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RAILROAD ACCIDENT REPORT
ILLINOIS CENTRAL RAILROAD COMPANY
AND
INDIANA HARBOR BELT RAILROAD COMPANY
COLLISION BETWEEN
YARD TRAINS AT
RIVERDALE, ILLINOIS
ON SEPTEMBER 8, 1970



NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
REPORT NUMBER: NTSB-RAR-71-3

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ADOPTED: NOVEMBER 24, 1971

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16. Abstract At 11:08 p.m. September 8, 1970, a collision occurred between Illinois Central (IC) Train 1218 and Indiana Harbor Belt (IHB) Train 8717 at Riverdale, Illinois. The collision of the two yard trains resulted in two fatalities and two serious injuries. Five cars and the caboose of the IC train were derailed and the locomotive cab of the IHB train was demolished. The IHB train was crossing over from an interchange track to an IC main track when the locomotive was struck by the unlighted caboose of the IC train. The IC locomotive was shoving 22 cars, and the caboose had passed a signal indicating "Restricted Proceed" 715 feet prior to impact. The Safety Board determined that the accident resulted from the failure of the IC crewmembers to operate IC Train 1218 at a speed so as to be able to avoid the collision. Additional contributing factors included: (a) the failure of IC crewmembers to display a light and occupy a conspicuous position when shoving cars as required by rule; (b) the failure of the IC to provide additional protection when track changes initiated a permanent display of "Restricted Proceed" for the involved signal in 1969; and, (c) inadequacies in operating rules, practices, and personnel training. Contributing to the accident severity was the lack of crash protection provided the occupants of the IHB locomotive.			
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FOREWORD

This report of facts and circumstances and the determination of probable cause by the National Transportation Safety Board are based on facts developed in an investigation conducted by the Federal Railroad Administration and from observations at the scene of the accident by personnel of the Board's Railroad Safety Division. In developing its recommendations, the Safety Board has considered the suggestions of the Federal Railroad Administration, but the recommendations are those of the Safety Board.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C 20591
RAILROAD ACCIDENT REPORT

ADOPTED: November 24, 1971

ILLINOIS CENTRAL RAILROAD COMPANY
AND
INDIANA HARBOR BELT RAILROAD COMPANY
COLLISION BETWEEN YARD TRAINS
AT RIVERDALE, ILLINOIS
SEPTEMBER 8, 1970

I SYNOPSIS

A collision between Illinois Central (IC) Train 1218 and Indiana Harbor Belt (IHB) Train 8717 occurred on trackage of the IC at Riverdale, Illinois, at 11:08 p.m., September 8, 1970. The collision resulted in the deaths of an IC conductor and an IHB engineer. Serious injuries were incurred by an IC flagman and an IHB front brakeman.

Both trains involved were yard trains, with IHB Train 8717 engaged in the delivery of cars in interchange to the IC at Markham Yard. The IHB train was making a crossover movement at slow speed from the IC-IHB interchange track to an IC main track when the locomotive was struck by the IC train traveling at a speed estimated to be between 10 and 20 miles per hour. The IC locomotive was shoving 22 cars headed by an unlighted caboos when the accident occurred. The IC caboos had passed an automatic block signal indicating "Restricted Proceed" 715 feet in advance of the point of impact. The "Restricted Proceed" connotation of this signal had been displayed continuously since 1969.

The collision caused the IC caboos to override the heavy underframe of the locomotive, initiating the demolition of the control

compartment of the IHB locomotive. Two following cars continued in the path established by the caboos and completed the destruction of the locomotive control compartment. The caboos overturned and landed upright at the bottom of the 10-foot roadway embankment. In all, five boxcars and the caboos of the IC train derailed, while the locomotive was the only derailed equipment in the IHB train.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the Illinois Central crewmembers to operate IC Train 1218 at a speed so as to be able to avoid the collision.

Additional factors that contributed to the occurrence of the accident were:

- a. The failure of the Illinois Central crewmembers to comply with the rule requiring that a crewman take a conspicuous position on the lead car and display a white light when cars are pushed by an engine.
- b. The failure of the Illinois Central Railroad Company to provide additional protection to accommodate the safe movement of trains on track No. 6 when track changes initiated a permanent display of "Restricted Proceed" on signal 6-1799 in 1969.

c Inadequacies in operating rules, practices, and personnel training

Contributing to the severity of the accident was the apparent lack of crash protection provided to the occupants of the IHB locomotive.

II. FACTS

A. General Location of the Accident

The collision between Illinois Central Railroad Company (IC) Train 1218 and Indiana Harbor Belt Railroad Company (IHB) Train 8717 occurred at Riverdale, Illinois, in clear weather at 11:08 p.m., September 8, 1970. Riverdale is a suburb of Chicago, approximately 20 miles south of the Chicago center city area.

The accident took place within yard limits on trackage owned by the IC at a location designated locally as Highlawn. Highlawn is the converging point of interchange trackage with the IHB.

The IC main tracks in this area run north and south between Chicago and Champaign, Illinois. The IHB main tracks cross under IC tracks approximately 650 feet north of the accident site. The IHB main tracks extend between Ivanhoe, Indiana, on the east extremity, and Franklin Park, Illinois, on the west.

B. Method of Operation

1. Track Layout and Use

A large-scale plan of the IC and IHB trackage in the immediate area is shown as Figure 1. A smaller scale layout, which covers all of the area involved, is shown as Figure 2.

a. IC Railroad Company

At Highlawn, there are seven main tracks numbered from west to east as No. 1 through

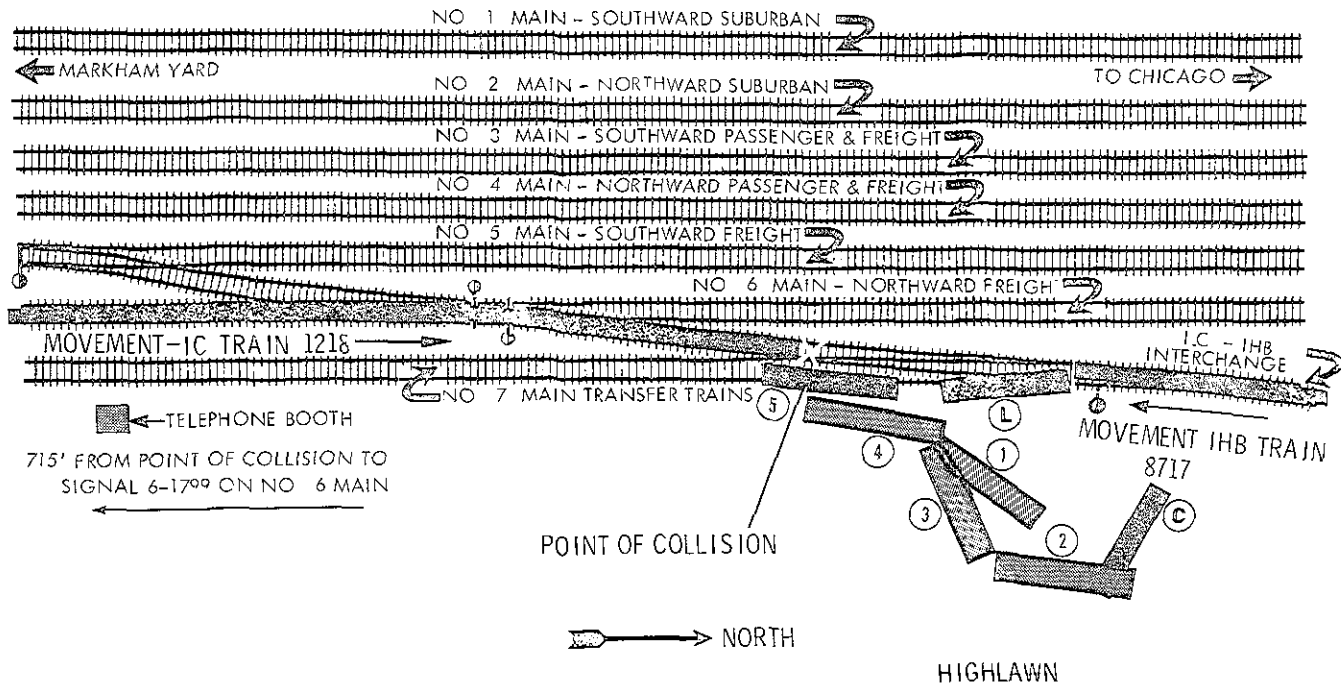
No. 7. Tracks No. 1 and No. 2 are designated as "Suburban" and tracks No. 3 and No. 4 are designated as "Passenger and Freight." The tracks involved in this accident were tracks No. 5, No. 6, and No. 7, designated respectively as "Southward, freight"; "Northward, freight"; and "Northward and southward transfer trains between Highlawn IHB Junction and Markham Yard." The track grades approaching the accident site from the south are 0.3 percent ascending.

At Highlawn, the IC-IHB interchange track converges from the northeast toward the IC main tracks and becomes track No. 7. Crossovers connect track No. 7 to track No. 6 and, subsequently, track No. 6 to track No. 5. This permits trains to make a southward facing-point movement from the IC-IHB interchange track to either track No. 6 or track No. 5. This arrangement necessitates the blockage of track No. 6, the northward freight main, when a southbound train moves from the IC-IHB interchange track to track No. 5, the southward freight main.

The switches of the crossovers operate manually by means of groundthrow switch stands. The switches normally are locked with a connecting bar that allows use of either an IC or IHB switch padlock. Switch position is indicated by reflectorized targets, which display green for the through-track movement and red for the diverging position. Switch stand and target details are shown in Figure 3.

The IC's Markham Yard is located 2.5 miles south of the accident site. Track No. 7 connects the Markham Yard and the IC-IHB interchange tracks and also the Grand Trunk Western Railroad Company (GTW) interchange track 1.7 miles south of where this accident occurred.

Approximately 2,000 feet north of the accident site, at a location designated as 138th Street, the six main tracks converge into four by means of crossovers installed between tracks No. 6 and No. 5 and between tracks No. 5 and



CAR LOCATION AND POSITION CHART			
DESIGNATION	TRAIN	FINAL POSITION	TYPE
L	IHB 8717	UPRIGHT, SO TRUCKS DERAILED	LOCO
C	IC 1218	UPRIGHT, UNDER ②	CABOOSE
1	IC 1218	ON SIDE	BOX
2	IC 1218	ON SIDE, ON TOP OF (C)	BOX
3	IC 1218	ON SIDE	BOX
4	IC 1218	ON SIDE	BOX
5	IC 1218	UPRIGHT, BOTH TRUCKS DERAILED	BOX

FIGURE 1
PLAN OF ACCIDENT AREA
HIGHLAWN IC-IHB ICT
RIVERDALE, ILL.

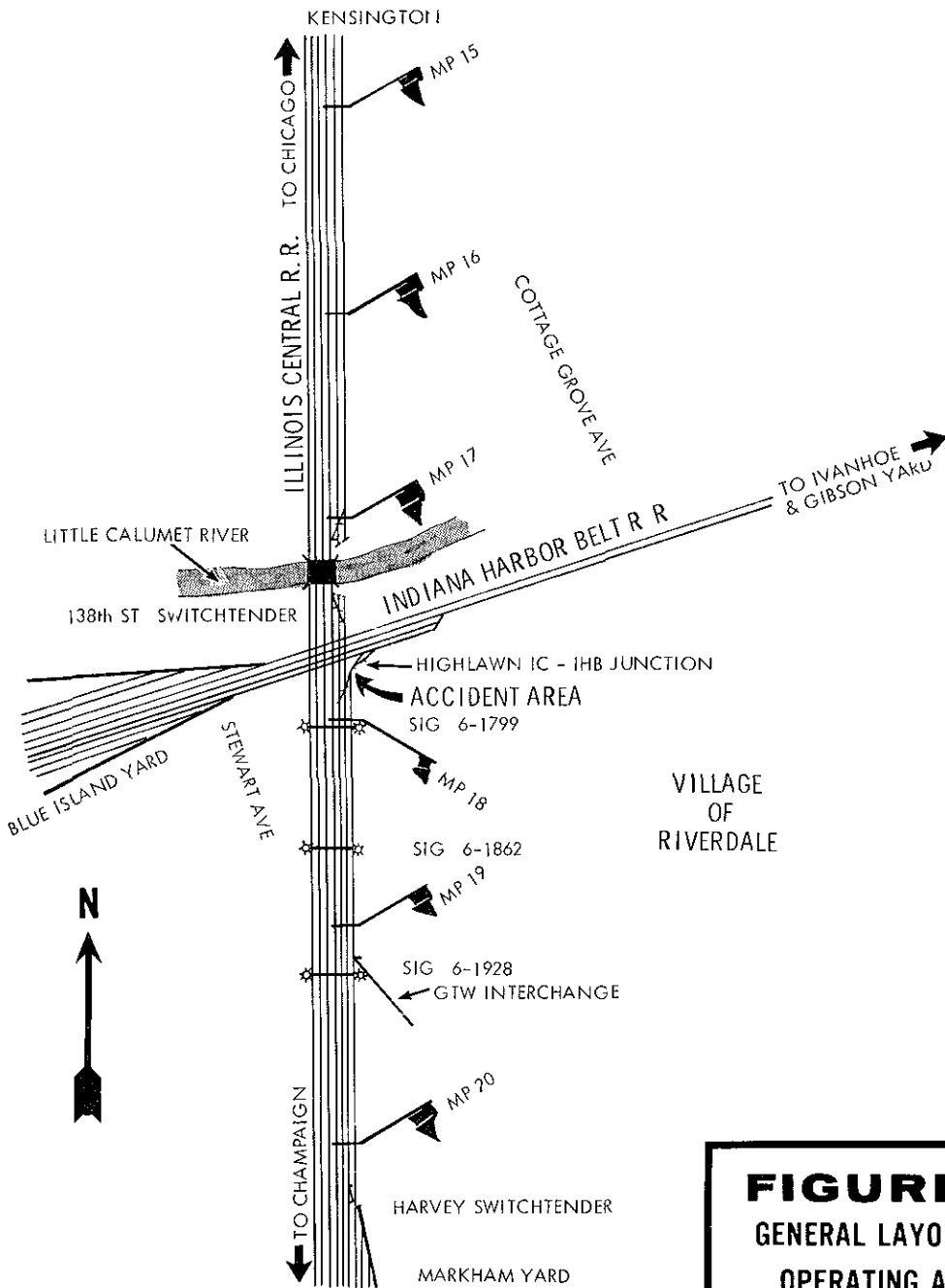
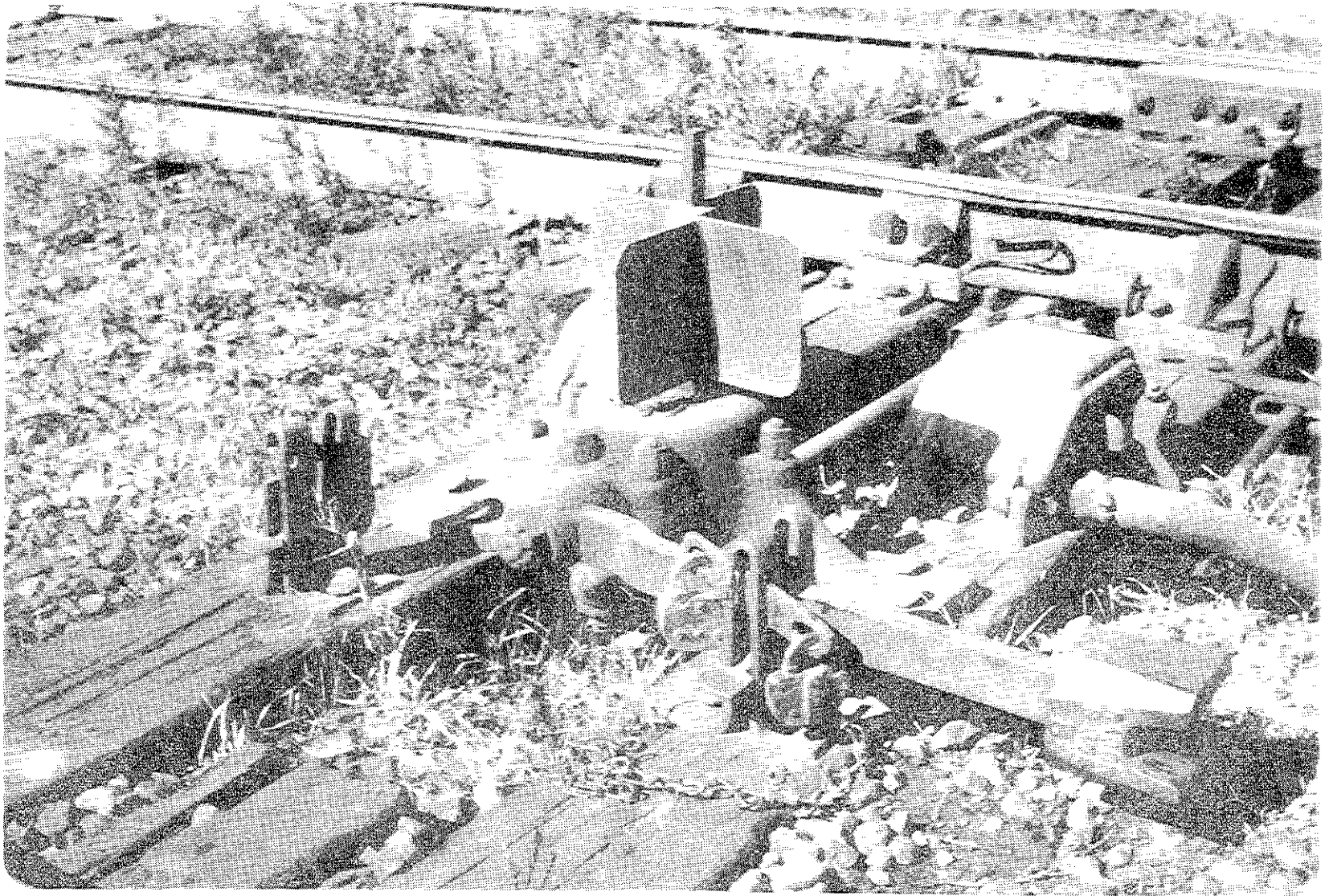


FIGURE 2
GENERAL LAYOUT OF
OPERATING AREA
RIVERDALE, ILL



5

Figure 3 — Switch Stand of the No. 5 Track
Crossover Switch at Highlawn

No 4 The crossovers are installed for a northward facing-point movement Tracks No 5 and No 6 are discontinued just beyond the north crossover The discontinuance of Tracks No 5 and No 6 was arranged to accommodate the widening of the Little Calumet River bridge immediately to the north, a project sponsored by the U S Army Corps of Engineers This track arrangement is temporary, but was commenced in 1969 The project is scheduled for completion in 1972

b IHB Railroad Company

In the general accident area, there are four through IHB running tracks, designated from north to south as No 1 track, No 2 track, No 5 lead, and No 9 lead The IC-IHB interchange track diverges from No 9 lead with a facing-point switch for westward movement The IC-IHB interchange track is an 8° curve to the right, 700 feet in length, eastward from the point of impact The track grade east of the accident site for a distance of 1,000 feet descends an average of 1.3 percent

2 Operational Control of Train Movements

a IC Railroad Company

The use of tracks No 5, No 6, and No 7 through the accident area is governed by a switchtender located at Harvey, which is the north entrance to Markham Yard, and an operator at Kensington Kensington is located 3.2 miles north of the accident site

The Harvey switchtender designates track usage between Harvey and Highlawn The Kensington operator designates track usage between Highlawn and Kensington Because of the track changes necessitated by the Little Calumet River bridge widening, there also is a switchtender located at 138th Street The 138th Street switchtender routes trains in accordance with instructions received from the Kensington operator.

Although tracks No 5 and No 6 have designated operational directions, movements are accomplished against the current of traffic During the 30 days preceding the accident date, 810 northward trains and 794 southward trains used tracks No 5, No 6, and No 7 Three of these movements were northward on track No 5, and 36 movements were southward on track No 6 Track No 7 was used by 169 northward trains and 125 southward trains The trains that use these three tracks are generally yard trains, as through freight trains, passenger trains, and commuter trains normally use tracks No 1 through No 4.

b IHB Railroad Company

The IHB uses the IC trackage in this area between Highlawn and Markham Yard only for the interchange of cars This use is confined to tracks No 5, No 6, and No 7 and is designated by the Harvey switchtender IHB movement on the IC-IHB interchange track is directed by an IHB operator, who has contact with the Harvey switchtender by telephone

3 Signal System

a IC Railroad Company

Tracks No. 1 through No 6 are equipped with automatic-block signals to govern train movement in the designated directions The involved tracks are not signalled for reverse directional movement There is no signal system governing movement on track No 7

Track No 5 is signalled for southward movement and track No 6 for northward movement Movements with the current of traffic are subject to signal indication and rules, even though track-use permission has been received from the designated switchtender or operator Movements against the current of traffic on tracks No 5 and No 6, and in either direction on nonsignalized track No 7, are dependent upon manual-block control by the

involved switchtender or operator. In these instances, no other trains are permitted to occupy the involved track within the specified block limits.

In the immediate accident area, a signal bridge is located 715 feet south of the point of impact. At this location, a southward signal is provided for track No. 5 and a northward signal for track No. 6. The track No. 6 northward signal is designated 6-1799 and has a number plate. Between Highlawn and Markham Yard, additional northward signals are provided on track No. 6 at locations 4,055 feet and 1.4 miles south of the accident site. These signals are designated 6-1862 and 6-1928, respectively.

All signals are continuously lighted and provide color-light aspects of red, yellow, or green. The signal operation is interfaced so that a red aspect of one signal necessitates a yellow aspect on the preceding signal.

A red signal aspect normally is precipitated by train occupancy, an open switch, or another interruption of the electrical track circuit within the block ahead of the signal involved. However, as the result of the track changes at 138th Street in 1969, northward signal 6-1799 on track No. 6 displayed a continuous red aspect and signal 6-1862 concurrently displayed a continuous yellow aspect.

In addition to the southward automatic-block signal protection, track No. 5 is equipped with a track-occupancy indicator in the accident area. This indicator is located in the area of the north switch of the crossover between tracks No. 6 and No. 5. This device displays a color aspect to indicate the presence of trains on track No. 5 between Kensington and Highlawn. There was no track-occupancy indicator for track No. 6.

b. IHB Railroad Company

The two IHB main tracks in this area are equipped with automatic-block signals of the

color-light type. The IC-IHB interchange track is not equipped with signals.

4 Communications

a. IC Railroad Company

The Harvey switchtender designates track usage between Markham Yard and Highlawn. This switchtender had a two-way "handie-talkie" radio which operated on channel No. 1. This channel was used for general communication to through IC trains in the Chicago area.

The Harvey switchtender also communicated with IHB operators via the public telephone system. The Kensington operator also could be contacted by the Harvey switchtender on a private IC telephone system. This latter system included a connection between the Harvey switchtender and a telephone located in a booth at Highlawn. The Highlawn telephone was inoperative on the date of the accident because of vandalism. IC records indicate previous vandalism of this telephone on July 27, 1970, and November 18, 1967.

The Harvey switchtender also could control the movement of northward trains from Markham Yard by hand signals, using a flag or lantern, or by voice signals. All trains under the switchtender's control passed his assigned position within, at most, 75 feet upon departing Markham Yard.

b. IHB Railroad Company

IHB Train 8717 was not radio equipped. Authority for track usage on IC property normally was obtained by telephone communication to the Harvey switchtender. The aforementioned telephone at Highlawn was installed for this purpose and provided direct communication. Alternate telephone facilities were available at Cottage Grove Avenue, which is approximately 1 mile east of the accident area. At this location, a telephone provided

communication with the IHB Stewart Avenue operator, who had contact with the Harvey switchtender via the public telephone system

5. Operating Rules

a. IC Railroad Company

The "Rules and Regulations of the Operating Department" of the IC became effective September 1, 1970, and superseded previous instructions issued July 1, 1958. The IC operating rules applicable to this accident are included as Appendix A

In addition to the "Rules and Regulations of the Operating Department," IC employees are governed by "Special Instructions" in the current timetable and current "Bulletin Orders." The "Special Instructions" supersede the rules in event of conflict, and the "Bulletin Orders" supersede both the "Special Instructions" and rules in event of conflict. Applicable IC "Special Instructions" and "Bulletin Orders" are included as Appendix B

b. IHB Railroad Company

The IHB is owned partially by the Penn Central, and the Penn Central's "Rules for Conducting Transportation" govern IHB employees. IHB employees also are governed by "Special Instructions" of the IHB current timetable and "Bulletin Orders" in a manner similar to IC employees. The current timetable on the date of the accident was IHB Timetable No. 3, effective April 26, 1970. Rule A-1 of this timetable states in part: ". . . IC rules and timetable govern between Highlawn and Markham Yard . . ." The applicable IC rules are included in Appendices A and B

The IHB is a bridge railroad for the Chicago area. Timetable No. 3 indicates that IHB employees are subject to the rules and timetables of seven other railroads, in addition to the IC, when operating on those tracks. The "Rules for Conducting Transportation" state

that IHB employees are to be governed by orders of officers of foreign railroads when operating on their railroads. Following the accident, four IHB bulletin boards were examined at locations where IHB crews report for duty. IC Bulletin Order No. 57, which applied to the accident tracks, was not displayed

C. Description of the Accident

1. Train and Crew

a. IC Railroad Company

The locomotive of the IC train was unit No. 1218, a diesel-electric yard switcher. The locomotive was equipped with a two-way radio having four channels. Channel No. 1 was assigned for general communications with IC through trains in the Chicago area. The other three channels were assigned for IC switching operations. The locomotive was not equipped with a speedometer or a speed recording device.

The caboose was IC unit No. 9636, a 28-foot caboose of the elevated-cupola type with an all steel body. The steel structural components on each end of the caboose included two 5- by 5- by 1/2-inch angles as cornerposts, two 3-inch, 67-pound Z-sections as intermediate vertical supports, and two 6- by 6-inch by 20-pound wide flange vertical door supports. Side supports included six 3-inch, 67-pound Z-sections as intermediate vertical supports in addition to the cornerposts. Brake valves, communicating whistles, and wheel-type handbrakes were located on each end platform. Inside the caboose, another brake valve was located on the caboose wall beneath the cupola. Interior furniture and appurtenances generally were wall mounted or secured to the floor. The caboose was not radio equipped, but the rear-end crew had been provided with two-way "handie-talkie" radios. The "handie-talkie" radios had two channels, both of which were assigned for switching operations. These

radios had been used for communication between the locomotive and the caboose prior to the accident. The caboose was not equipped with exterior lights or markers.

The consist of the train included 21 cars, excluding the caboose. Twenty of these cars were loaded.

The train crew included the engineer, conductor, front brakeman, flagman, and a fireman, who was also a student engineer. With the exception of the fireman, all of the crewmembers had previously worked this assignment, and the engineer and conductor were assigned regularly to this job. The crew's experience with the IC ranged from 7 to 26 years, except for the fireman who had approximately 1 year of experience.

An examination of the IC's personnel records indicated that except for the conductor, all of the train crew had records that were clear of major rule violations. There was no record of any rule violation by the conductor since 1968. All of the crew had been last examined on the IC operating rules during July or August 1970.

b IHB Railroad Company

The locomotive of the train was IHB unit No. 8717, a diesel-electric yard switcher, General Motors Model 567. The locomotive was not equipped with a radio, speed indicator, or a speed recording device. The control compartment was enclosed by steel sheeting supported by four 2½-by-1½-by-1/8-inch box-section cornerposts. The rear portion of the control compartment was supported additionally by four 2½-by-1½-by-1/8-inch box-section intermediate vertical supports spaced to accommodate the one rear door and two rear windows. On each side of the control compartment there also were two additional 2½-by-1½-by-1/8-inch box-section intermediate vertical supports.

IHB Train 8717 included 36 cars and the caboose. Twenty-one of these cars were loaded. Neither the caboose nor the rear-end train crew was equipped with radios.

The crew of IHB Train 8717 included the engineer, conductor, front brakeman, and the flagman. With the exception of the front brakeman, all of the crew were assigned regularly to this job. The trip to Markham Yard was familiar to the regularly assigned crewmembers and all of the crew were long-experienced railroaders.

The IHB personnel records indicated that the last rule violation for any of the crew involved the flagman, and occurred 7 years prior to the accident. The remaining IHB crewmembers had maintained records clear of any rule violations for at least 17 years.

The crew had been examined last on operating rules during 1969. The IHB crew had not been examined on current IC operating rules or the rules of other foreign railroads. None of the surviving crewmembers possessed the current applicable IC timetable.

Federal Railroad Administration (FRA) investigators interviewed the IHB crewmembers following the accident. The three crewmembers expressed three varying opinions as to the proper procedures required to crossover from the IC-IHB interchange track to track No. 5 at Highlawn. None of the crewmembers was sure whether the accident site was within designated IC yard limits. One crewmember indicated an interpretation of a red aspect on Signal 6-1799 as "Stop, then proceed at restricted speed," consistent with the IHB version of this rule. Following the accident, FRA investigators also corresponded with IHB management concerning the interpretation of IC rules for the intended crossover movement. The correspondence was inconclusive as to the required procedures necessary to comply with IC rules. IC officials stated that fuses were not required in making the crossover.

2. The Collision

a. IC Train 1218

The IC train crew went on duty at 10:30 p.m. on the date of the accident. This was a regular assignment that normally involved industrial switching service at various locations 4 miles north of Highlawn. The train normally was made up and was ready to go upon arrival of the crew at Markham yard. It was usual practice to have the caboose on the north end of the cars involved. The locomotive was normally positioned north of the caboose, so that the locomotive pulled the train.

September 8th was the first day following Labor Day and, because of this, the scheduled service was disrupted from normal practice. When the train crew reported for work, the train had been made up with the caboose on the north end of the cars, and the crew was instructed by the yardmaster to shove the train northward. This necessitated the placement of the locomotive on the south end of the train. The locomotive was placed headed northward with the cab on the south end. The brake system of the cars in the train had been charged previously by yard forces. There are conflicting statements concerning the performance of the brake tests prior to departure.

The flagman stated that a lighted trainman's lantern was placed inside the door on the north end of the caboose as he and the conductor boarded. They waited to allow passage of a passenger train, and the conductor then instructed the engineer by radio to shove the train northward. This instruction was preceded by a "high-ball" signal from the Harvey switchtender to the crew on the caboose. Both the conductor and the flagman were located in the cupola of the caboose when the caboose passed the Harvey switchtender. Rule 103 requires that when cars are pushed by a locomotive, a trainman must take a conspicuous position on

the leading car and at night he must display a white light. (See Appendix A.)

The Harvey switchtender had designated track No. 6 for the northward movement of Train 1218 and had lined the various yard switches to accommodate this movement. The IC crew was not advised by the switchtender of any conflicting movements. This opportunity existed when the train passed the switchtender's position and was available also via radio on the one common channel between the switchtender and the locomotive. Radio communications did not exist between the switchtender and the caboose of Train 1218 as their respective radios operated on different channels.

The Harvey switchtender's record of train movements indicated that IC Train 1218 received authority to operate northward on track No. 6 between Harvey and Highlawn at 11 p.m. The switchtender's records for train movements during the involved time period are recapitulated below:

Train	Time	Direction of Movement	Track Number
IHB 8717	10:30 p.m.	Southward	5
GTW*	10:45 p.m.	Southward	7
IHB*	10:50 p.m.	Southward	5
IC 1218	11:00 p.m.	Northward	6

*Train number not indicated.

On the trip from Markham Yard to Highlawn, the engineer occupied his normal position on the right side of the locomotive cab and the fireman and front brakeman were on the left side. The engineer stated that the cars ahead of him obstructed his view of the signals governing movement on track No. 6. During most of the trip, the engineer was engaged in conversation with the front brakeman concerning the method of performing the forthcoming

industrial switching. There was no further communication between the locomotive and the caboose after departure from Markham Yard.

The engineer estimated that the train's speed approximated 15 to 20 miles per hour immediately before the accident. The engineer was aware that the train was nearing Highlawn and was preparing to make a speed reduction when an emergency brake application was experienced. The engineer realized immediately that an accident had occurred, as he was able to see derailed cars going off to the east side of the right-of-way.

The conductor and flagman remained inside the caboose after departure from Markham Yard, occupying opposite seats in the cupola. The flagman stated that the conductor had a brief radio conversation with the yardmaster shortly after leaving Markham Yard and that was the last use of the radio.

The flagman indicated that he was able to observe the signals governing movement on track No. 6 on the trip from Markham Yard to Highlawn. The observed aspects were green, yellow, and red, respectively, for signals 6-1928, 6-1862, and 6-1799. No action was taken to reduce the speed of the train. The flagman estimated the speed of the train as 10 miles per hour when passing these signals. Rule 285 requires a train, passing a yellow signal, to approach the next signal prepared to stop. Rule 291 allowed the train to pass that red signal (6-1799) prepared to stop short of train, obstruction, or switch not properly lined and looking out for broken rail, but not exceeding 10 miles per hour. (See Appendix A.)

As the train approached Highlawn, the flagman observed the dimmed headlight of a locomotive near the IC-IHB interchange track, but assumed that the locomotive was in the clear. Rule 17 requires a train standing at a junction to extinguish its headlight. (See Appendix A.) He did not observe any lighted fuses. The flagman stated that he could not observe the switch position targets in the darkness. He did indicate that as the train ap-

proached the crossover from track No. 6 to the IC-IHB interchange track, the headlight glow of the opposing train revealed that the crossover switches were lined for a collision course.

The flagman then called a warning to the conductor and jumped from the cupola to operate the emergency brake valve, but the speed of the train was not reduced before impact. The conductor and flagman were both standing inside the caboose on the floor level near the south, or trailing end, at the time the collision occurred.

b IHB Train 8717

The IHB train crew went on duty at 2:15 p.m. on the date of the accident. This was a regular assignment that normally performed interchange service between the IHB and the Chicago, South Shore and South Bend Railroad, the Louisville and Nashville Railroad (L&N), and the Monon Railroad. This assignment did not make deliveries to the IC regularly, but had done so intermittently in the past. Because of the holiday disruption, the delivery to the L&N on the accident date was annulled and, instead, the crew was directed to make car deliveries to the IC at Markham Yard.

At the start of their day's assignment, the crew had been informed that locomotive No. 8717 would be exchanged for another. These instructions were later rescinded. This change in instructions meant that the locomotive would be operating in reverse position for the balance of the crew's tour of duty, an abnormal procedure on the IHB. The crew made two attempts to turn the locomotive prior to the accident and both attempts were blocked by conflicting yard movements. The conductor, therefore, decided to make the delivery to the IC at Markham Yard with the cab end forward, headed eastward.

At 10:07 p.m., IHB Train 8717 departed Gibson Yard, which is located approximately 7 miles east of Highlawn. The engineer and front brakeman were on the locomotive and the

conductor and flagman were in the caboose at the rear of the 36 cars that were being pulled.

At Cottage Grove Avenue approximately 1 mile east of Highlawn, the train stopped and a crewmember used the IHB telephone to secure authority for operation on IC trackage from Highlawn to Markham Yard. The crew was aware of the prior vandalism to the Highlawn telephone which precluded the use of that means of communication.

The front brakeman of Train 8717 contacted the IHB operator located at Stewart Avenue who, in turn, contacted the IC's Harvey switchtender. Authority was relayed to the extent that the IHB front brakeman was instructed to use track No 5 from Highlawn to Markham Yard. This instruction was issued by the Harvey switchtender at 10:30 p.m. The front brakeman was not informed of any conflicting movements.

IHB Train 8717 arrived at Highlawn at approximately 10:55 p.m. The front brakeman indicated that the switch leading to No 7 track was lined against their directed movement and, therefore, the locomotive was stopped short of this switch. The rest of the train then was standing on the ascending grade of the IC-IHB interchange track. The front brakeman then walked southward, lining No 7 track switch and the four switches of the two crossovers connecting the IC-IHB interchange track with IC track No 5. The front brakeman tried to operate the track-occupancy indicator for track No 5 on the way south, and again on his way back, but found the indicator inoperative. The front brakeman also stated that on his way back to the locomotive he dropped lighted fuses north of the No 5 track crossover switch and south of the No 6 track crossover switch.

The front brakeman returned to the locomotive and resumed his position in the control compartment on the west side of the locomotive. The engineer was in the normal operating position, but because the cab end

was forward, the engineer's position was on the left, or east side of the control compartment.

IHB Train 8717 started to move southward just after the brakeman entered the locomotive cab. The collision occurred shortly thereafter. The IHB front brakeman did not observe the approaching IC train prior to impact. (See Rules 99, D-99, D-152, 275, 510, and 513 in Appendix A.)

The conductor and flagman were located in the caboose at the rear of IHB Train 8717 when the accident occurred. Their statements regarding the movement of the train prior to the collision are generally consistent with the front brakeman's recollection. The conductor estimated that the train was standing 11 to 12 minutes before the short movement prior to impact, while the flagman estimated this interval as being 5 to 7 minutes. Their first knowledge of the accident was an emergency brake application, followed immediately by the backward movement of the train.

c. Witnesses to the Collision

The accident occurred in a residential area, and two residents of separate adjacent apartments were eyewitnesses to the collision. Both witnesses stated that the headlight on the IHB locomotive was lighted and the speed of the IC train was estimated as being 10 to 20 miles per hour before impact. The speed of the IHB Train was indicated to be very slow. One witness, who was in a position to observe the presence of lighted fuses, did not observe any. This witness was an off-duty city police officer. This witness stated that he was aware that the IHB locomotive stopped before entering upon IC trackage, and he estimated that a time interval of 3 minutes elapsed between the stop and start of the IHB train.

d. Point of Collision

The impact occurred on the crossover that connects the IC-IHB interchange track to IC

track No. 6. The crossover was 231 feet in length and the collision took place 120 feet north of the No. 6 track crossover switch.

D Results of the Collision

1 Trajectory of the Train Equipment

As the result of the collision, the IHB locomotive was moved backward approximately 50 feet. The locomotive remained substantially in line with the track, and only the south trucks were derailed. The derailment of the south trucks resulted from the rails overturning under the locomotive upon impact.

The IC caboose landed upright at the bottom of the 10-foot-high roadway embankment, turned approximately 115° from the direction of travel. The following three cars of the IC train were all box cars loaded with lumber. The first following car came to rest on the slope of the embankment. The second car landed on top of the upright caboose. In all, five boxcars and the caboose of the IC train derailed. The locomotive was the only derailed equipment in the IHB train. The relative positions of the derailed equipment following the accident are shown in Figure 1.

2 Casualties

The conductor of the IC train died shortly after the accident. The IC flagman was injured seriously.

The engineer of the IHB train was found dead in the wreckage. The IHB front brakeman survived the collision with serious injuries.

3 Equipment Damage

The IC caboose experienced the initial impact, overturned, and subsequently had a loaded boxcar land on top of it. The steel-body caboose survived without major deformation of the body configuration. Figure 4 shows the end of the caboose that collided with the IHB loco-

motive. Figure 5 shows the trailing end, and what originally was the west side, of the caboose. The interior of the caboose was cluttered with dislodged and overturned furniture and appurtenances. The IC estimated the damage to the caboose to be \$5,000.

The three cars that followed the caboose in IC Train 1218 were damaged extensively. The IC estimated damages of the cars, in the order the cars followed the caboose, to be \$10,000, \$6,000, and \$6,000, respectively. The fourth and fifth cars behind the caboose were damaged moderately.

The cab of the IHB locomotive was demolished, with the exception of a small area where the front brakeman was located. Figure 6 shows the engineer's side of the locomotive. Figure 7 shows the opposite side of the locomotive. The structural underframe of the locomotive appeared to be relatively undamaged. The IHB estimated the damages to the locomotive to be \$75,000.

4 Post-Collision Activities

The sound of the collision aroused the neighborhood and, within a few minutes, residents and crewmembers were on the scene effecting rescue. The IC conductor and flagman were found within the caboose by other IC crewmembers. The flagman was found standing at the impact end, which originally was the north end, of the caboose and he was removed after the dislodged north door was forced open. The conductor was found lying partially on one of the bunks near the center of the caboose. Interior debris necessitated that access to the conductor be accomplished through the trailing door of the caboose. This access was obtained only after disposing of a locked padlock that secured the door. The conductor was removed to the outside as there was concern by the IC crewmembers that the caboose might collapse under the weight of the boxcar on top of it.



Figure 4 – The Collision End of IC
Caboose No. 9636

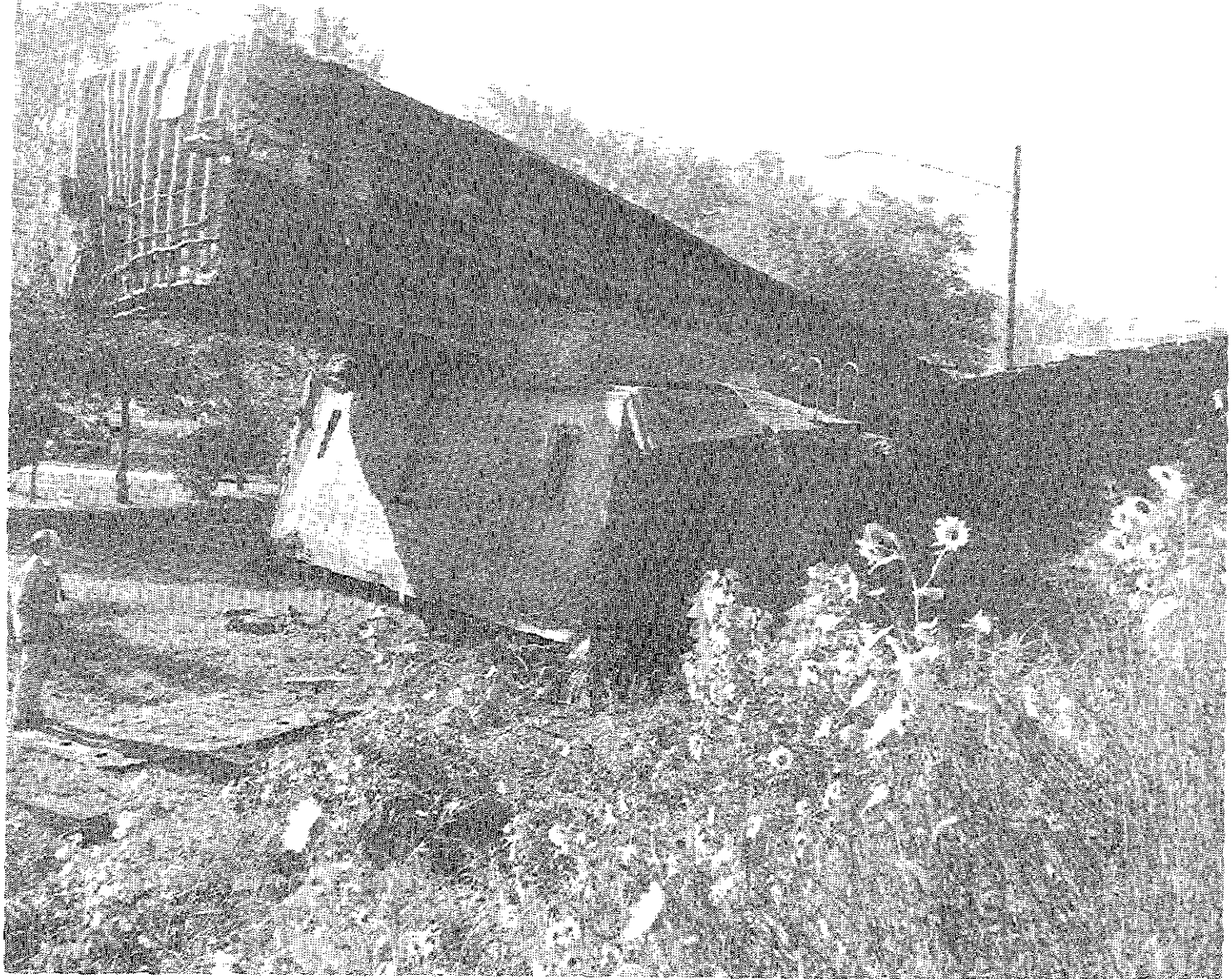


Figure 5 – The Trailing End of IC Caboose
No. 9636

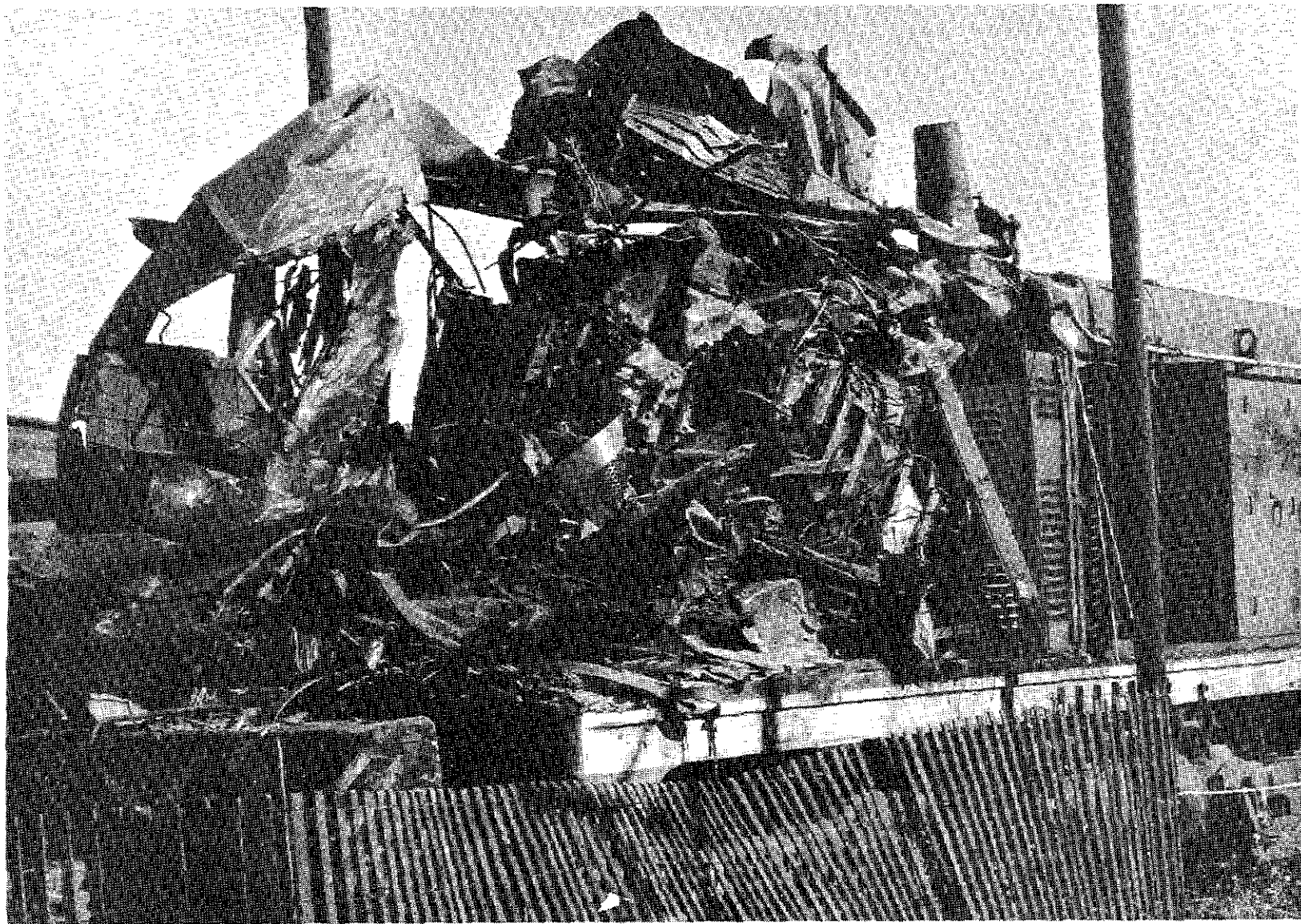


Figure 6 – The Right Side or Engineer's Side
Of IHB Locomotive No 8717

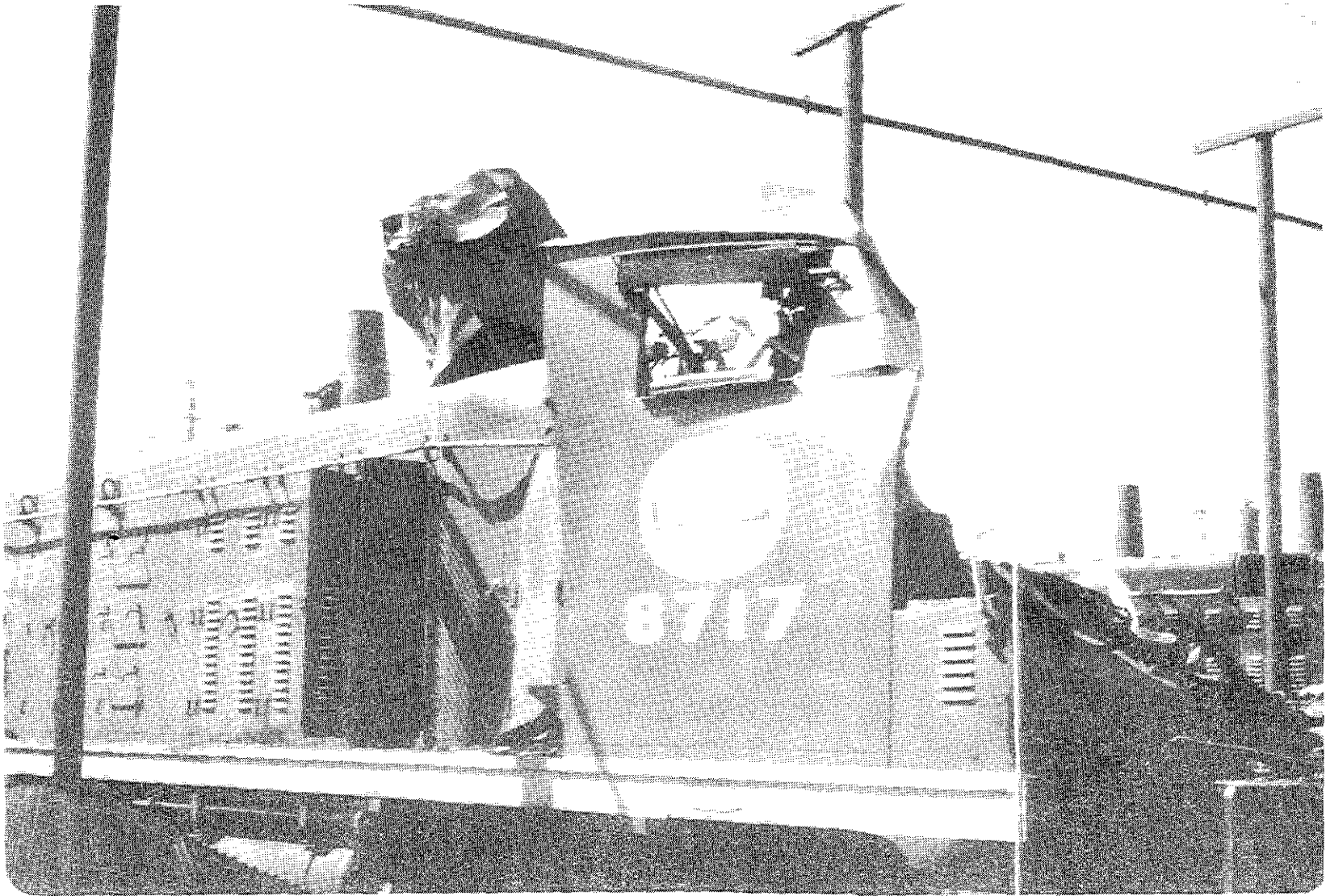


Figure 7 – The Left Side of IHB Locomotive
No. 8717

The IHB front brakeman was found conscious in the west side of the locomotive control compartment by local residents. He was assisted to the ground to await medical attention. The engineer had succumbed and was not discovered in the wreckage until after arrival of rescue units.

Local rescue units were advised immediately of the accident and responded promptly. The injured survivors were dispatched by ambulance to a local hospital. The IC conductor died in the hospital approximately 1 hour after the accident.

Post-mortem examinations of the IC conductor and the IHB engineer were performed by the county coroner. The cause of death of the engineer was determined as "multiple injuries extreme." The cause of death of the conductor was determined as "cranial cerebral injuries and internal fractures." An analysis of the conductor's blood for alcohol indicated an amount inconsequential to the accident.

A postaccident examination of the IC trackage in the area revealed that all of the switches were lined to accommodate movement from the IC-IHB interchange track to track No. 5. The No. 6 track crossover switch of the crossover between track No. 5 and track No. 6 showed evidence of having been run through by the trailing-point movement of Train 1218.

Inspection of the signals after the accident indicated that the signals were functioning as intended under the circumstances, that is, signal 6-1799 displayed a continuous red aspect regardless of track occupancy. The track-occupancy indicator for track No. 5 was found to be inoperative, as both lamps of the indicator were broken.

The IHB locomotive was damaged to an extent which precluded a postaccident inspection of the controls, brake system, or headlight. The IC locomotive and the 16 undamaged cars of Train 1218 were inspected, and no conditions were discovered to indicate

that equipment failure was a causal factor in the accident.

Substantiation of the IHB front brakeman's use of fuses prior to the accident was provided by a witness, an off-duty IHB switchman who lived in the area. This man indicated that he awoke to the sound of the collision, dressed, and arrived at the scene approximately 3 minutes after the accident and found one fuse burning between track No. 5 and No. 6. This man is the only witness who observed a fuse, either before or immediately after the accident. Residue from burned out fuses was prevalent in the immediate area the day following the accident, but fuses also had been used in this area, before and after the accident. The IHB normally uses fuses that take approximately 5 minutes to expire after ignition.

5 Cost of the Collision

The estimated cost of the accident is tabulated below. These costs do not include personal injury settlements, lading damage, expenses to clear the wreckage, legal fees, accident investigation costs, and the expense of delays to traffic.

IC Equipment Damage	-	\$ 28,400
IC Track Damage	-	100
IHB Equipment Damage	-	<u>75,000</u>
Total Costs		\$103,500

III ANALYSIS

A The Accident Would Not Have Occurred If . . . !!

As is the case in most accidents, there were many factors that were influential to the occurrence of this collision. The absence of any one of these factors most likely would have resulted in the avoidance of the fatal collision. Some of the factors involved in this accident

were circumstantial and nonreversible, while others were controllable. This section of the report deals with the controllable causal factors, or the causal "ifs."

1 If the Rules Had Been Observed?

This collision occurred on trackage owned by the IC and, therefore, both the IC and IHB train crews were governed by the current "Rules and Regulations of the Operating Department," subsequent timetable instructions, and subsequent bulletin order instructions, all issued by the IC and listed in Appendices A and B.

a The IC Train Crew

Most of the rules listed in the appendices appear influential in the movement of the IC train from Markham Yard to Highlawn according to the literal interpretation. However, all of these rules have not been indicated by the two railroads as being applicable to these circumstances, or the evidence presents conflicting circumstances. The matter of rule clarity will be discussed later, but two rules not complied with by IC personnel were Rules 103 and 291.

The IC conductor in charge of the train was in the caboose. This location was the best vantage point for control of the northward train movement. The conductor had communications with the engineer available through use of the radio and also could control the train's movement by use of the brake valves on the caboose.

Rule 103 states, "When cars are pushed by an engine, and the conditions require, a trainman must take a conspicuous position on leading car, and at night he must display a white light." Rule 291 involves movement by a signal with a number plate, such as signal 6-1799, when displaying a red aspect. This rule authorizes passing the signal without stopping, but at "Restricted Speed"

"Restricted Speed" is defined as "Proceed prepared to stop short of train, obstruction, or switch not properly lined and look out for broken rail, but not exceeding 10 MPH."

The conductor of the IC train failed to comply with these rules. The cupola of the caboose could not be interpreted logically as a "conspicuous position" and the placement of a lantern inside the caboose door was not a logical location to "display a white light." The fact that the IC train did not "stop short of a train or switch not properly lined" indicates noncompliance with Rule 291.

Compliance with Rule 103 might have averted the collision, and most certainly would have lessened the incidence of fatality and serious injury, even if the collision occurred. Full compliance with Rule 291 would have averted the accident.

Rules 106 and 106(a) delegate direct responsibility for the safety of a train to the conductor and the engineer, but also indicate that other crewmembers have a responsibility to prevent accidents or violation of the rules. The IC flagman, who was located in the caboose with the conductor, had the opportunity to take a conspicuous position and to display the required white light. He also had opportunity to control the northward movement of the train. The flagman failed to take any action until it was too late. The flagman saw the headlight of the IHB locomotive but evidently did not relate it to Rule 17 and realize the locomotive was not standing and waiting for the IC train to pass the junction.

The engineer of the IC train was located 21 car lengths back of the caboose and, therefore, in the darkness of the night, his exact control of the train was dependent to some extent upon the actions of the conductor or flagman in the caboose. However, the collision occurred 715 feet, or approximately 14 car lengths, north of signal 6-1799. Rule 291 specifies a maximum

speed of 10 miles per hour when any part of the train passes signal 6-1799, and under the conditions of darkness the required speed could be interpreted as considerably less than 10 miles per hour. A distance of 3,340 feet separates signal 6-1799 and the next signal to the south, signal 6-1862. Just prior to the collision, the engineer was starting to reduce the speed of the 22-car train. This action was taken approximately 3,900 feet after passing signal 6-1862, which had displayed a yellow aspect, requiring that the train be prepared to stop at the next signal. Although the aspect of signal 6-1799 did not require that the train stop before passing, it did require that the train be under control and able to stop short of a switch improperly lined.

The accident would not have occurred if the rules had been observed by the IC crewmembers.

b The IHB Train Crew

Rule N of the "Rules and Regulations of the Operating Department" of the IC indicates that trains of other railroads operating on the IC are subject to IC rules. The IHB train crew had not been examined on the IC rules, had not received the opportunity to review all IC bulletin orders, did not possess copies of IC rule books or timetables, and presented varying interpretations as to the methods of operation on IC trackage.

Most of the rules listed in the appendices would apply to IHB operation on IC trackage. It appears that Rule 93, Rule 99, Rule D-99, Rule D-152, Rule 510, and Rule 513 would be significant, particularly as these rules all concern the method of accomplishing the crossover movement from the IC-IHB interchange track across IC track No. 6 to IC track No. 5. These rules also were subject to varying interpretations by the involved IHB crewmembers, all of whom were experienced men. The specific point concerned is

whether this crossover movement should have been covered by fusee or flag protection.

The correspondence between the FRA and IHB representatives previously referred to was an attempt on the part of the FRA to clarify this point. The response was inconclusive. Sometime after the accident occurred, the two railroads convened a joint investigation of the accident to determine the cause. At this investigation, an IC representative stated that the crossover movement planned by the IHB did not require fusee protection. It is difficult to reconcile this reasoning with the literal language of Rules D-152 and 510, but this interpretation makes the use or nonuse of fuses academic.

Specific rule violation by IHB personnel has not been established as a causal factor from the evidence. It has been established that the IHB personnel were not familiar with applicable IC rules, instructions, and bulletin orders. To what extent this unfamiliarity contributed to the accident and the resulting severity is a matter of speculation.

2 If the Signal System Had Provided the Intended Control?

Chapter III of the "American Railway Signaling Principles and Practices"¹ commences with the following statement: "The purpose of railroad signals is the transmitting of information to employees in charge of the operation of trains."

Signal 6-1799 was located 715 feet south of the point of impact and controlled northward train movement on IC track No. 6. On August 21, 1969, track changes in the vicinity of the Little Calumet River bridge resulted in signal

¹ Published by the Signal Section, Association of American Railroads; May 1955 edition.

6-1799 displaying a continuous red aspect. Prior to the 1969 track changes, the alignment of any of the four crossover switches at Highlawn for a crossover movement resulted in a red aspect displayed by signal 6-1799 for northward movements on track No. 6. A red aspect demanded caution in advancing a train northward on track No. 6, as an accident could result from disregard of the red warning. After the 1969 changes, this warning no longer existed, as signal 6-1799 displayed red for normal conditions as well as abnormal. The evidence indicated that the IC conductor and flagman observed the red aspect of signal 6-1799, but ignored its meaning as it was a normal occurrence. The signal no longer transmitted positive information to the employees in charge of the operation of trains. However, no special instructions nullified the necessity for complying with the requirements of the restricted speed rule.

No alternative means were provided to protect northward movements on track No. 6 or the southward movement of IHB trains across track No. 6. These means were available within the economic boundaries of the Little Calumet River channel widening project and could have included such items as track-occupancy indicators at Highlawn for track No. 6, switch-position indicators for northward movement on track No. 6, or, simply, special instructions requiring precautionary measures in accomplishing the crossover movement at Highlawn.

A signal that displays a continuous warning indication may provide less protection than no signal at all. A continuously displayed warning signal invites disrespect of the intended warning and transmits sparse information to employees.

The accident might not have occurred if the signal system had provided the intended control.

3 If the Operating Rules Had Provided the Intended Control?

a Nonobjective Operating Rules

The interpretations of many rules were involved in this accident. The one glaring rule violation that had direct influence on the occurrence of the accident involved Rule 291. This rule authorized passing a red signal without stopping at "Restricted Speed." The wording of Rule 291 had been changed with the adoption of the new rule book on September 1, 1970. Prior to this date, a red aspect on signal 6-1799 required a train to stop, and then the train was permitted to proceed at "Restricted Speed." If this provision of Rule 291 still had been effective and observed on the accident date, it is likely that the overall severity of the collision would have been less. The speed of Train 1218 most likely would have been slower and it also is probable that the IC crew would have been more attentive to the circumstances.

The "Restricted Speed" rule, as well as other similar rules such as "Reduced Speed" or "Yard Speed," are subject to question as to their effectiveness in accomplishing the intended function. These rules have advanced operations, but in many instances it has come about at the expense of safety.

The FRA actively investigated 117 railroad accidents during the fiscal year ending on June 30, 1970.² Twenty-nine accidents involved collisions that occurred as the result of crewmembers not taking the proper action. Twenty-six, or 90 percent, of these collisions resulted from failures of crewmembers to operate their trains in accordance with restrictive signal indications and/or rules governing speeds within yard limits.

²"Summary of Accidents Investigated by the Federal Railroad Administration in the Fiscal Year 1969-1970."

Various railroads have shown their awareness of the problems of the "Restricted Speed" rule. The maximum speed permitted under this rule was originally 20 miles per hour. This speed has been lowered to 15 miles per hour on some railroads and to 10 miles per hour on others, like the IC. A 10 mile per hour speed limit did not prevent this accident, as the rule was violated and no signal device stopped the train.

The "Restricted Speed," "Reduced Speed," and "Yard Speed" rules appear impractical under present circumstances. It does not seem logical to expect employees to be prepared to stop a train short of an unspecified obstruction, a switch not properly lined, a broken rail, or one-half the range of vision while proceeding during the darkness of night over an unlighted pathway. The necessary speed to fulfill the requirement of these rules is not compatible to advancing operations and, therefore, the rules are not enforced until after an accident occurs. The end result advances neither safety nor efficient operations.

A similar argument concerning nonobjective rules could be presented on the proper display of the headlight on the IHB locomotive. The headlight of this locomotive was sighted by the IC flagman prior to the accident, yet the flagman took no action as he assumed the IHB train was in the clear. It is not known on what logical basis this assumption was made, as Rule 17 indicates that the headlight must be extinguished when a train is standing to meet another train at a junction. Special Instruction D-151 indicates that the interchange track at Highlawn is a "junction," but "junction" is not defined elsewhere in the rules. Rules 17 and 17(a) are structured as safety measures to control headlight display, but they are un-specific in the meaning and required action for conflicting train movements. The warning provided by the headlight of the IHB locomotive was disregarded as the rules did not cover fully the circumstances.

There were other rules involved in this accident that were not objective, and subject to various interpretations. A prime example involved the question as to whether flag or fusee protection was required by the IHB in accomplishing the intended crossover movement to IC track No. 5. For this instance, the carrier's interpretation must prevail; however, to be consistent in application, that interpretation must be disseminated and explained to all those governed by it. It would be better to rewrite the rules simply to express their intent objectively.

b Interchange Practices Between Railroads

Both the IC and the IHB have rules indicating that IHB employees operating on IC trackage are subject to IC rules. It would be an invitation to disaster to expect otherwise with present circumstances. However, IHB employees are exposed to this situation on railroads other than the IC. On the date of the accident, this IHB train crew was assigned work on two other railroads besides the IC. IHB timetable No. 3 indicates that IHB employees are subject to the rules of eight railroads, although it is unknown to what extent individual employees are involved with each road or rule.

The applicable IHB rule book contains 146 pages and the IHB timetable contains 46 pages. The applicable IC rule book contains 184 pages and the IC timetable 18 pages. Presumably, the other railroads on whose tracks IHB train crews operate have rule books and timetables of similar size. There were 33 IC rules interpreted as applicable to the operations in this accident and these are tabulated in Appendix A. Of these 33 rules, 23 either do not exist or carry markedly different connotations in the IHB rule book. Carrying this to an extreme, one could project this proportion of discrepancies through the 184 page IC rule book text and multiply it by the eight other

railroads involved. It is not difficult to understand why confusion existed among the members of the IHB train crew when they were interviewed for their understanding of IC rules.

Obedience to the rules is also dependent upon their being available for perusal by the involved crewmembers. The purpose of bulletin orders is to advise crewmembers of unusual circumstances or exceptions to rule book or timetable instructions.

The absence of IC Bulletin Order No. 57 at locations where IHB bulletins were posted is consistent with the IHB crewmembers' lack of knowledge of IC yard limits. This bulletin order, which connected the yard limit location, in itself, did not appear significant to the accident, as the IHB crewmembers did not possess the timetable that Bulletin Order No. 57 connected. The missing bulletin order, the absence of IC timetables, and the unfamiliarity of the IHB crewmembers with IC rules, suggest that overall operations were not conducted in accordance with IC rules. It appears, instead, that IHB operations on IC trackage were dependent more upon the experienced judgment of the IHB crewmembers. This is not good practice since judgment of individuals varies.

Presumably, the two railroads had valid reasons for structuring their respective operating rules in different manners. The reasons become obscured, however, when interchange practices and circumstances are considered in their entirety.

c The Need for Objective Operating Rules

The FRA now is considering the promulgation of regulations governing operating procedures for the Nation's railroads. This accident clearly illustrates the hazards of rules that do not describe conditions objectively, rules that are not compatible with each other or encountered conditions, and rules that are not enforceable until after an accident occurs. The railroad industry is a unique transportation

mode since its pathway is controlled by, and generally only accessible to, operators subject to company discipline. Objective, enforceable rules may accomplish a great deal in promoting the overall safety of the system if they are strictly observed. Rules such as "Restricted Speed," "Reduced Speed," and "Yard Speed," as defined in this case are examples of rules that do not breed a safe system.

A review of existing rules appears in order. The application of a systems approach in this review would reveal rules that are incompatible not only with each other, but also with the capabilities of the operating personnel and the total railroad environment. "Obedience to the rules" can be accomplished only when the rules are objectively defined, understandable, and readily located and identified.

The accident would not have occurred if the operating rules had provided the intended control.

4 If Good Communications Had Existed?

a The IC Switchtender at Harvey

As is the case in so many instances, adequate communications among the involved parties might have averted the accident. Three persons primarily were involved in the movements of IC Train 1218 and IHB Train 8717 prior to the collision, namely the IC conductor, the IHB front brakeman, and the IC switchtender located at Harvey. Of these three persons, only the switchtender knew of the possible coincidental movement of both trains over conflicting pathways. This information was not passed on to the respective involved train crews and the fatal accident occurred.

The switchtender's record of train movements indicates that IHB Train 8717 secured authority to operate southward on IC track No. 5 at 10:30 p.m., the starting time for the crew of IC Train 1218. This information was secured by the front brakeman of the IHB train from the Harvey switchtender, secondhand, via

an IHB operator located at Stewart Avenue. The IHB front brakeman was not advised of any possible conflict in train movement. The lack of such advice would be understandable in view of the uncertainty of the intended movement of IC Train 1218 at that time.

IC Train 1218 moved northward on track No. 6 from Markham Yard at 11 p.m. At that time, IHB Train 8717 had not arrived at Markham Yard and the possibility of a conflict between the authorized movements evidently existed. No action was taken by the switchtender, although radio communication was available to the locomotive of IC Train 1218, and the train passed by the switchtender's position at a relatively slow speed. The man who was directing traffic established unalterable routes for the trains, but assumed no control thereafter, as fail-safe procedures were not established.

The IC rules do not require communication between the switchtender and affected train crews nor do the rules direct responsibility to the switchtender for movements with the current of traffic on track No. 6. A proceed signal by the switchtender for a northward train movement on track No. 6 means only that the switches are lined for such a movement. Thereafter, a train is to be governed by the information transmitted by block signals, even though the switchtender has knowledge of conflicting movements and the information transmitted by the block signals is questionable. Communications are essential to safe operations.

b The Vandalized Telephone at Highlawn

Another consideration of the communication involvement with this accident concerns the telephone at Highlawn. This telephone allowed direct communication between the Harvey switchtender and IHB personnel seeking authority to use IC trackage between Highlawn and Markham Yard. The telephone had been vandalized sometime prior to the

accident and had not been repaired subsequently. Alternate procedural requirements for involved train crews and the Harvey switchtender had not been instituted to alleviate the loss of this telephone, even though vandalism at this location was not unusual.

There is the distinct possibility that if this telephone had been operable, the accident would not have occurred. Thirty minutes elapsed from the time the IHB front brakeman secured authority for operation on IC trackage and the authorization of the movement of IC Train 1218 from Markham Yard. A subsequent time interval of approximately 8 minutes occurred prior to the collision. Direct communications between the IHB train crew and the Harvey switchtender could have resulted in the switchtender's advising the IHB crew of the northward movement of the IC train. This becomes a more distinct possibility when the time of the two movements coincide, such as in this case. An operable telephone at Highlawn could have projected this direct communication.

Vandalism has been attributed as a causal factor of many railroad accidents in the past. Other acts of vandalism in this area were evident as shown by the inoperative track-occupancy indicator and the previous vandalism of the Highlawn telephone, but the area was not secured by right-of-way fences. The vandalized telephone at Highlawn had not been reported to the responsible IC maintenance officer prior to the accident, even though it was common knowledge among crewmembers that the telephone was inoperable. The requirement for communication extends to all involved. The accident might not have occurred if good communications had existed.

5. If the Pathway of IC Train 1218 Had Been Lighted?

For operational convenience, IC Train 1218 departed Markham Yard with the locomotive showing the train from the south end

with the unlighted caboose as the lead car on the north end of the train. The scheduled destination was approximately 4 miles from Markham Yard.

The train was expected to negotiate approximately one-half mile of trackage "prepared to stop short of train, obstruction, or switch not properly lined and look out for broken rail." According to rule, the lead car was to be marked by "a white light" of unspecified intensity. Normally, trainmen's lanterns are used for this purpose. These lanterns project a light similar in intensity to a household flashlight, but not necessarily in a directed beam. The IC conductor and flagman failed to comply fully with this rule, however, and no light was directed to the pathway ahead of them during their trip.

The train crew was to be prepared to stop short of any train that could be headed by a similar caboose or car. The train crew was to be prepared to stop short of an obstruction which could include an item such as a joint bar jammed between a switch point and stock-rail, or objects of similar size. The train crew was to be prepared to stop short of switches that were equipped with switch position targets that were dependent upon a light source for reflectivity. The train crew was to look out for broken rail that could be difficult to identify in the daytime, much less at night. It would appear that a creeping speed of 1 to 2 miles per hour would be as fast as a train could progress and still comply with the existing "Restricted Speed" rule when shoving an unlighted car at night.

The incompatibility of the "Restricted Speed" rule with a nighttime train movement involving a caboose as a lead car seems clear. A further consideration involves the visibility of such a train to others concerned. In this instance, if the approaching IC caboose clearly had been identifiable, it seems probable that the IHB front brakeman or engineer would have taken action either to avert the collision or most certainly, to lessen the severity of their injuries by abandoning the locomotive. Wheth-

er the white light required by the IC rule would have promoted this eventuality is a matter of speculation. A light of much greater intensity than a trainman's lantern would increase the possibility for ready identification of an approaching train under similar circumstances.

The movement made by IC Train 1218 in this accident was not unusual for railroad yard operations. In many instances, reverse movements with unlighted cars also are made over rail-highway or pedestrian grade crossings, complicating the hazard. Automobiles are equipped with backup lights for reverse movements. This case clearly illustrates the requirement for similar safety appurtenances on equipment used extensively for backup movements.

The accident would not have been as severe, and may not have occurred, if the pathway of the caboose of IC Train 1218 had been lighted adequately for the northward movement.

B Equipment Design

Thus far, this analysis has dealt substantially with the causal factors involved in the collision of the two trains. The dynamics of the collision and the cause of the subsequent fatalities and serious injuries also are significant to improving the safety environment of railroad employees. The Safety Board's reconstruction of the sequence of events that resulted in the fatalities and serious injuries follows.

Upon impact, the coupler of the IC caboose overrode the coupler of the IHB locomotive. The structural body of the caboose climbed over the heavy underframe of the locomotive, with the caboose losing its trucks in the process. The caboose angled to the east and subsequently struck the engineer's side of the control compartment of the locomotive. This impact initiated the collapse of the locomotive cab, trapping the IHB engineer. The caboose

was still being shoved by the weight of the train behind it and rolled off the side of the locomotive, overturning as it went down the 10-foot-high roadway embankment

The detached caboose trucks provided a ramp for the following loaded boxcars. The first and second following cars traversed the path of the caboose, climbing over the detached trucks and also the underframe of the locomotive. These cars subsequently struck the locomotive cab and completed the demolition of the engineer's side of the control compartment. The second following car subsequently rolled down the embankment and landed on top of the upright caboose.

The IHB engineer was trapped in the general wreckage and succumbed from multiple injuries. The IHB front brakeman survived by the circumstantial easterly trajectory of the caboose. This trajectory might have been influenced by the curvature of the crossover where impact occurred. In any event, the only portion of the locomotive control compartment that was not demolished in the collision was the area occupied by the front brakeman on the westerly side of the cab.

The IC conductor and flagman were standing in the trailing end of the caboose prior to collision. Upon impact, they evidently were thrown forward, but stayed within the caboose. During the initial impact and the subsequent overturning, some furniture and caboose appurtenances were dislodged. The two crewmembers were tossed around again as the caboose overturned and came to rest. The IC conductor died as a result of head injuries and internal fractures. Whether these injuries resulted from flying material or from the conductor's momentum during the crash gyrations was not determined.

This accident aptly illustrates two vehicular crash characteristics that have been prevalent in many previous railroad collisions. These characteristics include (1) the tendency of conventional car equipment to climb over the underframe of a locomotive upon collision,

and (2) the apparent lack of occupant crash protection provided with current locomotive cab design. Unfortunately, both characteristics have been coincidental in many instances and the results have been fatal.

The collision speeds in this accident were estimated to be 10 to 20 miles per hour for the IC train, while the IHB train had just commenced to move. The IHB locomotive cab was demolished, with one fatality resulting. There have been numerous other slow-speed collisions that have resulted in similar serious circumstances and they are documented in FRA railroad accident reports. A prime example is illustrated in the FRA's "Railroad Accident Report No. 4158." In this instance, one train was standing and the other train was backing at a speed estimated to be 3 to 6 miles per hour. The locomotive crew on the standing train had ample warning of the impending collision to evacuate the control compartment, but they expected only a hard bump and braced themselves accordingly. Upon impact, the caboose of the backing train climbed the underframe of the locomotive and demolished the locomotive cab. Two occupants of the locomotive cab were killed, while the third occupant lost a leg as a result of the collision. The caboose of the backing train was damaged slightly.

Modifications in locomotive design definitely are required. It does not appear logical to place a control compartment on the end of a massive locomotive where it is exposed to all collision hazards without providing protection for the occupants of that compartment. The caboose in this accident survived the dynamics of the collision relatively intact structurally. The critical vertical structural supports at the end of the caboose consisted of two cornerposts, which were 5- by 5-inch angles one-half inch thick. Intermediate supports included two 3-inch Z-sections, one-quarter inch thick, and two 6- by 6-inch-wide flange sections having a flange thickness of three-eighths inch and a web thickness of one-quarter inch. By contrast, the vertical struc-

tural supports at the end of the locomotive control compartment consisted of six box sections, each being 2½ by 1½ inches and one-eighth inch thick. The weight of each of the box sections used in the construction of the locomotive cab approximated 32 pounds per foot. The weights per foot for each of the members used as vertical supports in the caboose were 16.2 pounds for the cornerposts, 6.7 pounds for the intermediate Z-sections, and 20.0 pounds for the intermediate wide flange sections. It is apparent why the control compartment of the locomotive collapsed and the caboose remained intact upon impact.

It also is pertinent to note that although the IC caboose survived the collision in relatively good shape, the conductor within the caboose was a fatality. "The operation was a success, but the patient died." It was not determined what caused the fatal blow or blows. However, it is significant that although most of the caboose furnishings were secured, the interior of the caboose was cluttered with overturned furniture and appurtenances following the accident. This may have had some effect on the extent of the injuries incurred by the occupants. It is also likely that some injuries were incurred as a result of the unsecured crewmembers being tossed about.

The IC crewmembers evidently did not have time to escape the impending collision by means of the rear door of the caboose. If sufficient time had existed, any such attempt for escape would have been fruitless, as the rear caboose door was locked from the outside by a padlock. An exit that is provided for emergency escape is valueless under such conditions.

The FRA has recognized the lack of crashworthiness in present railroad locomotive design. The FRA recently conducted an industrywide seminar in an attempt to solve the problems. As the result, observations and ideas developed directed to the improvement of cab design. Locomotive crashworthiness may be improved by various design modifications including changes to the type or location

of the control compartment, but this also may promote unsuspected degradation of safety in other areas. It appears that a more systematic approach is required--one that will avoid the creation of other problems. The use of systems engineering in reviewing current locomotive design would consider not only the apparent problems illustrated by this accident, but the entire reliability and safety of the locomotive during its expected service life. Systems engineering has proven to be beneficial in the aerospace industry. There is no apparent reason why this technique cannot be applied to the railroad field with long-lasting results.

IV CONCLUSIONS

1. The IC crewmembers violated the rule requiring a crewman to take a conspicuous position and display a white light when cars are pushed by an engine. Compliance with this rule might have averted the collision and, if not, would have lessened the incidence of fatality and serious injury.

2. IC crewmembers violated the rule requiring that the IC train be operated prepared to stop short of a train or a switch improperly lined when passing a "Restricted Proceed" signal.

3. The IHB crewmembers had not been examined on IC rules, nor could they present consistent interpretations of applicable IC rules.

4. It could not be determined if fusee protection was used by the IHB crewmembers for protecting the intended crossover movement.

5. Track changes that took place in 1969 resulted in the continuous display of a red aspect by signal 6-1799. As a result, this signal did not transmit positive information to employees in charge of the operation of trains. No alternative means of control were provided.

6. The operating rules involved in this case did not define objectively the circumstances encountered. The rules were ambiguous, were

not compatible with the expected efficient operation of trains, and could not be interpreted as applicable without considerable cross-referencing and comparison with other rules

7 The rules of the IC and IHB were not consistent in structure or meaning. This inconsistency encouraged the prevalent lack of understanding of applicable IC rules by the involved IHB crewmembers

8. The failure of the IC switchtender to advise the crewmembers of the IC train of a possible conflict in movement with the IHB train played a significant role in the occurrence of the collision. The responsibility for establishing such communications or other applicable procedures was not covered by rule even though means were provided to promote communication

9 The vandalized telephone at Highlawn resulted in indirect and untimely communications between the IHB crewmembers and the IC switchtender, who was responsible for authorizing IHB movement upon IC trackage. The vandalized telephone had been inoperative for some time prior to the accident, but had not been repaired.

10. The practice of shoving cars over an unlighted pathway when visibility was restricted was not compatible with the provisions of rules that placed the responsibility for avoiding an accident upon the ability to stop short of sighted obstructions.

11 The severity of the accident was influenced by the lack of crash protection provided to the occupants of the IHB locomotive, and the proven tendency of railroad car equipment to climb over the heavy underframes of locomotives upon collision.

V. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the Illinois Central

crewmembers to operate IC Train 1218 at a speed so as to be able to avoid the collision.

Additional factors that contributed to the occurrence of the accident were:

- a The failure of the Illinois Central crewmembers to comply with the rule requiring that a crewman take a conspicuous position on the lead car and display a white light when cars are pushed by an engine.
- b. The failure of the Illinois Central Railroad Company to provide additional protection to accommodate the safe movement of trains on track No. 6 when other track changes initiated a permanent display of "Restricted Proceed" on signal 6-1799 in 1969
- c Inadequacies in operating rules, practices, and personnel training

Contributing to the severity of the accident was the apparent lack of crash protection provided to the occupants of the IHB locomotive.

VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

- 1 The Illinois Central Railroad Company take the necessary action to ensure that its employees comply with the company's operating rules
2. The Federal Railroad Administration, in establishing operating rules under the auspices of the Federal Railroad Safety Act of 1970, take the necessary action to ensure that such rules are:
 - a Objective and understandable
 - b Compatible with the environment and expected results
 - c. Enforceable before an accident occurs as well as after the fact
 - d Compact and readily identifiable as to applicability

- e Compatible with practices of interchange between railroads.
- 3 The Indiana Harbor Belt Railroad Company take the necessary action to ensure that its employees are veised thoroughly on the rules of other railroads over which these employees must operate
 - 4 The Illinois Cential Railroad Company develop definite safe procedures for the transfer of cats from the IC-IHB interchange track at Highlawn to IC tracks No 5 or No 6
 - 5 The Illinois Central Railroad Company take the necessary action to ensure that communication procedures or facilities used for the advancement of train operation are used to the fullest extent practicable, and that such communication facilities are maintained in a dependable, operable condition.
 - 6 The Federal Railroad Administration and the railroad industry continue and expand their cooperative efforts toward the timely improvement of the crashworthiness of railroad equipment, particularly as it is related to the protection of the occupants of locomotive control compartments. Improvement efforts should consider all aspects of locomotive safety as related to the entire environment of railroad operation, and not be confined to the improvement of individual components

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H McADAMS
Member

/s/ LOUIS M THAYER
Member

Isabel A Burgess, Member, was absent, not voting

November 24, 1971

APPENDIX A

EXCERPTS FROM "RULES AND
REGULATIONS OF THE OPERATING
DEPARTMENT,"
ILLINOIS CENTRAL RAILROAD COMPANY

GENERAL RULES

* * * *

Rule N.

* * * *

Trains of other railroads, running over any division of this railroad, are subject to these rules and are under the jurisdiction of officers of that division

* * * *

DEFINITIONS

* * * *

RESTRICTED PROCEED SIGNAL --

A block signal designated by a number plate.

* * * *

SPEEDS

* * * *

MEDIUM SPEED.—A speed not exceeding 30 MPH.

REDUCED SPEED -- Proceed prepared to stop short of train or obstruction.

RESTRICTED SPEED -- Proceed prepared to stop short of train, obstruction, or switch not properly lined and look out for broken rail, but not exceeding 10 MPH.

* * * *

YARD SPEED — A speed prepared to stop within one-half the range of vision.

* * * *

OPERATING RULES

* * * *

Rule 11 A train or engine finding a fusee burning on or near its track must stop. After stopping, the train or engine may proceed at REDUCED SPEED for not less than two miles.

* * * *

Rule 17 The headlight must be displayed to the front of trains by day and night. It must be extinguished when a train turns out to meet another train and has stopped clear of the main track, or is standing to meet a train at the end of two or more tracks or at a junction.

* * * *

Rule 17(a) Except when approaching public crossings at grade, the headlight must be dimmed under the following conditions:
(1) When standing or moving at points in yards where other engines are working.

* * * *

(4) When standing or moving on main track at meeting points.

* * * *

Rule 18 Yard engines will display a headlight to the front and rear by night, .

* * * *

Rule 93 Within yard limits main track may be used, and all trains and engines must move on main tracks within yard limits at YARD SPEED unless such tracks are known to be clear.

NOTE — Where Automatic Block Signal System, CTC, and Interlocking rules are in effect, “known to be clear” includes when track is known to be clear by signal indication.

Trains and engines must not be moved against the current of traffic within yard limits until provision has been made for the protection of such movement and, in addition, movement must be made at YARD SPEED

* * * *

NOTE – Yard limits are indicated by yard limit signs and their locations are shown in timetable

* * * *

Rule 98 Trains and engines must approach the end of two or more tracks, junctions, railroad crossings at grade, and drawbridges, prepared to stop, unless the switches are properly lined, signals indicate proceed, and track is clear . . .

* * * *

Rule 99. 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 view is obscured burning fuses must be thrown off at proper intervals

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 burning fuses . . .

When the conditions require, he will leave the torpedoes and a burning fuse

The front of the train must be protected in the same way when necessary by the forward trainman or fireman.

* * * *

Rule 99(a). Within Interlocking, Automatic Block System or Centralized Traffic Control System limits, flag protection is not required against following movements on the same track.

* * * *

Rule D-99 A train running against the current of traffic must protect itself as required by Rule 99

* * * *

Rule 103 When cars are pushed by an engine, and the conditions require, a trainman must take a conspicuous position on leading car, and at night he must display a white light

* * * *

Rule 106 Both the conductor and the engineer are responsible for the safety of the train and the observance of the rules and, under conditions not provided for by the rules, must take every precaution for protection, but this does not relieve other employees of their responsibility under the rules

Rule 106(a) When safety of trains and observance of rules are involved, all other crew members are responsible to the extent of their ability to prevent accident or violation of the rules

When the conductor or engineer fails to take action to stop the train, and an emergency requires, other crew members must take immediate action to stop the train

* * * *

Rule 109. Bulletin orders and notices will be issued by the proper official and will be numbered consecutively on each division, beginning with January first of each year, and will be posted on bulletin boards designated in timetable. When instructions are of a permanent nature, they will be transferred to timetable special instructions when new timetable is issued, otherwise they expire with the calendar year

Conductors, enginemen, trainmen, yardmen and others concerned must examine bulletin orders and notices before commencing each day's work or trip, if bulletin board is located at the station where work is started, and if bulletin board is not located at such station, they must examine such bulletin orders and notices at first opportunity and will be held responsible for their observance

Bulletin boards must not be used to post unofficial notices

Employes in charge of bulletin boards must promptly post on such boards bulletin orders and notices which they receive

* * * *

Rule D-152 When a train crosses over to, or obstructs another main track, unless otherwise provided, it must first be protected, as prescribed by Rule 99, in both directions on that track

* * * *

Rule 160 When speed is restricted by rule, special instructions, bulletin orders or otherwise, such speed restrictions must be observed. Speed restrictions, unless otherwise provided, apply to the entire train

Rule 161. Trainmen on rear of trains will, when practical, give proceed signal or notify engineer by radio, when so equipped, that rear of train has passed point where speed restriction applies.

* * * *

RULES GOVERNING MOVEMENT OF TRAINS BY BLOCK AND INTERLOCKING SIGNALS

* * * *

Rule 267 When a block or interlocking signal displays "Absolute Stop" or a block signal displays "Restricted Proceed," one or more of the following conditions may exist in the block or interlocking limits:

- (a) Train or other obstruction.
- (b) A main track switch or detail not set to normal position
- (c) Opposite switch of crossover not set to normal position.
- (d) A car or engine on a siding or auxiliary track within fouling distance of a main track
- (e) A broken rail
- (f) Drawspan of a drawbridge not in position for movement of a train
- (g) Failure of a signal

* * * *

Rule 275 When a movement through a crossover from one main track to another main track, or from a siding or auxiliary track to a main track, is to be made in Automatic Block Signal System or Centralized Traffic Control System limits, both switches of the crossover must be open before train starts the crossover movement, and the movement must be completed before either switch is restored to normal position

* * * *

Rule 281 (Signals)
Aspect -- Green
Indication -- Proceed
Name -- Clear

* * * *

Rule 285 (Signals)

Aspect – Yellow

Indication – Proceed, preparing to stop at next signal Train exceeding Medium Speed must at once reduce to that speed.

Name – Approach

* * * *

Rule 291 (Signals)

Aspect – Red (With number plate)

Indication – Proceed at Restricted Speed

Name – Restricted Proceed

See Rule 509(a)

* * * *

AUTOMATIC BLOCK SYSTEM RULES

* * * *

Rule 508(a) On any track signaled for traffic in one direction, block signals apply only to trains or engines moving with the current of traffic

* * * *

Rule 509(a) Except as provided in timetable special instructions, bulletin order or Rule 104 (g), trains or engines may pass “Restricted Proceed” signals without stopping, proceeding at RESTRICTED SPEED until entire train has passed through block, expecting to find one or more of the conditions mentioned in Rule 267.

* * * *

Rule 510. A switch must not be opened to permit a train movement to a main track, nor may a train move to a point within fouling distance of a main track, unless train is authorized by rule, timetable or train order to occupy main track or is protected as prescribed by Rule 99

Rule 513 Unless otherwise provided, before a train or engine enters or fouls a main track, or crosses from one main track to another, a member of the crew must operate the switch and wait five minutes at the switch before the train or engine fouls the main track.

* * * *

APPENDIX B

EXCERPTS FROM CHICAGO DIVISION THROUGH TRAIN TIMETABLE NO 16
AND APPLICABLE BULLETIN ORDERS,
ILLINOIS CENTRAL RAILROAD COMPANY

TIMETABLE NO. 16 – March 8, 1970

* * * *

SPECIAL INSTRUCTIONS

* * * *

93. Yard Limits:

* * * *

(MP 29 plus 264 feet to MP 31) Tracks 5 and 6

* * * *

101. Speed Restrictions: Speeds shown are maximum authorized between points named but do not modify any rule or special instruction which may require lower speed.

* * * *

Between Kensington and Richton – All Trains
Switcher or Transfer
Engines

* * * *

Tracks 5, 6 30 MPH

D-151. Two or more Tracks:

* * * *

Between Kensington and Richton: (See Rule 261)

<u>No</u>	<u>Location</u>	<u>Use</u>
1	West	Southward, suburban
2	Second	Northward, suburban
3	Third	Southward, passenger and freight
4	Fourth	Northward, passenger and freight
5	Fifth	Southward, freight
6	Sixth	Northward, freight
7	East of track 6 between Highlawn and Harvey only, northward and southward transfer trains between Highlawn I H B Junction and Markham Yard	

* * * *

Between Highlawn I.H.B. Junction and north end Markham Yard, tracks 6 and 7 may be used by northward and southward trains; these tracks must not be used without authority of switchtender located at north end of Markham Yard

Track No 7 between the above points has no block signals

Trains or Engines will move at reduced speed on Track No 7 and flag protection is not required.

* * * *

SUPERINTENDENT'S BULLETIN ORDER NO. 57 – March 9, 1970

* * * *

All Concerned:

Rule 93

That portion of special instructions contained in Chicago Division through train time table No. 16 taking effect 12:01 a.m., Sunday, March 8, 1970 is amended to read:

Rule 93 yard limits

MP 14 + 4488'	to MP 29 + 0264'	Tracks 5 & 6
MP 29 + 0264'	to MP 31	Track 3 & 4

* * * *

SUPERINTENDENT'S BULLETIN ORDER NO. 19 -- January 1, 1970

* * * *

ALL CONCERNED:

Effective 4:00 p.m., Thursday, August 21, 1969, and continuing until further notice, a system of hand operated crossover switches will be placed into service, connecting tracks 3, 4, 5 and 6 at 138th Street. Switchtender will be on duty at this location.

All trains and engines will approach this system of crossover prepared to stop and will not proceed until proper hand signal has been received by switchtender on duty

Movement through these turnouts must not exceed fifteen (15) miles per hour

* * * *