INTERSTATE COMMERCE COMMISSION

WASHINGTON

INVESTIGATION NO. 2938

CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY

REPORT IN RE ACCIDENT

AT NAPERVILLE, ILL., ON

APRIL 25, 1946

SUMMARY

Railroad:	Chicago, Burlington & Quincy	
Date:	April 25, 1946	
Location:	Naperville, Ill.	
Kind of accident:	Rear-end collision	
Trains involved:	Passenger	: Passenger
Train numbers:	11	: 39
Engine numbers:	Diesel-electric units 9920 A and 9920 B	: Diesel-electric units 9910 A and 9910 B
Consist:	13 cars	: 9 cars
Estimated speed:	Standing	: 45 m. p. h.
Operation:	Signal indications	
Tracks:	Three; tangent; 0.24 percent descending grade westward	
Weather:	Clear	
Time:	1:05 p. m.	
Casualties:	45 killed; 69 injured	
Cause:	Failure to operate following train in accordance with signal indications	
Recommendation:	That the Chicago, Burlington & Quincy Railroad Company discontinue the operation of passenger train cars which do not meet present standards, intermingled in trains with cars meeting such standards	
	Consideration of method for controlling speed deferred pending disposition of Docket No. 29043	

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 3988

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY

July 30, 1946.

Accident at Naperville, Ill., on April 25, 1946, caused by failure to operate the following train in accordance with signal indications.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner:

On April 25, 1946, there was a rear-end collision between two passenger trains on the Chicago, Burlington & Quincy Railroad at Naperville, Ill., which resulted in the death of 39 passengers, 4 dining-car employees, 1 employee off duty and 1 train-service employee, and the injury of 48 passengers, 1 porter, 19 dining-car employees and 1 train-service employee. This accident was investigated in conjunction with representatives of the Illinois Commerce Commission.

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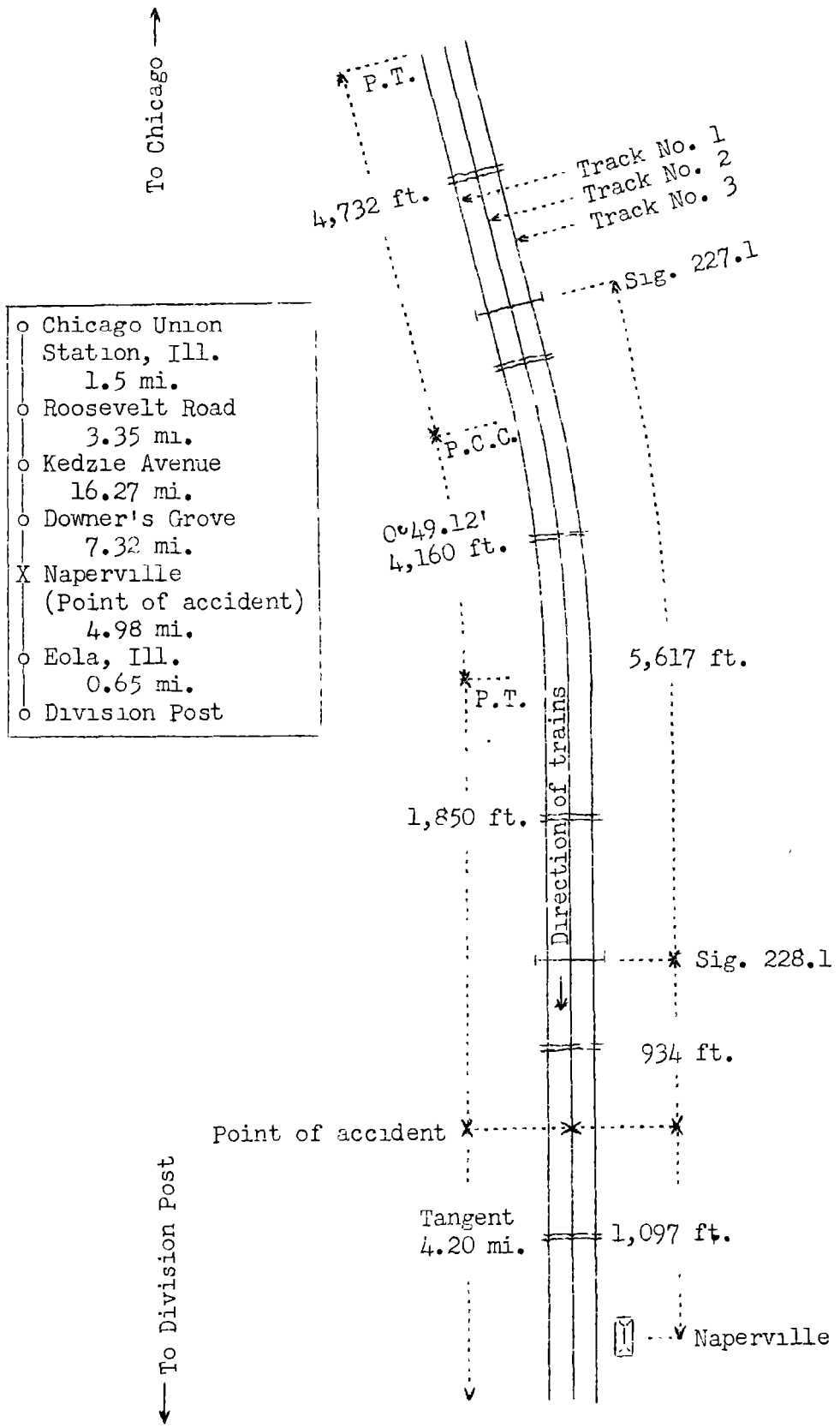
[1]Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.



Inv. No. 2988
Chicago, Burlington & Quincy Railroad
Naperville, Ill.
April 25, 1946

Location of Accident and Method of Operation

This accident occurred on that part of the Chicago Division extending between Roosevelt Road, Chicago, and Eola, Ill., 32.57 miles, a three-track line in the vicinity of the point of accident. The main tracks are designated from north to south as Nos. 1, 2 and 3. Trains moving in either direction on tracks Nos. 1 and 2 and east-bound trains moving on track No. 3 are operated by signal indications. The accident occurred on track No. 2 at a point 1,097 feet east of the station at Naperville, 26.94 miles west of Roosevelt Road. From the east there are, in succession, a tangent 4,732 feet in length, a compound curve to the right 4,160 feet, the maximum curvature of which is 0°49.12', and a tangent 1,830 feet to the point of accident and 4.20 miles westward. The grade for west-bound trains on track No. 2 varies between 0.014 and 0.10 percent descending 3,400 feet, practically level 1,600 feet, 0.60 percent ascending about 1,500 feet, then it varies between 0.11 and 0.27 percent descending 1,815 feet to the point of accident, where it is 0.24 percent.

Automatic signals 227.1 and 228.1, governing west-bound movements on track No. 2, are mounted on signal bridges located, respectively, 6,5 1 feet and 9[illegible] feet east of the point of accident. These signals are of the three-indication, color-light type, and are continuously lighted. The yellow aspect of signal 227.1 is 27.41 feet above the level of the tops of the rails and 5.5[illegible] feet north of the center-line of track No. 2. The red aspect of signal 228.1 is 21.89 feet above the level of the tops of the rails and 6.5 feet north of the center-line of track No. 2. The involved aspects and corresponding indications and names of these signals are as follows:

Signal	Aspect	Indication	Name
227.1	Yellow	APPROACH NEXT SIGNAL PREPARED TO STOP	Approach-Signal
228.1	Red	STOP; THEN PROCEED	Stop and Proceed-Signal

The controlling circuits of these signals are so arranged that, when a train is occupying track No. 2 in the block between signal 228.1 and the next signal westward, signal 227.1 displays approach-next-signal-prepared-to-stop, and signal 228.1 displays stop-then-proceed.

Operating rules read in part as follows:

DEFINITIONS

* * *

Restricted Speed.--Proceed prepared to stop short of train, obstruction, or anything that may require the speed of a train to be reduced.

11. A train finding a fusee burning on or near its track must stop and extinguish the fusee, and then proceed at restricted speed.

14. ENGINE WHISTLE SIGNALS.

Note.--The signals prescribed are illustrated by "o" for short sounds; "___" for longer sounds.
* * *

SOUND. INDICATION.

* * *

(c) ___ o o o Flagman protect rear of train.

* * *

35. The following signals will be used by flagmen:

Day signals--A red flag,
Torpedoes and
Fusees.

* * *

99. When a train stops under circumstances in which it may be overtaken by another train, the flagman must go back immediately with flagman's signals a sufficient distance to insure full protection, placing two torpedoes, and when necessary, in addition, displaying lighted fusees.

* * *

When a train is moving under circumstances in which it may be overtaken by another train, the flagman must take such action as may be necessary to insure full protection. By night, or by day when the view is obscured, lighted fusees must be thrown off at proper intervals.

* * *

509. * * *

* * *

When a train is stopped by a Stop and Proceed-signal it may proceed--

* * *

(B) On two or more tracks at once at restricted speed, expecting to find a train in the block, broken rail, obstruction or switch not properly lined.

Time-table special instructions read in part as follows:

1. When a distant signal is displaying a restricting indication, trains must reduce speed at once and move at "restricted speed" until the indication of the next governing signal can be determined.

37. * * *

* * *

EMERGENCY RED REAR END LIGHTS. Trainmen on trains equipped with oscillating emergency red rear end lights must familiarize themselves with the location of the switches which control the lights and will be governed by the following.

* * *

To provide supplemental protection under Rule 99 in all circumstances where its use is necessary to stop following trains on one or more tracks.

* * *

The use of this emergency red light do s not in any way relieve the flagman from full compliance with Rules 99 * * *.

* * *

The maximum authorized speed for the passenger trains involved was 80 miles per hour.

Description of Accident

No. 11, a west-bound first-class passenger train, consisted of Diesel-electric units 9920 A and 9920 B, one baggage car, one storage-mail car, two baggage cars, one mail car, one refrigerator-express car, two baggage cars, two coaches, one dining car, one parlor-lounge car and one coach, in the order named. The sixth car was of steel-underframe construction, the ninth to eleventh cars, inclusive, were of lightweight stainless-steel construction, and the remainder of the cars were of conventional all-steel construction. This train departed from Chicago Union Station, 28.44 miles east of Naperville, at 12:35 p. m., on time, and, moving on track No. 2, passed Downer's Grove, the last open office, 7.32 miles east of Naperville, at 12:57 p. m., 1 minute late. Soon afterward, some object was seen flying from beneath one of the cars and the train was stopped at Naperville for inspection at 1:03 p. m., with the rear end standing 1,097 feet east of the station. About 2 minutes later the rear end was struck by No. 39.

No. 39, a west-bound first-class passenger train, consisted of Diesel-electric units 9910 A and 9910 B, coupled in multiple control, three coaches, one dining car, two tourist sleeping

cars and three Pullman sleeping cars, in the order named. All cars were of steel construction. This train departed from Chicago Union Station at 12:35 p. m., on time, and moved on track No. 1 to Kedzie Avenue, 23.59 miles east of Naperville, then entered track No. 2, passed Downer's Grove at 1 p. m., 2 minutes late, passed signal 227.1, which displayed approach-next-signal-prepared-to-stop, passed signal 228.1, which displayed stop-then-proceed, passed the flagman of No. 11, and while moving at an estimated speed of not less than 45 miles per hour it collided with No. 11 at a point 934 feet west of signal 228.1.

The ninth car of No. 11 was derailed and leaned to the south at an angle of 15 degrees, but remained in line with track No. 2. The center-sill was twisted and the roof sheets and the end sheets were somewhat damaged. The tenth car stopped on its left side south of track No. 2 and at an angle of 15 degrees to it. Both ends were buckled, the center-sill and cross members were bent, both draft gears were broken and both trucks were damaged. The eleventh car was turned around, bent into an U-shape, stopped north of the tenth car and against it, and was demolished about three-fourths of its length. The knuckle of the front coupler and the shank of the rear coupler were broken. The twelfth car was derailed across track No. 1 and stopped with its front end about 10 feet west of the tenth car and leaned to the north at an angle of 25 degrees. Both draft gears were broken, and both trucks were badly damaged. The front unit of engine 9910 entered the rear car of No. 11 above the floor-line and demolished the superstructure of this car about three-fourths its length. This car remained upright on track No. 2, and at the rear of the eleventh and twelfth cars. The center-sill at the rear end was bent downward about 18 inches; the bend extended to the rear bolster. Both units of Diesel-electric engine 9910, of No. 39, were derailed but remained upright and in line with track No. 2. The front unit of this engine stopped inside the rear car of No. 11 at a point 205 feet west of the point of collision. The front truck was torn off and stopped 180 feet west of the point of collision. The frames, the trucks, and the electrical and air equipment of both units were badly damaged. The first to fourth cars, inclusive, and the rear truck of the fifth car of No. 39 were derailed. This equipment remained upright and in line with track No. 2. The rear end of the second car telescoped the front end of the third car about 6 feet. The derailed cars of No. 39 were damaged, but not extensively.

The weather was clear at the time of the accident, which occurred about 1:05 p. m.

The fireman of No. 39, who jumped from the engine just before the collision occurred, was killed. The engineer of No. 39 was injured.

According to data furnished by the railroad, the weight of the equipment of No. 39 was 1,043.04 tons. The ninth to eleventh cars, inclusive, of No. 11 were of lightweight stainless-steel construction. The twelfth and thirteenth cars of No. 11

were of conventional, all-steel, plate, girder, post and sill construction. The ninth and tenth cars were built in 1940, the eleventh car, in 1938, and the twelfth and thirteenth cars, in 1915.

Diesel-electric engine 9910 is provided with M-40-A brake equipment. A safety-control feature is so arranged that when there is no pressure exerted on either the foot pedal or the automatic brake-valve handle, the train brakes will be applied in emergency, unless a brake application of 30 pounds brake-cylinder pressure has been made. To apply the train-brake system in emergency by manual operation, the brake-valve handle must be moved to the extreme right of the brake-valve quadrant. The equipment is so arranged that during an emergency application of the brakes sand is automatically deposited upon the rails. The regulating devices were adjusted for brake-pipe pressure of 110 pounds and main-reservoir pressure of 140 pounds. Of the cars of No. 39, four were equipped with UC-12-B control valves, and five with LN-C control valves. Both units of the Diesel-electric engine and 8 cars were equipped with clasp brakes, and the other cars were equipped with one brake shoe per wheel.

After the accident, tests of the air-brake equipment of No. 39 disclosed that the automatic brake valve and all control valves of the units involved functioned as intended, both in service and in emergency applications. The brake-cylinder piston travel of the nine cars varied between 6-1/2 and 9-1/4 inches. The piston travel of one car only was in excess of 9 inches.

A few days after the accident a series of braking tests was conducted with a train comparable in weight, braking ratios, and consist to that of No. 39 on the day of the accident. During one test a speed of 81 miles per hour was attained and a 30-pound brake-pipe reduction, which was initiated at signal 227.1, stopped the train at a point 390 feet east of signal 228.1. During the next test, a speed of 85 miles per hour was attained and a 30-pound brake-pipe reduction, which was initiated at signal 227.1, stopped the train at a point 53 feet east of signal 228.1. During another test, an emergency application made at a point 8,293 feet east of signal 228.1, where the first unobstructed view of that signal can be obtained, stopped the train from a speed of 86 miles per hour in a distance of 3,529 feet, at a point 1,327 feet west of signal 228.1 and 393 feet west of the point of accident.

Discussion

As No. 11 was approaching Naperville, the speed was about 80 miles per hour. The front brakeman, who was making a running inspection of his train from the right rear vestibule of the tenth car, saw an unidentified object fly from under the train, and soon afterward sounded the communicating system signal to stop. The train was stopped 1-1/2 miles westward about 1:03 p. m., in the vicinity of the station at Naperville, with the

rear end standing 1,330 feet west of the west end of a 0°49.12'- curve to the right and 934 feet west of automatic signal 228.1. About 2 minutes later the rear end of No. 11 was struck by No. 39. At this time the train brakes of No. 11 were released, but the brakes on both Diesel-units were applied.

As No. 11 was approaching Naperville the flagman was stationed in the front end of the twelfth car, so that he could inspect his train as it moved on the curve to the right. His flagging equipment was on the rear platform of the rear or thirteenth car. When the flagman felt the application of the brakes as his train was preparing to stop at Naperville he proceeded to the rear end of the train and, after No. 11 stopped, he proceeded to the rear to provide flag protection. He had reached a point about 300 feet to the rear of his train and was giving stop signals with a red flag when the engine of No. 39 passed him. He said that he was unable to make an inspection of his train from any point to the rear of the front end of the twelfth car, because of the type of equipment involved. It had been his experience that fusees dropped from a train moving at high speed would not remain lighted, and for this reason he said it had not been his practice to drop lighted fusees from a moving train. In tests after the accident, lighted 10-minute fusees were dropped from the rear platform of a train moving on track No. 2. At speeds in excess of 40 miles per hour, fusees either bounced off track No. 2 or failed to burn. Burning fusees remained on track No. 2 when dropped at speeds of 40 miles per hour and lower, and continued to burn. The engineer of No. 11 said that he did not sound the engine-whistle signal for the flagman to protect the rear of the train until his train had stopped. The flagman proceeded to the rear immediately to provide flag protection. He did not operate the switch to light the oscillating red light which was provided at the rear of the train for giving additional warning. This device was therefore not operating. The sun was shining and, because of the curvature of track to the rear of No. 11, there is some question whether the engineer of No. 39 could have seen the oscillating red light, had it been lighted, in time to take action to stop his train short of the preceding train.

As No. 39 was approaching Naperville, the speed was about 80 miles per hour. Both enginemen were in the control compartment at the front end of the first Diesel-electric unit, and the members of the train crew were in various locations throughout the cars of the train. The engineer was seriously injured in the accident and he was unable to make a statement before this investigation was completed. The fireman jumped from the control compartment of the first Diesel-electric unit just before the impact occurred, and he was killed. Members of the train crew were not aware that anything was wrong until the collision occurred. Several members of the train crew said they felt a light service application of the brakes about midway between signals 227.1 and 228.1. These employees thought the speed was about 45 miles per hour at the time of the collision. The brakes of this train had been tested and had functioned

properly en route. In tests of the brake equipment of this train after the accident, the brakes functioned properly in both service and emergency applications, and the brake-cylinder piston travel was in conformity with the requirements. The automatic sanding feature of the Diesel-electric units functioned during emergency application of the brakes after the accident.

Signal 227.1 displayed approach for No. 39. Under the rules this indication required the train to "approach next signal prepared to stop." On most railroads the indication for an approach signal is "Proceed preparing to stop at next signal. Train exceeding medium speed must at once reduce to that speed." This latter indication establishes a definite minimum requirement which is essential to safe operation and which if it had been followed in this case would have prevented this accident. On the Chicago, Burlington & Quincy Railroad the approach indication is supplemented by a time-table instruction which provides that when a distant signal is displaying a restricting indication, trains must reduce speed at once and move at restricted speed until the indication of the next governing signal can be determined. Under this instruction, as soon as the approach aspect of signal 227.1 came into view the speed of No. 39 should have been reduced at once, and the train should have proceeded prepared to stop short of train, obstruction or anything that the restricted speed indication was protecting. Had the signal been observed and this instruction complied with, this accident would have been prevented. Signal 228.1 displayed stop-then-proceed, which indication required that the train must be stopped and then operated beyond this signal in such manner that it could be stopped short of a preceding train. The weather was clear and there was no condition which obscured the view of the aspects displayed by signals 227.1 and 228.1. Signal 227.1 could be seen from the control compartment of No. 39 throughout a distance of not less than 5,000 feet. In tests after the accident signals 227.1 and 228.1 functioned properly. Examination of Diesel-electric engine 9910 after the accident disclosed that the automatic brake valve was in service position. There was no indication that an emergency application of the brakes had been made. The members of the train crew of No. 39 said that they did not feel any brake application in the vicinity of Naperville until their train was midway between signals 227.1 and 228.1. A series of braking tests was conducted after the accident, with a train of similar weight and brake system to No. 39 on the day of the accident. As a result of 30-pound service brake-pipe reductions made at signal 227.1, the test train stopped from speeds of 80 and 85 miles per hour short of signal 228.1. Since it was not possible to question the engineer of No. 39 during this investigation, it is not known why action was not taken by him to operate No. 39 in accordance with the indications displayed by the signals involved.

According to the timetable in effect at the time of the accident, the scheduled leaving time from Chicago Union Station for Nos. 11 and 39 was 12:35 p. m. The leaving time for No. 11

from Downer's Grove, 7.32 miles east of Naperville, was 12:56 p. m., and for No. 39, 12:58 p. m. This was close headway. In the operation of trains under such headway engineers should be especially alert at all times. In a new timetable, effective May 26, 1946, the scheduled leaving time from Chicago Union Station for No. 11 is 12:30 p. m., and for No. 39, 12:45 p. m., which provides a time interval of 15 minutes. However, increase of the time interval between these schedules will not necessarily prevent similar accidents, because trains scheduled 15 or more minutes apart at their initial terminal can close up until a situation develops similar to the one involved in the accident here under investigation. If an adequate automatic train-stop or train-control system had been in use and functioning properly, the speed of No. 39 would have been controlled in accordance with the conditions of track occupancy ahead, regardless of any inaction on the part of the engineer, and this accident would have been averted. If a cab-signal system had been in use and functioning properly, an audible warning signal would have been sounded, and signal aspects indicating the presence of the train ahead would have been displayed continuously in the cab in the view of both the engineer and the fireman, and this accident might have been averted.

There is now pending before the Commission docket No. 29543, which is an investigation instituted May 20, 1946, on its own motion, to determine whether it is necessary, in the public interest, to require any common carrier by railroad to install block signal system, interlocking, automatic train stop, train control and/or cab signal devices, and/or other similar appliances, methods and systems intended to promote the safety of railroad operation, upon the whole or any part of its railroad on which any train is operated at a speed of 50 or more miles per hour. Hearing therein will be held in the near future.

The thirteenth or rear car of No. 11 was of conventional all-steel construction, and weighed 130,300 pounds. As a result of direct shock in the collision, the center-sills were bent downward about 18 inches at the rear end, and the bend extended to the rear bolster. The first unit of the locomotive of No. 39 was deflected upward; it entered the rear car above the floor level, and the superstructure was destroyed about three-fourths the length of the car. As a result of the upward deflection of the first unit of the locomotive, the buffing members of the rear car did not receive the full force of the collision. A considerable amount of the force was dissipated in the twelfth, eleventh, tenth and ninth cars. The greatest damage and practically all the deaths occurred in the thirteenth and eleventh cars. The twelfth car was of conventional all-steel construction, and weighed 129,800 pounds. It was not damaged extensively. The eleventh, tenth and ninth cars were of lightweight construction, and weighed, respectively, 115,800, 112,950, and 110,700 pounds. The eighth and seventh cars were of conventional all-steel construction, and weighed, respectively, 139,700

and 141,800 pounds. The eleventh car stopped in reverse direction. It was bent in an U-shape. The section between the body bolsters was demolished, and the sections between the body bolsters and the ends were considerably damaged. The eleventh, tenth and ninth cars were equipped with tightlock couplers.

Examination of the extent of damage to each of the rear five cars of No. 11 directs attention to the comparative capacities of these cars to withstand heavy buffing stresses. Specifications for end-to-end buffing stresses for passenger-train cars were first promulgated in 1912 for railway post office cars. These specifications required that such cars must be constructed so as to resist buffing stress of not less than 800,000 pounds, and this requirement has not been changed. In 1939, the Association of American Railroads recommended to its members certain specifications, based on the existing Railway Mail Service specifications, for the construction of passenger cars used in trains of more than 300,000 pounds light weight. These specifications, made standard by the Association of American Railroads in 1945, require that the car structure resist minimum static end load of 800,000 pounds applied on center line of draft without developing any permanent deformation in any member of the car structure. The eleventh car was a dining car built in 1938, and was of stainless steel construction. The center-sill of this car was of stainless steel, with a cross-sectional area of 8.38 square inches. This is insufficient to meet the specifications recommended by the Association of American Railroads in 1939 and made standard by it in 1945. In recent years similar cars have been constructed with stainless steel center-sills having a cross-sectional area of 18 square inches. The cross-sectional areas of the center-sills of the tenth and ninth cars were about 40 percent greater than that of the eleventh car. Several railroads have in use a total of about 105 cars of the same specifications as the eleventh car in No. 11, and about 20 of these are in use by the Chicago, Burlington & Quincy Railroad.

In 1938 the Commission investigated a head-end collision between two passenger trains in which there were cars of similar specifications to that of the dining car of No. 11. In that accident as well as the present one, the first car of such specifications in the line of travel of the force of collision received far greater damage than the adjoining cars which were of heavier construction. In both cases there were cars of heavier construction beyond the cars in question, and they received only minor damage.

The following recommendation was made in the Commission's report covering investigation of this 1938 accident:

It is recommended that railroad officials give serious consideration to discontinuance of operation of so-called lightweight cars between or ahead of standard cars unless and until the strength of construction has been determined by suitable tests to be substantially the same as that of other cars with which they are associated.

Notwithstanding this recommendation, and also the subsequent action of the Association of American Railroads establishing a minimum requirement of resistance to end buffing stresses for cars in unrestricted service, cars which do not conform to this standard are continued in operation in association with cars of substantially heavier construction and which meet this minimum requirement. The number of casualties which resulted in this case may have been attributable in part to this condition. Only the three lightweight cars were equipped with tightlock couplers. Had all the cars involved been equipped with tightlock couplers, and had all cars conformed to the standard for end buffing resistance, it is probable that the disastrous consequences of this accident would have been greatly reduced.

Cause

It is found that this accident was caused by failure to operate the following train in accordance with signal indications.

Recommendation

It is recommended that the Chicago, Burlington & Quincy Railroad Company discontinue the operation of passenger-train cars which do not meet present standards, intermingled in trains with cars meeting such standards.

No recommendation is made at this time with respect to the method of controlling the speed of these fast trains, since this matter is receiving comprehensive consideration in our docket No. 29543.

Dated at Washington, D. C., this thirtieth day of July, 1946.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL,
Secretary.