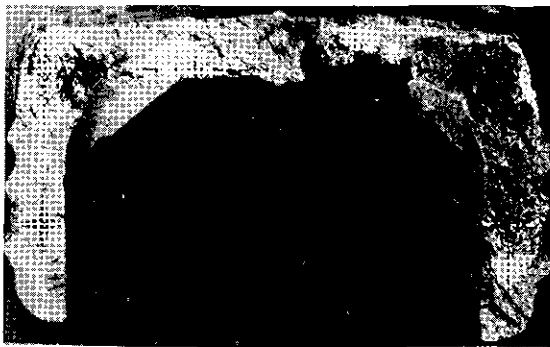
PLATE NO. 5

Photo No. 1



Fracture surface of truck-side-frame tension member.

Photo No. 2



Fracture surface of truck-side-frame compression member.

The studies further revealed evidence to indicate that the compression-member broke by bending, apparently after the tension-member broke. They also revealed evidence which indicated the compression-member fracture originated near the ends of the legs of the channel and propagated upward with the top edge of the channel breaking last, as indicated by a deformed lip on that edge. Approximately 5% of the fracture area consisted of casting defects, either shrinkage porosity or external hot tears. The remaining 95% consisted of new break. See Photo No. 2, Plate 5 for compression-member fracture.

Other fractures in the truck side frame, including the broken journal box tie bar bracket, were analyzed and found to be new breaks caused by the derailment.

#### Findings

1. At the time of the initial and general derailments, the train was moving 11 and 4 m p h, respectively, faster than its maximum authorized speed. This, however, apparently had no significant bearing on the accident.
2. The accident was caused by a broken truck side frame on the 18th car.
3. The tension member of the truck side frame broke due to casting defects and metal fatigue, causing the compression-member to break and drop sufficiently to contact the track structure, resulting in the derailment. The tension member apparently had been cracked for a considerable period of time before the accident.

Dated at Washington, D C, this 5th  
day of November 1970  
By the Federal Railroad Administration

Mac E Rogers, Director  
Bureau of Railroad Safety