RAILROAD ACCIDENT INVESTIGATION

Report No. 4123

CHICAGO, SOUTH SHORE AND SOUTH BEND RAILROAD

SOUTH BEND, IND.

APRIL 14, 1967

DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

Washington

Summary

DATE:	April 14, 1967
RAILROAD:	Chicago, South Shore and South Bend
LOCATION:	South Bend, Ind.
KIND OF ACCIDENT:	Collisions and derailment
TRAIN INVOLVED:	Passenger
TRAIN NUMBER:	29
CONSIST:	Electrically-propelled passenger unit 18
ESTIMATED SPEED:	30-40 m p.h
OPERATION:	Timetable, train orders; yard-limit rules
TRACK:	Single; tangent; level
WEATHER:	Clear
TIME:	7:15 p.m.
CASUALTIES:	17 injured
CAUSE:	The accident involving No 29 was caused by pressure loss in damaged pneumatic brake system after striking an object on track and subsequent hand brake failure and loss of electric power, resulting in electrically-propelled passenger unit moving out of control on descending grade until derailed.

DEPARTMENT OF TRANSPORATION

FEDERAL RAILROAD ADMINISTRATION

RAILROAD SAFETY BOARD

RAILROAD ACCIDENT INVESTIGATION

REPORT NO. 4123

CHICAGO, SOUTH SHORE AND SOUTH BEND RAILROAD

APRIL 14, 1967

Synopsis

On April 14, 1967, a Chicago, South Shore and South
and Railroad passenger train struck six automobiles and
erailed at South Bend, Ind Ten persons on the train and
even occupants of the automobiles were injured.

The accidents were caused by pressure loss in damaged
neumatic brake system after striking an object on track and
ubsequent hand brake failure and loss of electric power,
esulting in electrically-propelled passenger unit moving
ut of control on descending grade until derailed.

Location and Method of Operation

The accident occurred on that part of the railroad ex-
ending between Michigan City and South Bend Terminal, Ind ,
distance of 34.1 miles. In the accident area this is a
ingle-track line over which trains operate by timetable,
rain orders, and yard-limit rules. There is no block-
ignal system in use. A catenary system is provided for the
lectric propulsion of trains

The railroad terminates at South Bend Terminal, 0 1
ile east of the South Bend station. A system of five
ub yard tracks is connected to the east end of the main
ack at South Bend Terminal, as indicated in the sketch
ppended to this report. From the north, the yard tracks
e designated as Nos 1, 2, 3, 4 and 5 Throughout a
nsiderable distance west and a short distance east of the

South Bend station, the main track is laid in the center of LaSalle Street.

The collisions occurred on LaSalle Street, 421, 344, 32 and 6 feet west, and 70 and 108 feet east, of the east end of the South Bend station. The derailment occurred at South Bend Terminal, at the east end of stub yard track No. 4 and 1,167 feet east of the South Bend station.

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

Description and Discussion

No. 29, an eastbound first-class passenger train consisting of electrically-propelled passenger units 18, 28, 212, 11, 16, 205 and 20, in that order, left Randolph Street, Chicago, Ill., at 5:18 p.m., on time. At Gary, Ind., 24.9 miles west of Michigan City, units 16, 205, and 20 were detached from the train. On arrival at Michigan City, a crew-change point for some runs, units 28, 212 and 11 were also detached from the train and the incoming crew was relieved by a crew comprised of an engineer and conductor. The engineer of the incoming crew said the train brakes had been tested before leaving Chicago and had functioned properly at that time and when used en route to Michigan City. He said the air pressure regulating device of the first unit (passenger unit 18) was set for 70 pounds brake pipe pressure and 110 pounds main reservoir pressure.

No. 29, consisting of passenger unit 18 only, departed from Michigan City at 6:38 p.m. Its brakes were tested before departure, and no exceptions were taken.

Full details relating to the engineer's actions and observations while en route from Michigan City to South Bend could not be developed, as he was hospitalized during the investigation due to severe leg and head injuries. He stated that he could not recall any of the events occurring immediately before or after the accident

According to the conductor, the train proceeded eastward at approximately 70 miles per hour after leaving Michigan City At Hudson Lake, 15.2 miles west of South Bend, it made an uneventful stop to discharge passengers, and the conductor noticed nothing unusual. At New Carlisle, 13 6 miles west of South Bend, the train reduced speed from about 70 miles per hour to 15 miles per hour, as required for a short speed-restriction zone, indicating its air brake system was functioning properly at that time. After passing New Carlisle, the train accelerated to about 70 miles per hour, its maximum authorized speed, and apparently was moving at that speed as it approached two successive curves to the left and right at Bendix, 2 3 miles west of the South Bend station Between Bendix and South Bend Terminal, the maximum authorized speed for all trains is restricted to 10 miles per hour.

As No 29 neared Bendix and the speed-restriction zone, the engineer apparently moved the handle of the automatic

rake valve to service position, to apply the automatic ir brake and reduce speed as required, but found this action as ineffective in retarding the train He then evidently oved the handle to emergency position and found this action o be ineffective also, indicating that the air brake system ad become inoperative. Immediately afterward, from all ndications, the engineer moved the handle of the reverser o reverse position and applied power in reverse This ction was effective, according to statements of the conduc- or and a passenger, in reducing the speed to 35 or 40 miles er hour when the train entered the first of the two curves t Bendix. The reduced speed, however, was too fast for the urves The unit swayed excessively as it proceeded through he curves, causing the pantograph to foul supporting wires f the catenary system. As a result, the pantograph broke ff from its supports and fell to the ground alongside the rack structure at the curves, resulting in loss of power rom the catenary system to the unit, including the air com- ressor The excessive swaying action while moving through he curves also caused luggage to fall from the overhead acks in the passenger compartment, at which time the conduc- or and passengers first realized something was wrong.

The conductor promptly proceeded forward to the vestibule t the front of the train and saw that the automatic brake alve, at the control station on the right side of the estibule, was in emergency position At this time, according o the conductor, the engineer was applying the hand brake ocated on the left side of the vestibule, indicating the ngineer had realized that the automatic air brake was inoperative and electrical retardation features unavailable A passenger followed the conductor to the front vestibule nd assisted the engineer in applying the hand brake. He aid while they were tightening the hand brake, they felt a sudden loss of tension on the brake wheel, indicating the and brake had also become inoperative and had lost its effectiveness Meanwhile, the conductor reentered the passenger compartment and warned the passengers to prepare themselves for an accident. By this time, the train had entered LaSalle Street, South Bend, and was moving at an estimated speed of 30 to 40 miles per hour on a slightly descending grade, without any braking capability

While proceeding out of control in the middle of LaSalle Street, No. 29 struck six automobiles at various points between 421 feet west and 108 feet east of the South Bend station Shortly after striking the sixth automobile, it reached the end of the main track at South Bend Terminal and entered the west end of stub yard track No 4, at which time the engineer either jumped or fell to the ground from the doorway on the left side of the front vestibule The train continued eastward on track No. 4, and struck and destroyed a pair of wheel stops attached to the rails near the stub end of that track Immediately afterward, about 7:15 p m , while moving out of control at an estimated speed of 30 to 40 miles per hour, it derailed at the stub end of track No. 4, 1,167 feet east of the South Bend station After derailing, the train continued eastward across a driveway, penetrated the west wall of a building, and stopped with the front end

inside the building and 48 feet east of the stub end of track No 4. It was heavily damaged

The engineer, conductor, eight passengers, and seven occupants of the automobiles struck by the train, were injured

Passenger unit 18 (train No 29) has AMU air brake equipment with a U-4 universal valve It has a M-23 brake valve and a power controller at the control station in the vestibule at each end The air brake system includes five air reservoirs suspended from the underframe of the unit They are designated as the control reservoir, supplementary reservoir; auxiliary reservoir, and main reservoirs The brake piping is so arranged that should a substantial leak occur in the air brake system at, or beyond, the branch pipe connections from the trainline brake pipe and main reservoir supply pipes to the universal valve, a loss of pressure occurs in all the air reservoirs, resulting in loss of all pneumatic braking capability Depletion of pressure in the control reservoir also results in loss of functions of the electro-pneumatic control apparatus Under such circumstances electrical retardation with the pantograph down, utilizing the traction motors to retard the speed in a manner similar to dynamic braking, cannot be effected

Examination of passenger unit 18 after the derailment revealed that the bottom of the supplementary reservoir was normally about 19 inches above the tops of the rails The drain cock at the bottom of this reservoir was damaged and almost completely broken off at the ½-inch connection to the reservoir. Marks appearing on the drain cock and reservoir indicated that the drain cock assembly had not been damaged as a result of the collisions and derailment, but had been damaged sometime prior thereto apparently due to contact with an object on the main track structure The almost complete rupture of the nipple section between the drain cock and reservoir was such that would cause a rapid loss of pressure in the supplementary reservoir This in turn would cause loss of pressure in the control, auxiliary and main reservoirs After the damaged drain cock assembly had been replaced and minor repairs had been made to the brake piping, the air brake system of unit 18 was tested to the fullest extent possible Because of extensive damage to brake equipment of the front truck, the brake cylinder pipe to this truck was plugged for the tests and the truck brakes were cut out The tests revealed that the air brake system functioned properly

Tests were also conducted to determine what effect the broken drain cock assembly of the supplementary reservoir had on functioning of the air brake system For these tests, the air brake system was charged to 92 pounds main reservoirs pressure and 70 pounds brake pipe pressure, and the new supplementary reservoir drain cock was opened to simulate an almost complete rupture in the drain cock assembly. With the automatic brake valve in release-and-running position, the pressure in the main reservoirs and the brake pipe dropped to 32 and 0 pounds, respectively, after an elapsed time

of five minutes The brake cylinder pressure remained at zero throughout this period, indicating that a large rupture in the drain cock assembly of the supplementary reservoir would not cause the air brakes to apply automatically At the end of the five-minute period, the automatic brake valve was moved to emergency position This resulted in 10 pounds brake cylinder pressure and loss of all pressure in the main reservoirs All brake cylinder pressure was lost 45 seconds later It is evident that 10 pounds brake cylinder pressure would have little or no effect in retarding a train, particularly when such pressure is lost within a brief period

The hand brake in the vestibule at the east end of passenger unit 18 is of the vertical wheel geared type. The vertical wheel is 16 inches in diameter and is mounted on a pedestal, which is attached to the cement flooring material of the vestibule To apply the hand brake, a pedal at the pedestal base is depressed Such action moves a vertical trip rod upward, causing a pawl to raise to the position where it engages the ratchet of the geared assembly The vertical wheel is then turned clockwise to wind the brake chain on the drum of the brake assembly, and to apply the brake shoes of all four wheels of one truck by an arrangement of chains, rods, pulleys and levers beneath the floor of the unit The hand brake may be released by removing downward pressure from the pedal and counter clockwise rotation of the brake wheel The hand brake is designed to apply a force of 4,800 pounds on the brake chain

Examination after the derailment disclosed that a connection link for the 3/8-inch alloy hand brake chain under the floor of unit 18 was broken Thus, the hand brake was inoperative The examination also disclosed that the base of the hand brake pedestal had settled in the vestibule flooring sufficiently to restrict downward movement of the pedal Consequently, the pawl could not be raised to proper position for engagement with the ratchet In addition, it revealed that the trip rod spring was rusty and was not properly adjusted to engage the holding pawl with the ratchet

Since the air brake system of No 29 (passenger unit 18) evidently was functioning properly when the train reduced speed to 15 miles per hour at New Carlisle, and the air brake system later became inoperative due to the supplementary reservoir drain cock having struck an object on the track, the structure of the main track between New Carlisle and South Bend was inspected to determine what caused the damage to the drain cock assembly The inspection found a piece of ¼-inch steel cable several feet long on the south side of the main track near Olive, Ind , 3 2 miles east of New Carlisle and 8 1 miles west of Bendix It was looped in the middle area, and bore wheel marks on both sides of the loop From the appearance of the marks, it was evident that the cable had been lying across both rails of the main track and that it had been run over recently The loop in the cable was of sufficient dimension to have come in contact with the drain cock of the supplementary reservoir

The investigation disclosed that the air brake system of No 29 was functioning properly when speed was reduced to 15

miles per hour at New Carlisle. The train approached Olive a few minutes later while proceeding in automatic block-signal system territory at approximately 70 miles per hour, its maximum authorized speed Apparently as it moved in the vicinity of Olive, the front truck ran over the piece of ¼-inch steel cable, which was lying loosely across both rails of the main track, causing the cable to twist and form an upright loop between the rails Immediately afterward, the loop struck the drain cock of the supplementary air reservoir, causing the drain cock to be knocked backward and to be almost completely torn off at its connection to the reservoir. The rupture of the drain cock assembly permitted air to escape from the supplementary reservoir, resulting in depletion of pressure in all air reservoirs of the unit. While the air pressure was being depleted, the train continued eastward at unreduced speed, apparently without the engineer noticing that the air gauge in the control compartment was indicating loss of pressure in the main reservoirs and brake pipe Six or seven minutes after running over the piece of cable, the train neared Bendix By this time, air pressure in the reservoirs was depleted to the extent that the air brake system was no longer effective

The engineer evidently found the air brake system to be ineffective when he manipulated the air brake valve in approach to Bendix and the 10 miles per hour speed restriction zone extending eastward He then moved the reverser to reverse position and the controller to power position No. 1 or No 2 The resultant retardation reduced the speed to between 30 and 40 miles per hour when the train entered the curves at Bendix This speed, however, was too fast for the curves and resulted in excessive swaying of the train, which caused the pantograph to foul supporting wires of the catenary system and to break off from its supports The displacement of the pantograph resulted in loss of power from the catenary system to the unit, including the air compressor, and in loss of control reservoir pressure This in turn resulted in loss of all electrical retardation capability When this occurred, the engineer evidently realized he could not stop the train by manipulation of the controls at his control station, and he began to apply the hand brake in the front vestibule

Due to the poor condition of the hand brake assembly, the engineer apparently experienced difficulty in holding the brake wheel in applied position, and received assistance from a passenger With both the engineer and the passenger turning the brake wheel, the force applied to the brake chain was sufficient to break the chain connecting link under the floor of the passenger unit, resulting in the hand brake becoming inoperative When this occurred, all braking capability of the train was lost Hence, the train continued eastward, out of control on the descending grade, resulting in the collisions and derailment

On April 21, 1967, another eastbound CSS&SB passenger train, consisting of electrically-propelled unit 104, derailed at South Bend Terminal under circumstances somewhat similar to those involving No 29 of April 14th As unit 104 approached the two curves at Bendix, its speed was reduced by a

service application of the automatic brake Soon afterward, the air brake system became ineffective and the engineer further reduced the speed by reversing power to the traction motors While the train was moving slowly, the conductor tested the hand brake and found it to be operative He and the engineer then decided further movement of the unit could be safely controlled by application of the hand brake and by reversing power, after which the unit proceeded slowly eastward on the descending grade toward the South Bend station As the unit neared the station, the conductor or engineer started to apply the hand brake, but found it had become inoperative The engineer then moved the reverser to reverse position and applied power to the traction motors However, a fire immediately broke out above the rear truck and a power cable leading to the rear truck burned through, resulting in loss of retardation from this source Without effective means of retardation available, the train continued eastward out of control to South Bend Terminal, where it entered one of the yard tracks and derailed at the stub end of the track

Examination of unit 104 after the accident disclosed a series of holes burned in the brake cylinder induction pipe over the rear truck With such holes in the brake cylinder pipe of the type of air brake equipment installed on unit 104, no useful pressure could be developed or retained in the brake cylinders of the front and rear trucks Thus, under these conditions, the air brake system of the unit was rendered ineffective The series of holes in the brake cylinder induction pipe were evidently caused by electric arc burns It was evident that the power cable had been in contact with the brake pipe for a sufficient period of time to chafe away enough insulation from the cable for bared wire to intermittently contact the brake cylinder pipe, resulting in the electric arc which caused the holes in the brake cylinder pipe and resulting in the burned off power cable When the latter event occurred, all electric retardation capability of the unit was lost

Examination of the hand brake of unit 104 disclosed that two screws holding the chain hook fixed in the hand brake assembly housing were broken, and that a portion of the brake chain was jammed in the hand brake assembly housing, thereby preventing rotation of the chain drum From all indications, after testing the hand brake near Bendix, the conductor had inadvertently rotated the brake wheel counterclockwise sufficiently beyond the normal full release position to shear the two screws holding the chain hook and to jam the brake chain in the brake wheel assembly Thus, the hand brake of the unit was also rendered ineffective and there was no means to stop the unit on the slightly descending grade after its air brake and control for electrical retardation features became inoperative, resulting in the derailment

Findings

The accident involving No 29 was caused by a combination of factors, i e , ineffectiveness of the train air brake system due to damage sustained by the drain cock assembly of the supplementary air reservoir when the drain cock came in contact with the steel cable lying across the

rails in the vicinity of Olive; ineffectiveness of the train electric control system, due to loss of control reservoir pressure, when the pantograph became displaced as a result of excessive swaying of the train while moving through curves at Bendix, and failure of the hand brake due to a broken brake chain connecting link and to inadequate maintenance of the hand brake equipment A contributing factor was the arrangement of the brake piping in such manner that should a substantial leak occur in the train air brake system at, or beyond, the branch pipe connections from the trainline brake pipe and main reservoir supply pipes to the universal valve, loss of pressure occurs in all the air reservoirs to the extent that all pneumatic braking capability becomes lost. Had the hand brake been properly maintained and had the control reservoir been protected against loss of pressure in the air brake and main reservoirs systems, the accident probably would have been averted.

The accident involving unit 104 on April 21st was also caused by a combination of factors, i e inadequate maintenance of the hand brake equipment, and damage to the brake cylinder piping due to inadequate inspection and improper maintenance of power cable connections between the underframe and trucks

RECOMMENDATIONS MADE AND CORRECTIVE ACTION TAKEN

During this investigation, the factors contributing to the accident were reviewed with carrier management and certain recommendations to preclude repetition were made by the Bureau of Railroad Safety.

Immediately thereafter the carrier took action to -

1 Insure that hand brake equipment on its electrically-propelled passenger units is adequately maintained

2. Operate its trains with consists of no less than two cars, as a measure to provide the safety of an effective train brake in the event of failure of braking equipment of a single unit

3 Investigate measures for modification of the air brake and main reservoir piping arrangement on its electrically-propelled passenger units in such manner that should any loss of air pressure occur because of pipe breakage or other failure in the air brake system, sufficient pressure will be retained in the control reservoir for adequate utilization of electrical retardation features of the equipment

4. Investigate possible installation of a single-unit emergency brake arrangement, separate from the schedule air brake equipment and so located that it will not be susceptible to physical damage, which will make available pneumatic braking adequate to stop an electrically-propelled unit in the event of loss of main reservoir pressure or damage to individual brake cylinders of related piping on either truck

Cause

The accident involving No 29 was caused by pressure loss in damaged pneumatic brake system after striking an object on track and subsequent hand brake failure and loss of electric power, resulting in electrically-propelled passenger unit moving out of control on descending grade until derailed

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

Bette E. Holt
Acting Executive Secretary

(SEAL)

Appendix

Tracks

The main track is tangent between points 1 9 miles west and 500 feet east of the South Bend station Eastward from the latter point there are, successively, an 18°00' curve to the left 185 feet and a tangent 108 feet to the switch connecting the east end of the main track to the west end of the system of stub yard tracks at South Bend Terminal From Bendix to South Bend Terminal, the average grade is 0 25 percent descending eastward

Train Involved

No. 29 consisted of electrically-propelled passenger unit 18, which was built in August 1927 This unit is 77 feet 6 inches long over buffers, weighs approximately 120,000 pounds, and is of all-steel construction except the roof, which is wooden and is covered with treated canvas It has a single passenger compartment with seats for 80 persons It is equipped with two 4-wheel trucks spaced 55 feet 6 inches between truck centers Each truck has 36-inch wheels, roller bearings, two brake cylinders, and two cast iron brake shoes for each wheel

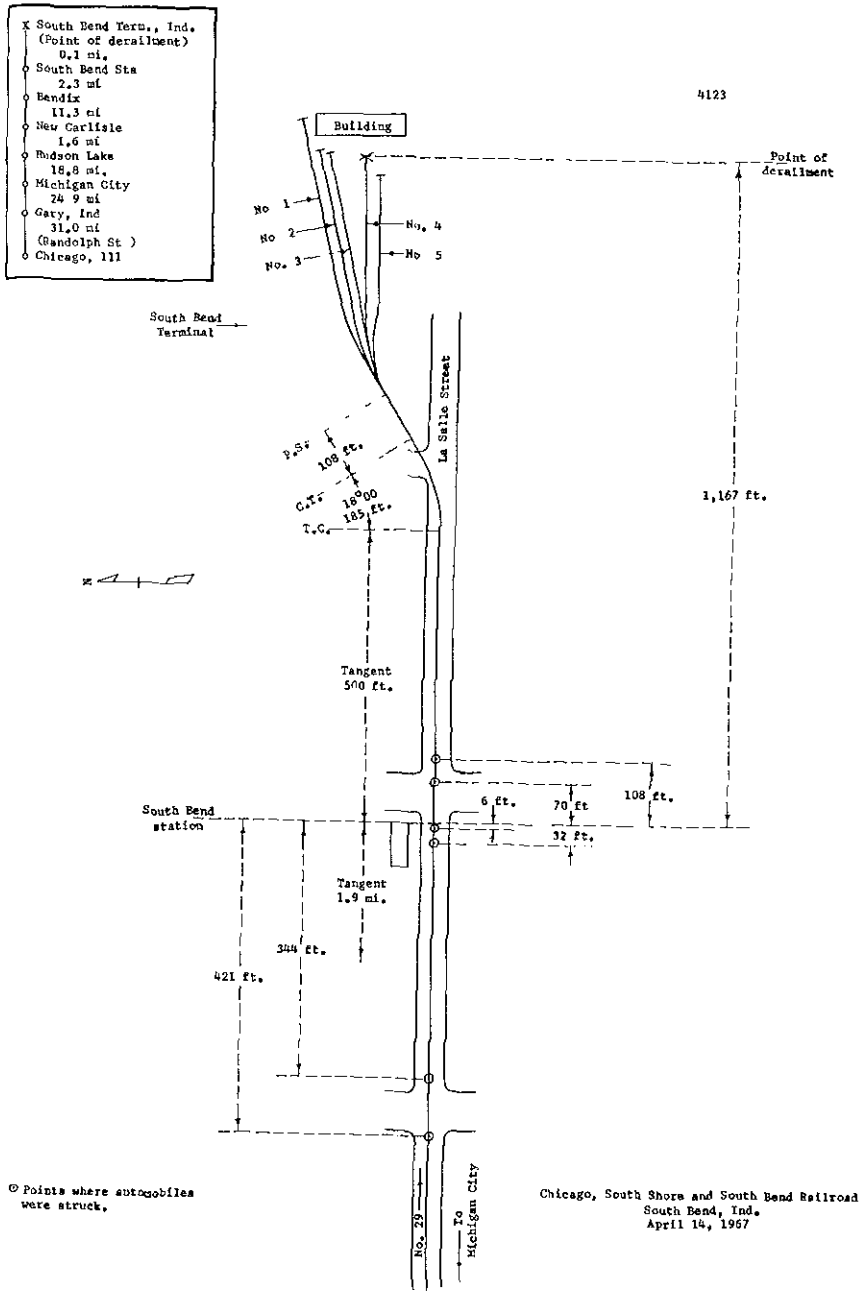
Two pantographs for collecting current from the cantenary system are mounted on the roof at the front and rear ends of the unit One pantograph was in use as the unit proceeded en route from Michigan City to South Bend. A vestibule is at each end of the unit and an engineer's control station is in each vestibule

Other Factors

The accident involving No 29 occurred about 7:15 p m., in clear weather

The maximum authorized speed for passenger trains in the territory involved is 79 miles per hour, but is restricted to 10 miles per hour between Bendix and South Bend Terminal

According to their daily time returns, the conductor and engineer of No. 29 had been continuously on duty 6 hours 41 minutes at the time of the accident, after having been off duty 8 hours.



© Points where automobiles were struck.

Chicago, South Shore and South Bend Railroad
South Bend, Ind.
April 14, 1967