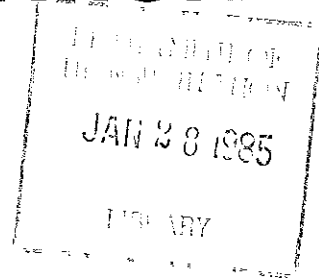


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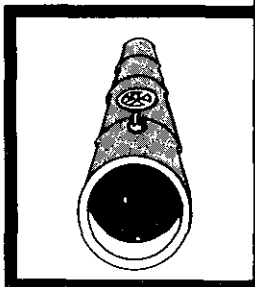
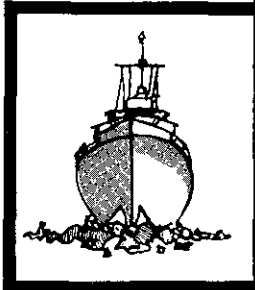
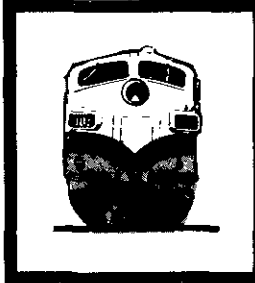
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NATIONAL TRANSPORTATION SAFETY BOARD



WASHINGTON, D.C. 20594



RAILROAD ACCIDENT REPORT

**DERAILMENT OF AMTRAK TRAIN NO. 5
(THE SAN FRANCISCO ZEPHYR)
ON THE BURLINGTON NORTHERN RAILROAD
EMERSON, IOWA
JUNE 15, 1982**

NTSB/RAR-83/02

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract About 3:15 a.m. on June 15, 1982, Amtrak Train No. 5 (the San Francisco Zephyr), with 315 persons onboard, derailed near Emerson, Iowa, while traveling about 74 miles per hour on the Burlington Northern Railroad. The train was traveling westbound on the No. 2 main track when it encountered floodwater over the top of washed-out rails. The accident resulted in 1 passenger fatality and 27 injuries. Damage was estimated to be about \$3,381,940. The National Transportation Safety Board determines that the probable cause of this accident was that the dispatcher allowed Amtrak Train No. 5 to continue onto tracks that had been washed out by floodwaters because the operating railroad did not have adequate means of collecting and evaluating meteorological information. Contributing to the accident was the failure of the locomotive crew to recognize and respond adequately to indications of possible unsafe track conditions due to flooding and the failure of other railroad employees, including the dispatcher, to assess weather conditions adequately and take action as prescribed by the rules.					
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Adopted: February 8, 1983

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SYNOPSIS

About 3:15 a.m. on June 15, 1982, Amtrak Train No. 5 (the San Francisco Zephyr), with 315 persons onboard, derailed near Emerson, Iowa, while traveling about 74 miles per hour on the Burlington Northern Railroad. The train was traveling westbound on the No. 2 main track when it encountered floodwater over the top of washed-out rails. The accident resulted in 1 passenger fatality and 27 injuries. Damage was estimated to be about \$3,381,940.

The National Transportation Safety Board determines that the probable cause of this accident was that the dispatcher allowed Amtrak Train No. 5 to continue onto tracks that had been washed out by floodwaters because the operating railroad did not have adequate means of collecting and evaluating meteorological information. Contributing to the accident was the failure of the locomotive crew to recognize and respond adequately to indications of possible unsafe track conditions due to flooding and the failure of other railroad employees, including the dispatcher, to assess weather conditions adequately and take action as prescribed by the rules.

INVESTIGATION

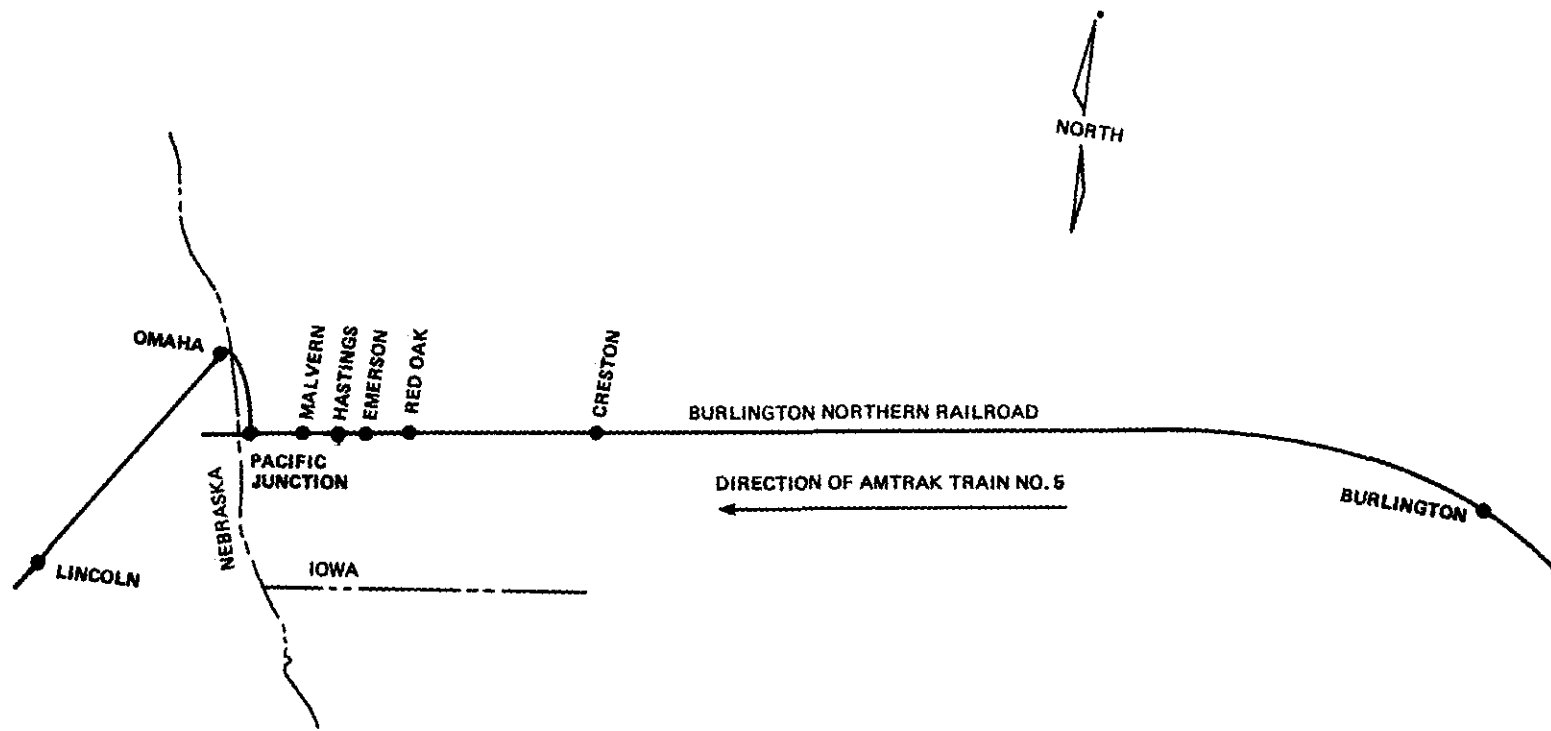
Events Preceding the Accident

Shortly after 10 p.m. 1/ on June 14, 1982, police began to evacuate parts of the towns of Malvern, Hastings, and Emerson, in southwest Iowa, because of flooding caused by heavy rainfall earlier in the evening. All of the towns, which are located about 5 miles apart, were stations on the Burlington Northern Railroad (BN). (See figure 1.)

The BN train dispatchers controlling train movements on the BN's main tracks of its Galesburg Division, in which the towns were located, were stationed at Cicero, Illinois. Cicero is located about 450 miles east of Emerson. The assistant chief dispatcher in Cicero stated that about 10:10 p.m. he became aware of a power-out indication 2/ on the dispatcher's console for a signal in Malvern. The indication also had occurred earlier about 6:30 p.m. The assistant chief dispatcher stated that, in response to both of the

1/ All times referred to herein are central daylight time.

2/ The power-out indication is a light on the console that, when illuminated, indicates that the commercial electric power supply to a given signal location has been interrupted, and the signal is functioning on backup battery power.



Not to Scale

Figure 1.—Location plan.

power-out indications, the dispatcher in Cicero contacted the operator at Pacific Junction, Iowa, and asked him to call out the local signal maintainer to correct the problem.

The assistant chief dispatcher at Cicero stated that shortly after 10:30 p.m., he overheard a radio conversation of the dispatcher on the adjacent Lincoln Division, ^{3/} indicating high water conditions and the use of extra track inspection patrols in southeast Nebraska. The assistant chief dispatcher stated that, before the end of his tour of duty at 11 p.m., he informed his relief of the extra track patrols and the weather reported in the Lincoln Division.

The track inspector for the Emerson area, who resides in Hastings, stated that he heard a tornado warning siren sound about 10:30 p.m. He said that when the rain stopped 15 or 20 minutes later, "I got in the car and I drove to [U.S.] Highway [No.] 34 and about a half-a-mile out of Hastings to see how much damage or water there was." He stated that he observed the BN tracks at an at-grade crossing in Hastings, "and there was nothing that appeared to me of any damage any place, so I went back home." He did not report his findings to anyone.

According to BN's tape recordings of the Cicero dispatcher's telephone communications, the operator at Pacific Junction called the Cicero dispatcher at 11:31 p.m. to report that he had contacted the signal maintainer. The operator said that the signal maintainer would go to the signal location at Malvern as soon as heavy rains subsided. The signal maintainer contacted the Cicero dispatcher at 11:51 p.m. to report that he had corrected the signal problem and to confirm that the power-out light on the dispatcher's console was no longer illuminated.

The signal maintainer and the Cicero dispatcher discussed the weather in general in the Malvern area. The signal maintainer reported that he had driven through water on a highway and that water was standing in some fields. The dispatcher mentioned the possibility of ordering track patrols to ride on the track to determine if water had affected the tracks. The signal maintainer said that the tracks were on a "high fill." The dispatcher then said, "All right . . . it could be a little later in the morning before we need [to check] out east where the river, or where the tracks are low." The signal maintainer later stated to Safety Board investigators that, while driving through Emerson about 12:15 a.m. on June 15 on his way home, he did not notice any flooding, evacuation, or other unusual conditions.

The operator at Pacific Junction stated that at the end of his tour of duty at midnight, he advised his relief of the extra track patrols on the Lincoln Division. About 12:40 a.m., while en route home eastbound on U.S. Highway No. 34, the operator had to stop at the Indian Creek Bridge near Emerson (see figure 2) because water was covering the bridge. An Iowa Department of Transportation pickup truck and a sheriff's car were being used to block the west approach to the bridge. The operator stated that he sat in his car during a light rain until about 1:30 a.m., and then joined the highway department employee in the pickup truck, where he sat until 3:30 a.m. waiting for the water to recede. He said that he talked with the highway department employee about the water, and that the highway employee was discussing the situation around Emerson with other

^{3/} The BN's Lincoln Division is adjacent to and generally west of the Galesburg Division. The two divisions join at Pacific Junction, Iowa, about 24 miles west of Emerson. The Lincoln Division dispatching office is located in Lincoln, Nebraska.

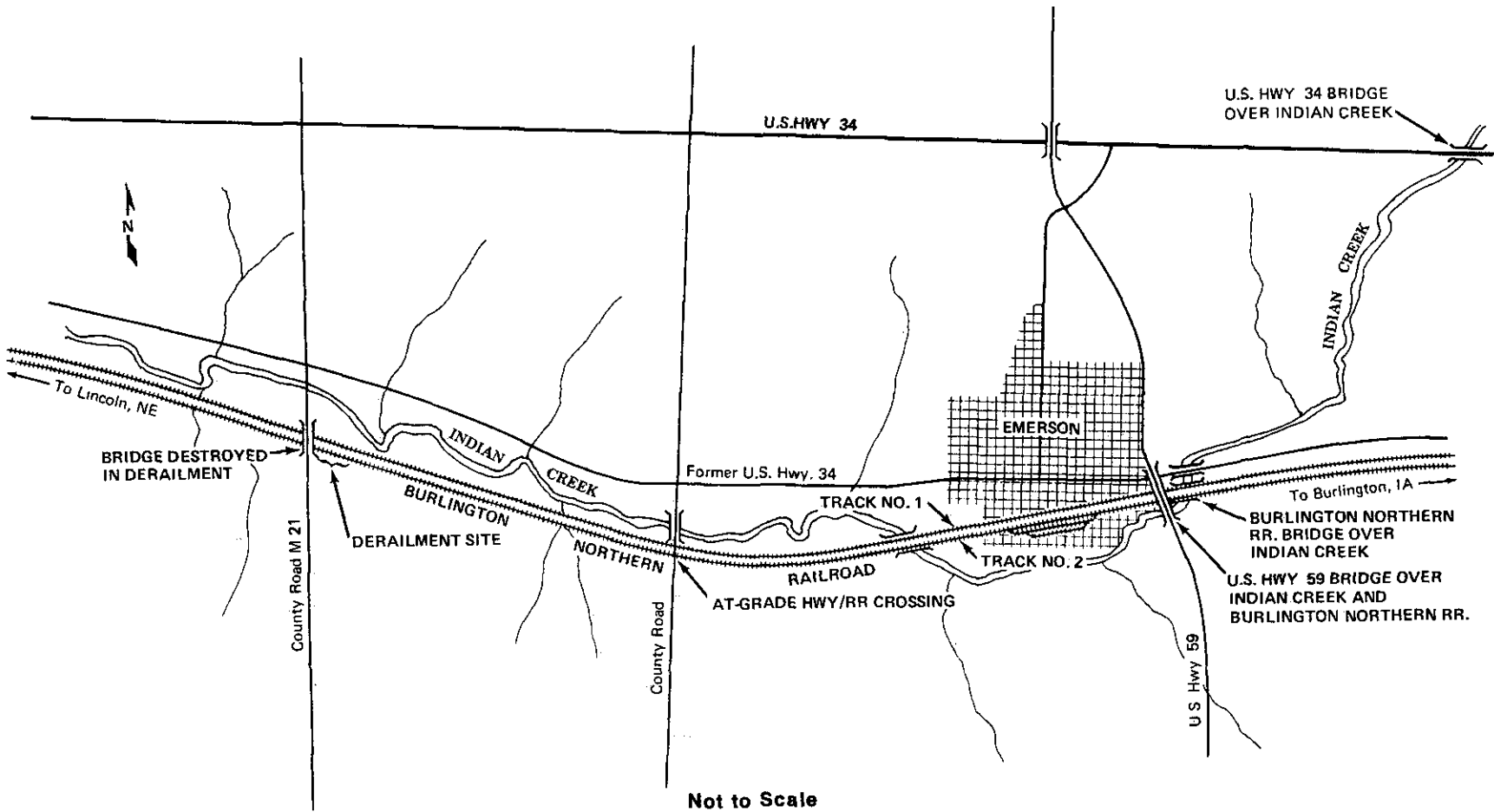


Figure 2.—Site plan.

persons via a two-way radio in the truck. The operator stated that he did not make any effort to contact the BN concerning the flooding situation at Emerson because "the [railroad] roadbed is several feet higher than the main street." Traffic was allowed to proceed over the Indian Creek Bridge when the water receded about 4:05 a.m.

Commercial electric power to Emerson was cut off at 2:10 a.m., as requested by the county sheriff. (Power was not restored until 8:50 a.m.) The sheriff stated that the flood in Emerson reached its crest about 2 a.m. and remained at crest until 3 a.m., at which time the water began to recede slowly.

The Accident

Shortly before 3:15 a.m., while the evacuation of Emerson was still in progress, National Railroad Passenger Corporation (Amtrak) Train No. 5 passed through the town westbound about 78 miles per hour on the No. 2 main track. The train had originated at Chicago, Illinois, about 1 hour behind schedule, and was en route to San Francisco, California. The train was being operated at that time by the fireman, who was qualified as an engineer. Both the engineer and the fireman stated that, as they neared Emerson, they observed the emergency lights on a sheriff's patrol car parked on the U.S. Highway No. 59 overhead bridge at the east end of Emerson. (See figure 2.) Neither the engineer nor the fireman observed anyone near the vehicle. The fireman began sounding the warning whistle for the two highway at-grade crossings in Emerson just before the train passed under the bridge. Just east of the highway bridge, the BN tracks traverse a railroad bridge which spans Indian Creek. The engineer and the fireman both stated that they did not observe any flooding of Indian Creek as they crossed the bridge.

The engineer told Safety Board investigators that after the fireman, who was in the engineer's seat on the north side of the locomotive, finished sounding the warning whistle, the fireman said, "that water is kind of high for what rain we did have. We didn't have any heavy rains." The engineer said that he had informed the fireman of some flooding he had seen to the south side of the tracks in Emerson. The fireman later stated to Safety Board investigators that he had not seen any water in the town of Emerson. Both the engineer and the fireman stated after the accident that they had never observed unusual flooding or water conditions at or near Emerson before.

After passing through Emerson, the train negotiated a curve to the right, and the fireman sounded the warning whistle for another highway at-grade crossing. The fireman stated that they had just passed the crossing and entered the tangent track when both the engineer and fireman saw water over the track ahead. Neither of them could recall the aspect of the last signal they had passed, which was located beyond the end of the curve and about 1,740 feet east of where the water covered the track. The fireman stated that he immediately placed the automatic airbrake in emergency, and that the throttle was in the third position at the time. The engineer and the fireman then lay on the floor of the locomotive cab, awaiting the derailment.

When the train entered the water-covered track, the two locomotive units derailed to the north and separated. The lead unit rotated about 180 degrees and came to rest underneath a county highway bridge. (See figure 3.) The trailing unit came to rest about 15 feet west of the leading unit, also under the bridge. The two baggage cars separated and jackknifed, coming to rest almost perpendicular to the roadbed. The remaining cars -- one combination coach/dormitory car, one diner car, one lounge car, four coach cars, and three sleeper cars -- derailed to the north, with the forward cars leaning to the north, at a 45-degree angle. The degree of divergence lessened toward the rear of the



Figure 3.--View facing north to lead locomotive unit of Amtrak Train No. 5.

train. (See figure 4.) Of the 315 persons onboard the train, 1 passenger was killed, and 27 persons were injured.

Injuries to Persons

<u>Injuries</u>	<u>Passengers</u>	<u>BN Crewmembers</u>	<u>Amtrak Employees</u>	<u>Total</u>
Fatal	1	0	0	1
Nonfatal	21	2	4	27
None	276	3	8	287
Total	298	5	12	315

Damage

Both locomotive units were damaged extensively. (See figure 5.) The front section of the lead locomotive unit came to rest on the end of the lead baggage car, while the rear section of the lead locomotive unit was on the rear section of the trailing locomotive unit. The trailing locomotive unit came to rest on the fireman's side of the unit, partially underneath the lead locomotive unit and the lead baggage car. The lead locomotive unit struck and destroyed the north bridge pier. The lead baggage car was destroyed, and the second baggage car was damaged extensively. The following coach/dormitory

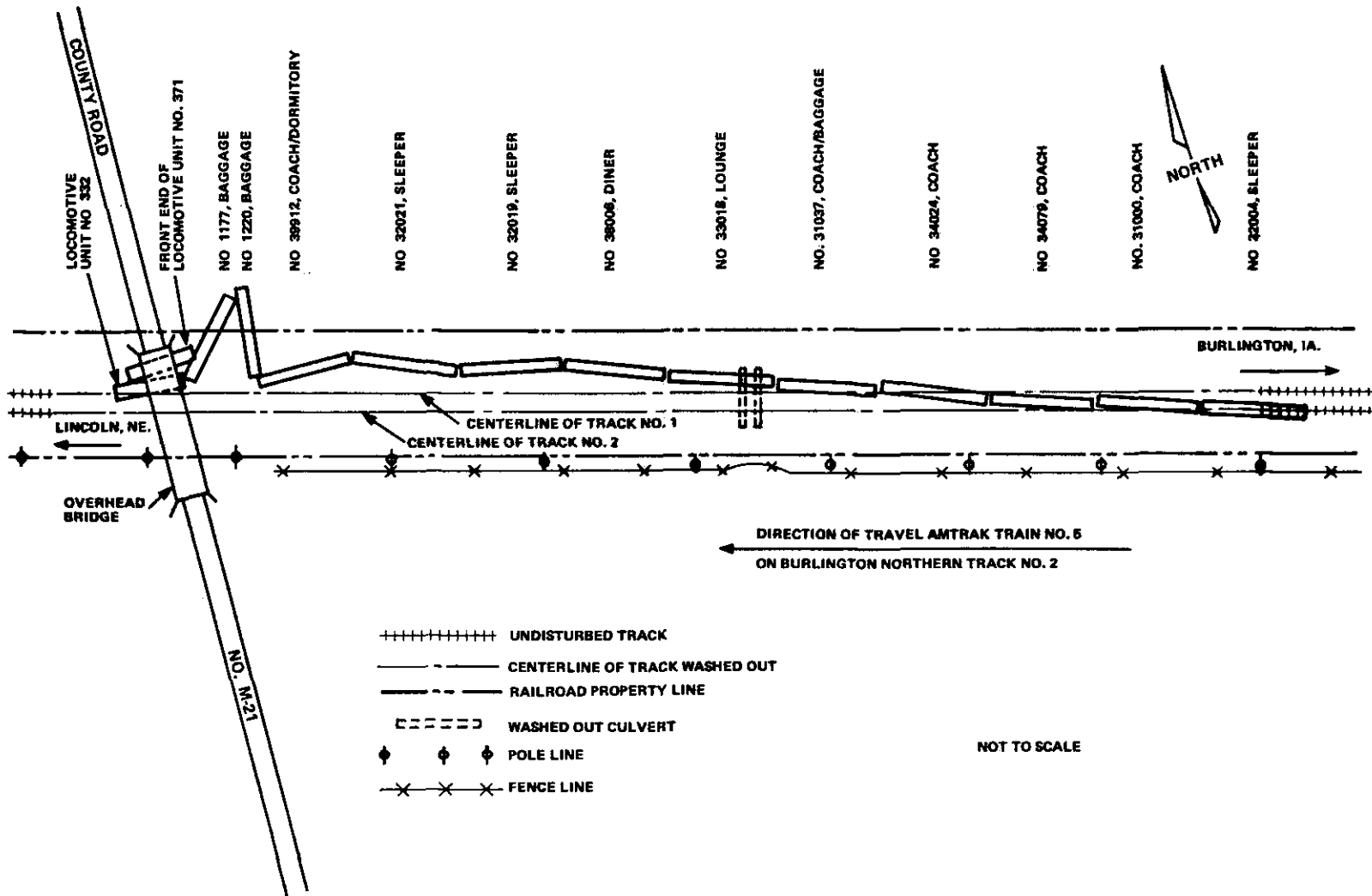


Figure 4.—Plan view of accident site.

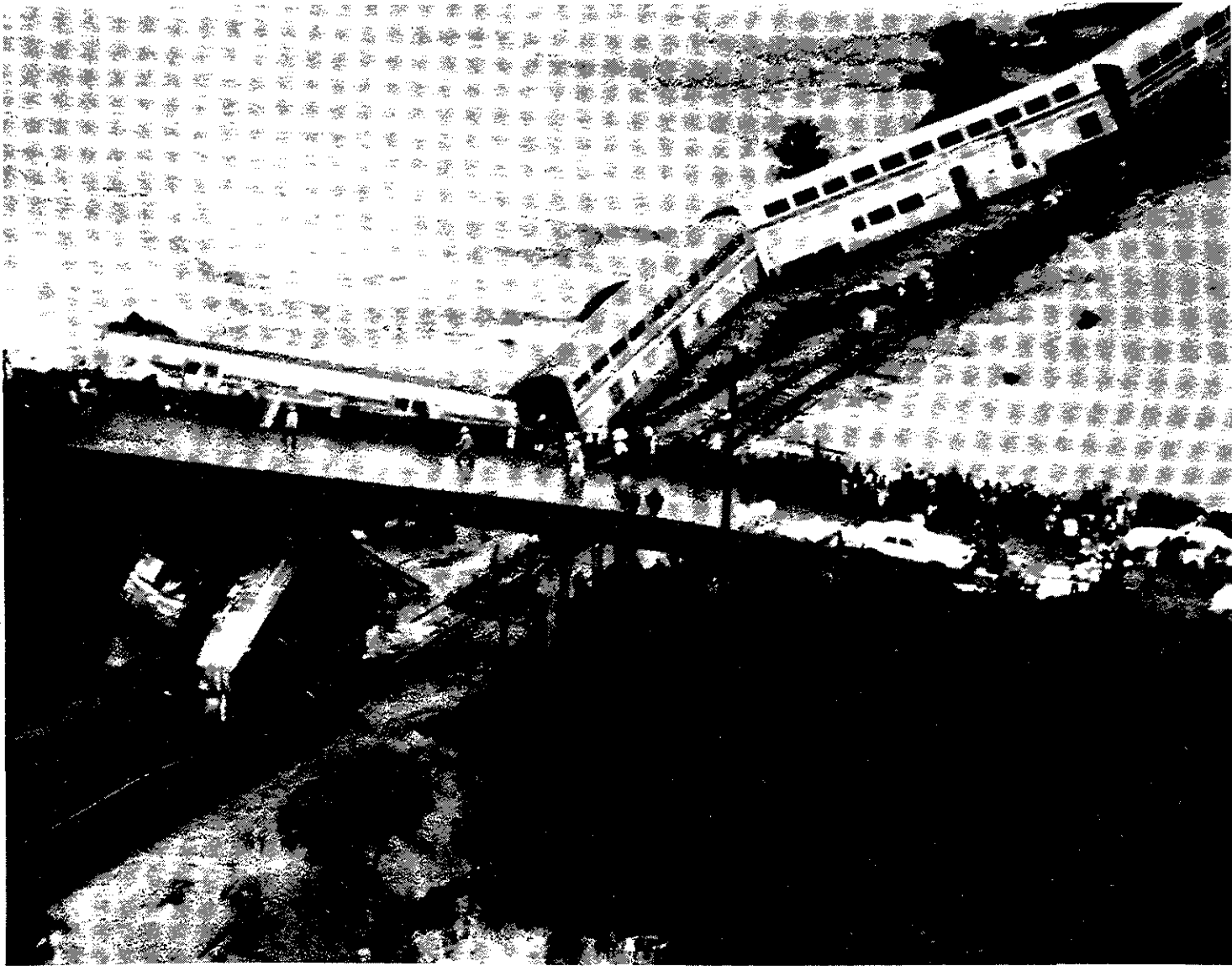


Figure 5.—Aerial view of Amtrak Train No. 5.

car sustained extensive undercar and end damage, and extensive interior mud and water damage. The following two sleeper cars also sustained structural damage and interior mud and water damage. The following diner car received undercar and structural damage and interior mud and water damage; the car's equipment room was damaged by an intruding rail. The following lounge car received undercar damage and interior mud and water damage. The following four coach cars were severely damaged, and the first three coach cars had interior mud and water damage. The last car, a sleeper car, was damaged at its leading end and at the derailed front truck.

About 1,000 feet of double main track, roadbed, and two culverts were destroyed. The signal system track circuit also was damaged.

The county highway bridge that was struck by the locomotive was extensively damaged. The destruction of the north pier resulted in damage to the spans and road. Damage was estimated as follows:

Equipment	\$3,035,000
Track	50,000
Signals	5,000
Wreck Clearing	41,940
Bridge	250,000
Total	<u>\$3,381,940</u>

Personnel Information

The engineer and fireman of Amtrak Train No. 5 were both qualified as locomotive engineers. They had departed from Creston, Iowa, about 2:21 a.m. on June 15 and were to operate to Lincoln, Nebraska. The conductor, brakeman, and flagman had departed from Burlington, Iowa, about 10:35 p.m. on June 14. All the train crewmembers were current on BN operating rules and were qualified for their respective positions in accordance with BN requirements. (See appendix B.)

The tours of duty for the assistant chief dispatcher and dispatcher in Cicero and for the dispatcher in Lincoln ended at 11 p.m., on June 14, and their reliefs came on duty. They were all current on BN operating rules and were qualified for their respective positions in accordance with BN requirements. (See appendix B.)

The track inspector's inspection motor car was maintained at Hastings, and he normally used that location as the starting point for his inspections. Hastings is the approximate midpoint of the 40 miles of railroad which is his inspection assignment. The track inspector was current on BN operating rules and was qualified for his position in accordance with BN requirements. (See appendix B.)

The signal maintainer was headquartered at Emerson and was assigned a territory of about 26 miles of centralized traffic control (CTC) railroad with associated signal apparatus. The signal maintainer was current on BN operating rules and was qualified for his position in accordance with BN requirements. (See appendix B.)

The Pacific Junction operator's tour of duty ended at midnight on June 14. Pacific Junction is a point designated as a weather reporting location. The weather reporting hours are 6 a.m., noon, 6 p.m., and midnight. The operator was current on BN operating rules and was qualified for his position in accordance with BN requirements. (See appendix B.)

Train Information

The locomotive of Amtrak Train No. 5 consisted of two diesel-electric locomotive units. They were model F40PH, 3,000-horsepower units, manufactured by the Electromotive Division of General Motors Corporation. The locomotive units were equipped with operable radio, 26-L airbrake system, blended air and dynamic brake, speed indicator, alertness device, and an event recorder. 4/ (See appendix C.)

The first baggage car was manufactured by Pullman Standard, Inc., and the second baggage car was manufactured by The Budd Company. All of the passenger cars were stainless steel cars manufactured by Pullman Standard, Inc., except the coach/dormitory car, which was manufactured by The Budd Company. The traincrew had two operable portable radios for their use.

Method of Operation

Trains are operated through Emerson by timetable, special instructions, train orders, and signal indications of the automatic wayside signals of a centralized traffic control (CTC) system. The maximum allowable speed at this location is 79 miles per hour for passenger trains and 60 miles per hour for freight trains. The train dispatchers responsible for supervising train operations through Emerson are located at Cicero, Illinois. The dispatchers receive weather reports from the operators at designated stations along the BN four times daily, at least once every 6 hours. The designated stations nearest to Emerson are Creston and Pacific Junction. The designated stations are not equipped with weather monitoring devices, nor are the station operators able to gather weather forecast data from commercial news and weather media sources while on duty. Rule No. 701(C) of the BN's Consolidated Code of Operating Rules states, in part: "Employees whose duties are connected with the movement of trains or engines must not, while on duty . . . use radios or television other than those provided by the company."

Amtrak Train No. 5 is operated daily over the BN by contractual agreement between BN and Amtrak. According to BN and Amtrak officials, the contractual agreement provides for financial incentive in the form of a bonus for on-time performance. Amtrak, also under the agreement, reimburses the BN for road foreman or trainmaster supervision of the train and engine service crews. The reimbursement is a monthly flat rate and does not stipulate such supervision by name or assignment. The engineer told Safety Board investigators after the accident that he could not recall a supervisor checking on crew performance while operating an Amtrak train. The fireman said he remembered a road foreman being on an Amtrak locomotive before.

BN locomotive crews receive on-the-job training for service on Amtrak passenger trains. The crews are required to make qualifying trips aboard Amtrak trains on the territory over which they are to operate. According to the BN, it is the responsibility of the road foreman and the trainmaster, who supervise the locomotive crews and traincrews respectively, to determine the qualification level of the individual crewmember. The number of qualifying trips necessary is dependent upon the ability of the individual employee to learn the operations and procedures. After qualification, an employee may submit a bid for assignment to Amtrak service. The bids are then assigned on a seniority basis.

4/ The event recorder recorded elapsed time, mileage, speed in miles per hour, alertness device operation, load in amps, cab signal acknowledgment, automatic brake pipe reduction, warning whistle use, throttle setting, and dynamic brake.

After the accident, the engineer stated that neither he nor the fireman conversed with the train dispatcher while operating Amtrak Train No. 5 between Creston and the accident site.

BN management officials informed Safety Board investigators after the accident that all of the company rules that prescribe the conduct of employees with regard to protection of train movements in conditions of severe weather apply to those employees while on duty or off duty. Safety Board investigators asked the locomotive engineer, fireman, dispatcher, operator, signal maintainer and track inspector whether they had ever received instructions or training to assist them in interpreting and applying the BN rules regarding unusual weather. The track inspector was the only employee questioned who could recall having received such instruction from the BN.

The following are excerpts from the Burlington Northern Railroad Rules of the Maintenance of Way Department, and govern employees of the Maintenance of Way and Structures, Engineering, Communication, and Signal Departments:

GENERAL RULES

D. Accidents, injuries, defects in track, bridges, signals, or any unusual condition which may affect the safe operation of the railroad, must be reported by the quickest available means of communication to the proper authority, and must be confirmed by wire or on required form.

GENERAL INSTRUCTIONS

882. During threatening or prevailing storms or high water where track or any portion of the railroad property is liable to suffer damage, track and bridge foremen, with necessary men, will be on duty, day or night, and will not await instructions from the train dispatcher or Supervisor, but must carefully patrol their entire territory, to make sure track is safe. If on arrival at the end of their section, it appears probable that the adjoining section may have been damaged, and there is a possibility that this condition may not have been discovered by the foreman on that section, they will continue as far as necessary to insure safety to trains.

883. They must carefully inspect bridge foundations when patrolling track on account of past or prevailing storms. If a train arrives, stop the train and notify the crew what part of the track has not yet been patrolled. When there is any liability of damage to track or bridges, foreman must make frequent personal inspections of conditions, to insure safety of trains, reporting frequently to train dispatcher and to the Supervisor.

The following is an excerpt from the Burlington Northern Train Dispatcher's Manual:

24. UNUSUAL TRACK OR WEATHER CONDITIONS

If an apparent unsafe condition exists or threatens safe train movement, dispatcher must take action to stop trains immediately and determine if safe to proceed.

When notified of broken rail or unsafe track conditions, until information is obtained regarding speed restriction, issue order: "(track condition) reported at MP between (station) and (station). Stop and determine if safe to proceed."

In case of threatened storms, obtain additional information. When visibility is restricted due to weather conditions, consult with Chief dispatcher or division officers as to necessity of blocking trains.

When trains are stopped pending track inspection, they must not be released until conditions are known to be safe. When trains are released to follow employe on track car under Maintenance of Way rule 886, train must be instructed to run at reduced speed per item 14t.

The following is an excerpt from the Burlington Northern Railroad Safety Rules and General Rules:

590. Accidents, injuries, defects in track, bridges, signals, or any unusual condition which may affect the safe operation of the railroad, must be reported by the quickest available means of communication to the proper authority, and must be confirmed by wire or on required form.

The following is an excerpt from the Burlington Northern Railroad Consolidated Code of Operating Rules regarding Station Agents and Operators:

954. Agents and operators must keep train dispatchers informed as to weather conditions, particularly in regard to fog, heavy wind, rain or snow. Indications of abnormal weather conditions not in immediate vicinity of station but which may affect track or bridges must also be promptly reported.

When there are indications of heavy winds, cloudbursts, or abnormal weather conditions, agents and operators must see at once that cars at their stations are secured so that they will not move.

The following is an excerpt from the Burlington Northern Consolidated Code of Operating Rules regarding Movement Of Trains:

101. (A) During severe storms or when there is indication of high water or any condition which threatens damage, trains must move at reduced speed. If in doubt as to being able to proceed safely, train must, if practicable, be placed on siding. Conductors and engineers must make inquiries at stopping places and, when advisable, extra stops must be made to ascertain extent and severity of storms and to examine bridges, culverts or other places subject to damage by high water.

When a train is flagged by a track patrolman in case of storm or high water, patrolman must, if necessary, patrol track ahead of train throughout the storm area.

(B) Trains must run carefully in locations affected by drifting sand or slides and under conditions of dense fog or stormy weather when visibility is restricted.

(C) Unless otherwise authorized, diesel engines must not be moved through water above top of rail.

According to the BN, 14 passenger trains and 112 freight trains were operated through Emerson in the 7-day period preceding the accident. The last train to operate through the accident site was an eastbound freight train which passed through about 8:45 p.m. on June 14.

Track Information

Both of the main tracks through the Emerson area are constructed of 132-lb RE section 5/ continuous welded rail (CWR). The rails are laid in double-shouldered tieplates atop 9-inch by 7-inch by 8-foot 6-inch-long, treated, mixed hardwood and softwood crossties. The CWR is fastened by two rail-holding and two plate-holding spikes per each tieplate. The CWR is anchored on both sides of alternate crossties. The crossties in both of the tracks are laid in crushed granite ballast with compacted full tie cribs. The shoulder ballast section extends more than 12 inches beyond the outer crosstie ends. A crosstie renewal program was completed in 1977. The CWR was laid in 1980, at which time surfacing of both tracks also was accomplished. The tracks met or exceeded the minimum standards of the Federal Railroad Administration's track safety standards for class 4 6/ track. The track alignment at the accident site was tangent and descended westwardly at an approximate 0.28-percent grade. The tracks are on a westwardly descending grade of varying percentages for about 3 1/2 miles approaching the accident site. The track alignment is tangent for about 4,000 feet approaching the accident site up to the point at which the high water elevation equaled the top-of-rail elevation on track No. 2.

Inspection of the roadbed at the accident site revealed that about 1,000 feet of roadbed had been scoured out to a maximum depth of about 3 feet below normal rail profile. The depth of scour was greatest immediately to the north of the original roadbed and immediately east of the county highway bridge embankment. Both of the main tracks were displaced to the north by the force of the water. Safety Board investigators also noted a scour which had occurred near an at-grade highway crossing about 1 mile east of the accident site.

Meteorological Information

During the evening of June 14 and the early morning of June 15, severe thunderstorm activity passed easterly from southeast Nebraska to southwest Iowa. Radar data from the National Weather Service Local Warning Radar, located at Omaha, Nebraska, for the period from 7:18 p.m. on June 14, to 1:30 a.m. on June 15, described an area of thunderstorms moving from west to east at 10 to 30 knots, with rainshower

5/ 132-lb RE section refers to rail which nominally weighs 132 pounds per linear yard and is a standard rail section recommended for use by the American Railway Engineering Association.

6/ According to 49 CFR 213.9, "Classes of track: operating speed limits," Class 4 track prescribes a maximum allowable operating speed of 80 miles per hour for passenger trains, and 60 miles per hour for freight trains.

intensities generally to level 5 (rainfall rate of 4.5 to 7.1 inches per hour), with occasional intensities of level 6 (rainfall rate in excess of 7.1 inches per hour). Mills County, Iowa, in which Emerson is located, was within the rainfall area throughout most of this period, with the heaviest rainfall activities reported at 7:18 p.m., 9:35 p.m., and 10:35 p.m. on June 14.

Twenty-four-hour rainfall reports from cooperative observers maintaining rain gages were received by the National Weather Service Forecast Office in Omaha. The report from Emerson, for the period from 7 a.m., June 14, to 7 a.m., June 15, indicated an aggregate rainfall exceeding 5 inches, while several nearby surrounding observers reported rainfall of 6 inches.

A series of weather forecasts was issued by the National Weather Service Forecast Office concerning flood and storm watches and warnings in southeast Nebraska and southwest Iowa during the evening of June 14 and early morning of June 15. (See appendix D.) A weather "watch" indicates that a potential threat exists and that persons in the affected area should make necessary preparations and keep informed of pending conditions. A weather "warning" indicates that the threat has materialized and is imminent or has been reported, and that persons in the affected area should take immediate precautions. Severe thunderstorm warnings were first issued for Mills County at 9:50 p.m. on June 14. A flash flood watch was issued at 10:30 p.m., and six subsequent weather bulletins indicated severe weather in that area.

The weather warnings associated with the severe thunderstorms and flooding that affected southwestern Iowa and southeastern Nebraska on the evening of June 14 and morning of June 15 were transmitted via several communications networks. The following are the networks primarily directed to local governments, civil defense, business, medical, and interested persons:

National Oceanic and Atmospheric Administration (NOAA) Weather Radio.--A VHF continuous radio broadcast which transmits weather warnings, observations, forecasts, and other environmental information. A 600-hertz tone is broadcast prior to weather warnings and other critical information which can be used to automatically activate appropriately equipped receivers.

NOAA Weather Wire.--A Statewide teletypewriter network which transmits weather warnings, observations, forecasts, and other environmental information. It is available by subscription.

NOAA Service "A."--A national/regional teletypewriter service which carries extensive weather information including forecasts and warnings. This circuit is primarily for use by weather agencies but is available to private interests by subscription with license by NOAA.

National Warning System (NAWAS).--A telephone hot line for disaster warnings directed primarily to law enforcement agencies and civil defense. There are 15 stations in Iowa connected to this circuit, primarily law enforcement agencies which, in turn, transmit the information to the appropriate agencies and persons.

Also, the weather warnings and forecasts were available to the public from commercial radio and television stations.

Enhanced infrared satellite photographs taken by the Geostationary Operational Environmental Satellite (GOES), operated by the National Satellite Service of NOAA, showed a small area of apparent convective activity over extreme southwestern Iowa at 12:01 p.m. on June 14. This system enlarged somewhat and moved east, passing out of the Mills County area by 4 p.m. The heaviest convective activity at 4 p.m. was photographed over south-central Nebraska. It moved eastward and expanded, reaching the extreme southwest corner of Iowa by 6:30 p.m. At 7 p.m., the convective area had reached the southwestern corner of Iowa. At 8:30 p.m., cold tops, indicating possible severe thunderstorms, appeared over east-central Nebraska and southwestern Iowa, and at 9:30 p.m., the intense convective activity had expanded over eastern Nebraska. At 11 p.m., this activity formed a line and began to move over southwestern Iowa. (See figure 6.) It continued its eastern movement, moving past Mills County by 1 a.m. on June 15. At this time, the large area of apparent convective activity covered the entire State of Iowa. By 2 a.m., the large area of convective activity had moved east of Mills County. Satellite photographs become available to users about 30 minutes after they are taken.

At Emerson, Indian Creek has a drainage area of approximately 37.3 square miles, situated generally to the north and east of the town. U.S. Geological Survey data regarding stream flow and flood measurements for Indian Creek, based on measurements from a recording station located at the bridge on U.S. Highway No. 34 over Indian Creek, revealed that peak discharge recorded from the water flows of June 14 and 15 was 15,800 cubic feet of water per second. The statistical flood flows are as follows:

<u>Flood frequency</u>		<u>Cubic feet per second</u>
1-year	-	1,200
5-year	-	2,400
100-year	-	7,500

Medical and Pathological Information

Of the 298 passengers on the train, 1 passenger died as a result of hemorrhage and blunt trauma. At the time of the accident, this passenger was walking between two of the cars and became caught and crushed between these two cars when they derailed.

Twenty-seven persons were injured as a result of the derailment. Sixteen persons were admitted to the area hospitals, and 11 were treated for their injuries and released. The injuries were mostly fractures, lacerations, and contusions. Attending physicians attributed the low number and degree of injuries to the fact that most of the passengers were relaxed and asleep when the derailment occurred.

Survival Aspects

Immediately after the accident, the flagman, who had been in the last car of the train, ran east along the tracks to a wayside BN telephone to report the derailment to the dispatcher and to summon assistance. A sheriff's officer, who was notified of the accident over his two-way radio while he was assisting in the evacuation of Emerson, was the first person to arrive at the accident site. Using a bullhorn from his patrol vehicle, he spoke to the passengers on the train and advised them that rescuers were arriving at the site. He then dropped down from the damaged highway bridge onto the train and began rendering assistance back through the train. Emergency rescue personnel who arrived shortly were hampered by the swift floodwaters at the site and had to employ

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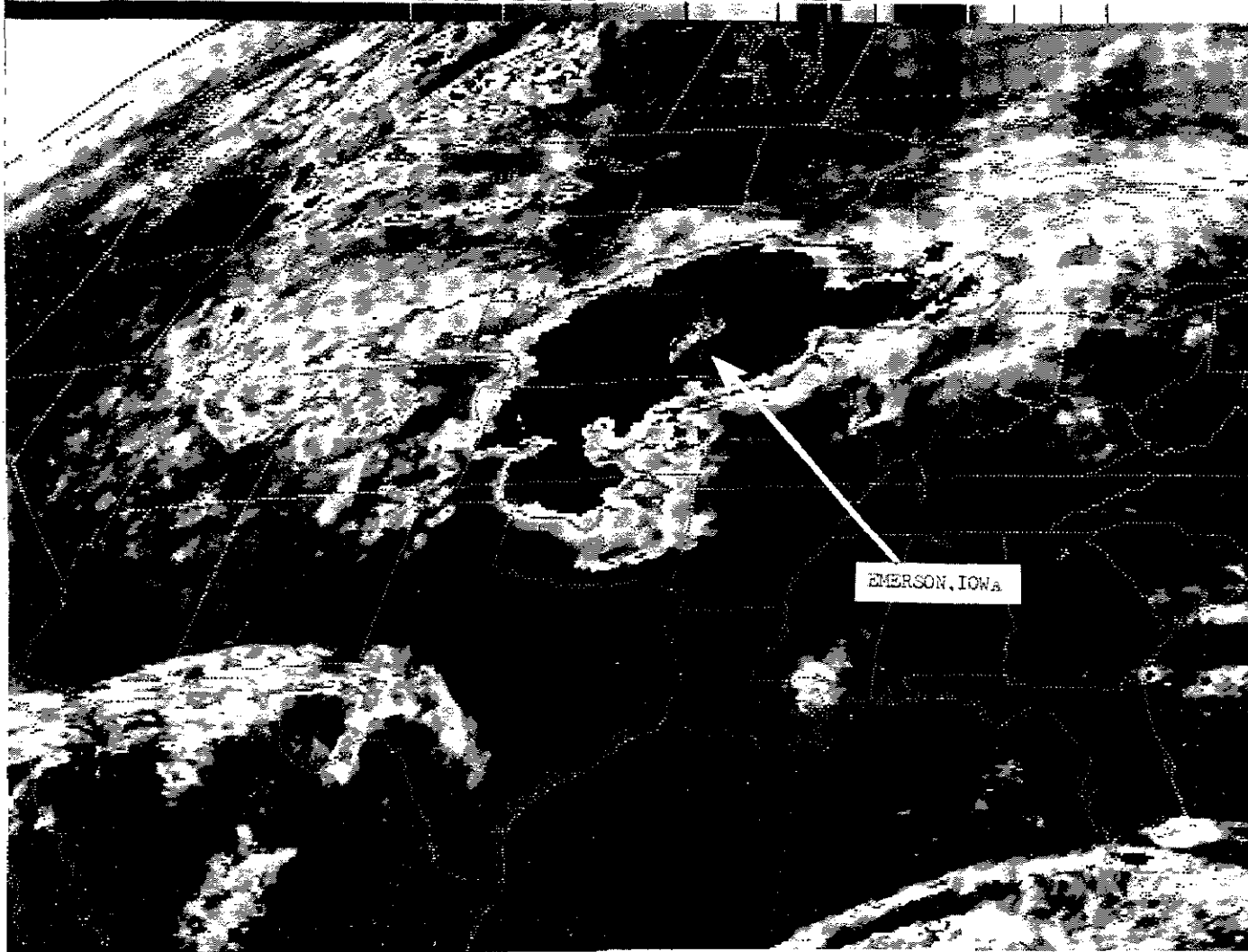


Figure 6.—Infrared photograph with contoured temperature enhancement taken by NOAA Geostationary Operational Environmental Satellite at 11 p.m. on June 14, 1982.

small boats with outboard motors to get to the train and bring out the passengers. The sheriff's department established a command post on the south side of the bridge, and triage 7/ areas were established on both sides of the bridge. Rescue units from a 50-mile radius of the accident responded. "Life Flight" rescue service helicopters 8/ and helicopters of the Iowa National Guard assisted in transporting the seriously injured to hospitals.

Evacuation of the injured was complicated by the tilting of several of the cars and by the mud and floodwater in the cars. The Acting Civil Defense Disaster Coordinator, who assisted in the emergency response, stated that the rescue effort also was complicated because the emergency lights installed on the train did not function and the rescuers had to rely on flashlights. He further stated that the rescue efforts were hampered by an absence of clearly marked emergency window exits and by an absence of instructions for their use. He said that the onboard Amtrak employees did not seem to know about the location or operation of the emergency exits. He stated that rescuers were not able to break one of the inner Lexan 9/ plastic windows with extrication bars to use as an emergency exit. The rescuers also experienced difficulties with the operation of the power-assisted end doors in the passenger cars. The Acting Civil Defense Disaster Coordinator stated that he and his colleagues had not seen or been aware of an Amtrak booklet entitled "Emergency Evacuation Procedures."

The crewmembers on the locomotive were injured during the derailment and could not assist in the preliminary emergency response. The conductor was in the dining car, which was the sixth car in the train, at the time of the accident. He stated that the rear exit of that car was blocked and that he could not get through to the remainder of the train. He stated that two Amtrak employees in this portion of the train assisted passengers out of the flooded lower levels of the passenger cars to the upper levels. An Amtrak coach attendant, the brakeman, and the flagman assisted in the rescue by leading passengers off the last car on the train and onto the roadbed east of the flooded site.

Injured passengers and crewmembers were transported by helicopters and ambulances to local hospitals. Passengers and crewmembers who were not injured were transported to a local school building, where two nurses were available. The evacuation was completed about 7:30 a.m. on June 15.

Tests and Research

A postaccident inspection of the components of the track structure disclosed no defects in the rails, crossties, or fasteners that would have contributed to the accident.

The signal system was tested after the accident and no defects were noted. The signals functioned as they were designed to do after the track and signal circuitry were rebuilt. No determination could be made as to the aspect the signals displayed immediately before the accident. Investigators determined that the commercial electric power cutoff at Emerson at 2:10 a.m. on June 15 did not affect the BN's signal system, because the two systems are isolated from each other.

7/ A triage area is a site established at or near an accident scene and which is utilized by emergency medical technicians to classify treatment of the injured on a priority basis.

8/ "Life Flight" is the designation for those rescue service helicopters which were used for the medical evacuation of injured persons from the accident site to local hospitals.

9/ A clear tough, puncture resistant polycarbonate plastic sheet used for unbreakable windows.

A postaccident inspection of the locomotive and all of the cars of the train disclosed no mechanical defects that would have contributed to the accident. No meaningful postaccident observation of the locomotive controls could be made because of the severity of the damage to the locomotive from the derailment and flood.

After the accident, the event recorder cassette was removed from the locomotive and taken by Safety Board investigators to the event recorder's manufacturer for expanded format playback and verification. Results of the playback indicate that the speed of the train was reduced from about 78 miles per hour to about 74 miles per hour in the last 2 miles of operation prior to the point at which intense deceleration began. The playback indicated that the power supply to the event recorder was terminated during the period of intense deceleration; the speed of the train at this point was about 60 miles per hour. The playback indicated that the throttle was in either the idle, first, or second positions, and the playback indicated that a zero amperage load existed for about 2 1/2 minutes before the recording stopped. The automatic brake was recorded in the release position, and a PCS Open 10/ indication was not recorded. The recorder uses a sampling cycle of once every 6 seconds at the airbrake manifold to record the use of the automatic brake. The playback also indicated an elapsed time of approximately 30 seconds from the time at which the warning whistle for the at-grade crossing was finished until the recording stopped. (See appendix C.)

Two Safety Board investigators and the Assistant Division Superintendent of the Galesburg Division rode the lead locomotive unit of a westbound BN freight train through Emerson at 1 a.m. on June 17 to determine the sight distances available from the locomotive headlights to alert persons located in the darkness of a locomotive cab. The headlight was of a comparable height and brightness to the headlight of an Amtrak locomotive. The speed of the train at Emerson was about 50 miles per hour. The weather was dark and overcast. The observers agreed, independently and unanimously, that the headlight provided a field of vision up to 50 feet north of the track, up to 50 feet south of the track, and up to 1,200 feet directly ahead of the locomotive.

Safety Board investigators noted high-water marks at the derailment site and in and about Emerson after the accident. High-water marks were identified by mud and debris deposits on the roadbed, rails, pole-line, and vegetation along the railroad at the accident site and on structures in Emerson. The marks indicate that the water covered the top of the rail at the accident site for a distance along the track of about 1,000 feet, and to a depth of up to 8 inches above the normal top-of-rail profile. The most easterly edge of the area where the water was above the top of the rail was located about 4,000 feet west of the end of the curved track west of Emerson and about 1,740 feet west of the last signal before the accident site. In Emerson, high-water marks were noted at several locations within 10 feet of the north track on the north side of the railroad and within 25 feet of the south track on the south side of the railroad. Mud and debris also were found on the tops of the concrete piers, just below the steelwork, of the railroad bridge over Indian Creek, just east of Emerson. The channel depth during the flood was measured at up to 22 feet. During periods of no precipitation, the streambed is practically dry.

Other Information

The Safety Board has investigated weather-related derailments on the BN and a subsidiary railroad at Forsyth, Montana, and Trinidad, Colorado, as well as on other

10/ PCS is the acronym for the Power Cutoff Switch, which places the diesel engine into idle upon an emergency brake application.

railroads. In the derailment at Forsyth on June 14, 1980, 11/ the Safety Board noted that severe weather warnings were first issued for the area of the derailment more than 3 hours before the train derailed on a washed-out track structure. However, the dispatcher was not aware of the severe weather conditions because he relied solely on data relayed to him from operators along the railroad. Although no one was injured in the accident, damage was estimated to be about \$824,000. In the derailment at Trinidad on July 3, 1981, 12/ the Safety Board noted that the dispatcher was aware of severe weather conditions and had called an extra track patrol to inspect the track. However, the train that derailed was not held to allow the extra track patrol to inspect the track before the train's passage. The engineer and front brakeman died in the accident when their train encountered the washout, and damage was estimated to be \$1,135,000.

The Federal Railroad Administration reported in its Accident/Incident Bulletin that 24 derailments in 1981 were attributed to damage to track by washout, rain, slides, and ice.

ANALYSIS

The Accident

As Amtrak Train No. 5 neared the town of Emerson, it passed over the railroad bridge spanning Indian Creek. At this time, the floodwaters were near crest stage, had flowed over Indian Creek's banks, and had covered the piers supporting the bridge. The engineer and fireman should have been able to see the flood condition at this location, according to the postaccident sight distance test. The statements of the engineer and fireman indicate, however, that their attention was diverted from the track structure ahead of their train to the flashing emergency lights on the patrol car situated on the overhead highway bridge located west of the Indian Creek railroad bridge. Since the flashing emergency lights were near the upper limit of the crew's cone of vision from the locomotive, while the floodwater was located near the lower limit, this distraction of the crew's attention from the track structure at a critical moment delayed the crew's awareness of the imminent danger.

Although the fireman stated that he did not see any water in Emerson, the engineer stated that he and the fireman talked about the high water in Emerson after passing Indian Creek. Since the train was about 1 hour behind schedule, the Safety Board believes that the locomotive crew would have been operating the train at its maximum allowable speed of 79 miles per hour so as to not further delay the schedule. The event recorder playback indicated that the speed of the train decreased from 78 miles per hour to 74 miles per hour before the rapid deceleration that occurred during the derailment. The playback also indicated that the throttle was in either the idle, first, or second position and that the amperage load reading was zero. Because the zero load is more consistent with the throttle's being in the idle position rather than in running positions one or two, or running position three as stated by the fireman, the Safety Board concludes that the throttle was in the idle position at the time of the accident. The decrease in speed and the idle throttle position indicate that the locomotive crew doubted the safety of operating at the maximum allowable speed. The Safety Board believes that the event recorder playback indicates a manner of train operation that substantiates the engineer's

11/ For more detailed information see National Transportation Safety Board, Denver Field Office Report of Railroad Accident Investigation, Burlington Northern Railroad Co. Freight Train Derailment at Forsyth, Montana, June 14, 1980 (DEN-80-F-R-026).

12/ For more detailed information see National Transportation Safety Board, Denver Field Office Report of Railroad Accident Investigation, Colorado and Southern Railway Co. Rail Train Derailment at Trinidad, Colorado, July 3, 1981 (DEN-81-F-R-032).

testimony that both he and the fireman observed at least some of the flood at Emerson. Since the engineer and fireman stated that they had never experienced flooding or unusual water conditions at this location in the past, the Safety Board believes that they did not recognize the severity of this flood condition and its effect on the track structure. The Safety Board also notes that neither the engineer nor the fireman could recall the aspect of the last signal they passed, about 1,740 feet east of the washed-out track structure. This signal should have been in the range of vision of an alert and responsive locomotive crew, and its aspect should have been evident to such a crew before the water ahead came into view. The Safety Board believes that the locomotive crew's lack of awareness of the signal further indicates that they may have been preoccupied with looking at the flooding along the sides of the track structure east of the accident site.

The event recorder playback indicated an elapsed time of about 30 seconds between the last use of the warning whistle and the recording termination. The recording terminated while the locomotive was still traveling in excess of 60 miles per hour, and probably ceased when water was forced through the locomotive and its electrical system when the locomotive entered the washed-out track structure. If the fireman had placed the automatic airbrake in emergency just after sounding the warning whistle, as he stated he did, the event recorder would have registered such a brake application. Since the event recorder did not register any such brake application, and based on the 6-second sampling cycle the event recorder uses for recording automatic airbrake application, the Safety Board concludes that the only time an emergency application may have been made was in the final 6-second cycle before the train entered the washed-out track structure. At a speed of 74 miles per hour, as recorded before the rapid deceleration, and with a nominal reaction time of about 3 seconds, the locomotive would have been about 980 feet from the washed-out track structure when the fireman recognized the danger and may have applied the automatic airbrake in emergency. This delay in recognizing and responding to the danger was excessive and precluded the possibility of effectively stopping or slowing the train to prevent the accident or to mitigate the effects of the accident. The Safety Board concludes that sufficient warning was available to the locomotive crew and that the crew should have realized that the potential danger of flooded or washed-out tracks justified the slowing or stopping of Amtrak Train No. 5.

Operating and Safety Rules

The track inspector was aware of severe weather conditions after hearing the tornado warning siren at Hastings about 10:30 p.m. on June 14. After waiting for the rain to stop, he made a cursory inspection, by automobile, of the track in the vicinity of an at-grade crossing in Hastings and apparently determined that there was no need to patrol the tracks. The Safety Board believes that, had the track inspector decided that a track patrol was advisable to determine whether the track structure had been damaged, as provided by General Instructions 882 and 883, he would have discovered the flooding at Emerson and taken measures, including reporting to the dispatcher as required by General Rule D, to restrict the movement of trains in the area. Such action would have prevented the accident.

The signal maintainer had driven through water on a highway and noticed that water was standing in some fields when he was sent out to correct a signal problem before midnight on June 14. When the dispatcher mentioned the possibility of ordering track patrols, the signal maintainer pointed out that the tracks were on a "high fill," implying that there was no immediate need for such action. The signal maintainer said that while driving through Emerson about 12:15 a.m. on June 15, he did not notice any flooding, evacuation, or other unusual conditions. Areas of Emerson were being evacuated because

of flooding at that time, and by 12:40 a.m. water was covering the Indian Creek Bridge on U.S. Highway No. 34. The Safety Board concludes that the signal maintainer did not adequately assess, and relate to the dispatcher, as provided by General Rule D, the severity of the weather conditions and the potential effects of those weather conditions on the track structure.

The dispatchers were aware of potential severe weather conditions by their knowledge of the earlier extra track patrols on the adjacent Lincoln Division and from the conversation with the signal maintainer regarding the weather. The Safety Board concludes that if the dispatchers in Cicero had called for an extra track patrol, as provided by Rule 24 of BN's Train Dispatcher's Manual, the accident would have been avoided. The dispatchers' decisions, however, were based on limited meteorological data and on subjective evaluation of weather conditions which were made by other employees.

The Pacific Junction operator was aware of the severe weather and of the flood in Emerson. The operator's route to his home, after his work assignment was completed, was blocked by the flood at the Indian Creek highway bridge near Emerson for almost 3 1/2 hours. The operator knew that Amtrak Train No. 5 was due to pass through Emerson. The operator should have requested the sheriff's officer or the highway department employee to relay a warning message of the flood to the BN. The Safety Board concludes that had the operator exercised better judgment and had he acted as provided by Rule 590 of BN's Safety Rules and General Rules and Rule 954 of BN's Operating Rules, this accident would have been avoided.

The foregoing circumstances indicate that although BN has several operating and safety rules in effect regarding protection of train movements during severe weather, the involved employees did not act as provided by the rules to take the necessary actions that would have prevented the accident. The Safety Board believes that this may have been due to the lack of training afforded the involved employees to assess adequately the particular weather conditions at their locations and the effects that these conditions might have on the safe operation of train movements.

Meteorological Data Collection

The BN collects meteorological data from designated stations along its railroad four times daily. The weather data conveyed to the dispatchers are furnished by observations made by the station operators. The operators must rely on their personal evaluations because the stations are not equipped with any weather monitoring devices and because the operators do not have access to commercial weather data. Further, since all of the stations are located directly along the railroad, the scope of the observations is limited to a small area. In this instance, the weather reporting stations encompassing the accident site were located about 82 miles apart. The BN's method of collecting meteorological data proved to be inadequate in this instance to prevent the derailment. The Safety Board believes that the BN, and all railroad common carriers which gather meteorological data through similar methods, should implement professionally gathered and evaluated meteorological data collection methods, such as subscribing to data services offered by NOAA, to better assure the safe operation of trains. The Safety Board also believes that such use of subscription services has become vital as centralization of dispatching functions has increased.

Survival Aspects

As Amtrak Train No. 5 entered the washed-out track structure, it diverged northwardly from the normal track alignment, because the tracks had been displaced by the rushing floodwaters. The two locomotive units became separated, and the lead unit

rotated about 180 degrees. The Safety Board believes that this rotation preceded the impact with the north bridge pier, because the front of the unit came to rest east of the pier's original and displaced locations. This circumstance enhanced the locomotive crew's ability to survive the accident.

The emergency personnel were prompt, efficient, and well organized in their response efforts, despite the difficulty of working on a derailed passenger train in a flood situation in the dark. The rescue of passengers was impeded by onboard emergency lights that did not function and by the lack of clearly marked emergency exits. The Safety Board has noted these problems in prior Board investigations of derailments of Amtrak passenger trains. After a collision between a commuter train and a passenger train at Seabrook, Maryland, on June 19, 1978, 13/ the Safety Board recommended that the National Railroad Passenger Corporation (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)

In response to that recommendation, Amtrak prepared and published a self-instructive booklet entitled "Emergency Evacuation Procedures." Amtrak advised the Safety Board that the booklet was being distributed to fire departments and rescue squads along all Amtrak routes in the United States. Based on this action, the Safety Board classified the recommendation in a "Closed—Acceptable Action" status. The Safety Board believes that, as a result of this accident, Amtrak should evaluate the distribution that was made of the "Emergency Evacuation Procedures" booklet to determine why the emergency personnel involved in this accident were not aware of the booklet, and whether this informational hiatus was isolated or typical of other situations which may exist along all Amtrak routes.

As a result of the Seabrook, Maryland, accident, the Safety Board also recommended that Amtrak:

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

This recommendation was reiterated to Amtrak as a result of an accident at Lawrence, Kansas, on October 2, 1979. 14/ The Safety Board noted that in both these accidents, Amtrak personnel on the train were not prepared to render effective aid to the passengers. Amtrak advised the Safety Board of a training program that it had instituted for its employees, which included the standard Red Cross Multi-Media First-Aid Training and detailed training in emergency procedures. Based on Amtrak's implementation of this training program for Amtrak onboard employees after these accidents, the Safety Board classified the recommendation in a "Closed—Acceptable Action" status. The Safety Board believes that as a result of the Emerson accident, Amtrak should evaluate the effectiveness of its training program to better assure that onboard employees can render effective aid to passengers in emergency situations.

13/ For more detailed information, see National Transportation Safety Board Railroad Accident Report--"Rear-End Collision of Conrail Commuter Train No. 400 and Amtrak Passenger Train No. 60, Seabrook, Maryland, June 19, 1978" (NTSB-RAR-79-3).

14/ For more detailed information see National Transportation Safety Board 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).

Amtrak Train No. 5 derailed at a time when most passengers were asleep and relaxed. More of the 298 passengers could have been seriously injured and more fatalities could have occurred if the train had derailed when passengers were awake and walking about. The Safety Board believes that the possibility for large numbers of passengers being injured in an accident further supports the need for adequate training of both Amtrak employees and emergency response personnel. Also, the Safety Board believes that Amtrak should consider implementing an onboard briefing program to instruct passengers in methods of emergency evacuation.

CONCLUSIONS

Findings

1. Severe thunderstorm warnings for Mills County, Iowa, were first issued by the National Weather Service Forecast Office about 5 hours 25 minutes before the train derailed; a flash flood watch was issued about 4 hours 45 minutes before the derailment; and six subsequent forecasts or statements indicating severe weather in the Mills County area were issued before the derailment.
2. Adequate forecast warnings of the severity and magnitude of the weather affecting Emerson were readily available through established channels of the National Weather Service.
3. The means of collecting information employed by the Burlington Northern Railroad were inadequate to obtain the meteorological data necessary to assure the safety of the main tracks for passage of the train, and to detect the washout.
4. The track inspector was aware of severe weather conditions about 4 hours 45 minutes before the derailment; however, he apparently determined that there was no need to perform an extra inspection to assure that the track was safe, as provided by BN's General Instructions 882 and 883.
5. The signal maintainer was aware of the severe weather conditions at least 3 hours 30 minutes before the derailment; however he did not adequately assess, and relate to the dispatcher, as provided by General Rule D, the severity of the weather conditions and the potential effects of those weather conditions on the track structure.
6. The dispatchers were aware of potential severe weather conditions in the Emerson area; however, they determined that there was no need to call for extra inspections to assure that the track was safe for the operation of the train as provided by Rule 24 of BN's Train Dispatcher's Manual.
7. The Pacific Junction operator had knowledge of the flooding and evacuation of Emerson and had access to communications that could have been used to warn the Burlington Northern Railroad, but did not take action to do so, as provided by Rule 590 of BN's Safety Rules and General Rules and Rule 954 of BN's Operating Rules regarding Station Agents and Operators.

8. Burlington Northern Railroad Operating and Safety Rules regarding protection of train movements during severe weather did not prevent the derailment of Amtrak Train No. 5 because the employees governed by the rules did not assess adequately the significance of the weather conditions at their locations.
9. High-water marks, mud, and debris left by the floodwaters in the Emerson area indicate that the floodwaters were within the normal cone of vision of the locomotive crew, as confirmed by test observations made after the accident.
10. The locomotive crewmembers were distracted from viewing the track structure ahead by the flashing emergency lights on the patrol car on the highway bridge west of the Indian Creek railroad bridge at a critical moment, which delayed the crew's awareness of the imminent danger to the train.
11. The locomotive crew observed some of the flooding in the Emerson area, but did not recognize the severity of the conditions, since they had never experienced flooding or unusual water conditions at that location in the past.
12. Based on event recorder data, the only time an emergency brake application may have been made was in the final 6 seconds before the train entered the washed-out track structure; this delay in response precluded the possibility of effectively stopping or slowing the train to prevent or mitigate the effects of the accident.
13. Sufficient warning was available to the locomotive crew when passing through Emerson, and the crew should have realized that the potential danger of flooded or washed-out tracks justified the slowing or stopping of the train.
14. The emergency personnel were prompt, efficient, and well organized in their response efforts, but their efforts were impeded by the malfunction of the onboard emergency lights , and by the lack of clearly marked identification of emergency exits.
15. The emergency personnel were not aware, prior to the accident, of the Amtrak booklet entitled "Emergency Evacuation Procedures," and thus were not informed of the proper procedures to be used in entering and evacuating the passenger cars.
16. The Amtrak training program in emergency procedures for its onboard employees was not effective in providing adequate assistance to passengers involved in the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was that the dispatcher allowed Amtrak Train No. 5 to continue onto tracks that had been washed out by floodwaters because the operating railroad did not have adequate means of collecting and evaluating meteorological information. Contributing to the accident was the failure of the locomotive crew to recognize and respond adequately to indications of possible unsafe track conditions due to flooding and the failure of other railroad employees, including the dispatcher, to assess weather conditions adequately and take action as prescribed by the rules.

RECOMMENDATIONS

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

--to the Burlington Northern Railroad Company:

Adopt a system of professionally gathered and evaluated meteorological information to better assure timely knowledge of climatic conditions that may affect the safe operation of train movements. (Class II, Priority Action) (R-83-19)

Review and revise, where necessary, the training provided to employees whose responsibilities may affect the protection of train movements during conditions of severe weather, to enable those employees to better assess climatic threats to safe train movements. (Class II, Priority Action) (R-83-20)

--to the National Railroad Passenger Corporation (Amtrak):

Adopt a system of professionally gathered and evaluated meteorological information to better assure timely knowledge of climatic conditions that may affect the safe operation of passenger train movements for all Amtrak routes. (Class II, Priority Action) (R-83-21)

Require that those railroads under contractual agreement to operate passenger trains adopt a system of professionally gathered and evaluated meteorological information to better assure timely knowledge of climatic conditions that may affect the safe operation of those passenger train movements. (Class II, Priority Action) (R-83-22)

Provide copies of Amtrak's Emergency Evacuation Procedures booklet to all emergency response organizations not possessing those procedures from the original distribution, along all designated passenger train routes. (Class II, Priority Action) (R-83-23)

Review and revise, where necessary, the training and retraining programs for onboard employees in emergency procedures, including the operation of emergency exits, to improve onboard employee competence to render effective assistance to passengers in emergency situations. (Class II, Priority Action) (R-83-24)

Evaluate and modify, as necessary, emergency lighting systems in passenger-carrying cars to better protect the functioning of emergency lights in emergency situations. (Class II, Priority Action) (R-83-25)

Formulate and implement an onboard briefing program for onboard passengers in methods of emergency evacuation. (Class II, Priority Action) (R-83-26)

—to the Association of American Railroads

Inform its membership of the facts and circumstances of the derailment at Emerson, Iowa, on June 15, 1982, and recommend to its member railroads that they adopt a system of professionally gathered and evaluated meteorological information to better assure timely knowledge of climatic conditions that may affect the safe operation of train movements. (Class II, Priority Action) (R-83-27)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G. H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

PATRICIA A. GOLDMAN, Vice Chairman, dissenting:

While the absence of accurate meteorological information contributed to the accident, even the sketchy weather information possessed by the Burlington Northern employees should have prompted them to follow the railroad's operating rules as discussed in the report. It was this failure to follow the rules which resulted in the accident.

February 8, 1983

APPENDIXES

APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident at 5:27 a.m. on June 15, 1982. The Safety Board immediately dispatched investigators from its Washington, D.C., headquarters, and from its Denver, Colorado, field office to the site.

Groups were formed to investigate the mechanical, meteorological, operational, track, and human factor aspects of the accident. The groups were comprised of personnel from Amtrak, Burlington Northern, Federal Railroad Administration, and emergency response groups, and were headed by Safety Board personnel.

A formal deposition proceeding was held in Omaha, Nebraska, on August 18-19, 1982. Sworn testimony of the facts of the accident was taken from 15 witnesses. Parties to the proceeding were the Burlington Northern, Amtrak, American Train Dispatchers Association, Brotherhood of Locomotive Engineers, United Transportation Union, and the Federal Railroad Administration.

APPENDIX B
PERSONNEL INFORMATION

Conductor

Vinton R. Metzger, 45, was first employed by the Chicago, Burlington, & Quincy (CB&Q) Railroad, a predecessor company of the Burlington Northern (BN) Railroad, as a brakeman on August 21, 1961. He was promoted to conductor on November 6, 1966. He was last examined on BN operating rules on March 6, 1981. He passed a company physical examination on April 5, 1976.

Engineer

Joseph M. Schwartz, 56, was first employed by the CB&Q as a coach cleaner, on June 9, 1943. He transferred to train and engine service and became a fireman on August 15, 1947. He was promoted to engineer on July 22, 1960. He was last examined on BN operating rules on March 19, 1982. He passed a company physical examination on October 30, 1979.

Fireman

Kenneth E. Moore, 29, was first employed by the BN as a freight car apprentice on April 9, 1976. He transferred to train and engine service as an engineer trainee on December 6, 1978. He was promoted to engineer on August 15, 1979. He was last examined on BN operating rules on March 2, 1981. He passed a company physical examination on October 5, 1978.

Brakeman

Gordon R. Becker, 59, was first employed by the CB&Q as a freight car helper on June 7, 1948. He transferred to train and engine service as a brakeman on July 7, 1948 and was promoted to conductor on October 28, 1970. He was last examined on BN operating rules on March 8, 1982. He passed a company physical examination on March 8, 1982.

Flagman

Donald D. Herold, 29, was first employed by the BN as a section laborer on June 12, 1974. He transferred into train and engine service as a brakeman on August 10, 1975, and was promoted to conductor on March 14, 1978. He was last examined on BN operating rules on February 23, 1982. He passed a company physical examination on August 1, 1978.

Assistant Chief Dispatcher (3 p.m. to 11 p.m., June 14, 1982)

Edwin A. Miller, 54, was first employed by the CB&Q as a telegraph operator on December 27, 1950. He was promoted to train dispatcher on May 30, 1959. He was last examined on BN operating rules on October 25, 1981. He passed a company physical examination on August 6, 1981.

Assistant Chief Dispatcher (11 p.m., June 14, 1982 to 7 a.m., June 15, 1982)

Craig F. Meling, 25, was first employed by the BN as an agent-operator on June 14, 1975. He was promoted to train dispatcher on July 26, 1978. He was last examined on BN operating rules on December 19, 1979. He passed a company physical examination on November 26, 1980.

Dispatcher (11 p.m., June 14, 1982 to 7 a.m., June 15, 1982)

Max E. Parcel, Jr., 27, was first employed by the BN as a section laborer on October 17, 1974. He transferred to the position of agent-operator on August 30, 1976, and was promoted to train dispatcher on April 7, 1980. He was last examined on BN operating rules on October 26, 1981. He passed a company physical examination on February 27, 1978.

Track Inspector

Paul J. Taylor, 43, was first employed by the CB&Q as a section laborer on August 28, 1961. He was promoted to section foreman on February 7, 1972, and transferred to track inspector on December 26, 1975. He held several subsequent positions as a foreman and/or inspector. He was last examined on BN operating rules and maintenance rules on February 6, 1981. He passed a company physical examination on January 16, 1981.

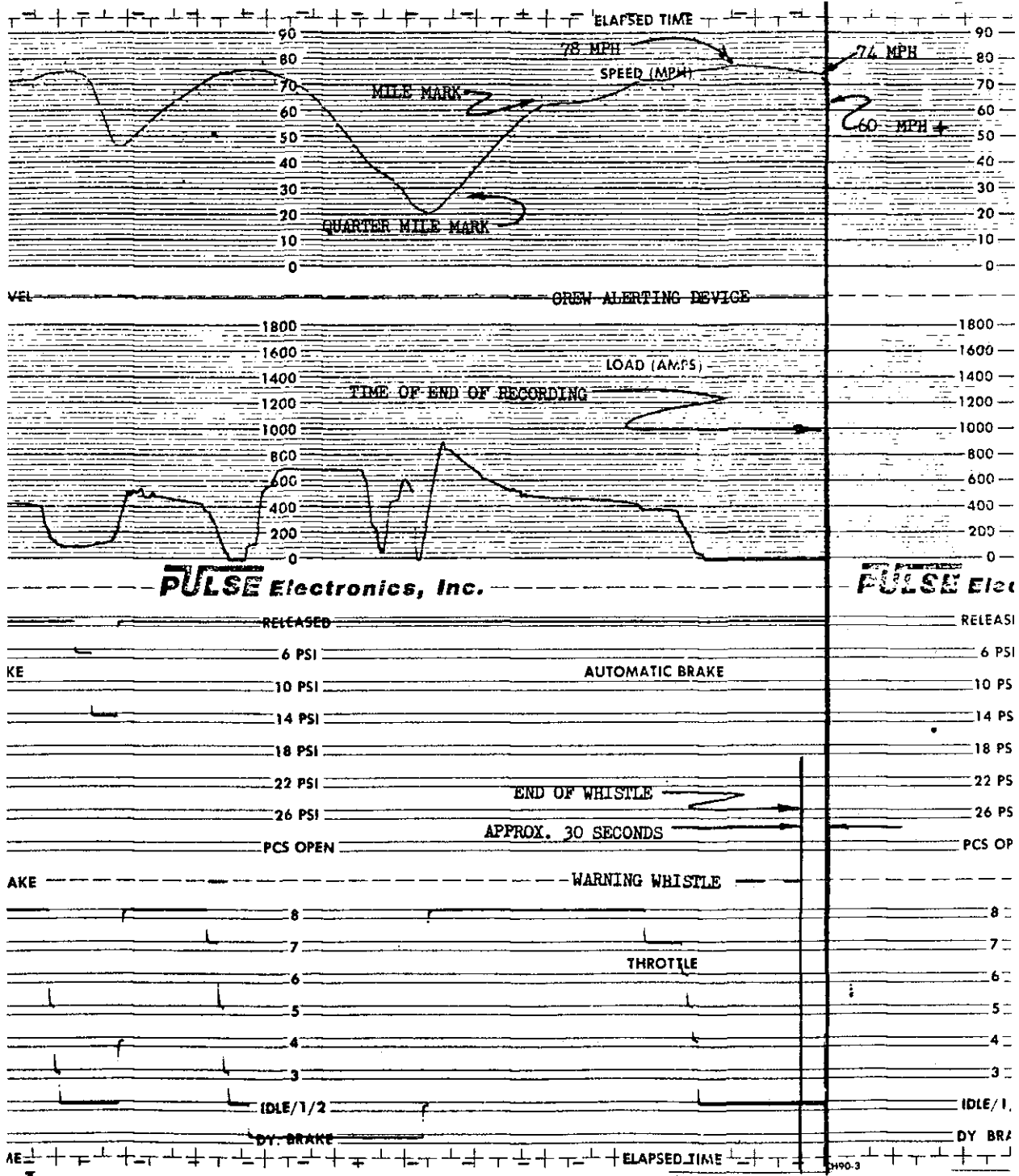
Signal Maintainer

Leo R. Farlin, 42, was first employed by the CB&Q as a signal-helper on October 19, 1964. He was promoted to signaller on August 26, 1965, and to signal maintainer on December 1, 1981. He was last examined on BN operating rules and maintenance rules on February 5, 1981. He passed a company physical examination on August 22, 1980.

Operator (Pacific Junction, 4 p.m., June 14, 1982, to 12 a.m., June 15, 1982)

Lyle E. Myers, 45, was first employed by the CB&Q as an agent-operator on April 4, 1958. He was last examined on BN operating rules on October 21, 1981. He passed a company physical examination on April 4, 1975.

APPENDIX C EVENT RECORDER PLAYBACK



APPENDIX D

METEOROLOGICAL INFORMATION

The following are summaries of the weather warnings and bulletins issued by the National Weather Service Forecast Office, Omaha, Nebraska, during the evening of June 14, 1982, and early morning of June 15, 1982.

Time of Issue: 2125 until 0100
Type of Warning: Flash flood warnings
Area Affected: Saunders, Sarpy, Lancaster, and Cass Counties, Nebraska
Summary: 3 to 4 feet of water over highway 77 near Ceresco in Saunders County. Flooding reported around Agnew in northern Lancaster County. Water reported covering the road at Springfield in Sarpy County.

Time of Issue: 2130
Type of Warning: Flash flood watch
Area Affected: East central and southwest Nebraska, south and east of a line from Blair, Nebraska, to Hastings, Nebraska
Summary: Heavy rains and thunderstorms in central and eastern Nebraska tonight are moving southeast and may cause many of the streams in eastern and southeast Nebraska to swell to bankful. This may result in localized but intense flash flooding.

Time of Issue: 2140
Type of Warning: Tornado watch until midnight; flash flood watch
Area Affected: Omaha, Council Bluffs, and vicinity
Summary: Local forecast including notice of tornado watch and flash flood watch.

Time of Issue: 2150 until 2235
Type of Warning: Severe thunderstorm warning
Area Affected: Mills County, Iowa
Summary: Radar indicates a severe thunderstorm in western Mills County moving east at 30 mph. Winds estimated to 55 mph reported by a react spotter south of Bellevue, Nebraska.

Time of Issue: 2230
Type of Warning: Flash flood watch
Area Affected: Southwest corner of Iowa
Summary: Heavy rains have occurred over portions of southwest Nebraska and extreme southwest Iowa this Monday evening. Around 3 inches of rain was reported in Mills County and still raining. The storms producing these rains are progressing slowly eastward into southwest Iowa.

Time of Issue: 2240 until 2340
Type of Warning: Severe thunderstorm warning
Area Affected: Mills and Montgomery Counties, Iowa
Summary: At 2240 a severe thunderstorm was indicated by radar in eastern Mills County, Iowa, moving east at 30 mph. High winds with this storm blew a truck off the road east of Glenwood, Iowa. Considerable wind damage has also been reported to farm buildings at Strahan, Iowa.

Time of Issue: 2330
Type of Warning: Flood statement
Area Affected: Central and eastern Nebraska and western Iowa
Summary: A general summary of forecast and observed flooding which included the following statement: In Iowa heavy rain has also occurred along the West Nishnabotna River in Mills and Fremont Counties. Sharp rises are expected and there may be flooding by early Tuesday morning in lowland areas.

Time of Issue: 2335 until 0035
Type of Warning: Severe thunderstorm warning
Area Affected: Montgomery, Fremont, and Page Counties, Iowa
Summary: At 1135 a severe thunderstorm was indicated by radar from Emerson to north of Sidney, Iowa, moving east at 30 m.p.h. High winds with this storm damaged trees of Malvern, Iowa. Heavy rains with urban and lowland flooding are also possible with this storm.

Time of Issue: 0000
Type of Warning: Severe thunderstorm watch and flash flood watch
Area Affected: State of Nebraska
Summary: Updated State forecast including statement that a severe thunderstorm watch and a flash flood watch are in effect until 0600.

Time of Issue: 0000 until 0300
Type of Warning: Flash flood warning
Area Affected: Mills County, Iowa
Summary: Flash flooding was reported along Silver Creek at Malvern, Iowa in Mills County at 2350. Sheriff was reported evacuating some people.

Time of Issue: 0040 until 0600
Type of Warning: Severe thunderstorm watch
Area Affected: Southeast corner of Nebraska and southwest Iowa
Summary: At 0035 radar indicated a line of very heavy thunderstorms from southwest Adair County in Iowa through Red Oak to northeast Fremont County. These storms are moving east-northeast at 20 to 25 mph.

Time of Issue: 0055 until 0500
Type of Warning: Flood warning
Area Affected: Saunders, Douglas, Sarpy, Cass, Otoe, and Lancaster Counties, Nebraska, and Pottawattamie, Mills, Fremont, and Montgomery Counties, Iowa
Summary: Flooding of small creeks and streams along with urban flooding has been reported in these counties from excessive rainfall. Residents should take immediate precautions as required. Do not attempt to cross swiftly flowing water by auto or foot. Rainfall of 3 to 5 inches has occurred in sections of these counties. Some reports of flooding include Big Papillion Creek at Papillion, Nebraska, 2 feet over flood stage; Wahoo Creek at Ithaca, Nebraska; Weeping Water Creek at Union and Nehawka, Nebraska; Salt Creek flooding at Greenwood, Nebraska; flooding in Lancaster County including Oak Creek; flooding in Syracuse, Nebraska; and flooding along Silver Creek and Keg Creek in Mills County, Iowa.