RAILROAD ACCIDENT INVESTIGATION

Report No 4112

THE PENNSYLVANIA RAILROAD COMPANY

TRAFFORD, PA.

OCTOBER 26, 1966

Department of Transportation

Federal Railroad Administration

Washington

Summary

DATE:	October 26, 1966
RAILROAD:	Pennsylvania
LOCATION:	Trafford, Pa.
KIND OF ACCIDENT:	Derailment
TRAIN INVOLVED:	Freight
TRAIN NUMBER:	Extra 6120 West
LOCOMOTIVE NUMBERS:	Diesel-electric units 6120, 6074, 6104, 2229, 6027
CONSIST:	67 cars, caboose
SPEED:	4 m.p h.
OPERATION:	Interlocking
TRACKS:	Four; $10^{\circ}00'$ curve; 0.83 percent descending grade westward
WEATHER:	Clear
TIME:	9:17 a.m.
CASUALTIES:	3 injured
CAUSE:	Excessive lateral forces being transmitted to the truck of a long piggyback flat car, displacing its wheels from the rail, due to accumulative buffing forces and the angularity of couplers between two long piggyback flat cars moving over adjoining crossovers.

RECOMMENDATION:

That the Pennsylvania Railroad Company, and all other railroad carriers engaged in hauling flat cars of the long piggyback type and length, immediately take such action as is necessary to eliminate the hazards inherent in movements of long piggyback flat cars, coupled together, over curves of adjoining turnouts while subject to strong buffing or pulling forces.

DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

RAILROAD SAFETY BOARD

RAILROAD ACCIDENT INVESTIGATION

REPORT NO. 4112

THE PENNSYLVANIA RAILROAD COMPANY

OCTOBER 26, 1966

Synopsis

On October 26, 1966, a Pennsylvania Railroad freight train derailed at Trafford, Pa., resulting in the injury of three bridge maintenance employees.

This accident was caused by excessive lateral forces being transmitted to the truck of a long piggyback flat car, displacing its wheels from the rail, due to accumulative buffing forces and the angularity of couplers between two long piggyback flat cars moving over adjoining crossovers

Location and Method of Operation

The accident occurred on that part of the Pittsburgh Division extending between Torrance and Pittsburgh, Pa., a distance of 53.2 miles. In the accident area this is a four-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 south, the main tracks are designated as No. 1, eastward freight; No. 2, westward freight; No. 3, eastward passenger, and No. 4, westward passenger. An interlocking designated as SZ is located at Trafford, 16.8 miles east of Pittsburgh. The interlocking station is on the north side of the track structure, 620 feet west of the Trafford station. A yard track designated as "O" track parallels track No. 1 on the south at the SZ interlocking. A series of crossovers connects the main tracks and "O" track within the SZ interlocking limits, as shown in the sketch appended to this report. Crossover No 7 connects tracks No. 2 and No. 1. It is 180 feet in length, with turnouts having a curvature of $7^{\circ}32'$. The east switch of this crossover is 1,082 feet west of the Trafford station and is facing point for westbound movements on track No 2. Crossover No. 5, which is 233 feet in length, connects track No. 1 and "O" track. Its turnouts have a curvature of $10^{\circ}00'$. The east switch of this crossover is 11 feet west of the west switch of crossover No. 7 and is facing point for westbound movements on track No. 1.

The derailment occurred on crossover No. 5, within the SZ interlocking limits, 35 feet 6 inches west of the east crossover-switch and 1,308 feet west of the Trafford station.

Interlocking signal 14L, governing westbound movements from track No. 2 to "O" track, via crossovers No 7 and No. 5, is 398 feet east of the SZ interlocking station. Automatic signal 3345, governing westbound movements on track No. 2, is 2 miles east of signal 14L.

A steel signal bridge spans the main tracks, 880 feet west of the SZ interlocking station and 192 feet west of the derailment point. Two concrete piers supporting the south end of the signal bridge are between track No. 1 and "O" track.

Details concerning the tracks and crossovers, train, damages, and other factors are set forth in the appendix.

Description and Discussion

Thirteen days before the accident here under investigation occurred, the 6th, 7th and 8th cars of a 96-car westbound freight train routed from track No. 2 to "O" track via crossovers Nos. 7 and 5 in SZ interlocking, derailed while moving over crossover No. 5 at a point 25 feet 8 inches west of its east switch. The derailed equipment, which consisted of 2 piggyback flat cars and a box car, struck the concrete piers at the south side of the signal bridge, dislodging the bridge from its supports.

On October 26, 1966, in the instant case, a bridge maintenance force was repairing the signal bridge mentioned above. Shortly before 9:15 a.m. the operator at SZ interlocking established the route for Extra 6120 West to proceed from track No. 2 to "O" track, via crossovers No. 7 and No. 5.

Extra 6120 West, a westbound freight train consisting of 5 diesel-electric units, 67 cars and a caboose, left Harrisburg, Pa., 195.3 miles east of Torrance at 3:55 a.m. on the day of the accident. It passed Torrance at about 8:35 a.m. Thirty-five minutes later, it passed CP interlocking, 3 8 miles east of SZ interlocking, and was routed from track No. 4 to track No. 2. As the train approached signal 3345, which displayed an Approach aspect, the engineer fully applied the dynamic brake to reduce speed in approach to the SZ interlocking The speed was reduced to about 30 miles per hour as the train passed signal 3345. Shortly thereafter, it moved onto an 0.83 percent descending grade.

The engineer said that as the train moved westward on the descending grade and approached the SZ interlocking, the speed continued to be reduced by the dynamic brake application, and the slack was bunched. He further stated that he did not apply either the automatic brake or the independent locomotive brake at any time as the train approached the derailment point. The speed was reduced to 10 miles per hour, as indicated by the speed-recording tape, when the train neared signal 14L, which displayed a Restricting aspect. Soon afterward, the locomotive passed signal 14L and the train began to diverge from track No. 2 to "O" track, via crossovers No. 7 and No. 5. As the train entered "O" track,

the front brakeman alighted from the locomotive to be in position for subsequent movement of the train from "O" track to another auxiliary track Immediately thereafter, at 9:17 a.m., while the train was moving at approximately 4 miles per hour, the front wheels of the rear truck of LTTX 550092, the 5th car, a loaded piggyback flat car, derailed on crossover No. 5 at a point 35 feet 6 inches west of the east switch of this crossover and 1,308 feet west of the Trafford station. Immediately thereafter, the rear truck of the 4th car; the front truck and rear wheels of the rear truck of the 5th car; both trucks of the 6th and 7th cars, and the front truck of the 8th car also derailed. All the derailed cars were of the long piggyback flat car type and length.

The brakes of the train became applied in emergency during the derailment as a result of damage to the air brake system of the 6th car, and none of the crew members was aware of anything being wrong before this time. The derailed equipment struck the south supports of the signal bridge located 192 feet west of the derailment point, causing the signal bridge to collapse onto the main tracks.

Three members of a bridge maintenance force working on the signal bridge were injured.

Examination of the track structure throughout a considerable distance east of the derailment point disclosed no indication of a defective track condition, dragging equipment, or of an obstruction having been on the track.

The first mark of derailment was a flange mark on the gage side of the top of the north rail of crossover No. 5. It appeared 35 feet west of the east switch of this crossover and extended about 6 inches diagonally westward across the head of the north rail to a point on the field side. Numerous other marks of derailment appeared on the structure of crossover No. 5, but it could not be determined whether they resulted from this derailment or the previous derailment which occurred at this point.

LTTX 550092, the 5th car of Extra 6120 West, was an all-steel piggyback flat car loaded with two highway trailers.

Its light weight, nominal capacity and load limit were, respectively, 57,000, 120,000, and 122,000 pounds. Its height, width, and length over strikers were 2 feet 8½ inches, 9 feet 6 inches and 89 feet 7 inches, respectively. The trucks of this car were spaced 62 feet between truck centers. The car was equipped with F-79 interlocking couplers. Each coupler was 43 inches in length from the center of the pivot point to the pulling face of the knuckle The specified maximum lateral angle of the couplers was 13 degrees, or a specified maximum lateral displacement of 9 67 inches from the coupling line.

GTTX 300196, the 6th car of the train, was an all-steel piggyback flat car loaded with two highway trailers. Its light weight, nominal capacity and load limit were, respectively, 68,500, 130,000, and 135,000 pounds. Its width, height, and length over strikers were 10 feet 3 inches, 3 feet 1½ inches and 85 feet 8 inches, respectively. The trucks of the car were spaced 66 feet 8 inches between truck centers The car was equipped with F-70A interlocking couplers. Each coupler was 29¼ inches in length from the center of the pivot point to the pulling face of the knuckle The specified maximum lateral angle of the couplers was 13 degrees, or a specified maximum lateral displacement of 6.58 inches from the coupling line.

The investigation disclosed that the derailment occurred on crossover No. 5 as the 5th and 6th cars of Extra 6120 West were moving over the west 7°32' turnout of crossover No. 7, the east 10°00' turnout of crossover No. 5, and the intervening 11 feet of tangent track. Considering the previous derailment which occurred on the east turnout of crossover No. 5 on October 13, 1966, and the circumstances involved in the instant case, it is apparent that under certain conditions similar cars of the piggyback flat car type and length, when coupled together in trains moving from track No. 2 to "0" track at SZ interlocking, via crossovers No 7 and No. 5, may be unable to safely negotiate the east 10°00' turnout of crossover No. 5 Because of the reverse curves, with no spirals, formed by the west and east turnouts of crossovers No. 7 and 5, respectively, and the short distance (11 feet) of tangent track between those turnouts, the

coupler angle between long piggyback flat cars moving westward over the crossovers is considerably in excess of the specified 13-degree angle, at the switch of the east turnout of crossover No. 5 and throughout most of the distance between that switch and the derailment point. (See print attached to this report). This condition evidently resulted in considerable increase in the lateral force transmitted to the rear truck of the 5th car of Extra 6120 West as it moved on the east turnout of crossover No. 5. The increased lateral force transmitted to the rear truck of the 5th car combined with the force being tansmitted to that car from the accumulated weight of the buffing action of the cars to the rear, while moving on the 0.83 percent descending grade, evidently was sufficient to cause the wheels of the rear truck of the 5th car to raise from the rails of the east turnout of crossover No. 5 and to derail, resulting in the general derailment.

Findings

All the cars in the consist of Extra 6120 West were of the long piggyback flat car type and length. The maximum coupler angle designed for such cars is 13 degrees. However, due to the reverse curvature of the east and west turnouts of crossovers No. 7 and No. 5, respectively, with only 11 feet of tangent track between the turnouts, the positions of two westbound piggyback flat cars coupled together moving through the turnouts are such that the coupler angle exceeds 13 degrees as the rear truck of the preceding car moves on the east turnout of crossover No. 5, between the switch and the derailment point. Because of the excessive coupler angle, the lateral force transmitted to the rear truck of the 5th car of Extra 6120 West was greatly increased as it moved on the east turnout of crossover No. 5. This increased lateral force combined with the force resulting from the buffing action of the cars to the rear of the 5th car, caused the wheels of the rear truck of the 5th car to raise sufficiently to permit the front pair of wheels of that truck to derail, causing the general derailment.

Cause

This accident was caused by excessive lateral forces being transmitted to the truck of a long piggyback flat car, displacing its wheels from the rail, due to accumulative buffing forces and the angularity of couplers between two long piggyback flat cars moving over adjoining crossovers

Recommendation

It is recommended that the Pennsylvania Railroad Company, and all other railroad carriers engaged in hauling flat cars of the long piggyback type and length, immediately take such action as is necessary to eliminate the hazards inherent in movements of long piggyback flat cars, coupled together, over curves of adjoining turnouts while subject to strong buffing or pulling forces.

Dated at Washington, D. C., this 7th day of July 1967.
By the Federal Railroad Administration, Railroad Safety Board.

(SEAL)

Bette E. Holt
Acting Executive Secretary

Appendix

Tracks and Crossovers

From the east on track No. 2 there are, in succession, a tangent 5,150 feet in length, a 1°00' curve to the right 3,323 feet, and a tangent 2,430 feet to the east switch of crossover No. 7. Westward on crossover No. 7 from the east switch there are, successively, a 7°32' curve to the left 76 feet, a tangent 27 feet, and a 7°32' curve to the right 76 feet to the west switch. Westward from this switch on track No. 1 there is a tangent 11 feet to the east switch of crossover No. 5. Westward on crossover No. 5 from the east switch there are, successively, a 10°00' curve to the left 35 feet to the derailment point and 41 feet beyond, a tangent 81 feet, and a 10°00' curve to the right 76 feet to the west switch. The grade for westbound trains is 0.83 percent descending 3,279 feet to the derailment point and 40 feet beyond, 1.71 percent descending 82 feet, 0.53 percent ascending 75 feet and 0.62 percent descending 507 feet.

The structure of crossovers No. 7 and No. 5 consists of 131-pound rail with No. 10 frogs and 20-foot switch rails.

Train

Extra 6120 West consisted of road-switcher type diesel-electric units 6120, 6074, 6104, 2229 and 6027, coupled in multiple-unit control, 67 piggyback flat cars and a caboose. The derailed cars were of all-steel construction and were equipped with type F interlocking couplers. As the train approached the derailment point, the engineer and front brakeman, the only crew members on the locomotive, and an Assistant Trainmaster, were in the control compartment of the first diesel-electric unit. The conductor and flagman were in the caboose. The brakes of the train had been tested and functioned properly when used en route.

Damages

Extra 6120 West stopped with the front end 825 feet west of the derailment point, the 4th to the 8th cars,

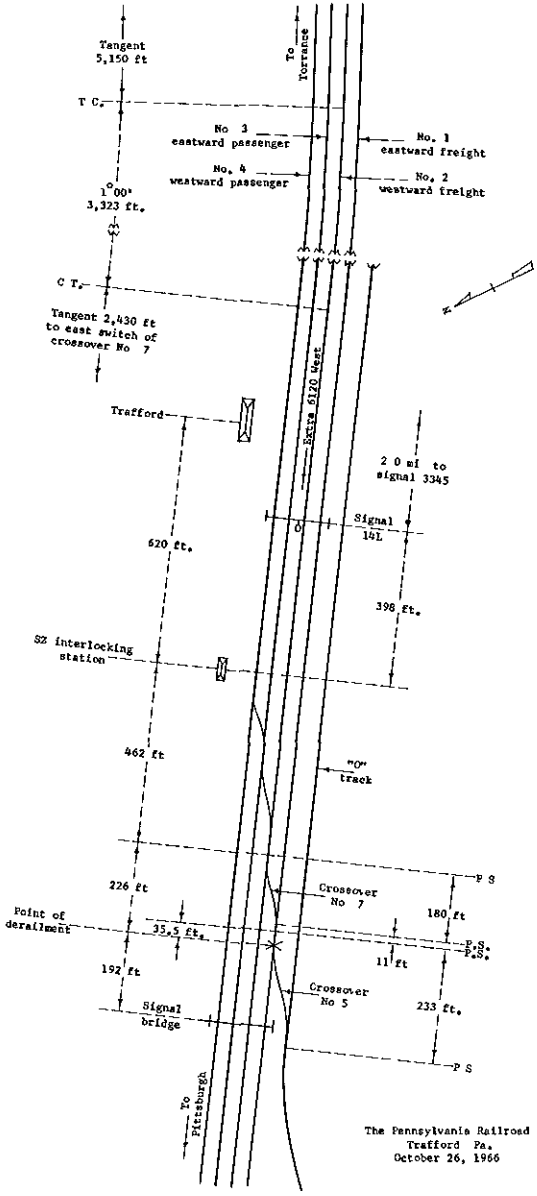
inclusive were derailed. They stopped upright, practically in line with the track structure. Of the derailed cars, 3 were slightly damaged, and 2 were heavily damaged.

Other Factors

The accident occurred at 9:17 a.m., in clear weather

The maximum authorized speed for freight trains in the area involved is 50 miles per hour, but is restricted to 15 miles per hour through the crossovers at SZ interlocking.

According to their daily time returns, all the crew members of Extra 6120 West had been on duty 9 hours 47 minutes at the time of the accident Prior to the accident trip, the engineer had been off duty 12 hours 45 minutes. The conductor, front brakeman and flagman had been off duty more than 24 hours.


Tangent
5,150 ft
To
Torrance
T C.
No 3
eastward passenger
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No. 4
westward passenger
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crossover No 7
Trafford
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Signal
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station
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track
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No 7
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Point of
derailment
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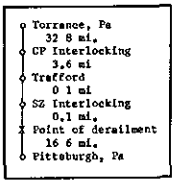
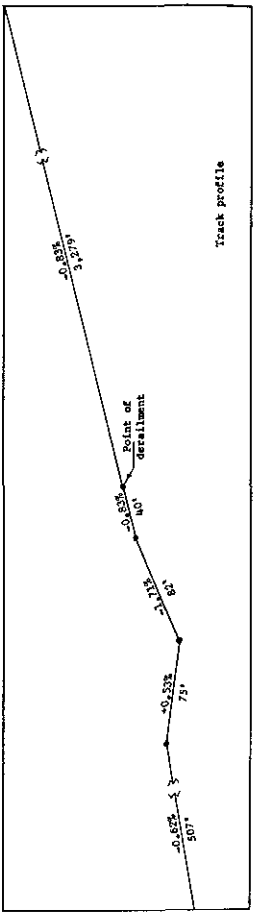
P.S.
P.S.
11 ft
192 ft
Crossover
No 5
Signal
bridge
233 ft.
P S
To
Pittsburgh
The Pennsylvania Railroad
Trafford Pa.
October 26, 1966


Torrance, Pa
32 8 mi.
CP Interlocking
3.6 mi
Trafford
0 1 mi
SZ Interlocking
0.1 mi.
Point of derailment
16 6 mi.
Pittsburgh, Pa


Track profile
-0.83%
3,279'
Point of
derailment
-0.83%
40'
-1.77%
82'
-0.53%
75'
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507'

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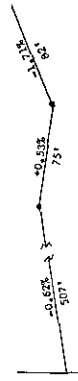
Track profile

derailment



Approximate coupler angles at rear of 5th car, at various locations on crossover No. 5