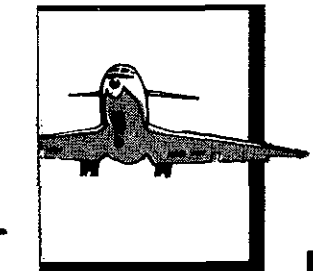

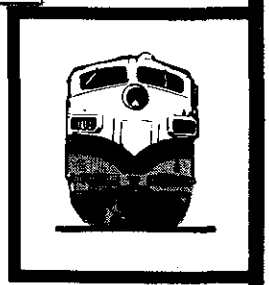

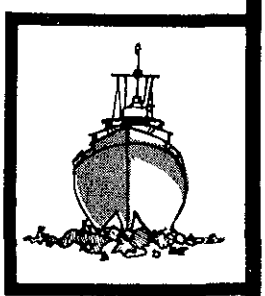

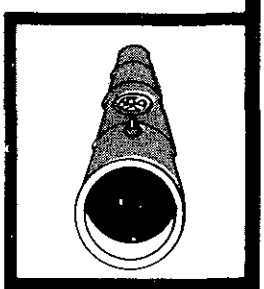

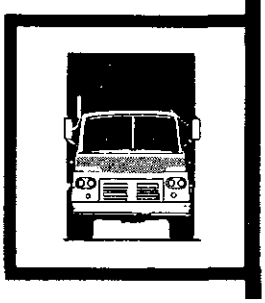

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF AMTRAK TRAIN NO. 4
THE SOUTHWEST LIMITED
ON THE ATCHISON, TOPEKA
AND SANTA FE RAILWAY COMPANY
LAWRENCE, KANSAS
OCTOBER 2,1979

NTSB-RAR-80-4

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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15 Supplementary Notes

16 Abstract

About 6:10 a.m., on October 2, 1979, Amtrak passenger train No. 4, the Southwest Limited, derailed 3 locomotive units and 17 cars while moving through a 7° curve on the Atchison, Topeka and Santa Fe Railway Company's tracks at Lawrence, Kansas. The speed of the train was 78 mph. Of the 147 passengers and 30 crewmembers, 2 persons were killed and 69 persons were injured. Property damage was estimated at $4,634,330.

The National Transportation Safety Board determines that the probable cause of this accident was the operation of the train at an excessive rate of speed into a 7° curve. The engineer failed to reduce the speed of the train because of a missing speed-restriction sign, inoperative automatic train stop equipment, and his unfamiliarity with the route. Contributing to the accident were the assignment of an engineer who did not meet the Atchison, Topeka and Santa Fe Railway Company's operating familiarization qualifications for the route, and a resume-speed sign placed within 1,100 feet of the missing speed-restriction sign.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: April 29, 1980

DERAILMENT OF AMTRAK TRAIN NO. 4 THE SOUTHWEST LIMITED ON THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY LAWRENCE, KANSAS, OCTOBER 2, 1979

SYNOPSIS

About 6:10 a.m., c.s.t., on October 2, 1979, Amtrak passenger train No. 4, the Southwest Limited, derailed 3 locomotive units and 17 cars while moving through a 7° curve on the Atchison, Topeka and Santa Fe Railway Company's tracks at Lawrence, Kansas. The speed of the train was 78 mph. Of the 147 passengers and 30 crewmembers, 2 crewmembers were killed and 69 persons were injured. Property damage was estimated at $4,634,330.

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INVESTIGATION

The Accident

Prior to October 2, 1979, Amtrak operated train No. 4, the Southwest Limited, over the tracks of the Atchison, Topeka and Santa Fe Railway Company (AT&SF) from Los Angeles, California, to Chicago, Illinois, via Newton, Emporia, and Ottawa, Kansas, and Kansas City, Missouri. Amtrak also operated train No. 16 over AT&SF tracks from Houston, Texas, to Chicago, via Newton, Emporia, Topeka, and Lawrence, Kansas, and Kansas City, Missouri. (See figure 1.) On October 2, train No. 16 was discontinued and train No. 4 was rerouted to Kansas City via Topeka and Lawrence (the first district, eastern division). The last run of train No. 16 was to terminate in Newton on October 2, and the train equipment was to be consolidated with that of train No. 4.

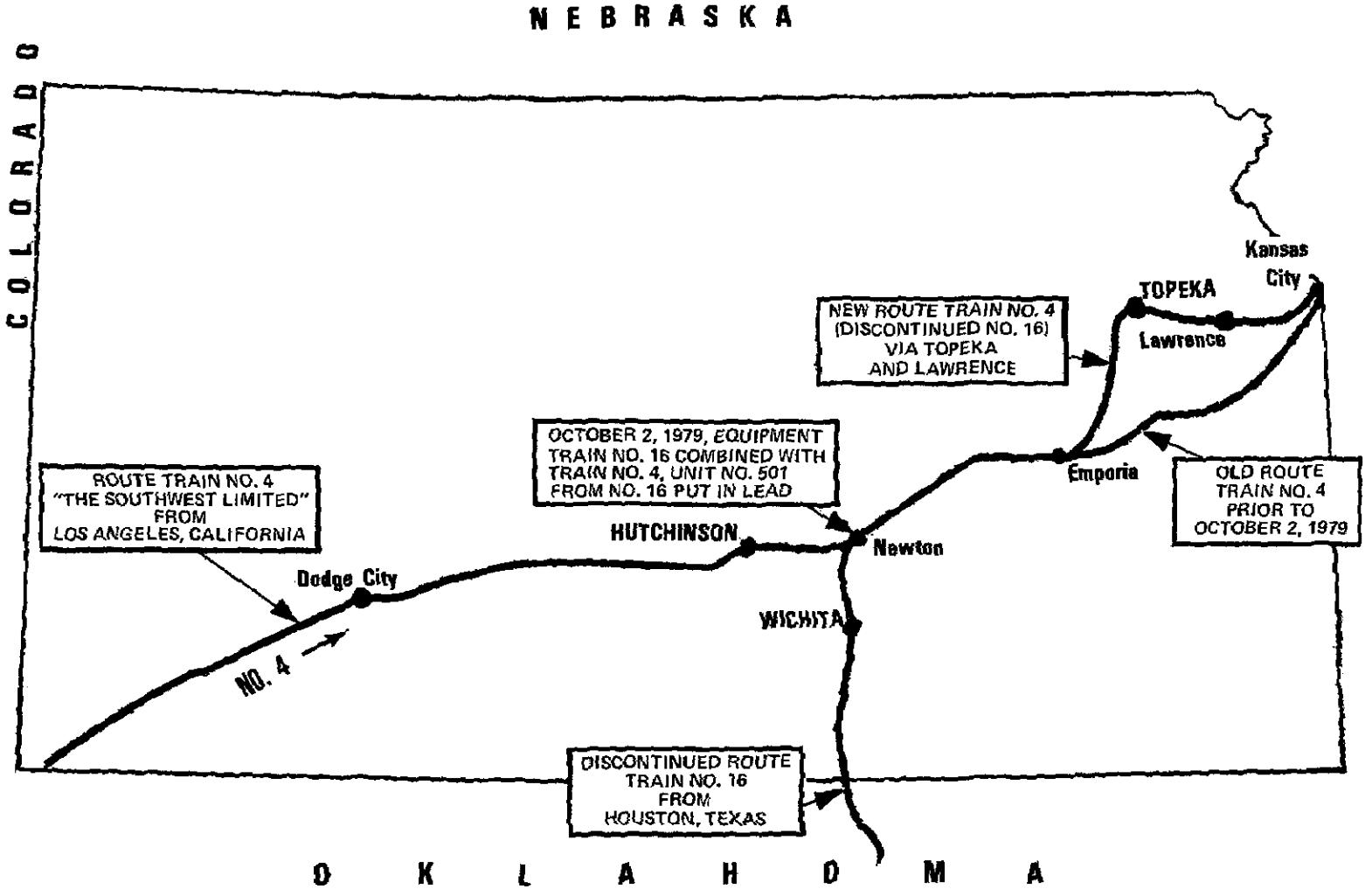

Figure 1.—Former routes of trains Nos. 4 and 16 through Kansas.

Train No. 4 arrived at Newton at 2:30 a.m. on October 2. The arriving crew did not report any problems with the locomotive or the train to the relieving crew. No defective conditions were disclosed by predeparture inspections and tests. After train No. 16 arrived, its 7 cars were added to the rear of the 11 cars of train No. 4. The single locomotive unit from train No. 16 was coupled ahead of the two units of train No. 4. After the 3-unit locomotive and 18 cars were assembled, the engineer performed the required airbrake tests; no problems were noted. The engineer stated that in the lead locomotive unit the control switches for the electronic alertness control (alertor) 1/ were in the "off" position and that their seals were broken when he checked their condition before leaving Newton. Inspection of the automatic train stop (ATS) equipment 2/ disclosed no defects. Train No. 4 departed Newton at 3:15 a.m., 40 minutes late. After leaving Newton, the engineer performed a running brake test and again did not note any problems. The fireman, who was seated on the left side of the cab, stated that he did not hear an alarm from the alertor, but did not ask the engineer if the device was working.

The engineer and fireman stated that they had copies of new timetable No. 9 which became effective at 12:01 a.m., October 2, 1979, because of the consolidation of trains Nos. 4 and 16, and that they had reviewed them. (See appendix C.) Consequently, they were aware that there was no ATS system between Newton and Emporia and that at Emporia train No. 4 would be routed over the first district of the eastern division which did have an ATS system.

Train No. 4 was given 8 train orders at Emporia indicating 15 locations between Emporia and Topeka where track forces were working, material was piled along the track, or temporary speed restrictions were in effect. (See appendix D.) Train No. 4 left Emporia at 4:24 a.m., 34 minutes late. The engineer and fireman observed a restrictive signal indication at the first block signal after leaving Emporia. The engineer pressed the ATS acknowledgment button on the control console about 5 seconds before reaching the inductor located along the track and kept it depressed until the first unit passed the inductor. As a result, the ATS whistle alarm did not sound and there was no automatic application of the train's brakes. The engineer also stated that about 15 miles from Topeka he operated the ATS acknowledgment button in the same manner. Just before this inductor's location, which indicated a restricted-speed location for a sharp curve ahead, he saw an ATS sign and a 45-mph speed-restriction sign on the right side of the track. The engineer stated he said the word "bell" to inform the fireman that he was alert and was acknowledging the ATS system. The fireman recalled hearing the engineer say "bell" at one of the locations. Nowhere en route to Topeka did the engineer or

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1/ The electronic alertness control is a safety device which requires the engineer to touch metal for ground about every 40 seconds to prevent an automatic application of the train's brakes.

2/ The automatic train stop is a safety device which requires the engineer to press an acknowledgment button while the ATS receiver mounted on the locomotive passes over an inductor in the track at a block signal with a restrictive indication. If the engineer fails to press the acknowledgment button, an alarm will sound alerting the engineer to press the button within 6 seconds to prevent an automatic application of the train's brakes.

fireman feel anything which may have damaged the ATS receiver strike the locomotive.

At Topeka, the engineer was given 6 train orders which indicated 11 locations between Topeka and Kansas City where track forces were working, material was piled along the track, or temporary speed restrictions were in effect. (See appendix E.) Train No. 4 left Topeka at 5:38 a.m. with 147 passengers and 30 crewmembers. The train was now 43 minutes behind schedule. The engineer stated that as he left Topeka he read the orders in the dim light from the small overhead reading lamp. He kept the orders on the control panel where they were available to the fireman. Neither the engineer nor the fireman saw any track gangs or recalled striking any object en route to Lawrence. The engineer stated that since there were numerous speed restrictions listed in the timetable for curves, railroad and street crossings, and other special conditions, he depended upon signs adjacent to the track to indicate where the permanent speed restrictions were located. He stated that because the train moved at speeds up to 90 mph, which required continuous operating functions, he did not have time to read the timetable and the train orders to determine where the next speed restrictions were located. He further stated that reading the signs offered the most viable method of keeping himself aware of speed restrictions.

The fireman said that he called all signal indications and that the engineer was alert and responsive. He stated that the last two signals he saw, as the train approached Lawrence, were a 65-mph speed restriction for a curve and a "proceed" block signal aspect. The engineer stated that when leaving the 65-mph curve he saw a green resume-speed sign and increased the throttle to its maximum position. He said that while the train was increasing its speed from 65 mph to about 75 mph, he was looking for the sign which indicated a required reduction in speed to 30 mph for the series of curves at Lawrence. However, the next sign he saw was a whistle post for a grade crossing, and he blew the locomotive's whistle as required. He stated that he never saw a 30/25-mph speed-restriction sign or an ATS sign. After leaving the 65-mph curve, he did not see an inductor or receive a whistle alarm from the locomotive's ATS system, and he did not depress the ATS acknowledgment button. As the locomotive moved over the grade crossing, the engineer saw a curve in the track immediately ahead and realized that the curve might be the first of six for which the train's speed should have been reduced to 30 mph. As the locomotive entered the second curve immediately after the first curve, it derailed and tipped over onto its right side; the speed of the train was 78 mph. The fireman was standing as the locomotive entered the curve. After the locomotive stopped on its side, the engineer asked the fireman if he had seen the restrictive speed sign, and the fireman replied that he had not.

The conductor, who was riding in the fourth car, stated that he did not feel a brake application before the train derailed. After the train stopped, he radioed the engineer, who asked him to determine the condition of the passengers. The conductor then radioed the flagman, who had disembarked from the rear car to protect the rear of the train. The flagman radioed the AT&SF operator at Lawrence to inform him of the derailment about 6:10 a.m.

The locomotive derailed near the middle of a 7°, 526-ft curve to the left (See figure 2.) The lead locomotive unit slid on its side and hit a 6-ft-high concrete retaining wall on the outside of the curve. The other locomotive units tipped on their right sides and stopped adjacent to the wall, 500 ft east of the point of the derailment. (See figure 3.) The two baggage cars jackknifed across the track, and the lead one turned onto its side. The following dormitory car separated from the baggage cars and continued tangentially over the wall, stopping next to a residence adjacent to the railroad property. The next four coaches and a diner followed, remained upright, and stopped somewhat in line. The ninth car, a sleeping car, separated from and struck the rear of the diner. Two Amtrak employees inside the diner were killed. (See figure 4.) The sleeping car continued forward about 100 ft along the left side of the diner before stopping. The following three sleeping cars jackknifed across the track and turned onto their sides. The next five coaches, including a second diner, remained upright, leaning, and in-line; they stopped on the inside of the curve adjacent to the track. The last car, a sleeper, stopped on the track and did not derail. In all, 3 locomotive units and 17 cars derailed.

Shortly after the derailment, small fires started in the area of the gas stoves in each diner. The responding fire department quickly extinguished the fires.

Injuries to Persons

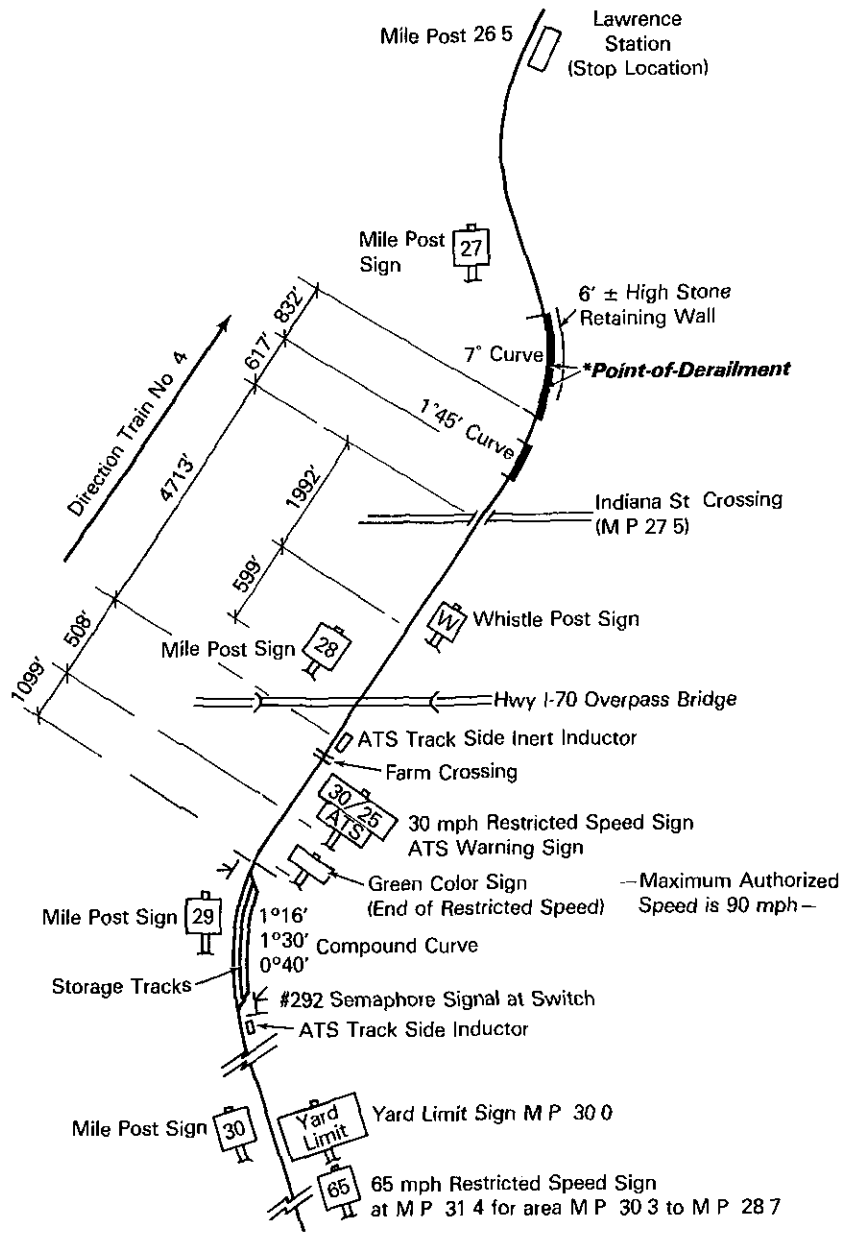
Injuries	Passengers	Crewmembers		Total
		Amtrak	Santa Fe	
Fatal	0	2	0	2
Nonfatal	49*	14	6	69
None	98	8	0	106
Total	147	24	6	177

*An additional 53 passengers filed injury reports with the AT&SF during the 2 months following the accident.

Damage

The lead locomotive unit was damaged extensively on the right side. A section of rail passed through the right front of the locomotive near the engineer's seat and out through the roof. The second unit was damaged extensively on the right side; the third unit was damaged extensively on its left side since it was operating with its front rearward when it overturned to the right of the track and slid along the ground. The first three cars were destroyed. The following four coaches sustained considerable interior damage to seats, compartment bulkheads, and doors; the exterior frames and trucks were also damaged. The eighth car, the first diner, was destroyed. Sleeping compartment berths and doors on the ninth car were damaged. The interiors of the next three sleeping cars were destroyed. The last five derailed cars sustained moderate interior damage to the seats and exterior damage to the trucks.

SIGN	DISTANCE BETWEEN
Indiana St Crossing	1992'
Whistle Post	599'
Mile Post 28	2620'
30/25 mph Sign(missing)	1099'
Green Board	1561'
Mile Post 29	1387'
Signal No 292	3892'
Yard Limit Sign	1'
Mile Post 30	5280'
Mile Post 31	1700'
Whistle Post	1233'
65/60 mph Sign	340'
Signal No 312	1746'
Lakeview Station Sign	2093'
Signal No 314	168'
Mile Post 32	5095'
Station Board	185'
Mile Post 33	1222'
Whistle Post	2396'
Whistle Post	1662'
Mile Post 34	1841'
Green Board	139'
Whistle Post	3300'
Mile Post 35	585'
Signal No 352	2951'
65/60 mph Sign	1744'
Mile Post 36	



(not to scale)

Figure 2.--Plan view of track and signs approaching derailment site.

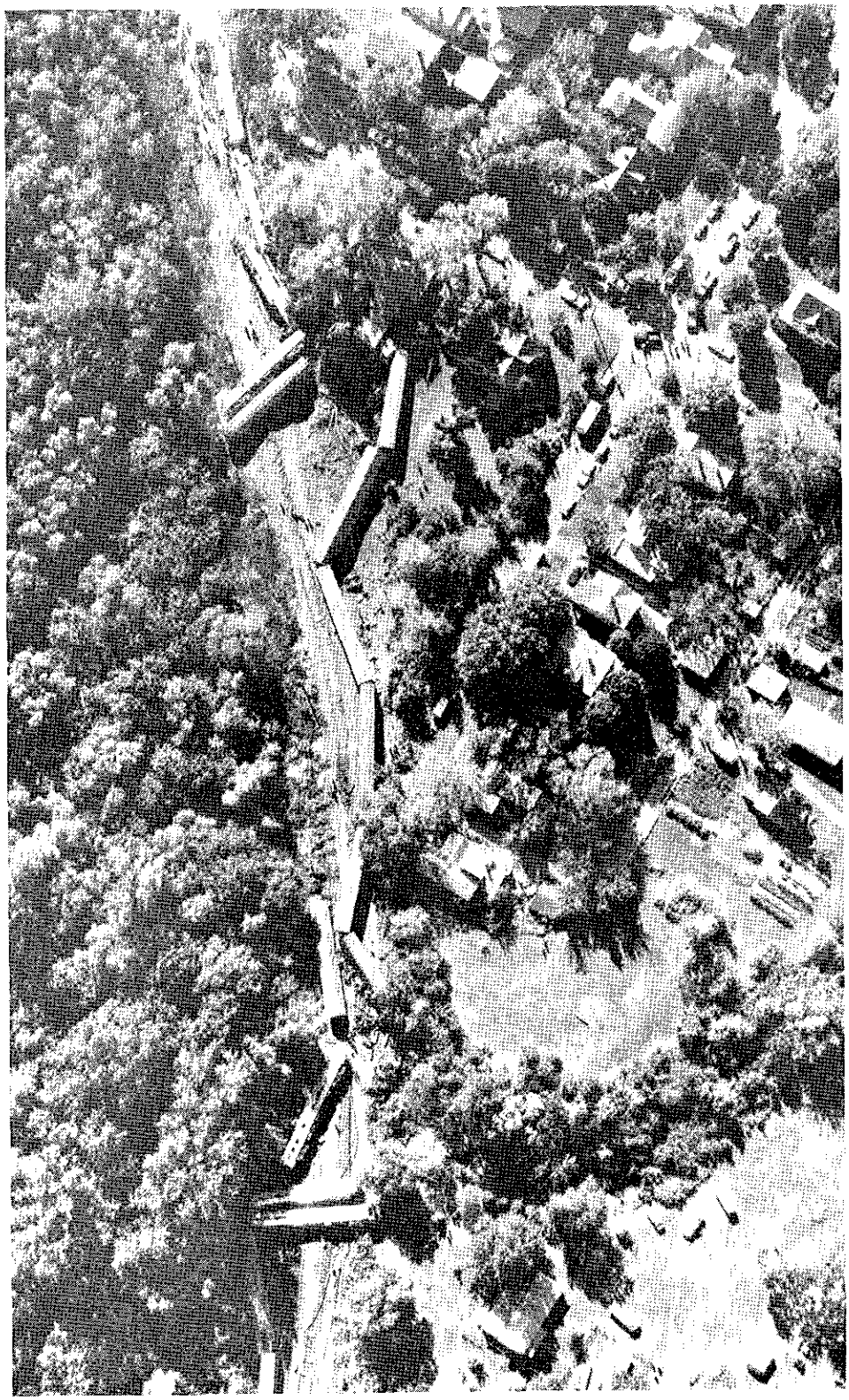


Figure 3.—Aerial view of accident site.

Figure 4.--West end of destroyed diner.

As a result of the derailment 1,400 ft of track and roadbed were destroyed, along with 600 ft of signal and communications lines. Costs of damage were estimated as follows:

Locomotives	$ 460,000
Cars	4,090,000
Track	17,250
Signal and Communications lines	6,600
Removal of Wreck	50,480
Total	$4,624,330

Crewmember Information

The engineer, aged 63, was hired as a fireman on the AT&SF in June 1941. At the time of the accident, he was the No. 2 employee on the engineers' seniority roster. 3/ Since the discontinuance and rerouting of trains on October 2 required reassignment of jobs, the engineer bid on trains Nos. 3 and 4. On October 1, 1979, the engineer was notified by the AT&SF crew clerk that he would be engineer on train No. 4 and that he was to report to work at 2:30 a.m., October 2, 1979. The crew clerk did not ask, nor was he required to ask, if the engineer was qualified according to Bulletin 308. Bulletin 308 requires that a familiarization trip be made over the district within 12 months of an assigned trip. The engineer had not operated a train over the first district between Emporia and Kansas City, via Topeka and Lawrence, since July 1974. The AT&SF did not maintain a list of the engineers who were qualified in accordance with Bulletin 308. According to railroad officials, each engineer was responsible to see that he was qualified.

The engineer's operating record was assessed as "very good" by the AT&SF. His March 1979 examination test scores indicated that he had knowledge of the operating and airbrake rules. The railroad and other employees thought of him as a very capable engineer. His last physical examination, in June 1979, indicated that he was in good health and fit for duty. He stated that he does not drink alcoholic beverages. When he reported for work on October 2, he had not taken any medication and had been off duty the required hours as prescribed by 49 CFR 228.

The fireman, who had been an engineer on freight trains, was selected for train No. 4 in the same manner as the engineer. The fireman had operated over the first district westbound during July 1979 as a fireman. However, the AT&SF did not regard the fireman as a qualified pilot.

The engineer and fireman stated that this was their first eastbound trip over the first district in over 3 years. The engineer stated that he did not request a pilot to help him operate over the first district because on several occasions the AT&SF had rerouted his train over the first district due to a derailment and a pilot had not been assigned to accompany him.

3/ The senior employee was in a supervisory position.

Train Information

Train No. 16 was assembled at Houston on September 30, 1979, and consisted of one locomotive unit and six cars. En route to Newton, one car was added and the locomotive unit was replaced. Train No. 4 was first assembled at Los Angeles on September 30, 1979. After the consolidation of trains Nos. 4 and 16 at Newton, the train consisted of two baggage cars, one dormitory car, two lounge cars, two dining cars, five sleeping cars, and six high-level coach cars. (See appendix F.) The cars were of a lightweight, stainless steel construction and were equipped with type-H tightlock couplers, four-wheel trucks, and truck-mounted brake cylinders. Four cars were equipped with 26C-type brake valves and the others with D-22-type brake valves. Various cars were equipped with self-contained diesel engines, fuel tanks, and electrical generating and battery systems. The emergency lights did not have a separate battery system. Also charcoal, wood, and propane fuels were used in the cooking stoves in the diner and lounge cars.

The three units on train No. 4 were SDP 40F-type locomotives built by the Electro-Motive Division of General Motors Corporation. Each locomotive unit was powered by a 3,000-horsepower diesel engine and was propelled by an electric traction motor on each axle of the two, three-axle HT-C-type trucks. Each locomotive unit weighed about 400,000 lbs and was equipped with a 26-L-type airbrake system. (See appendix F.) Each locomotive unit was provided with a speed recorder and with an overspeed device. Each was equipped with an alertor, ATS equipment, a fixed and an oscillating headlight, and a five-chime air horn.

The intermittent, inductive-type ATS equipment consisted of four main features: (1) a trackside inductor, (2) a receiver, (3) a brake application valve, and (4) an acknowledgment valve. The ATS operates as the result of interaction between the inductor, which is mounted alongside the track (see figure 5), and a receiver located on the locomotive. The receiver, an electromagnet, is mounted on a locomotive journal box with brackets. As the locomotive moves along the track, the receiver passes directly above each inductor. When the receiver passes over an inductor within a required 1 1/2-in clearance, $\pm$ 1/4 in, a warning whistle sounds and a 4-second timing circuit to an electropneumatic valve in the braking system is activated. If the acknowledgment button is depressed by a crewmember during the 4-second delay period, the system is deactivated and the brakes will not apply. This procedure is known as "postacknowledgment." (See appendix G.)

Since acknowledgment proves that the engineer is alert, the system permits him to retain full control of the brakes. To prevent a crewmember from keeping the acknowledgment button in the depressed position, thus nullifying the ATS system, a timer is energized which produces an automatic brake application when the acknowledgment button is depressed for more than 15 seconds. The acknowledgment button can be used also to "preacknowledge" the presence of a wayside inductor by actuating the acknowledgment button before passing over the inductor. When this is done, however, the warning whistle does not sound to indicate passage over an inductor.

Figure 5.--Inert inductor to outside of right rail on south side of track.

At Newton, Amtrak passenger trains are given a 500-mile inspection by AT&SF employees in accordance with Federal regulations. (See appendix H.) This inspection, however, does not require that the ATS equipment be tested for proper operation; only that its valves and switches are checked to determine if they are in the "on" position and sealed. The ATS receiver is checked only to see if it is tightly mounted.

The passenger train equipment, which was constructed between 1946 and 1964, is owned and furnished by Amtrak. These cars lacked the survival features, such as emergency windows and doors, and padded and rounded interior surfaces, that Amtrak has been installing in older style cars. At Los Angeles, the locomotive units for train No. 4 were serviced and inspected by Amtrak personnel before the train consist was assembled for operation by AT&SF crewmembers. The ATS equipment on the locomotive, installed by Amtrak to meet AT&SF operating requirements, was checked by Amtrak with a portable test set to determine if electrical features were functioning and by preacknowledging the system over inert inductors to determine if the system was operational. Amtrak personnel filled out required AT&SF Form 1167 indicating that the ATS had been tested and was operative in compliance with AT&SF air brake rules 3.4.1 and 3.5.2. However, rule 3.5.2 also requires that during the ATS test the brakes be allowed to apply after passing over the inductor. Amtrak does not perform the test. (See appendix I.) The locomotive units are then delivered to the AT&SF for train makeup. The AT&SF uses the Amtrak ATS tests for compliance with 49 CFR 236.587 Departure Test. (See appendix H.)

The lead unit's ATS equipment had been tested before the accident about 10 p.m. on September 30, 1979, while the unit was on train No. 460 at Dallas, Texas. It was checked by Amtrak personnel with a portable electrical test set. The test indicated that it was working properly, and the whistle did sound. However, the electrician immediately pushed the acknowledgment button when he heard the whistle, and there was no automatic brake application. He said he did not measure the height of the receiver above the top of rail to determine its proper height, and that he signed an ATS inspection card Form 1167 and postdated it October 1, 1979. He did not test the ATS equipment over inert inductors as prescribed in AT&SF rule 3.5.2.

When the lead unit was placed on train No. 16 at Cleburne, Texas, on October 1, 1979, AT&SF personnel checked the ATS system by placing a steel bar against the receiver. The engineer stated that the whistle sounded, indicating that the ATS was functioning, but that he pushed the acknowledgment button to prevent a brake application. The engineer stated also that at one time when passing over an inert inductor north of Fort Worth, Texas, he waited until the ATS whistle sounded before pressing the acknowledgment button; thus the brakes did not apply.

The AT&SF employees who installed the ATS receiver on the lead unit at Fort Madison, Iowa, on September 29, 1979, had measured it for proper clearance, and had tested it with a steel bar for proper installation. It was not tested over inert inductors in accordance with AT&SF rule 3.5.2. Because of clearance problems in the Chicago area, ATS receivers are first installed at Fort Madison, when a locomotive arrives on a southbound or westbound train.

Track Information

The single main track approaches the westerly city limits of Lawrence in the vicinity of the Kansas River. The 7° curve to the left for eastbound trains was 526 ft long including two 230-ft spirals. Its superelevation was 3 1/2 in. The alignment of the track immediately approaching the 7° curve from the west consisted of 368 ft of tangent, a 1°45' curve to the left, which was 475 ft long, 6,937 ft of tangent, and a 0°40' to 1°16' compound curve to the right, which was 5,922 ft long. There was a minimal descending grade in the track from the compound curve to the 7° curve where the grade began to ascend at 0.14 percent.

The track was constructed of 115-lb, 39-ft rails connected with 6-hole, 36-in, head-free joint bars. Each rail was box-anchored with 24 anchors. The rails rested on 7 3/4-in by 14-in, double-shoulder, 1-in-40 canted tie plates. There were an average of 24 7-in by 9-in by 8-ft treated oak crossties per 39-ft rail. The crossties rested on about 8 in of Pueblo slag ballast with about 8 in of shoulder ballast. The rail was held with two 5/8-in by 6-in cut track spikes per tie plate, except on the 7° curve, where three track spikes per tie plate were used.

During August and September, AT&SF track gangs had been replacing crossties and surfacing the track in Lawrence and westward to Topeka. At the time, the superelevation of the 7° curve in Lawrence was changed from 6 in to 3 1/2 in. Defective crossties removed from the track were placed on the roadway adjacent to the south side of the track. These crossties were to be picked up by a contractor hired by the railroad. In order to reach track locations where the crosstie gang was working and the piles of used crossties, trucks and forklift tractors were driven along the south side of the track. As a result, some trackside signposts 10 ft from the track were temporarily removed or installed in temporary postholes farther from the track. In the 3 miles approaching the curves at Lawrence, the whistle post sign, 30/25 mph speed-restriction and ATS sign, resume-speed sign, and yard limit sign had to be moved to gain access to the crossties.

Twice weekly, and at least 1 calendar day apart, an AT&SF track supervisor inspects the track to insure that the track complies with Federal standards for class 5 track and that trackside signs are in place. On October 1, 1979, the track supervisor reported that he inspected the signs for eastbound trains approaching Lawrence to determine sign compliance for the new timetable. According to his report, all signs were in place about 3:30 p.m., October 1, 1979. The track supervisor stated that he knew of a need to change the 30/25-mph speed-restriction sign because of a change in the authorized speed for freight trains to 30 mph on October 2, 1979, and that he had been carrying the replacement sign in the rear of his truck for over a week. However, he had never been furnished any sign standards as to its proper location.

The theoretical speed at which locomotives similar to the units in train No. 4 would overturn on the 7° curve was calculated to be 81 mph.

Method of Operation

Trains are operated on the first district from Emporia to Lawrence by automatic block signals (ABS) which are supplemented by an ATS system.

Trackside inductors for the ATS system are required and located at all block signals, and additional inert inductors are located about 1 mile before all curves having permanent speed restrictions of less than 45 mph. Federal regulations do not require that inert inductors be installed before curves, and the locations of the inert inductors are not given in the timetables. (See appendix I.) AT&SF air brake and train-handling rule 3.4.9 instructs engineers to depress and hold the acknowledgment button until the trackside inductor has been passed when approaching other than "clear" aspects. (See appendix J.) Trains are equipped with radios so that engineers can contact the train dispatchers, operators at stations, and crewmembers of other trains. The conductor and flagman are also furnished portable radios so that they can contact each other and the engineer.

Because of the ATS system, the maximum authorized speed for passenger trains on the first district, eastern division, between Emporia and Lawrence is 90 mph. Permanent speed restrictions for curves and other locations are listed in the timetable according to milepost location. In addition, speed-restriction signs and milepost signs are installed adjacent to the track. At Lawrence, there is a permanent speed restriction of 30 mph through a series of six curves between mileposts 26.2 and 27.4. (See appendix C.)

According to AT&SF operating rules and sign standards, the restrictive speed signs and other informational signs adjacent to the track are considered "fixed" signals, and are to be located within 10 ft of the track. (See figure 6.) A fixed signal is defined as a signal of fixed location indicating a condition affecting the movement of a train or engine. Operating rules Nos. 27 and 30 state that the indication of such signals should be communicated between crewmembers and should be regarded as indicating their most restrictive aspect when missing or imperfectly displayed. Any improper condition must be reported promptly to the train dispatcher and a report must be wired to the trainmaster and signal supervisor. (See appendix J.)

Meteorological Information

On the morning of October 2, 1979, the weather at Lawrence, Kansas, was clear, the temperature was 47° F, and the humidity was about 69 percent. At 6:10 a.m., it was dark, and visibility was good but limited to the illumination provided by the headlights of the locomotive.

Medical and Pathological Information

The injuries to passengers and crewmembers included fractures of the skull, ribs, nose, and spine; back, abdomen, leg, and facial injuries; and contusions and lacerations. The two Amtrak employees died from massive and multiple crushing injuries. The engineer sustained severe crushing injuries to his chest and as a result his heart was damaged. It was first believed that his heart damage may have resulted from a heart attack immediately before the accident. Subsequent examination definitely determined that his heart damage was the direct result of the accident. Toxicology tests made in preparation for surgery to repair his damaged heart indicated that he had not consumed any alcohol or drugs before the accident.

Figure 6.--New 30-mph speed-restriction and ATS signs installed in location of missing 30/25-mph speed-restriction sign on south side of track.

Survival Aspects

When the train derailed, the flagman notified the operator at Lawrence who then summoned emergency help. In addition, many residents near the scene of the accident notified the Lawrence Police Department of an explosion-like noise and derailment. Policemen who arrived at the site notified the fire department at 6:14 a.m. Law enforcement units from the Kansas Highway Patrol, the Lawrence Sheriff's Office, Kansas University, and security personnel from the AT&SF Railroad also responded to the accident site. Physicians from Lawrence Memorial Hospital established a triage area at the derailment site for initial injury evaluation and early transport of the more seriously injured to the hospital. A secondary triage area was established at the Lawrence Community Center and was staffed with physicians, paramedics, nurses, emergency medical technicians, and volunteers.

In March 1979, the city of Lawrence and Douglas County had conducted a disaster drill for a simulated freight-train derailment. They were preparing for another simulated freight-train, hazardous material-type derailment and disaster drill on October 5, 1979, when this accident occurred. The previous drill and preparation were of a great help in that they had established rescue procedures and coordination between city and county agencies and private groups.

Arriving police and fire department personnel were not aware of the amount of destruction or the locations of the injured. The darkness and the large area covered by the derailed and overturned cars hampered an initial overall assessment of the magnitude of the accident scene. The location of the accident scene, which was behind a residential area and adjacent to woods and a swamp, combined with the darkness to impede direct access of rescue equipment and personnel. The firefighters had not been informed by the AT&SF or Amtrak of the various interior layouts of the cars or of the equipment contained in the cars. In addition, they were not told that the car windows were provided with unbreakable polycarbonate panes until they discovered that they could not remove or break the windows with their rescue tools.

Passengers in the sleeping compartments were injured during the derailment and the rollover. Some became trapped when compartment doors jammed and berths came free from their attachments. Others were thrown from their berths and struck hard, unyielding surfaces. Loose articles, including berths, compartment furnishings, and personal belongings, struck the occupants.

Passengers in the bilevel coaches were thrown into hard, unyielding surfaces or adjacent seats as the cars derailed; and in some instances, they were thrown to the floor after their seats swiveled. Personal effects and luggage which fell from overhead racks struck passengers. Many passengers became disoriented inside the dark and overturned cars when the emergency lighting failed. They were not able to open windows or jammed doors. Many did not know how to react to the emergency.

Because of injuries, only about 10 of the 24 Amtrak employees were available to aid the injured. However, none of the Amtrak or AT&SF employees had formal training in rudimentary first aid or rescue procedures.

Tests and Research

In the postaccident tests and inspections, measurements taken of the track structure west of the derailment site did not disclose any deviations greater than those allowed by the applicable Federal track safety standards. No dragging equipment or derailment marks were noted on the track approaching the 1°45' curve. The first wheel flange mark on a rail was located on the outside elevated rail 34 ft west of the east end of the 1°45' curve. The track for 1,235 ft east of this point, which included the entire 526-ft-long 7° curve, was destroyed because of the derailment so measurements could not be taken in the 7° curve to determine its actual elevation, gage, alignment, and profile.

Investigation of the track in the derailment area was limited to an inspection of individual components such as crossties, tie plates and rail. The undamaged crossties met the requirements of the Federal track safety standards. These crossties did not exhibit lateral tieplate movement except for that which occurred after the derailment. All broken rails exhibited crystalline surfaces indicative of breaking under stress during the derailment.

Postaccident inspection of trackside signs approaching Lawrence disclosed that the post with the 30/25-mph speed-restriction and ATS signs that should have been in place 5,838 ft before the first of the curves was not in place. The post with these signs was broken at the ground line and was found lying in the tall grass next to a posthole 14 ft from the south side of the track, 4 ft beyond its proper erected location, about 11 a.m., October 2, 1979, by AT&SF engineering department survey personnel. Investigators could not determine who moved the sign. All other trackside signs in the area were found to be in place except the yard limit sign at milepost 30 which was located about 14 ft rather than the required 10 ft from the track. Track signs 14 ft or more from the track are difficult to see if they are placed in the tall grass of the seldom-maintained edges of the track right-of-way. (See figure 6.)

Postaccident inspection of the ATS inert inductor for the six curves at Lawrence indicated that it was in good condition and was properly located. Its height above top-of-rail was 2 7/8 in, which is the proper height according to AT&SF standards.

Postaccident inspection of the damaged cars, locomotive units, and pertinent equipment were conducted at both railroad and manufacturer facilities. The inspection of brake equipment on the passenger cars and locomotive units did not disclose any conditions which would have contributed to or caused the brakes to malfunction. Inspection of the trucks and undercarriage of locomotive units did not reveal any defects in the wheels, axles, or suspension systems. The speed recorders on the locomotive units were checked for accuracy; on the lead unit a speed of 78 mph was recorded as 80 mph, and on the second unit a speed of 80 mph was recorded as 75 mph. Examination of the speed recorder tapes indicated the engineer had properly controlled the speed of the train prior to approaching the curve where the accident occurred. (See appendix K.)

Inspection of the lead locomotive unit immediately after the derailment disclosed that the brake valve was in its suppression position, the dynamic brake

lever was in the "off" position, the independent brake valve was in a one-fourth applied position, and the throttle was in the No. 4 position. Inspection also disclosed that the alertor was cut out pneumatically, its seal was broken, and its circuit breaker, located in an electrical panel behind the engineer, was in the "off" position and its seal was broken. Postaccident tests of the electrical circuitry of the alertor revealed that the contacts on the brake relay did not always complete the electrical circuitry, which caused it to operate intermittently.

The lead unit's ATS receiver was broken and damaged during the derailment and its bracket was bent. The electric switch was found in the "on" position and sealed, and the pneumatic cutout valve was in the "in" position and sealed. Tests of the ATS components indicated that the relays and valves were operational and that the whistle valve could function. The damaged receiver's 12.8-ohm primary coil was still intact and functional; however, the 24-ohm secondary coil was "open" and the receiver's laminations were damaged. It could not be determined whether the open condition occurred before or after the derailment. When the rear receiver bracket was rotated to its vertical position, the receiver measured 4 3/4 in above the top-of-rail and 27 in from the gage of the rail to its outside edge. These measurements correspond to AT&SF specifications. No measurement could be obtained for the front bracket because it was broken during the derailment.

Four ATS performance tests were conducted between October 19 and 25, 1979, using other Amtrak locomotive units operating between Emporia and Kansas City via Lawrence. These units had been dispatched with ATS systems that portable test sets had indicated were operable. During the test trips the ATS acknowledgment button was not pressed until after passing over inductors at restrictive signals and over inert inductors. On the first two test trains the ATS system would not activate the warning whistle or automatically apply the brakes. Examination of the ATS equipment disclosed that on one unit the ATS selector switch was defective and would break electrical continuity intermittently. On the other unit the laminations on the receiver coils were damaged; this affected the magnetic field of the receiver. In the other two tests the ATS equipment functioned properly. During the fourth test while moving about 65 mph, the engineer did not acknowledge the inert inductor approaching Lawrence. The warning whistle sounded when passing over the inductor and the brakes automatically applied. The train came to a stop about 500 ft west of the Indiana Street crossing in Lawrence.

Other Information

The engineer of a freight train that preceded train No. 4 into Lawrence by about 20 minutes on October 2, 1979, stated that the 30/25-mph speed-restriction and ATS signs for the inert inductor and curves at Lawrence were missing. He and other locomotive engineers stated that the signs had not been in place for several weeks before October 2, 1979. One of the engineers stated that he had reported the missing signs to AT&SF supervisors. An AT&SF trainmaster had also sent a message to the roadmaster on September 19, 1979, that a 30/25-mph sign and several other types of signs were not in place in the Lawrence area. The roadmaster had track inspectors investigate these sign conditions; however, he

stated there are two 30/25-mph sign locations, one on each side of Lawrence, for eastbound and westbound trains approaching the six restricted-speed curves. He did not recall if the condition of the 30/25-mph sign west of Lawrence was checked.

Several witnesses told investigators that just before train No. 4 derailed they heard its whistle being blown repeatedly in a fashion of two long sounds, a short sound, and another long sound until the locomotive had passed over the Indiana Street crossing.

ANALYSIS

Engineer Familiarization

When the engineer was notified on October 1, 1979, that he had been awarded the position of engineer on trains Nos. 3 and 4, and was assigned to work that night on train No. 4 for its first trip via the new route through Lawrence, he should have known he was not qualified as prescribed in Bulletin No. 308. Also, he should have known that since he was the senior employee he would be awarded the job and that he should have made a qualifying familiarization trip while the bids were being processed. However, since the AT&SF had allowed the engineer to move trains over the first district before without being familiar with the area, and since the engineer was told several times to go ahead without a pilot, the engineer believed that these previous waivers of Bulletin No. 308 by the AT&SF also waived his requirement for compliance in this particular instance. Consequently, the engineer tried to successfully operate train No. 4, without first having made a familiarization trip over the first district in compliance with Bulletin No. 308, by relying on speed restriction signs beside the track.

By making engineers responsible for their own compliance with Bulletin No. 308, the AT&SF had no effective method of enforcement. Consequently, the engineer, who had 38 years of experience and had worked over the first district numerous times during these years, thought there was no justifiable reason preventing his operation of train No. 4 on October 2, 1979. The Safety Board believes that the AT&SF should keep a record of engineers who meet Bulletin No. 308 requirements and should not allow engineers to operate on routes without having made the required familiarization trips or unless a pilot is on board.

Automatic Train Stop

Since there is no automatic train stop between Newton and Emporia, train No. 4 first entered ATS territory on the first district after leaving Emporia. The engineer correctly followed AT&SF rules by depressing the acknowledgment button within 15 seconds before passing over the track inductor at the restricted signal. Since on most Amtrak locomotives the engineer receives no indication of whether the ATS system is functioning when he depresses the acknowledgment button before passing over an inductor, the preacknowledgment procedure will not alert him if the ATS system is inoperative. Only if acknowledgment is deferred until the locomotive passes over the inductor will the whistle alarm sound. Consequently,

the engineer of train No. 4 never knew if the ATS was actually working since he routinely preacknowledged the inductors on the first district between Emporia and Lawrence.

The test of the ATS equipment on the lead unit at Dallas with only a portable test set did not eliminate the possibility that the ATS would not function even though the test indicated the locomotive-mounted equipment was operable. The postaccident ATS tests performed with other Amtrak locomotives indicated that a defective selector switch and damage to the laminations on the receiver coils would not be detected by use of the portable test set. Since the height of the receiver above the top of rail was not measured, an incorrect air gap could have existed between the receiver and track inductor, or the receiver might not have been level and could have been tilted more than the 1/4-in allowable in its forward direction. When the ATS was tested at Cleburne by placement of a steel bar against the receiver and the alarm sounded, it still did not eliminate the possibility of an intermittent or other type of improper operation between Cleburne and Lawrence. It is evident that the tests performed were neither adequate nor in compliance with 49 CFR 236.587 which requires that the tests determine if the ATS apparatus is "on" and functioning properly.

Since conditions, such as a damaged receiver, can exist which make the ATS system inoperable the system cannot be considered fail-safe. When the AT&SF installed the ATS receiver on the lead locomotive on September 29, 1979, an inservice test of the equipment over inert inductors should have been performed to fulfill AT&SF rule 3.5.2. to determine that the ATS warning whistle sounded and that the brakes applied automatically. The Safety Board also concludes that ATS equipment on a locomotive should be provided with an indication that alerts the engineer whenever the equipment fails en route if he preacknowledges the inductors according to AT&SF rule 3.4.9.

Even though a functioning ATS system would initiate an automatic brake application and would stop a train before entrance into the curves at Lawrence, the installation of the inductor at that location to provide such protection is not required by Federal regulation. Federal regulation requires the ATS to operate and be interconnected only in connection with the automatic block signal system. However, the location of inert inductors should be made known to locomotive engineers in the timetable special rules in a manner similar to other warning devices presently shown.

When train No. 4 left Topeka the engineer had 6 new train orders which described 11 locations of specific concern. Of the 11, 3 were of particular concern before 6 a.m. Order No. 8 concerned material piled along the main track and order No. 6 involved two temporary speed restriction areas which overlapped existing permanent speed restrictions between Topeka and Lawrence. Since the timetable also listed six other permanent speed-restriction areas in the 26 miles to Lawrence, the engineer would have been watching for the speed signs installed along his right-hand side of the track to inform him where he should act to control the speed of the train, instead of depending upon information in the timetable. Postaccident examination of the speed recorder tapes with the locations of the temporary and permanent speed restrictions revealed that the engineer had at all times properly

controlled the speed of the train prior to the accident location. With the speed recorder indicating that the train was traveling between 60 and 80 mph in the 8 miles before Lawrence, the four automatic block signals, five whistle posts, and four speed signs in this area would have come into the engineer's view at the rapid pace of about one every 30 seconds. Consequently, the engineer, in the dimly lit cab would have found it difficult to consult his timetable for a location reference as to what to do or expect next; his dependence would be entirely upon the track-side signs. Only an engineer familiar with the territory and the timetable could operate a train safely up to 90 mph using other landmarks or milepost signs for reference. Therefore, it is evident that, as train No. 4 approached Lawrence, the engineer and fireman were alert and that it was their unfamiliarity with the territory that prevented them from realizing the 30/25-mph speed-restriction and ATS signs were missing.

Since the 30/25-mph and ATS signs and post were found lying in the tall grass near a shallow posthole 14 ft from the track after the accident, and since the engineer of the eastbound train entering Lawrence 20 minutes before train No. 4 did not see the signs, the Safety Board concludes that the 30/25-mph and ATS signs were not standing at the time of the accident and could not be seen by the engineer of train No. 4 who was relying on such signs in the safe operation of his train. Other locomotive engineers and an AT&SF supervisor said the sign had been missing for several weeks before the accident. The sign would have interfered with the crosstie installation and removal in the area, and it is likely that the sign would have been moved to a temporary location or removed to allow passage of equipment when the track gangs and contractor worked in the area. When the track inspector told investigators that the 30/25-mph and ATS signs were in place when he passed the location about 3:30 p.m., on October 1, 1979, it is apparent that he was mistaken or just took no exception to the missing sign.

When train No. 4 passed the location where the 30/25-mph and ATS signs should have been, it would have been only about 10 seconds since the train had passed the green resume-speed sign. Even though an engineer is aware of a need to slow for the curves in Lawrence, he would probably not be too concerned about not seeing a 30/25-mph sign so quickly after the resume-speed sign; especially without having prior knowledge of its location.

The need and wisdom of having a resume-speed sign, allowing an increase in speed to 90 mph, as an end of the 65-mph zone only 1,099 ft before the location of the 30/25-mph sign is questionable. A train moving at 65 mph would pass the 30/25-mph sign indicating a required reduction in speed in a minimum of 2,500 ft, only about 10 seconds after resuming speed. Without the resume-speed sign, the engineer of train No. 4 would have continued operating the train at 65 mph into the curves at Lawrence when he did not see the 30/25-mph sign. Since the overturning speed for the 7° curve was about 80 mph, the train might not have derailed.

If the engineer did not see the 30/25-mph and ATS signs, he would not have been looking for an ATS inductor in the track or expecting to activate the ATS acknowledgment button. Consequently, he and the fireman should have heard a loud whistle alarm when the locomotive passed over the inductor about 15 seconds

after passing the resume-speed sign. Since the engineer continued operating the train over 70 mph, it is obvious he never took any action to slow the train. The Safety Board concludes that the ATS apparently was not working since the engineer and fireman did not hear a warning whistle and the brakes did not apply automatically to slow the train.

Survival Aspects

After the derailed locomotive and cars came to rest, the survivability of the passengers and crewmembers was contingent upon environmental hazards, training of the traincrew, injuries sustained, and onscene medical treatment. Because of the early hour, many passengers were asleep in the coach and the sleeper cars when the train derailed. If more persons had been up and walking in the cars, or had been in the lounge and dining cars, it is likely that several more persons would have been injured seriously and that there would have been more fatalities. To protect people from being seriously injured or even sustaining minor injuries that could prevent them from initiating their own escape it is necessary to provide protection against striking hard or irregular surfaces.

In this accident, the injury-producing hazards were:

- o sleeping compartment berths that came free of their attachments and trapped several persons;
- o hard unyielding surfaces on seats, inside compartments and coach cars, and inside lounge and dining cars;
- o unrestrained food service equipment in pantries and kitchens;
- o coach seats that swiveled and ejected passengers to the aisle or into other seats; and
- o passenger luggage and personal effects that became missiles and struck persons.

These hazards from the failure of the designers of the railroad equipment to follow design practices to eliminate the hazards or reduce the risks. For example, improved methods could have been used to stow and retain baggage and food service items. Sleeping compartment berth attachments could have been designed to take into account car rollover forces and attitudes, and coach seats could have been made more resistant to lateral loads to prevent them from swiveling. The edges of environmental surfaces could have been provided with larger radii; the surfaces could have been padded with energy-absorbing materials.

The hazards that hampered or prevented passengers, particularly those in sleeping compartments, from escaping included:

- o compartment doors that jammed;
- o disorientation of persons inside dark and overturned cars;

- o furnishings inside compartments that trapped the occupants and prevented them and rescuers from moving around in the compartments;
- o inability to open windows without special tools;
- o lack of awareness by passengers on what to do in an emergency; and
- o crews inadequately trained in emergency procedures.

With regard to these hazards, the d.c. electrical system could have been more resistant to failure when cars were overturned or just derailed. Adequate hazard analyses could have provided designers and engineers insight into how the system could fail and thus allow them design options on how to lower the probability of such failures. Reflective signs could have been used to identify exits both to passengers and to rescue workers. Emergency portable high-intensity lights could have been located in each car for use by traincrew and passengers. Sleeping compartment, car-end, and lavatory doors could have been designed to permit entry or removal even if they were jammed. Loose chairs in dining cars and lavatories could have been attached to the floor with fasteners which would allow removal of the chairs when the cars are cleaned.

Since the window assemblies consisted of a pane of impact- and shatter-resistant glass and a panel of clear polycarbonate, occupants could not use windows for emergency exits. In addition, the window assemblies were not made to be easily removed so the opening could be used as an emergency access. Also of interest is the fact that the fire department's rescue tools were not adequate for removal of the polycarbonate panes or the entire window assemblies.

As a result of its investigation of the derailment of an Amtrak passenger train on the AT&SF tracks at Melvern, Kansas, on July 5, 1974, 4/ the Safety Board recommended that Amtrak require passenger cars be equipped with windows that can be removed from the outside, and that railroad and emergency rescue personnel be instructed on their removal (recommendation R-75-4), and that Amtrak install crashworthiness features when cars are renovated or when new cars and locomotives are purchased (recommendation R-75-5). Amtrak replied that it has identified a certain series of cars for conversion which will be fitted with emergency features as they undergo overhaul. This conversion program was scheduled for completion by the first quarter 1980 but is not yet completed. The Safety Board has stated its concern and is still concerned about the time lag in modifying the cars and is holding the recommendations open.

Also as a result of the Melvern, Kansas, accident the Safety Board recommended that the Federal Railroad Administration (FRA) promulgate regulations that all passenger cars be provided with emergency exits and emergency lights that will function when regular power is lost (recommendation R-75-3). The FRA replied that it was "conducting research that will be used as a basis for promulgating minimum safety standards for passenger cars. Standards for emergency lighting and emergency exits will be included in the rulemaking." The

4/ "Railroad Accident Report--Derailment of an Amtrak Train on the Tracks of the Atchison, Topeka and Santa Fe Railway Company, Melvern, Kansas, July 5, 1974" (NTSB-RAR-75-1).

FRA later replied that the research was completed in 1978. In an effort to expedite the issuance of these minimum safety standards, the Safety Board in 1979, as a result of its investigation of a rear-end collision of Amtrak trains at Seabrook, Maryland, on June 8, 1978, 5/ recommended that the FRA: "Promulgate regulations to establish minimum standards for the design and construction of the interiors of passenger-carrying cars so that adequate crash-injury protection will be provided passengers. (R-79-38)" The FRA replied that it and the Urban Mass Transportation Administration are developing a comprehensive passenger safety program that includes all aspects of the problem. The program is scheduled for completion about the first quarter of 1981. The Safety Board cites the prolonged delay due to a continued study of obvious problems and is holding the recommendation "Open--Unacceptable Action."

Since the uninjured AT&SF traincrew had specific duties immediately following the accident such as protecting the train from following trains and notifying the dispatcher, the burden fell upon Amtrak personnel to provide help to the injured. Because of injuries, only 10 of the 24 Amtrak employees were available to render first aid to the injured passengers. It is unknown how many did render aid but the effectiveness of the aid is in doubt because these personnel had no formal training in rudimentary first aid or rescue procedures. Additional work needs to be done to prepare traincrews, particularly Amtrak service employees, to act appropriately following an accident.

As a result of its investigation of an accident near Wilmington, Delaware, on October 17, 1975, 6/ the Safety Board recommended that the FRA:

> Require carriers to train employees in emergency procedures to be used after an accident, to establish priorities for emergency action, and to conduct accident simulations to test the effectiveness of the program, inviting civic emergency personnel participation. (R-76-29)

The FRA replied that it is "analyzing carrier testing and training programs submitted under [49 CFR] Part 217--Railroad Operation Rules . . . and will determine what training and testing regulations are necessary to ensure adequate training programs . . . ." The Safety Board is holding the recommendation "Open--Acceptable Action."

In its investigation of the accident at Seabrook, Maryland, 7/ the Safety Board recommended that the FRA: "Promulgate regulations establishing minimum standards for the training of traincrews in the safe operation of trains and in emergency procedures. (R-79-40)" and that Amtrak: "Establish a program to train crewmembers in the proper procedures for care of passengers in derailment and emergency situations. (R-79-36)"

5/ "Railroad Accident Report--Rear-End Collision of Conrail Commuter Train No. 400 and Amtrak Passenger Train No. 60, Seabrook, Maryland, June 9, 1978" (NTSB-RAR-79-3).

6/ "Railroad Accident Report--Collision of Penn Central Transportation Company-Operated Passenger Trains Nos. 132, 944, and 939, near Wilmington, Delaware, October 17, 1975" (NTSB-RAR-76-7).

7/ Op. cit.

Amtrak replied that it would "follow up on the training of the crewmembers to deal with derailments and emergency situations" and include such training in its on-going employee training program. The Safety Board is holding recommendation R-79-36 "Open--Acceptable Action."

The FRA replied that it does not intend to promulgate regulations in the area of training and that it can "best serve the training needs of the industry through research projects" to improve railroad employee training. The Safety Board, however, believes that such research does not guarantee improved action or adoption of standards by the railroad industry and is holding recommendation R-79-40 "Open--Unacceptable Action." As a result of its special study of railroad emergency procedures, 8/ the Safety Board recommended on March 5, 1980, that the FRA "Require operating railroads to develop emergency response plans, put them into effect, and file those plans . . . with the FRA. (R-80-7)"

State or Federal agencies should require railroads that operate passenger trains over a territory to provide basic information to fire and rescue agencies along the route. Fire and rescue agencies should be provided information on where to gain access to passenger cars and the location of powerplant and electrical system components, and the location and operation of exits. These training aids should be augmented with periodic walk-through familarization tours for rescue personnel to reinforce their knowledge of the configurations of different coaches.

As a result of the Seabrook, Maryland, accident, 9/ the Safety Board recommended that Amtrak: "Arrange for a program along passenger train routes for training and familiarizing emergency rescue organizations in the type of train equipment being used. (R-79-35)" The Safety Board is encouraged by the recent publication of Amtrak's booklet entitled "Emergency Evacuation Procedures," and hopes it receives wide distribution to fire and rescue agencies throughout the country. The Safety Board is holding the recommendation "Open--Acceptable Action."

CONCLUSIONS

Findings

1. The engineer did not comply with AT&SF Bulletin No. 308, which required him to have made a familiarization trip over the first district within the preceding 12 months.

2. Compliance with Bulletin No. 308 was not recorded and was not enforced by the AT&SF.

3. The routine use of the preacknowledgment procedure for an ATS inductor precluded the engineer from knowing if the ATS system was operative. Only by use of the postacknowledgment procedure for an ATS inductor would the ATS alarm whistle have sounded on Amtrak locomotive unit No. 501.

8/ "Special Study Report--Railroad Emergency Procedures," January 18, 1980 (NTSB-RSS-80-1).
9/ Op. cit.

4. Amtrak and AT&SF initial terminal tests of the ATS system do not insure that the device is operable as required by 49 CFR 236.587.

5. The ATS can fail en route without the locomotive engineer's knowledge and without an automatic application of the brakes.

6. Because of his unfamiliarity with the route, the engineer was depending upon the trackside speed-restriction signs to inform him when and where to take action to control the speed of the train.

7. The engineer had controlled the train properly until approaching the curve where the derailment occurred.

8. The 30/25-mph speed-restriction and ATS signs were not in place when train No. 4 passed this location on October 2, 1979.

9. The location of the resume-speed sign 1,099 ft before the missing 30/25-mph speed-restriction sign gave the engineer a misleading indication of how to operate the train entering Lawrence.

10. The engineer was not looking for, and was unaware of, the inert inductor for the curves at Lawrence. Because he was unfamiliar with the location and the ATS sign was missing, he took no action to acknowledge the inductor.

11. Investigators could not determine if the ATS was working properly on unit No. 501 because of damage caused by the derailment, but there is reason to believe that it did not function since the whistle did not sound and the brakes did not apply automatically.

12. The train was operating at excessive speed when it entered the 30-mph curves on which the accident occurred.

13. The track was in good condition and did not contribute to the derailment.

14. The passenger cars and locomotive cabs were not designed properly to minimize injury and to facilitate emergency evacuation.

15. The Amtrak and AT&SF crewmembers involved in this accident were not trained adequately in emergency procedures.

16. The Lawrence Fire Department and other rescue agencies had received no training in emergency access to passenger trains from Amtrak or the AT&SF.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the operation of the train at an excessive rate of speed into a 7° curve. The engineer failed to reduce the speed of the train because of a missing

speed-restriction sign, inoperative automatic train stop equipment, and his unfamiliarity with the route. Contributing to the accident were the assignment of an engineer who did not meet the Atchison, Topeka and Santa Fe Railway Company's operating familiarization qualifications for the route, and a resume-speed sign placed within 1,100 feet of the missing speed-restriction sign.

RECOMMENDATIONS

During its investigation of this accident, the National Transportation Safety Board made the following recommendations to the Atchison, Topeka and Santa Fe Railway Company on January 25, 1980:

> Establish requirements for testing of automatic train stop (ATS) equipment over inert inductors at initial terminals before in-service departure of locomotives to determine that both the ATS alarm will sound and the brakes will automatically apply. (Class I, Urgent Action) (R-80-2)
>
> Establish rules and procedures which require crewmembers operating Amtrak locomotives to postacknowledge all automatic train stop (ATS) inductor locations unless the ATS equipment has a preacknowledgment device which indicates that the system is functioning. (Class I, Urgent Action) (R-80-3)

As a result of its completed investigation of this accident, the National Transportation Safety Board made the following recommendations:

— to the Atchison, Topeka and Santa Fe Railway Company:

> Establish rules and procedures to verify that locomotive engineers are familiar with a district so they can operate safely in the event any fixed signal or other pertinent sign is inoperative or missing. (Class II, Priority Action) (R-80-23)
>
> Establish special rules which explain and identify the location of automatic train stop inductors that are not located at automatic block signals. (Class II, Priority Action) (R-80-24)

— to the National Railroad Passenger Corporation (Amtrak):

> Redesign automatic train stop equipment to provide an audible and visual alarm which will indicate that the system is functioning during both preacknowledgment and postacknowledgment procedures. (Class II, Priority Action) (R-80-25)

— to the Federal Railroad Administration:

> Determine and advise if test procedures being employed by the Atchison, Topeka and Santa Fe Railway Company at all locations are sufficient to determine if automatic train stop apparatus is functioning properly for in-service operation. (Class II, Priority Action) (R-80-26)

The Safety Board reiterates and reemphasizes the importance of the following recommendations made to the Federal Railroad Administration as a result of previous accident investigations:

> Promulgate regulations to require that all passenger-carrying railcars be provided with emergency exits and with emergency lights that will function when regular power is lost. (R-75-3)
>
> Require carriers to train employees in emergency procedures to be used after an accident, to establish priorities for emergency action, and to conduct accident simulations to test the effectiveness of the program, inviting civic emergency personnel participation. (R-76-29)
>
> Promulgate regulations to establish minimum standards for the design and construction of the interiors of passenger-carrying cars so that adequate crash-injury protection will be provided passengers. (R-79-38)
>
> Promulgate regulations establishing minimum standards for the training of traincrews in the safe operation of trains and in emergency procedures. (R-79-40)

The Safety Board also reiterates the following recommendation made to the National Railroad Passenger Corporation (Amtrak):

> Establish a program to train crewmembers in the proper procedures for care of passengers in derailment and emergency situations. (R-79-36)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

April 29, 1980

APPENDIX A

INVESTIGATION AND PUBLIC HEARING

Investigation

The National Transportation Safety Board was notified of the accident about 8:30 a.m., on October 2, 1979. The Safety Board immediately dispatched an investigator from its Kansas City field office and an investigative team from Washington, D.C., to the scene. Investigative groups were established for operations, vehicle factors, track and structures, and human factors.

Hearing

The Safety Board convened a public hearing as part of its investigation into this accident on December 4, 1979, in Lawrence, Kansas. Parties to this hearing included the Atchison, Topeka and Santa Fe Railway Company, National Railroad Passenger Corporation, Federal Railroad Administration, Brotherhood of Locomotive Engineers, United Transportation Union, Kansas Corporation Commission, and Douglas County, Kansas.

APPENDIX B

ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY
CREWMEMBER INFORMATION, TRAIN NO. 4
OCTOBER 2, 1979

Engineer Lawrence H. Graham, 63, was employed by the AT&SF as a section laborer on August 27, 1937. He left service on December 8, 1937. He was reemployed as a fireman on the middle division on June 23, 1941, and was promoted to an engineer on June 15, ~~1979~~ 1946. He passed his last operating rules examination in March 1979, and his last physical examination in June 1979.

Fireman William P. Hand, 50, was employed as a fireman on the AT&SF western division on July 4, 1949. He left service on January 26, 1951, and returned to work on August 7, 1953. He left service again on July 1, 1957, and was reemployed as a fireman on the middle division on March 28, 1970. He was promoted to engineer on March 23, 1973. He passed his last medical examination on February 6, 1979, and his last operating rules examination in May 1979.

Conductor John D. Gunkel, 52, was employed as a brakeman on the AT&SF eastern division on June 3, 1959. He was promoted to conductor on November 11, 1964. He has held the job as conductor on the eastern division continually since August 1, 1977. He passed his last medical examination on October 5, 1978, and his last rules examination in October 1978.

Brakeman Ray M. Maupens, 45, was employed as a roundhouse clerk in the AT&SF Argentine Yard, Kansas, on April 1, 1968. He transferred to brakeman on the eastern division on November 29, 1969. He left service on January 25, 1971, and was reemployed as a brakeman/switchman on January 7, 1972. He left service again on October 11, 1975, and was reinstated as a brakeman on August 19, 1976. He qualified for service as a conductor on October 28, 1976; however, he has been a brakeman continually since September 16, 1977. He passed his last physical examination on December 26, 1978, and his last rules examination on October 1978.

APPENDIX C

EXCERPTS FROM AT&SF TIME TABLES NO. 9

EASTERN DIVISION

W W MATZEN, Trainmaster	Emporia
C J. THOMPSON, Trainmaster	Topeka
J W LANE, Trainmaster-RFofE	Chanute
C E BAXTER, Road Foreman of Engines	Emporia
R D MARTIN, Rules Examiner	Emporia
L D HODGSON, Safety Supervisor	Emporia
G D BLANKENSHIP, Safety Supervisor	Topeka

KANSAS CITY DIVISION

D E PARSONS, Asst Superintendent	Argentine
J L SULLIVAN, Asst Superintendent	Argentine
F S KOWALCZYK, Trainmaster	Argentine
B D JOHNSTON, Trainmaster	Argentine
B. R. DAVIS, Trainmaster	Argentine
W H PITTS, Trainmaster	Argentine
W H McGINN, Asst Trainmaster	Argentine
R L DeCANEY, Asst Trainmaster	Argentine
G T HARDCASTLE, Asst Trainmaster	Argentine
T R ADAMS, Asst Trainmaster	Argentine
H J RAWLINGS, Asst. Trainmaster	Argentine
J D JOHNSON, Asst Trainmaster	Argentine
J M LOTZ, Road Foreman of Engines	Argentine
C E TRESSLER, Safety Supervisor	Argentine

EASTERN LINES

C L HOLMAN, Asst General Manager Engineering	Topeka
H L HAWKINS, Asst General Manager-Mechanical	Topeka
B R TUCKER, Supervisor of Air Brakes-General Road Foreman of Engines	Argentine
W J McMEANS, Trainmaster-RFofE-AMTRAK	Argentine

R T. POLLEY, Chief Dispatcher	Emporia
C W McCOY, Asst Chief Dispatcher	Emporia
D E HAMMAN, Asst Chief Dispatcher	Emporia
C I WALKER, Asst Chief Dispatcher	Emporia

TRAIN DISPATCHERS—EMPORIA

W K GAGE	R D DONOVAN	D I. STEINBRINK
A E JUDD	J A FACKLAM	C K CARNES
D L. SEXTON	S E QUINTANA	G B MILLER
D W McALISTER	R A TURNER	

AVOID DAMAGE—SWITCH CUSTOMERS CARS CAREFULLY
OVERSPEED Couplings are DAMAGING.

Damage to freight or car can be avoided by always keeping coupling speed within the safe range—NOT OVER 4 MILES PER HOUR—A BRISK WALK

HANDLE FREIGHT CAREFULLY AND KEEP OUR CUSTOMERS

IT'S EVERYBODY'S JOB ON THE SANTA FE

SPEED TABLE

Table of speeds (minutes and seconds per mile, in terms of *miles per hour*)

Time Per Mile Min	Time Per Mile Sec	Miles Per Hour	Time Per Mile Min	Time Per Mile Sec	Miles Per Hour	Time Per Mile Min	Time Per Mile Sec	Miles Per Hour
	36	100		58	62 1	1	40	36 0
	37	97 3		59	61 0	1	42	35 3
	38	94 7	1		60 0	1	44	34 6
	39	92 3	1	02	58 0	1	46	34 0
	40	90 0	1	04	56 2	1	48	33 3
	41	87 8	1	06	54 5	1	50	32 7
	42	85 7	1	08	52 9	1	52	32 1
	43	83 7	1	10	51 4	1	54	31 6
	44	81 8	1	12	50 0	1	56	31 0
	45	80 0	1	14	48 6	1	58	30 5
	46	78 3	1	16	47 4	2		30 0
	47	76 6	1	18	46 1	2	05	28 8
	48	75 0	1	20	45 0	2	10	27 7
	49	73 5	1	22	43 9	2	15	26 7
	50	72 0	1	24	42 9	2	30	24 0
	51	70 6	1	26	41 9	2	45	21 8
	52	69 2	1	28	40 9	3		20 0
	53	67 9	1	30	40 0	3	30	17 1
	54	66 6	1	32	39 1	4		15 0
	55	65 5	1	34	38 3	4	30	13 3
	56	64 2	1	36	37 5	5		12 0
	57	63 2	1	38	36 8	6		10 0

The Atchison, Topeka and Santa Fe Railway Co.

EASTERN LINES

EASTERN DIVISION

TIME TABLE No.

9

IN EFFECT

Tuesday, October 2, 1979

At 12:01 A M.
Central Standard Time

This Time Table is for the exclusive use and guidance of Employes

H J BRISCOE
General Manager
Topeka, Kansas

C R ROSE
Asst General Manager
Topeka, Kansas

J. D. McPHERSON
Emporia, Kansas

M F SMITH
Argentine, Kansas

Superintendents

2 EASTERN DIVISION — FIRST DISTRICT

TCS IN EFFECT:

On main tracks N R. Jct. to Constitution Street (MP 111 9) *Emporia*

RULE 251 IN EFFECT:

On North and South Main Tracks Constitution Street (MP 111 9) Emporia to Interlocking Merrick (MP 115 3)

Between Constitution St (MP 111 9) Emporia and Interlocking Merrick (MP 115 3) first track south of Main Tracks designated as Yard Track No 3

Eastward trains via First District must secure clearance card at *Emporia* Passenger Station

Mile post signs 51 and 52 west of station Topeka designated as 51W and 52W

HAND THROW SWITCHES IN TCS LIMITS:

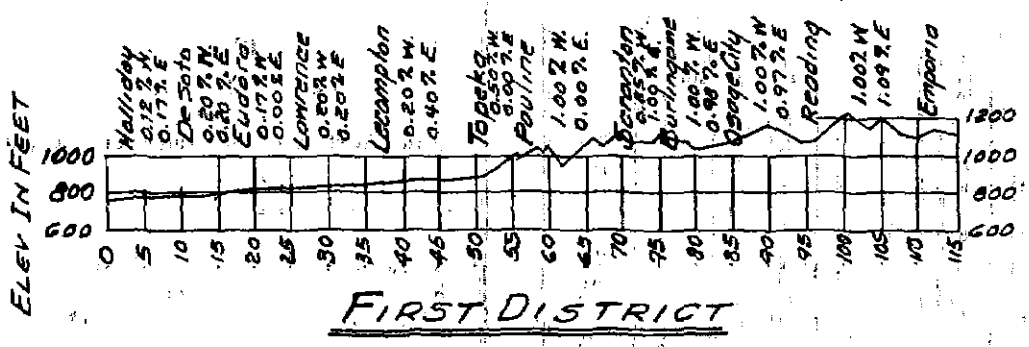
Within TCS limits, where maximum speed exceeds 20 MPH, a train or engine must not clear the main track or siding where TCS is in effect through a hand throw switch, not electrically locked, for the purpose of meeting, passing, or being passed by another train or engine. Tracks where such switches are located are:

MP 111 3, NR Jct, Bunge Corporation
MP 111 6, NR Jct, Teichgraeber Milling (CLIC 03-70)

TRACK SIDE WARNING DETECTORS—
SPECIAL RULE 13

DETECTOR LOCATION	TYPE	SIGNALS AFFECTED
M P 3	High Water	*Signals 11 and 32*
M P 7 8-8 0	Slide fence	Signals 51, 81 and 82
M P 8 1-8 4	Slide fence	Signals 81 and 82
M P 8.5-8.7	Slide fence	Signals 81, 82 and 102
M P 36 9-37 2	Slide fence	Signals 341 and 372
M P 62 9	High water	Signals 621 and 652

WEST-WARD First Class 3	Capacity of Sidings in Feet	Rating Grade Ascending	TIME TABLE No 9 October 2, 1979	Rating Grade Ascending	Mile Post	Communications Train Tables and Wyes	EAST-WARD First Class 4
Leave Daily		Feet Per Mile	STATIONS	Feet Per Mile			Arrive Daily
AM 12.40		64	HOLLIDAY 3 4	0			AM 5.55
12.43		0	WILDER JCT 8 0	89	8 1	B	5.52
12.50	6350	106	DE SOTO 8 0	106	11.1	C	5.45
12.59	2450	0	EUDORA 4 1	0	19 1	B	5.37
1.00		92	NORIA YL 3 3	0	23.2		5.33
s 1.05	6600	106	LAWRENCE YL 5 1	106	26 5	Y GR	s 5.30
1.10	2600	0	LAKE VIEW 5.8	0	31 6		5.14
1.15	2600	106	LECOMPTON 8 6	211	37 4	B	5.09
1.23	7900	70	TECUMSEH 6.6	0	46 0	B	5.02
s 1.45	2050		A T.&S.F. Crossing		52 6	Y O R	s 4.55
		264	TOPEKA YL 6.7	0	50.6		
1.51	2450	528	PAULINE YL 14 3	0	57 8	C	4.43
2.05	3000	450	SCRANTON 5 3	528	71 6	B	4.30
2.10	8400	52.8	BURLINGAME 7 9	516	76.9	C	4.25
		106	Mo Pac. Crossing 0 3	0	84.8		
2.18	8000	528	OSAGE CITY 11 4	511	85 1	C	4.18
2.29	4000	528	READING 14 5	578	96 5	B	4.07
2.41		58	N.R JCT YL 1 1	158	111 0	Y	3.53
s 3.00 AM			EMPORIA YL		112.1	T CR	3.50 AM
Arrive Daily			(111 9)				Leave Daily
48.8			Average speed per hour				42.6



FIRST DISTRICT — EASTERN DIVISION 3

SPECIAL RULES
1 SPEED REGULATIONS
(A) MAXIMUM AUTHORIZED SPEED:

BETWEEN	MPH Psgr.	MPH Frt.
Holliday and Emporia	60	60*
Sunflower Ordnance Track M.P. 11.3	25	25

*Maximum authorized speed for freight trains when averaging 90 tons and over per car or over 5,000 tons total 45 MPH

Maximum authorized speed for freight trains handling one or more empty cars (Cabooses and cars loaded with empty trailers or empty containers are considered loads) 55 MPH

(B) SPEED RESTRICTIONS - CURVES, TRACK AND RR CROSSINGS:

		MPH Psgr.	MPH Frt.
2 Curves,	M.P. 0.0 to 0.3	30	30
Curve,	M.P. 0.7 to 0.9	65	.....
Curve,	M.P. 1.8 to 2.4	75	.....
2 Curves,	M.P. 2.8 to 3.3	55	55
Curve,	M.P. 3.7 to 3.9	65	.....
Curve,	M.P. 6.3 to 6.5	65	.....
Curve,	M.P. 8.8 to 9.3	60	.....
4 Curves,	M.P. 15.1 to 16.1	65	.....
4 Curves,	M.P. 18.3 to 19.5	60	55
Curve,	M.P. 23.4 to 23.6	55	55
Curve,	M.P. 24.6 to 24.8	65	.....
2 Curves,	M.P. 25.2 to 25.9	55	55
6 Curves,	M.P. 26.2 to 27.4 LAWRENCE	30	30
2 Curves,	M.P. 28.7 to 30.3	65	.....
2 Curves,	M.P. 34.3 to 34.7	55	.....
2 Curves,	M.P. 34.8 to 35.2	50	50
2 Curves,	M.P. 36.9 to 37.3	60	.....
2 Curves,	M.P. 37.4 to 37.8 TOPEKA	65	.....
3 Curves,	M.P. 51.1 to 52.0	60	.....
M P 52 2 (Viaduct), to Fourth Street (Topeka)		10	10
RR Crossing M.P 52 6 (Automatic Interlocking)		10	10
Curve,	M.P. 58.9 to 59.1	65	.....
Curve,	M.P. 59.8 to 60.0	65	.....
Curve,	M.P. 60.3 to 60.6	70	.....
9 Curves,	M.P. 61.0 to 63.6	50	50
2 Curves,	M.P. 63.7 to 64.2	45	45
Curve,	M.P. 64.5 to 64.7	60	.....
Curve,	M.P. 65.0 to 65.3	65	.....
2 Curves,	M.P. 66.5 to 67.2	50	50
2 Curves,	M.P. 67.5 to 67.8	55	55
Curve,	M.P. 68.2 to 68.8	70	.....
Curve,	M.P. 69.0 to 69.4	55	55
Curve,	M.P. 69.8 to 70.0	70	.....
Curve,	M.P. 70.6 to 70.9	70	.....
Curve,	M.P. 75.1 to 75.3	65	.....
2 Curves,	M.P. 76.0 to 77.1	55	55
Curve,	M.P. 84.0 to 84.4	55	50
RR Crossing M.P 84 8 (Automatic Interlocking)		40	40
Curve,	M.P. 85.3 to 85.7	80	.....
Curve,	M.P. 88.5 to 88.9	55	55
Curve,	M.P. 89.5 to 90.2	65	.....
Curve,	M.P. 93.7 to 94.0	65	.....
Curve,	M.P. 96.1 to 96.4	65	.....
2 Curves,	M.P. 97.8 to 98.3	55	50
2 Curves,	M.P. 107.3 to 108.1	55	55
Curve,	M.P. 110.0 to 110.3	55	55
Curve,	M.P. 110.8 to 111.0 EMPORIA	80	80

(C) SPEED RESTRICTIONS - SWITCHES

Maximum speed permitted through turnout of switches, except main track switches listed below, 10 MPH

Trains and engines using other than main track must not exceed turnout speed for that track, unless provided otherwise in Time Table Special Rule 1(A)

"I"—Interlocked Switch
"S"—Spring Switch

STATION	TYPE	LOCATION	MPH
Holliday	I	Turnout First District	30
DeSoto	S	East end siding	10
	S	West end siding	10
Eudora	S	Both ends siding	10
Lawrence	S	Both ends siding	10
Lake View	S	Both ends siding	10
Lecompton	S	Both ends siding	10
Tecumseh	S	Both ends siding	10
Topeka	S	Both ends siding	10
	S	West end of yards	10
Pauline	S	Both ends siding	10
Scranton	S	Both ends siding	30
Osage City	S	Both ends siding	30
Reading	S	Both ends siding	30
N.R. Jct.	I	Turnout First Dist.	30

(D) SPEED RESTRICTIONS - STREET CROSSINGS:

Restriction applies only while head end of train is passing crossings at cities and towns named below:

STATION	BETWEEN:	MPH
Topeka	M P. 50 6 and M.P 51.3 (Fourth and Tenth)	20
Osage City	M.P. 84.4 and M.P. 85.5	40
Emporia	M P. 110.1 and M.P 111 9 (Whilden and Constitution)	30

2 OVERHEAD AND SIDE OBSTRUCTIONS (Rule 769)

Mile Post	Name
	De Soto Highway Viaduct
	Ordnance Plant Track
19 6	Wakarusa River
26 5-26 9	Lawrence Mill tracks and Overhead Conveyor
52 2	Topeka, Branner Street Viaduct
107.9	Neosho River

3 TRACKS BETWEEN STATIONS:

Name	Location	Capacity (Feet)
Cooperative Farm Chem Assn (Spur)	M P 24 6	8,950
Industrial Spur	M P 28 7	9,400
Storage Tracks	M P 29 3	4,300
Kansas Power and Light Co (Spur)	M P 30 3	1,800
Nationwide Warehouse (Spur)	M P 54 5	500
White Lakes Warehouse (Spur)	M P 54 6	682
Seymour Industrial (Spur)	M P 55 6	1,250
Carbondale House Track	M.P. 67.8	2,200

JUNCTION SWITCHES:

LOCATION	NORMAL POSITION
Wilder Jct.	First District

SPECIAL RULES — EASTERN DIVISION 13

4 REGISTER STATIONS (Rule 83 (B)).

STATIONS LISTED BELOW ARE REGISTER STATIONS ONLY FOR TRAINS DESIGNATED:

Station	Designated Trains
Topeka	Originating or terminating
Emporia	Originating or terminating
Turner	Originating or terminating
Moline	Originating or terminating
Wellington	Originating or terminating
Winfield	Originating or terminating

AT STATIONS LISTED BELOW TRAINS DESIGNATED WILL REGISTER BY FORM 903:

Emporia	Trains on which engine or train crews do not change
Ottawa	Trains to and from Third District.
Tulsa Yard	Extra trains.
Winfield	Through trains.

5 JOINT TRACK FACILITIES

KANSAS CITY—Santa Fe Jct A.T.& S.F trains will use K.C.T (Kansas City Terminal Ry Co) tracks between Union Station and Santa Fe Jct.

CANEY-STATE LINE—Mo. Pac. trains use A.T.& S.F main track between connecting switches MP 21 4 and State Line MP 22 7.

DY Jct.—BE Jct.—M K.T trains use A T & S F main track between DY Jct and BE Jct, and Bartlesville yard tracks east of BE Jct, and are governed by A T.& S.F time table and rules.

WINFIELD—WN. Jct.—Mo Pac. trains use A T & S F tracks and are governed by A T.& S F time table and rules.

TERMINAL YARD—A T.& S.F trains will use St. Joseph Terminal Ry Co tracks between Terminal Yard and M K Jct

TERMINAL JCT.—MO. RIVER BRIDGE A.T & S F trains will use C R I & P. Ry Co tracks between Terminal Jct. and a point 462 feet east of Mo River Bridge

ATCHISON—A T & S.F trains will use tracks of Atchison Br. Co, Inc, from 462 ft east of bridge to west end of bridge. Will use Mo. Pac. track between west end of bridge and A.T.& S F main track 884 feet west of Mo Pac crossing C.R I & P. trains will use A.T & S.F. main and yard tracks at Atchison and will be governed by A T & S F time table and rules

FREDONIA—Mo Pac trains use A T.& S F. main track between connecting switches M.P 150 9. Fredonia, and M.P 144.2, Benedict, and operate on authority of A T &S.F. dispatcher and are governed by the A T.& S F Operating Book of Rules

FREDONIA—S.L.S.F engines use A.T.& S F. main track between connecting switch M P 152.1 and M P 150 0 in making interchange A.T.& S F engines use S.L.S.F. main track between connecting switch and S L S.F M P F412 plus one pole

FRONTENAC—PITTSBURG—A.T.& S F. trains and engines will use KCS tracks between M P 50 3 (KCS M P 127 1) and M P 52 7 (KCS M P 129 4)

6 MAXIMUM SPEED OF ENGINES

Engines	Forward or dead in train (MPH)	When not controlled from Leading Unit (MPH)
Amtrak 100-799 5940-5948	90*	45
1158, 1160, 1215-1260, 1416-1441, 1500-1536, 2326-2390	45	45
ALL OTHER CLASSES	70	45

Forward speed applies when lead unit of train is controlling and is in backing position EXCEPTION: When such unit is car body type, maximum authorized speed 45 MPH

*Engine without cars must not exceed 70 MPH.

7 MAXIMUM DEPTH OF WATER THROUGH WHICH ENGINES MAY BE OPERATED AND MAXIMUM SPEED IN SUCH OPERATION

	Maximum Depth Above Top of Rail (Inches)	Maximum Speed (MPH)
All Classes except Amtrak	4	5
Amtrak	2	2

8 DERRICKS, PILE DRIVERS, CRANES, SCALE TEST CARS.

Derricks, cranes, pile drivers, spreaders and similar machinery moving on their own running gear, must not be moved in trains except on authority of Trainmaster, and trains or engines handling such equipment must not exceed speeds indicated below:

DISTRICT	Wrecking Derricks MPH	Pile Drivers AT-199454 AT-199455 AT-199457 AT-199458 AT-199459 AT-199460 AT 199461 Locomotive Crane AT-199720 and Jordan Spreaders MPH	Other Machines including Pile Drivers AT-199452 AT-199453 AT-199456 MPH
First, Second, and Third; Fourth M.P 127 7 to M.P. 171 0 and M P 238.9 (New Salem) to M.P. 238 9 (Wellington)	40	45	30
Atchison, Girard, Leavenworth, and Coffeyville; Fourth M P. 171.0 to M.P. 238.9 (New Salem)	24	24	24

Trains or engines handling wrecking derricks, cranes, pile drivers, Jordan spreaders, and similar machinery moving on their own running gear, through a turnout must not exceed one-half the maximum authorized speed for that turnout

Locomotive Crane AT 199720, and pile drivers must be handled in trains next to engine

All foreign line scale test cars must be handled in trains immediately ahead of caboose at speed not exceeding 50 MPH

14 EASTERN DIVISION — SPECIAL RULES

9 YARD LIMITS

Atchison	M P 2.0 West	Independence	M.P 164.3 East
AU Jct	M P. 130 6 West		M P 1.8 West
	4th Dist	Iola	M P 108 3 East
	M P. 1 0 West		M P 111.6 West
	Girard Dist	Lawrence	M P 22 5 East
Baldwin Dist	M.P 25 3 East		M P 27 9 West
	Baldwin Dist	Leavenworth	M P 20 2 East
	M P 40 3 East		M P 24 8 West
Bartlesville	M P 43 1 West	N R Jct.	M P 110 3 East
Caney	M P 20 8 East		1st Dist.
	M P 23 1 West	Ottawa	M.P. 55.3 East
Chanute	M P 124 9 East		2nd Dist.
	M P 130 4 West		M P 58.4 West
Cherryvale	M P 154 2 East		2nd Dist.
	M P 157 3 West		M.P 63 0 West
Coffeyville	M P 12 0 East		3rd Dist.
Dewey	M P 35.7 East	Pauline	M P 56 2 East
Emporia	M P 115 6 West		M P 59 1 West
	1st Dist	Topeka	M P 49.7 East
	M P 111 9 East		1st Dist.
	2nd Dist.		M P 62.5 West
Fredonia	M P 150 0 East		1st Dist.
	M P 154 0 West		M P. 47 6 East
Frontenac	M P 47 9 East		Atchison Dist
Garnett	M P 82 1 East	Tulsa	M P 79 2 East
	M P 84.0 West	Wellington	M P 266 8 East
Humboldt	M P 115 8 East		M P 267 6 West
	M P 119 5 West	Winfield	M P 244 9 East
			M P 249 9 West

10 BULLETIN BOOKS

Kansas City	Rm 125-L, Union Station
Argentine	Yard and Roundhouse Offices
Turner	Yard Office
Olathe	Station
Ottawa	Station
Emporia	Telegraph, Yard and Roundhouse Offices
Topeka	Yard Office
Lawrence	Passenger Station
Atchison	Station
Chanute	Telegraph and Roundhouse Offices
Moline	Station
Wellington	Telegraph, Yard and Roundhouse Offices
Newton	Telegraph and Roundhouse Offices
Bartlesville	Passenger Station
Tulsa Yard	Yard Office
Tulsa	Passenger Station
Winfield	Station
Coffeyville	Station

11 STANDARD CLOCKS

Argentine	Yard and Roundhouse Offices
Topeka	Yard and Telegraph Offices
Lawrence	Ticket Office
Turner	Yard Office
Kansas City	Rm 125-L, Union Station
Emporia	Telegraph, Yard and Roundhouse Offices
Ottawa	Telegraph Office
Terminal Yard	Yard Office
Atchison	Station
Chanute	Telegraph and Roundhouse Offices
Bartlesville	Passenger Station
Tulsa Yard	Yard Office
Tulsa	Passenger Station
Winfield	Station
Wellington	Telegraph, Yard and Roundhouse Offices
Coffeyville	Station

12 At Wilder Jct., crews on eastward trains from Leavenworth District will contact dispatcher, using phone near switch, for permission to occupy First District main track Verbal authority from train dispatcher will authorize trains from Leavenworth District to run extra Wilder Jct. to Holliday

13 TRACK SIDE WARNING DETECTORS

HOT BOX AND DRAGGING EQUIPMENT DETECTORS

Abnormal heat from hot wheels (sticking brakes), overheated journals, traction motor or suspension bearings, will actuate track side indicators causing rotating white light on field side of associated track to illuminate at detector (scanner) and locator locations Dragging equipment will also actuate track side indicators

When actuated by a train, stop must be made with head end at locator, if possible, readout observed and instructions in locator cabinet complied with. If abnormal heat or dragging equipment is not found on equipment indicated by locator, close inspection must be made on three cars (or units) on either side of indicated equipment

If lamp or counters fail to show location of overheated equipment, the entire train must be thoroughly inspected for hot journals, wheels, bearings, or dragging equipment

On inspections required above, give particular attention to heat of journals and hub of wheels If nothing found wrong, train may proceed at prescribed speed, but must make two stops within next sixty miles at approximately thirty mile intervals for thorough inspection of train, unless train passes an intervening hot box detector or train is delivered to terminal where mechanical inspection is made At crew change points where mechanical inspections are not made, inbound crew will inform relieving crew of existing condition

When track side indicator is illuminated before train reaches scanner, stop must be made and locator observed unless otherwise instructed by train dispatcher If any lamps in locator cabinet are lighted, be governed by above instructions If no lamps are lighted, train may proceed at prescribed speed and must be observed closely enroute

When suspected journal on freight equipment indicated by locator is a roller bearing journal, the car must be set out unless cause found to be sticking brakes and condition corrected

When a train is stopped by detector, Form 1572 Standard must be filed at first office of communication

Trains must not exceed speed of 30 MPH while moving over hot box detectors (scanners) when:

(a) it is snowing or sleeting; or,

(b) there is snow on ground which can be agitated by a moving train

SHIFTED LOAD DETECTORS

When condition in train actuates indicators, they will display rotating white light, and when so displayed, the train must be stopped immediately, inspection must be made of both sides of train for shifted load and protruding objects Dispatcher must be advised promptly by radio or telephone the result of inspection

HIGH WATER DETECTORS

High water detectors have been placed at certain locations where high water might occur These detectors, when actuated by high water, set adjacent block signals in stop position. Under such conditions, trains must not cross bridges or pass through other areas so protected until a thorough inpection has been made to determine track is safe for passage of trains and, in addition, must observe the requirements of Rules 320 or 321. Crews should promptly communicate with train dispatcher and every precaution for safety should be taken

SLIDE DETECTOR FENCES

Slide detector fences placed in certain areas which will cause adjacent signals to be in stop position if fence circuit is broken Due precaution for slides must be taken by crews in such areas when observing the requirements of Rules 320 or 321 Train dispatcher must be promptly notifed if slide conditions observed

W F KILPATRICK, Asst. Superintendent	Newton, Kans
T. H SHALIN, Trainmaster	Newton, Kans.
W C LYMAN, Trainmaster	Newton, Kans
J E ANDERSON, Asst. Trainmaster	Wichita, Kans
G L BERRY, Asst. Trainmaster	Salina, Kans
C A GARRISON, Road Foreman of Engines	Newton, Kans
G E GUTHRIE, Road Foreman of Engines	Emporia, Kans.
T H LINN, Rules Examiner	Newton, Kans
R. E JONES, Safety Supervisor	Newton, Kans
W F BOWEN, Asst Superintendent	Oklahoma City, Okla
R A KURTZ, Trainmaster	Oklahoma City, Okla.
R F SMITH, Asst. Trainmaster	Oklahoma City, Okla
C H TATE, Asst, Trainmaster	Oklahoma City, Okla
T M JOYCE, Asst. Trainmaster	Oklahoma City, Okla
D R HAYES, Asst. Trainmaster	Arkansas City, Kans
R E CLEMENTS, Road Foreman of Engines	Arkansas City, Kans
D G. SIBLEY, Rules Examiner	Oklahoma City, Okla.
A W DeMOSS, Safety Supervisor	Oklahoma City, Okla.

EASTERN LINES

C L HOLMAN, Asst. General Manager-Engineering	Topeka, Kans
H L HAWKINS, Asst General Manager-Mechanical	Topeka, Kans
B R. TUCKER, Supervisor of Air Brakes—General Road Foreman of Engines	Argentine
W J. McMEANS, Trainmaster—RF of E—AMTRAK	Argentine

K L SEBO, Chief Dispatcher	Newton, Kans
M C. SEELY, Asst. Chief Dispatcher	Newton, Kans.
R F SHIELDS, Asst. Chief Dispatcher	Newton, Kans
D L RESER, Asst Chief Dispatcher	Newton, Kans.
K F KIEFER, Asst. Chief Dispatcher	Newton, Kans
J. C MATHIES, Asst Chief Dispr	Newton, Kans
D D GAFFNEY, Asst Chief Dispr	Newton, Kans.

TRAIN DISPATCHERS—NEWTON, KANSAS

J. Q. COOPER	R C. COPPOCK	T A STUTZMAN
W G WILLIAMS	J L MITCHAM	D R LACKEY
B. J. ECKERT	G. H HARDEY	D. G LITTON
W G BURTON	M. A PORTER	W G LORD
W P VAUGHN	J. D. CATHCART	R. D LEDERER
D S. OSBURN	D G CARGILL	S J SHIELDS
E M SMITH	R L TREFETHEN	

AVOID DAMAGE—SWITCH CUSTOMERS CARS CAREFULLY
OVERSPEED Couplings are **DAMAGING.**
Damage to freight or car can be avoided by always keeping coupling speed within the safe range—NOT OVER 4 MILES PER HOUR—A BRISK WALK.

SPEED TABLE

Table of speeds (minutes and seconds per mile, in terms of miles per hour)

Time Per Mile Min	Sec.	Miles Per Hour	Time Per Mile Min	Sec.	Miles Per Hour	Time Per Mile Min.	Sec	Miles Per Hour
	36	100		58	62 1	1	40	36 0
	37	97 3		59	61 0	1	42	35 3
	38	94 7	1		60 0	1	44	34 6
	39	92 3	1	02	58 0	1	46	34.0
	40	90 0	1	04	56 2	1	48	33 3
	41	87 8	1	06	54 5	1	50	32 7
	42	85 7	1	08	52 9	1	52	32.1
	43	83 7	1	10	51 4	1	54	31.6
	44	81 8	1	12	50 0	1	56	31 0
	45	80.0	1	14	48 6	1	58	30 5
	46	78 3	1	16	47 4	2		30.0
	47	76 6	1	18	46 1	2	05	28 8
	48	75 0	1	20	45 0	2	10	27 7
	49	73 5	1	22	43 9	2	15	26.7
	50	72 0	1	24	42 9	2	30	24 0
	51	70 6	1	26	41 9	2	45	21 8
	52	69 2	1	28	40 9	3		20 0
	53	67 9	1	30	40 0	3	30	17.1
	54	66 6	1	32	39 1	4		15 0
	55	65 5	1	34	38 3	4	30	13 3
	56	64 2	1	36	37 5	5		12 0
	57	63.2	1	38	36.8	6		10.0

The Atchison, Topeka and Santa Fe Railway Co.

EASTERN LINES

MIDDLE DIVISION

TIME TABLE No.

9

IN EFFECT

Tuesday, October 2, 1979

At 12:01 A. M.

Central Standard Time

This Time Table is for the exclusive use and guidance of Employes.

H. J. BRISCOE,
General Manager
Topeka, Kansas

H. L. ROGERS,
Asst. General Mgr
Topeka, Kansas

D. F. DUNCAN,
Superintendent,
Newton, Kansas

2 FIRST DISTRICT — MIDDLE DIVISION

WEST-WARD First Class 3	Capacity of Sidings in Feet	Rising Grade Ascending	TIME TABLE No 9 October 2, 1979	Rising Grade Ascending	Mile Post	Communications Turn Tables and Wyes	EAST-WARD First Class 4
Leave Daily		Feet Per Mile	STATIONS	Feet Per Mile			Arrive Daily
AM 3 00			EMPORIA YL — 3 2 — (DT)	21 2	112 1	T C R	a AM 3.50
		6 1	MERRICK YL — 8 1 — (ABS)	0	115 3		3 37
		6 1	SAFFORDVILLE — 1 3 — (ABS, Tracks 3)	0	123 4		
		6 8	ELLINOR — 7 0 — (TCS)	0	124 7		
3.10		9 2		0			3.30
	11762	10 4	STRONG CITY — 4 1 — (TCS)	0	131 7	1 C	
		0	NEVA — 2 5 — (TCS)	0	135 8		
		17 4	ELMDALE — 6 5 — (TCS)	12 8	138 3		
	8583	13 0	CLEMENTS — 5 9 — (TCS)	0	144 8		
		0	CEDAR POINT — 6 2 — (TCS)	0	150 7		
	8079	19 3	FLORENCE — 11 4 — (TCS)	0	156 9	C	
	10487	14 8	PEABODY — 0 3 — (TCS)	0	168 3		
		45 4	C R I &P. Crossing — 9 7 — (TCS)	16 8	168 6		
	8419	0	WALTON — 6 3 — (TCS)	21 1	178 3		
		0	Mo Pac. Crossing — 0 5 — (TCS, Tracks 3)	19 1	184 6		
a 4.10 AM			NEWTON		185 1	T C R	2.35 AM
Arrive Daily			(73 0)				Leave Daily
82 5			Average speed per hour				58 4

TCS IN EFFECT:

South Track between Merrick and Ellinor
On main track and sidings, Ellinor to Newton
Three main tracks, Newton

RULE 251 IN EFFECT:

Main Tracks between Emporia and Merrick

North Track and Middle Track between Merrick and Ellinor

Trains originating Emporia, Newton or Sand Creek must secure clearance card

Strong City District and McPherson District trains originating Emporia, Sand Creek or Newton must secure two clearance cards—one marked "First District" and one marked "Strong City District" or McPherson District". McPherson District trains also secure Rock Island clearance

Between Constitution Street (M P 111.9) Emporia and interlocking Merrick (M P 115.3) first track south of main tracks designated as Yard Track No 3

Between Merrick and Ellinor mile post numbers have suffix "X" on South Track

Between Merrick and Ellinor current of traffic is westward on North Track, eastward on Middle Track

At Newton three main tracks between Mo Pac crossing and M P 185 5

SPECIAL RULES

1 SPEED REGULATIONS

(A) MAXIMUM AUTHORIZED SPEED

BETWEEN:	MPH Psgr	MPH Frt
Emporia and Newton	79	60*
Constitution Street (M.P 111 9) Emporia and Merrick (M.P. 115.3) Yard Track No. 3	20	20
Newton between Mo. Pac. crossing and interlocked crossover M.P. 186.0 on main tracks	20	20
Newton-Sand Creek eastbound and westbound freight leads	20	20

*Maximum authorized speed for freight trains when averaging 90 tons and over per car, or over 5,000 tons total 45 MPH

Maximum authorized speed for freight trains handling one or more empty cars (Cabooses and cars loaded with empty trailers or empty containers are considered loads) 55 MPH

Freight trains may observe passenger train speed but not to exceed 70 MPH, except eastward between M P 117 5 and Emporia and westward between Emporia and Merrick (M P 115 3), provided:

(1) *Maximum district speed is 60 MPH for freight trains*
(2) Train does not exceed 5,000 tons
(3) Train does not exceed 90 cars
(4) Train does not average more than 75 tons per car
(5) Locomotive can control speed to 70 MPH without use of air brakes

Maximum authorized speed on sidings 20 MPH while head end of train passing over hand throw switches listed below:

Strong City	Both ends of Yard Track No 1
Florence	Both ends of Yard Track No 1
Peabody	Both ends of storage track

MIDDLE DIVISION — FIRST DISTRICT 3

(B) SPEED RESTRICTIONS—CURVES AND RR CROSSINGS

			MPH
3 Curves,	M.P. 116.2X to 118.1X	South Track	75
Curve,	M.P. 122.5X to 123.0X	South Track	75
4 Curves	M P 116 2 to 118 9	North Track Middle Track	70
Curve,	M P 122 5 to 123 0	North Track Middle Track	75
Curve,	M.P. 126.1 to 126.4		70
Curve,	M.P. 129.4 to 130.0		75
Curve,	M.P. 132.4 to 132.8		70
Curve,	M.P. 133.7 to 133.9		50
Curve,	M.P. 134.2 to 134.8		75
Curve,	M.P. 135.9 to 136.4		65
Curve,	M.P. 136.9 to 137.1		75
Curve,	M.P. 142.2 to 142.5		75
3 Curves,	M.P. 148.0 to 150.5		75
Curve,	M.P. 153.4 to 154.2		75
3 Curves,	M.P. 155.6 to 157.9		75
Curve,	M.P. 160.5 to 160.7		75
3 Curves,	M.P. 161.6 to 163.6		70
2 Curves,	M.P. 164.7 to 165.9		75
Curve,	M.P. 166.4 to 166.8		65
Curve,	M.P. 168.0 to 168.4		65
RR Crossing,	M.P. 168.6 (Auto. Interlocking)*		30
Curve,	M.P. 168.9 to 169.1		70
Curve,	M.P. 170.0 to 170.5		65
Curve,	M.P. 171.2 to 171.4		75
4 Curves,	M.P. 173.3 to 175.9		65
Curve,	M.P. 176.1 to 176.4		75
Curve,	M.P. 180.4 to 180.7		70
Curve,	M.P. 181.8 to 182.3		75
RR Crossing,	M.P. 184.6 (Interlocking)		20

*If *governing signal indicates* "STOP", *after communicating* with Control Station, follow instructions posted in control box

(C) SPEED RESTRICTIONS—SWITCHES

Maximum speed permitted through turnout of switches, except main track switches listed below, 10 MPH.

Trains and engines using other than main track must not exceed turnout speed for that track unless provided otherwise in Time Table SPECIAL RULE 1(A)

"I"—Interlocked Switch

STATION	TYPE	LOCATION	MPH
Merrick	I	Crossovers between Middle Track and North Track and west crossover between Middle Track and South Track.	50
	I	East crossover between Middle Track and South Track	30
	I	Turnout to Yard Lead	10

(C) SPEED RESTRICTIONS—SWITCHES —(Cont'd)

Ellinor	I	Main track turnouts and crossovers.	40
Strong City	I	Both ends siding	30
Neva	I	Turnout to Strong City District	20
Clements	I	Both ends siding	30
Florence	I	Both ends siding	30
Peabody	I	Both ends siding	30
	I	Connection to Rock Island	20
Walton	I	Both ends siding	30
	I	East switch, storage track	10
Newton	I	Main track crossovers and turnouts M P 184 5 to M P 185 5	30
	I	Turnout to lower yard M.P. 185.6	10

3 TRACKS BETWEEN STATIONS

Name	Location	Capacity (Feet)
Cottonwood Falls Spur	M P 131 4	8,976

TRACK SIDE WARNING DETECTORS
HOT BOX AND DRAGGING EQUIPMENT DETECTORS

Detector Location	Locator Location
M P 134 0	Westward M P 135 9 Eastward M.P. 131.7
M P 159 0	Westward M.P. 161 4 Eastward M P 156 9

Hotbox or dragging equipment will actuate alarm
See Special Rule 12

Between Ellinor and Newton all block signals, equipped with number plates, governing eastward movements are located immediately to the left of the main track

Controlled signals governing eastward movements are located immediately to the left of the track at the following locations:

M P. 184 7 North Track, Mo Pac. crossing—Newton
M P 182 4 Main Track, between Newton & Walton
M P 178 1 Main Track, west end Walton
M P 176 4 Main Track, east end Walton
M P 168 8 Siding, east end Peabody
M P 155 0 Siding, east end Florence
M P 143 3 Main Track, east end Clements
M P 135 9 Strong City District, Neva
M P 129 3 Main Track, east end Strong City

Controlled signals governing westward movements are located immediately to the left of the track at the following locations:

M P 131 6 Siding, west end Strong City
M P 145 0 Siding, west end Clements
M P 156 7 Main Track, west end Florence
M P 170 7 Main Track, west end Peabody
M P 178 1 Siding, west end Walton
M P. 185 1 North Track, Newton

APPENDIX D

TRAIN ORDERS FOR TRAIN NO. 4 BETWEEN EMPORIA AND TOPEKA

Holl 10-78—1,3164—8284 COPY

Santa Fe

CLEARANCE CARD FORM 902

Oct 2, 19 79

TO C & E No 4

At Emporia To Via

I have 8 orders for your train.

Orders: No. 107 No. 19 No. 15 No. 10 No. 9 No. 5
No. 4 No. 1 No. No. No. No.
No. No. No. No. No. No.

If no train order, operators must write the word "No" in space provided.

Clearance Card No. (Rule 217)

Clearance Card No. 110 Time OK 601A M By DIS Dispr.

Garnes Opr.

Conductor Engineman

To be signed by conductor and engineman when required by Rule 218

Holl 1-78—3334—9847

Santa Fe COPY

OCT 2 19 79 TRAIN ORDER NO. 107

To C AND E NO 4

At	EMPORIA	X	Opr.	M.

1) NO 4 WAIT AT TOPEKA UNTIL FIVE TWENTY 520 AM FOR EXTRA 2474 WEST

JIM

Holl 5 75 117M 6567

Santa Fe COPY Form 902-B Standard

OCT 2 19 79 TRAIN ORDER NO. 19

To C AND E EASTWARD TRAINS FIRST DIST

At	EMPORIA	X	Opr.	M.

1) SEVEN NAUGHT ONE 701AM
UNTIL FIVE NAUGHT ONE 501PM DAILY
APPROACH GANG NO 12
BETWEEN 20 POLES WEST MP 95
AND 20 POLES WEST MP 96
BETWEEN OSAGE CITY AND READING
PREPARED TO STOP SHORT OF MEN AND MACHINES FOULING
TRACK UNTIL PROPER PROCEED SIGNAL RECEIVED OR
NOTIFIED VERBALLY BY FOREMAN SCOLARO
GANG NO 12 THAT TRACK IS CLEAR OF MEN AND MACHINES

JIM

THIS WARNING MUST BE SIGNED AND RETURNED WITH

THIS WARNING MUST TO BE RETURNED FROM

Santa Fe Copy

OCT 2 19 79 TRAIN ORDER NO. 15

To C AND E EASTWARD TRAINS FIRST DIST

At EMPORIA X Opr. M.

1) EIGHT NAUGHT ONE 801 AM
UNTIL THREE THIRTY 330 PM
APPROACH GANG NO 64
BETWEEN 4
AND 10 POLES WEST MP 51W
BETWEEN TOPEKA AND PAULINE
PREPARED TO STOP SHORT OF MEN AND MACHINES FOULING
TRACK UNTIL PROPER PROCEED SIGNAL RECEIVED OR
NOTIFIED VERBALLY BY FOREMAN EDWARDS
GANG NO 64 THAT TRACK IS CLEAR OF MEN AND MACHINES

JIM

Santa Fe Copy

SEPT 28 19 79 TRAIN ORDER NO. 5

To C AND E EASTWARD TRAINS FIRST DIST

At EMPORIA X Opr. M.

1) SPEED LIMIT 10 M P H THROUGH SIDINGS AT SCRANTON
OSAGE CITY AND READING
2) SPEED LIMIT 40 M P H BETWEEN 33 AND 34 POLES WEST MP 65
BETWEEN PAULINE AND SCRANTON
3) SPEED LIMIT PSGR TRAINS 50 M P H AND FRT TRAINS 40 M P H
BETWEEN MP 73 AND MP 79 BETWEEN SCRANTON AND OSAGE CITY
4) SPEED LIMIT 30 M P H BETWEEN 20 POLES WEST MP 95 AND
20 POLES WEST MP 96 BETWEEN OSAGE CITY AND NR JCT
5) SPEED LIMIT 60 M P H BETWEEN 20 POLES WEST MP 103 AND MP 106
BETWEEN READING AND NR JCT

JIM

Santa Fe Copy

SEPT 23 19 79 TRAIN ORDER NO. 9

To C AND E EASTWARD TRAINS FIRST DIST - YM

At EMPORIA X Opr. M.

1) TRACK MATERIAL SCATTERED ALONG TRACK BETWEEN MP 68 AND MP 70 BETWEEN PAULINE AND SCRANTON WATCH YOUR STEP

2) AT EMPORIA YARD BALLAST PILED ALONG BOTH SIDES OF

3) WESTBOUND TRACK NO 5 AND BAD FOOTING NEAR TRACK NOS 8 9 AND 10 WATCH YOUR STEP

JIM

Santa Fe Copy

SEPT 26 19 79 TRAIN ORDER NO. 4

To C AND E EASTWARD TRAINS FIRST DIST

At EMPORIA X Opr. M.

1) AT EMPORIA WESTBOUND YARD TIES SCATTERED BETWEEN TRACK NO 5 AND TRACK NO 3 BETWEEN WYE SWITCH AND LEAD SWITCH ON TRACK NO 3 WATCH YOUR STEP

JIM

Santa Fe Copy

SEPT 30 19 79 TRAIN ORDER NO. 10

To C AND E EASTWARD TRAINS FIRST DIST

At EMPORIA X Opr. M.

1) AT TOPEKA TRAINS USING YARD TRACKS STOP AND FLAG HEAD END OF TRAIN OVER TENTH STREET CROSSING ACCOUNT CROSSING FLASHERS NOT WORKING ON YARD TRACKS

2) HOLES ALONG TRACK THIS LOCATION

3) BAD FOOTING ALONG CLIC 145 WEST LEG OF WYE TRACK

4) AND BETWEEN MAIN LINE AND ELEVATOR TRACK AT TENTH STREET WATCH YOUR STEP

JIM

Santa Fe Copy

OCT 1 19 79 TRAIN ORDER NO. 1

To C AND E EASTWARD TRAINS FIRST DIST YM

At EMPORIA X Opr. M.

1) TIME TABLE NO 9 IS EFFECTIVE AT TWELVE NAUGHT ONE 1201 AM TUESDAY OCT 2

JIM

APPENDIX E

TRAIN ORDERS FOR TRAIN NO. 4
BETWEEN TOPEKA AND KANSAS CITY

Form 10-70-1,31484-1004 OPY

Santa Fe

CLEARANCE CARD FORM 902

[October 2, 19 79]

TO C & E [No. 4]

At [Topeka] To Via

I have [6] orders for your train.

Orders: No. [18] No. [17] No. [16] No. [8] No. [6] No. [3]

No. No. No. No. No. No.

No. No. No. No. No. No.

If no train order, operators must write the word "No" in space provided.

Clearance Card No. (Rule 217)

Clearance Card No. [113] Time OK [512 A] By [DIS] Dispr.

Opr.

Conductor Engineman

To be signed by conductor and engineman when required by Rule 218

Form 1-70-31344-9067

Santa Fe Copy

SEPT 25 19 79 TRAIN ORDER NO. 17

To C AND E EASTWARD TRAINS FIRST DIST

At TOPEKA X Opr. M.

1) EIGHT NAUGHT ONE 801AM UNTIL SIX NAUGHT ONE 601PM DAILY SPEED LIMIT 30 M P H BETWEEN MP 34 AND 20 POLES WEST MP 39 BETWEEN LAKE VIEW AND TECUMSEH

JIM

Form 1-70-31344-9067

Santa Fe Copy

SEPT 25 19 79 TRAIN ORDER NO. 18

To C AND E EASTWARD TRAINS FIRST DIST

At TOPEKA X Opr. M.

1) EIGHT NAUGHT ONE 801AM UNTIL SIX NAUGHT ONE 601PM DAILY MEN AND MACHINES WORKING NEAR TRACK BETWEEN MP 34 AND 20 POLES WEST MP 39 BETWEEN LAKE VIEW AND TECUMSEH SOUND WHISTLE FREQUENTLY THIS LOCATION

JIM

THIS MARGIN NOT TO BE WRITTEN UPON

THIS MARGIN NOT TO BE WRITTEN UPON

Complete 151 AM. Opr.

Form 5 75 8/78M 8267

Santa Fe

Copy

Form 938-B Standard

OCT 2 19 79 TRAIN ORDER NO. 16

To C AND E EASTWARD TRAINS FIRST DIST

At TOPEKA X Opr. M.

1) SEVEN THIRTY 730 AM
UNTIL THREE THIRTY 330 PM

APPROACH GANG NO 31

BETWEEN MP 34

AND MP 40

BETWEEN LAKE VIEW AND TECUMSEH

PREPARED TO STOP SHORT OF MEN AND MACHINES FOULING

TRACK UNTIL PROPER PROCEED SIGNAL RECEIVED OR

NOTIFIED VERBALLY BY FOREMAN WALTER

GANG NO 31 THAT TRACK IS CLEAR OF MEN AND MACHINES

JIM

THIS MARGIN NOT TO BE WRITTEN UPON

Form 5 75 8/78M 8267

Santa Fe

Copy

Form 938-B Standard

SEPT 23 19 79 TRAIN ORDER NO. 8

To C AND E EASTWARD TRAINS FIRST DIST - YM

At TOPEKA X Opr. M.

1) TRACK MATERIAL SCATTERED ALONG TRACK BETWEEN MP 36
AND 20 POLES WEST MP 39 BETWEEN LAKE VIEW AND TECUMSEH
WATCH YOUR STEP

2) AT LECOMPTON HOUSE TRACK OUT OF SERVICE

3) AT TOPEKA IN EAST FIELD YARDS OLD MAIN LINE
OPEN TRENCH ON EAST END OF BRIDGE 51.3
WATCH YOUR STEP

JIM

THIS MARGIN NOT TO BE WRITTEN UPON

Santa Fe

Copy

SEPT 28 19 79 TRAIN ORDER NO. 6

To C AND E EASTWARD TRAINS FIRST DIST

At TOPEKA X Opr. M.

1) SPEED LIMIT 30 M P H ON TRACK NO 2 BETWEEN MP 11 AND 5 POLES WEST MP 11 BETWEEN MORRIS AND HOLLIDAY

2) SPEED LIMIT PSGR TRAINS 50 M P H AND FRT TRAINS 40 M P H BETWEEN MP 5 AND MP 20

3) SPEED LIMIT 30 M P H BETWEEN MP 36 AND 10 POLES WEST MP 39

4) SPEED LIMIT PSGR TRAINS 50 M P H AND FRT TRAINS 40 M P H BETWEEN 10 POLES WEST MP 39 AND MP 49 BETWEEN WILDER JCT AND TOPEKA

JIM

THIS MARGIN NOT TO BE WRITTEN UPON

THIS MARGIN NOT TO BE WRITTEN UPON

Santa Fe

Copy

SEPT 24 19 79 TRAIN ORDER NO. 3

To C AND E EASTWARD TRAINS FIRST DIST

At TOPEKA X Opr. M.

1) TIES LAYING BETWEEN TRACK NO 1 AND TRACK NO 2 AT MP 11 BETWEEN HOLLIDAY AND TURNER

WATCH YOUR STEP

JIM

THIS MARGIN NOT TO BE WRITTEN UPON

THIS MARGIN NOT TO BE WRITTEN UPON

APPENDIX F

MAKEUP OF TRAIN NO. 4

CAR NUMBER	TYPE OF CAR	TYPE OF UNDERFRAME	TYPE OF COUPLER
1263	Baggage	Stainless Steel	CS80
1207	Baggage	Stainless Steel	CS80
2292	Dormitory	Mallable Steel	Titelock
9922	Coach	Tri-Ten Hi-Level Underframe	CS80
9953	Coach	Tri-Ten Hi-Level Underframe	CS80
9911	Coach	Tri-Ten Hi-Level Underframe	CS80
3352	Lounge	Mallable Steel	Titelock
8030	Diner	Stainless Steel	CS80
2203	Sleeper	Stainless Steel	Titelock
2629	Sleeper	Stainless Steel	Titelock
2832	Sleeper	Stainless Steel	Titelock
2220	Sleeper	Mallable Steel	CS80
8061	Diner	Stainless Steel	Titelock
9929	Coach	Tri-Ten Hi-Level Underframe	CS80
9925	Coach	Tri-Ten Hi-Level Underframe	CS80
9908	Coach	Tri-Ten Hi-Level Underframe	CS80
3382	Lounge	Stainless Steel	CS80
2350	Sleeper	Mallable Steel	CS80

Note: CS80 type coupler is a limited slack coupler.

UNIT NO.	BUILDER	BUILDER NO.	MODEL NO.	GROSS WEIGHT
501	EMD	72694-2	SDP-40-F	399,000 lbs.
504	EMD	72694-5	SDP-40-F	399,000 lbs.
532	EMD	*Not available	SDP 40-F	399,000 lbs.

*Badge plate on Unit 532 was torn off unit in derailment.

The above units are equipped with 26-L Brake Equipment.

Location of cab in leading unit was forward, or eastward.

APPENDIX G

EXCERPT FROM AMTRAK OPERATING AND MAINTENANCE INSTRUCTIONS FOR ATS SYSTEM

OPERATION

INTERMITTENT INDUCTIVE AUTOMATIC TRAIN STOP

Transmission of Control

Transmission of control between the wayside signal circuits and the locomotive is accomplished through the interaction of an inductor, mounted beside the track, and a receiver, carried on the locomotive.

The U-shaped inductor, with a laminated magnetic core fitted with pole pieces, is located on the ties, parallel with and 22 1/4 inches outside the gauge line, and with its pole faces 2 7/8 inches above the top of rail.

The receiver, an inverted U-shaped electromagnet, has a laminated core carrying two windings and pole pieces of the same spacing as those of the inductor. The receiver, mounted on a locomotive journal box by means of suitable brackets, is adjusted so that as the locomotive moves along the track the receiver passes vertically above each inductor, with about 1 1/2-inch clearance between their respective pole faces.

The method of transmitting control from the wayside to the moving locomotive is shown in simplified form in Figure 5. The circuits on the locomotive are controlled through a normally-energized primary relay; if the primary relay is deenergized for more than 4 seconds, a penalty brake application occurs unless the acknowledging button (not shown) is in its actuated position. The primary relay is energized through its own front contact and the secondary coil wound on the receiver core structure.

Also wound on the receiver core structure is a primary coil, which is energized from the converter. The current flowing through the primary coil magnetizes the receiver core structure; the strength of the magnetic flux is limited when the receiver is not over an inductor by the long air gap between the pole pieces. As the locomotive moves along the track between inductors the magnetic and electrical conditions in the receiver remain unchanged, and the primary relay is held energized.

When the receiver passes over an inductor, conditions affecting the magnetic flux in the receiver change rapidly. During this time, the inductor provides a good magnetic path between the pole pieces of the receiver with relatively small air gaps at each pole. As a result, a surge of magnetic flux builds up in the receiver, inducing a voltage in the secondary coil which bucks the voltage from the converter.

Curve A-B-C-D-E, Figure 6, shows the effect this induced voltage would have on the current passing through the primary relay if it were not a stick relay. Starting with the normal current at point A, the bucking voltage causes the relay current to drop to a minimum at D. Then, as the receiver moves away from the inductor, the current rises again to its normal value. (The small fluctuations on the current curve before and after the main current dip are caused by minor flux variations as the receiver approaches and leaves the inductor, and have no effect on the over-all operation of the system.)

In actual practice, of course, this complete curve would not occur, because the primary relay would drop as soon as the current became less than the drop-away current *shown in Figure 6, and would then remain down because of the opening of the stick circuit.*

Since the system must distinguish between restrictive and nonrestrictive conditions, provision is made for controlling the effect of the inductor on the receiver in accordance with signal indications. This is done by the choke coil (sometimes called "control" coil) wound on the inductor core, as shown in Figure 5. When the signal is restrictive, the

signal control relay is down, leaving the choke coil open-circuited. Under this condition no current can flow in the coil, and the inductor produces a flux surge in the receiver to drop the primary relay. But if the signal is clear, the signal control relay is up, and the choke coil circuit is closed through a front contact on the signal control relay Now, when the receiver passed over the inductor and the flux starts to build up in the receiver inductor magnetic circuit, the voltage induced in the choke coil causes a current to flow through the coil. According to the laws of induced currents, the magentic flux produced by this current opposes the magentic flux which causes the current. As a result, the net change in flux is much less than the change which occurs when the choke coil is open-circuited, and the bucking voltage, which appears in the secondary coil, is much smaller. Curve A-F-C-G-E, Figure 6, shows the current variation in the primary relay under these conditions The current does not go below the dropaway value at any point, so that the primary relay remains energized while the receiver passes over the inductor

To summarize: when the signal is restrictive, the inductor choke coil circuit is open, and the inductor produces a flux change in the receiver which causes the primary relay to release. When the signal is clear, the inductor choke coil circuit is closed, and the flux change produced in the receiver is not enough to release the primary relay.

Note that the transmission of control between inductor and receiver requires no energy in the inductor winding Whether or not a locomotive receives a train control pulse depends only on the inductor choke coil circuit. If this circuit is open, the primary relay releases when the receiver passes; if the circuit is closed, the primary relay remains energized

Since acknowledgment proves that the engineman is alert, the system permits him to retain full control of the brakes when a restrictive inductor is passed while acknowledgment is being made. This is done by circuits through the acknowledging button which prevent a brake application when the primary relay drops, and which also provide for reenergizing the primary relay after it is down. To avoid the chance that the acknowledging button might be continuously held in the actuated position, making the train control system ineffective, a timer is energized which produces an automatic brake application if the acknowledging button is held closed for more than 15 seconds

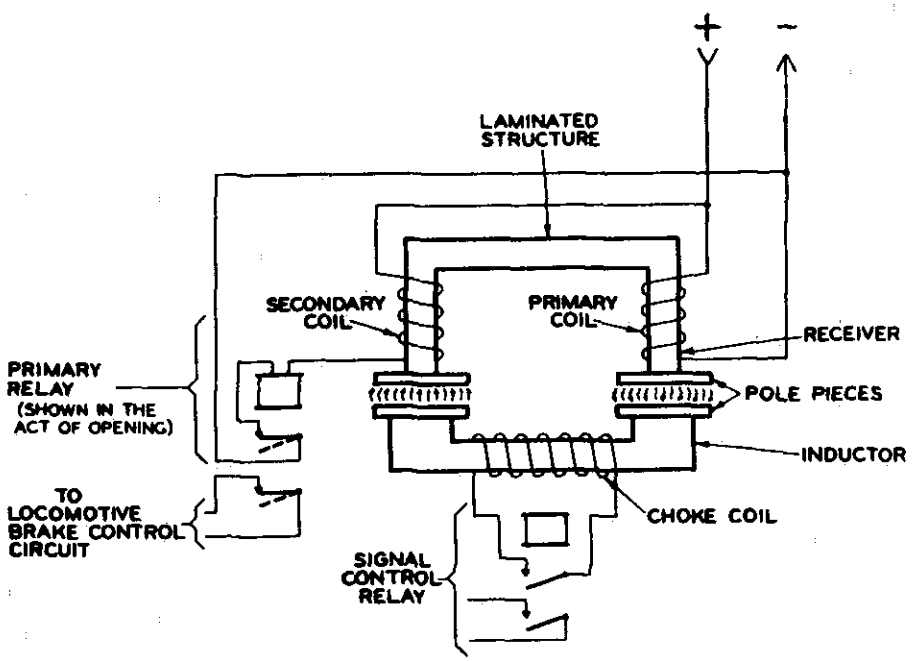


Figure 5. Principle of inductive control, wayside to train.

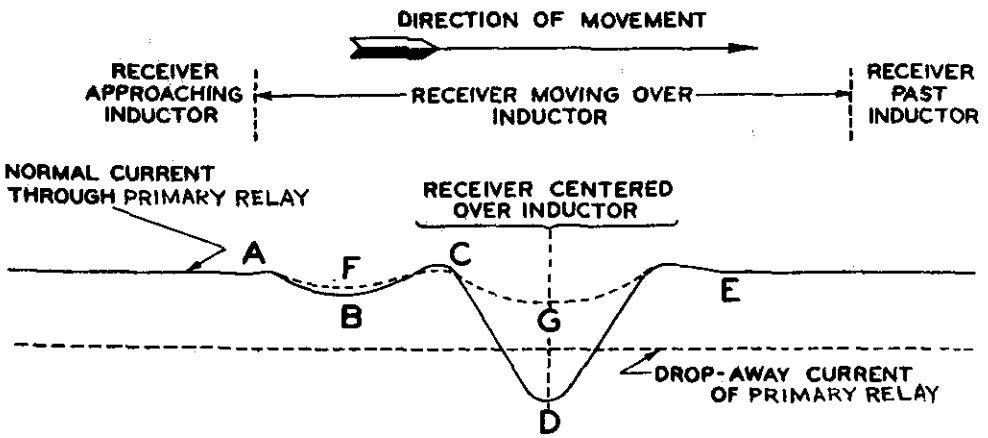


Figure 6. Current through primary relay.

APPENDIX H

EXCERPTS FROM TITLE 49 CFR CONCERNING TRAIN INSPECTIONS

§ 232 13 Road train and intermediate terminal train air brake tests

(a) *Passenger trains* Before motive power is detached or angle cocks are closed on a passenger train operated in either automatic or electro-pneumatic brake operation, except when closing angle cocks for cutting off one or more cars from the rear end of train, automatic air brake must be applied. After recouping, brake system must be recharged to required air pressure and before proceeding and upon receipt of proper request or signal, application and release tests of brakes on rear car must be made from locomotive in automatic brake operation If train is to be operated in electro-pneumatic brake operation, this test must also be made in electro-pneumatic brake operation before proceeding Inspector or trainman must determine if brakes on rear car of train properly apply and release

§ 232.14 Inbound brake equipment inspection.

(a) At points where inspectors are employed to make a general inspection of trains upon arrival at terminals, visual inspection must be made of retaining valves and retaining valve pipes, release valves and rods, brake rigging, safety supports, hand brakes, hose and position of angle cocks and make necessary repairs or mark for repair tracks any cars to which yard repairs cannot be promptly made.

(b) Freight trains arriving at terminals where facilities are available and at which special instructions provide for immediate brake inspection and repairs, shall be left with air brakes applied by a service brake pipe reduction of 20 pounds so that inspectors can obtain a proper check of the piston travel Trainmen will not close any angle cock or cut the locomotive off until the 20 pound service reduction has been made. Inspection of the brakes and needed repairs should be made as soon thereafter as practicable.

* * *

§ 232.16 Running tests.

When motive power, engine crew or train crew has been changed, angle cocks have been closed except for cutting off one or more cars from the rear end of train or electro-pneumatic brake circuit cables between power units and/or cars have been disconnected, running test of train air brakes on passenger train must be made, as soon as speed of train permits, by use of automatic brake if operating in automatic brake operation or by use of electro-pneumatic brake if operating in electro-pneumatic brake operation Steam or power must not be shut off unless required and running test must be made by applying train air brakes with sufficient force to ascertain whether or not brakes are operating properly If air brakes do not properly operate, train must be stopped, cause of failure ascertained and corrected and running test repeated.

* * *

Subpart C—Other Than Steam Locomotives and Appurtenances

§ 230.200 Applicability of subpart

This subpart contains rules and instructions for the inspection and testing of locomotives propelled by other than steam power except electrically operated units designed to carry freight and/or passenger traffic operated by a single set of controls For multiple operated electric units see Subpart D of this part

§ 230 200a Responsibility for design, construction, inspection, and repair.

The railroad company is held responsible for the general design construction, inspection, and repair of all locomotives used or permitted to be used on its line It must know that all inspections, tests, and repairs are made and reports made and filed as required, and that all parts and appurtenances of every locomotive used are maintained in condition to meet the requirements of the law and the rules and instructions in this subpart Nothing contained in the rules and instruc-

tions in this subpart, however, shall be construed as prohibiting any carrier from enforcing additional rules and instructions not inconsistent with those in this subpart contained, tending to a greater degree of precaution against accidents.

* * *

INSPECTION AND TESTS; ROADWAY

§ 236.576 Roadway element.

Roadway elements, except track circuits, including those for test purposes, shall be gaged monthly for height and alinement, and shall be tested at least every 6 months.

§ 236.577 Test, acknowledgment and cut-in circuits

Test, acknowledgment and cut-in circuits shall be tested at least once every six months

INSPECTION AND TESTS, LOCOMOTIVE

§ 236.586 Daily or after trip test.

The automatic train stop, train control, or cab signal apparatus on each locomotive operating in equipped territory shall be inspected and tested either once every 24 hours or within 24 hours before departure upon each trip, except that such inspection and tests of the automatic train stop, train control or cab signal equipment on Diesel-electric and electric locomotives shall not be required provided that periodic tests be made on such locomotives each 6,000 miles, or at intervals of not more than 2 months whichever shall occur first.

§ 236.587 Departure test.

A test of the automatic train-stop, train-control, or cab-signal apparatus on each locomotive, except locomotives and multiple-unit cars equipped with mechanical trip stop only, shall be made over track elements or test circuits or with portable test equipment, either on departure of locomotive from its initial terminal or, if locomotive apparatus is cut out between initial terminal and equipped territory, prior to entering equipped territory, to determine if such apparatus is in service and is functioning properly If a locomotive makes more than one trip in any 24-hour period only one departure test shall be required in such 24-hour period. If departure test is made by an employee other than engineman, the engineman shall be informed of the results of such test and a record kept thereof

§ 236.588 Periodic test.

Except as provided in § 236.586, periodic tests of the automatic train stop, train control or cab signal apparatus shall be made at least once every three months, and on multiple-unit cars as specified by the carrier, subject to approval by the FRA.

§ 236 589 Relays.

At least once every 4 years each relay shall be removed from service, subjected to thorough test, necessary repairs and adjustment made, and shall not be replaced in service unless its operating characteristics are in accordance with the limits within which such relay is designated to operate.

APPENDIX I

EXCERPTS FROM AT&SF AIR BRAKE AND TRAIN HANDLING RULES

SECTION NO. 3

SAFETY DEVICES, EMERGENCY REPAIRS, WHEELS SLIPPING, SLIDING OR OVERHEATING, USE OF SAND, DUMMY COUPLINGS AND REPORTING

3.1. SAFETY DEVICES—GENERAL

3.1.1. SAFETY DEVICES THAT ACTUATE WHEN ENGINEER FAILS TO PERFORM PRESCRIBED FUNCTIONS

Diesel locomotives are equipped with safety devices to stop a locomotive and train if the engineer fails to perform prescribed functions These devices are: (1) Safety Control Foot Valve; (2) Electronic Alertness Control; (3) Automatic Train Stop (ATS); (4) Overspeed Control

3.1.2 REPORTING OF INOPERATIVE SAFETY DEVICES

Engineers will report all cases of safety devices being inoperative

When defects exist and repairs cannot be made en route making it necessary to cut out a safety device to continue the locomotive in service, the seal should be broken on a defective device cut out cock only and the device cut out Engineers must retain the seal and mail to the Road Foreman of Engines, with full particulars on the reason and which device was cut out The locomotive should continue its run to first available maintenance point where repairs can be made, except when necessary to cut out the Automatic Train Stop in ATS territory, when other instructions govern (Operating Rules 602, 603 and 604)

3.1.3. CUTTING OUT THE APPLICATION VALVE

The application valve must not be cut out unless the application valve itself is defective Cutting out the application valve renders all safety devices on the locomotive inoperative

3.1.4. DEFEATING A SAFETY DEVICE—PROHIBITED

Defeating a safety device on a locomotive by other than proper acknowledgment or suppression is prohibited

* * *

3.4. AUTOMATIC TRAIN STOP (ATS)

3.4.1. TYPE OF SERVICE REQUIRING AUTOMATIC TRAIN STOP EQUIPMENT AND ENGINEER'S CHECK FOR OPERATIVE ATS

Except as otherwise provided, a locomotive from which the air brakes of a passenger train are controlled, operating within ATS limits, must be equipped with operative ATS device The engineer must see that ATS cut out cock is cut in, sealed and check cab card Form 1167 Standard, to assure himself the device has been tested and is operative and properly reported if cut out cock is not sealed or cab card fails to indicate proper test has been made A passenger locomotive used in freight service must have the ATS cut out

3.4.8. REPORTING UNDESIRED ATS APPLICATIONS

ATS failure, interruptions, or the removal of seals must be reported by wire to the Trainmaster, Mechanical Supervisor and Road Foreman of Engines, from the first open office of communications

3.4.9. "AMTRAK" PROCEDURE FOR ACKNOWLEDGMENT AND RELEASE OF ATS APPLICATIONS

"AMTRAK" locomotive units are equipped with an INTERMITTENT INDUCTIVE AUTOMATIC TRAIN STOP SYSTEM, which enforces the acknowledgment of temporarily energized wayside inductors located in advance of block signals, and interlocking signals displaying other than a "CLEAR" aspect and at other permanently energized inductors

The system becomes operative for Santa Fe ATS when it is cut in electrically and pneumatically and the selector (located in the cab) is set to the "AT&SF" position

Upon approaching such inductors, the engineer must depress and hold the ACKNOWLEDGE push button until the inductor has been passed A properly acknowledged inductor will prevent a penalty brake application

A 15 second time limit is placed on the closure of the ACKNOWLEDGE push button to prevent defeating the switch The switch must be pressed and released at each energized inductor without keeping it closed for more than 15 seconds

Failure to acknowledge a restrictive signal or for exceeding the 15 second time limit is a full service penalty brake application

In the event a penalty brake application is experienced, the train handling will depend on the conditions of operation at the time Should a penalty occur, operating in power or idle, the throttle, if open, must be closed and the automatic brake valve handle immediately moved to suppression position The locomotive brakes will be kept released during the first part of the reduction If there is no dynamic braking available on the locomotive, the locomotive brakes will be applied after the train brakes have become effective When the application valve has returned to release position the PC will be extinguished At this time if dynamic braking is available and the train brakes have become effective, the dynamic brake may be applied Dynamic braking may be used until the speed has reduced to the extent the dynamic breaking amperage is decreasing greatly, at which time the locomotive brakes will be applied with the independent brake valve, being careful to not allow the wheels to slide Should the penalty occur while in dynamic braking the automatic brake valve handle must be placed immediately in suppression position and the dynamic brake reduced to "OFF." The locomotive brakes will be allowed to apply but must be controlled to prevent wheel sliding

To recover from an ATS penalty, the automatic brake valve handle must be left in suppression position until the train has stopped The reset button, located outside the locomotive on the right hand side, must be depressed and held depressed two seconds, observe application pipe air gauge hand has returned to above 120 PSI, at which time the automatic brake valve handle may be returned to running position to release the brakes on the train

ATS equipped locomotives have "POST ACKNOWLEDGMENT" This operates in conjunction with ATS equipment to give a warning of an impending ATS brake application When a restrictive inductor or miscellaneous metal objects near the track are passed over by the ATS receiver, a whistle will sound for four to six seconds, after which a full service penalty brake application will be imposed The penalty can be forestalled by depressing the acknowledgment button for a period of two seconds, or until the whistle stops blowing Acknowledgment must be made during the four to six seconds warning period

3 5. SETTING OF ATS AND TESTING EQUIPMENT

3.5.1. SWITCH LOCATIONS AND POSITIONS

Locomotive 5940 Class has a switch located on the distribution panel and one near the magnet valve in the nose The switches are marked and when operating passenger trains, the switches must be in the "ON" position in the controlling units and the "OFF" position in the trailing units

Pneumatic train stop cut out cocks should be open and sealed on controlling units and trailing units

3.5.2. ATS TEST PROCEDURE

A test of intermittent train stop on each locomotive unit used in control of a passenger train will be made over test inductors or train stop tests set prior to departure of the locomotive from its initial terminal If such departure test is made by an employe other than engineer, the engineer shall be informed of such test and a record kept thereof

The test inductors, where used, are spaced approximately 150 feet apart and the locomotives are to be moved over the inductors at 3 to 5 MPH Move the acknowledging valve handle forward not to exceed 15 seconds before passing over the first inductor and observe that the train stop bell rings, then return the acknowledging valve handle to the backward or charging position When passing over the second inductor allow the ATS to apply the brakes After the application has occurred, move the automatic brake valve handle to suppression posi tion After the application valve has reseated, move the acknowledging valve handle forward then return automatic brake valve handle to running position

On locomotives other than Santa Fe equipment, follow the instructions as outlined in the cab of the locomotive

APPENDIX J

EXCERPTS FROM AT&SF OPERATING DEPARTMENT RULES

11. Permanent slow signs, yellow with numerals, will be located not less than 2500 feet (when practicable) in advance of locations where speed of trains must be reduced The numerals thereon nearest the track, or those at the top of the sign, indicate the maximum speed for passenger trains, and the other numerals the maximum speed for freight trains Where only one numeral is shown it shall govern the speed of both passenger and freight trains. Indicated speeds must not be exceeded until rear of train has passed a permanent resume speed sign.

There may be more than one permanent slow sign in advance of a permanent resume speed sign, in which case the reduced speed shown on each permanent slow sign must be observed in succession until rear of train has passed the permanent resume speed sign

* * *

USE OF SIGNALS

27. A signal imperfectly displayed, or the absence of a signal at a place where a signal is usually displayed, must be regarded as the most restrictive indication that can be given by that signal. When a light is absent from a semaphore signal, trains will be governed by the indication given by the arm when it can be seen, except at an open office at night, when light is not displayed on a train order signal, train must secure clearance card.

Imperfectly displayed signals must be reported promptly to the train dispatcher and wire report made to the trainmaster and signal supervisor from first available office of communication.

* * *

30. When train or engine is moving, a close lookout ahead must be maintained. All members of the crew in the control compartment of the engine must, and other members of train and yard crews will, when practicable, communicate to each other, by its name or aspect, the indication of each signal affecting the movement of their train or engine as soon as it becomes visible or audible. If the engineman fails to control speed in accordance with signal indication or speed restriction, other crew members must take necessary action to insure safety.

* * *

210(B). Conductors and enginemen must read train orders and clearance cards, and check the correctness thereof Enginemen must show orders and clearance cards to other members of crew on engines; conductors, when practicable, must show them to the brakeman. All members of crew are required to read the orders and clearance cards, must see that the order numbers shown on clearance card correspond with the numbers of orders received, and must remind each other of the contents of the orders and clearance cards

* * *

RULES APPLICABLE ONLY WITHIN ATS LIMITS

600. Except as provided in Rule 602, the engine from which the air brakes of a passenger train are controlled, operating within ATS limits, must be equipped with an operative ATS device.

601. The seal on cut out cock must not be broken, or ATS device cut out, unless it fails to operate properly. ATS failures, interruptions, or the removal of seals must be reported by wire to the trainmaster, mechanical supervisor and road foreman of engines, from the first open office of communication

602. Within ATS limits, if the ATS device on an engine controlling the air brakes on a passenger train fails, is cut out enroute, or if the engine on a passenger train that is being detoured is not equipped with an operative ATS device, the following must be observed:

The train dispatcher must be notified as promptly as practicable by radio or telephone

Train may proceed according to signal indication, but medium speed must not be exceeded until absolute block is established in advance of the train

If absolute block is established in advance of the train, it may proceed according to signal indication, but not to exceed 79 miles per hour

603. Absolute block may be established verbally in advance of a train between open offices of communication by the train dispatcher, but such train must not pass an open office of communication within ATS limits until it receives Form W train order

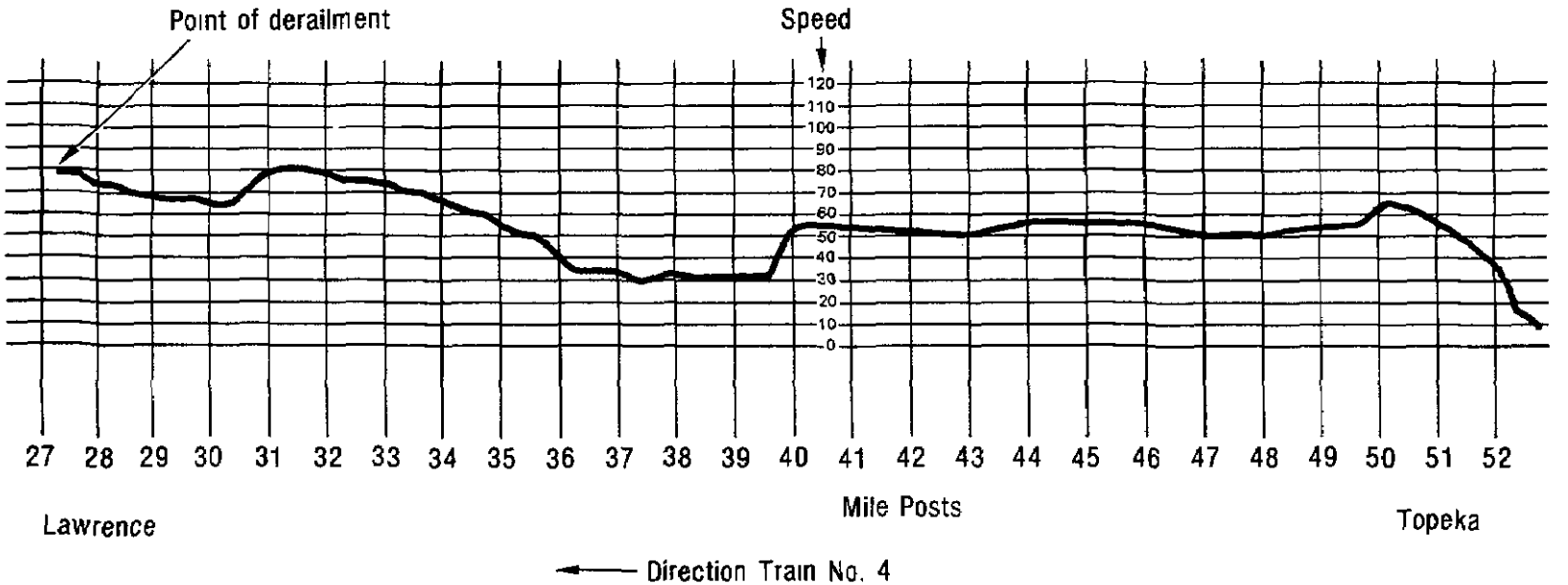
604. When absolute block is established in advance of a train, such train must not pass a signal in stop position, or a permissive signal, unless verbally authorized to do so by the train dispatcher, except to leave the main track through a switch immediately beyond the signal

When absolute block is established in advance of a train, the train dispatcher must not authorize such train to pass a signal in stop position, or a permissive signal, until it is known that the block governed by that signal is clear of trains and engines

A train authorized to pass a signal in stop position, or a permissive signal, must proceed at restricted speed to the next governing signal

APPENDIX K

SPEED RECORDER TAPES FROM TRAIN NO. 4

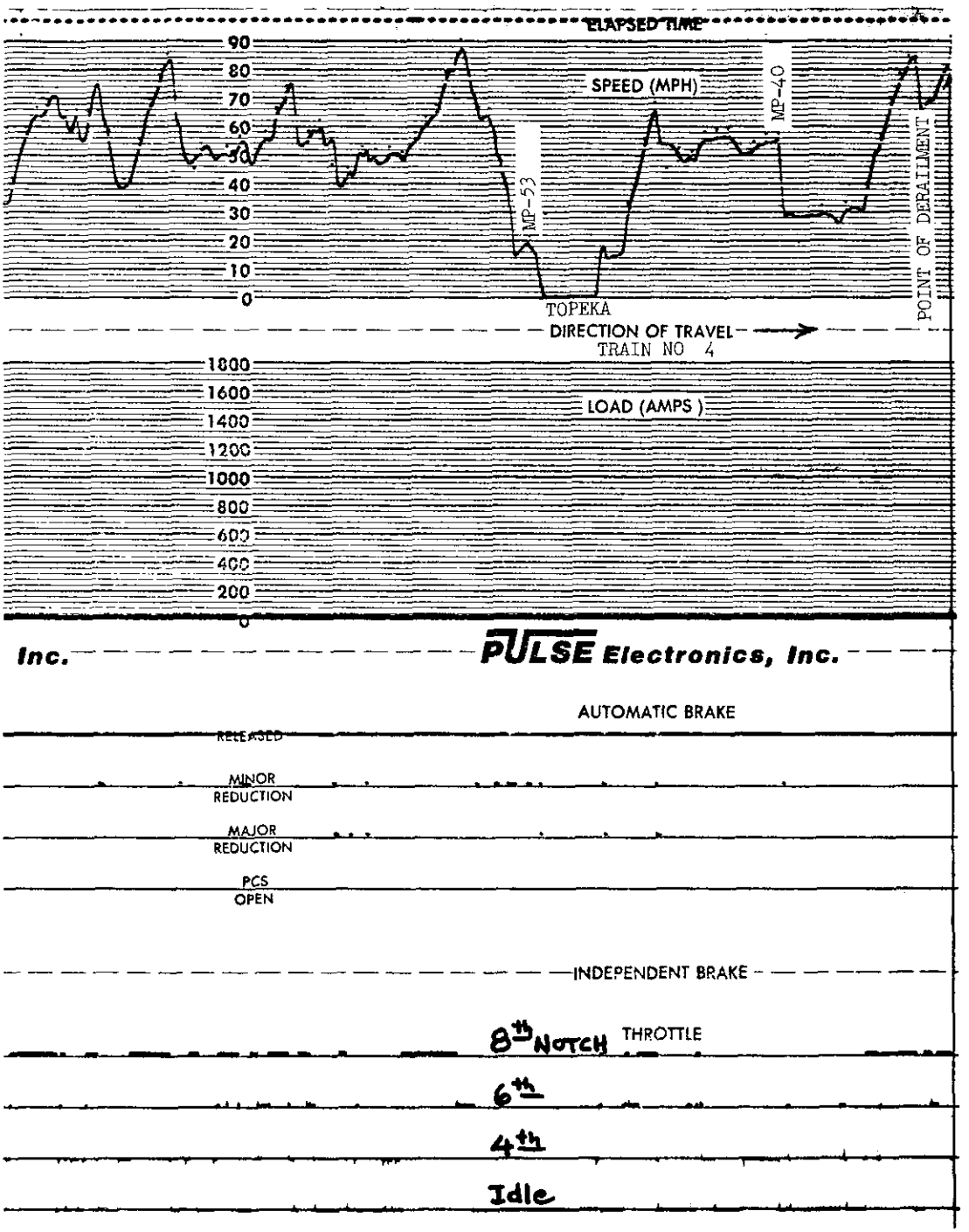


LOCOMOTIVE: AMTRAK SDP40 No. 501

DATE: OCTOBER 2, 1979

LOCATION: LAWRENCE, KS

RAILROAD: AT&SF


ELAPSED TIME
90
80
70
60
50
40
30
20
10
0
SPEED (MPH)
MP-53
MP-40
POINT OF DERAILMENT
TOPEKA
DIRECTION OF TRAVEL
TRAIN NO 4
1800
1600
1400
1200
1000
800
600
400
200
0
LOAD (AMPS)
Inc.
PULSE Electronics, Inc.
AUTOMATIC BRAKE
RELEASED
MINOR REDUCTION
MAJOR REDUCTION
PCS OPEN
INDEPENDENT BRAKE
8th NOTCH THROTTLE
6th
4th
Idle