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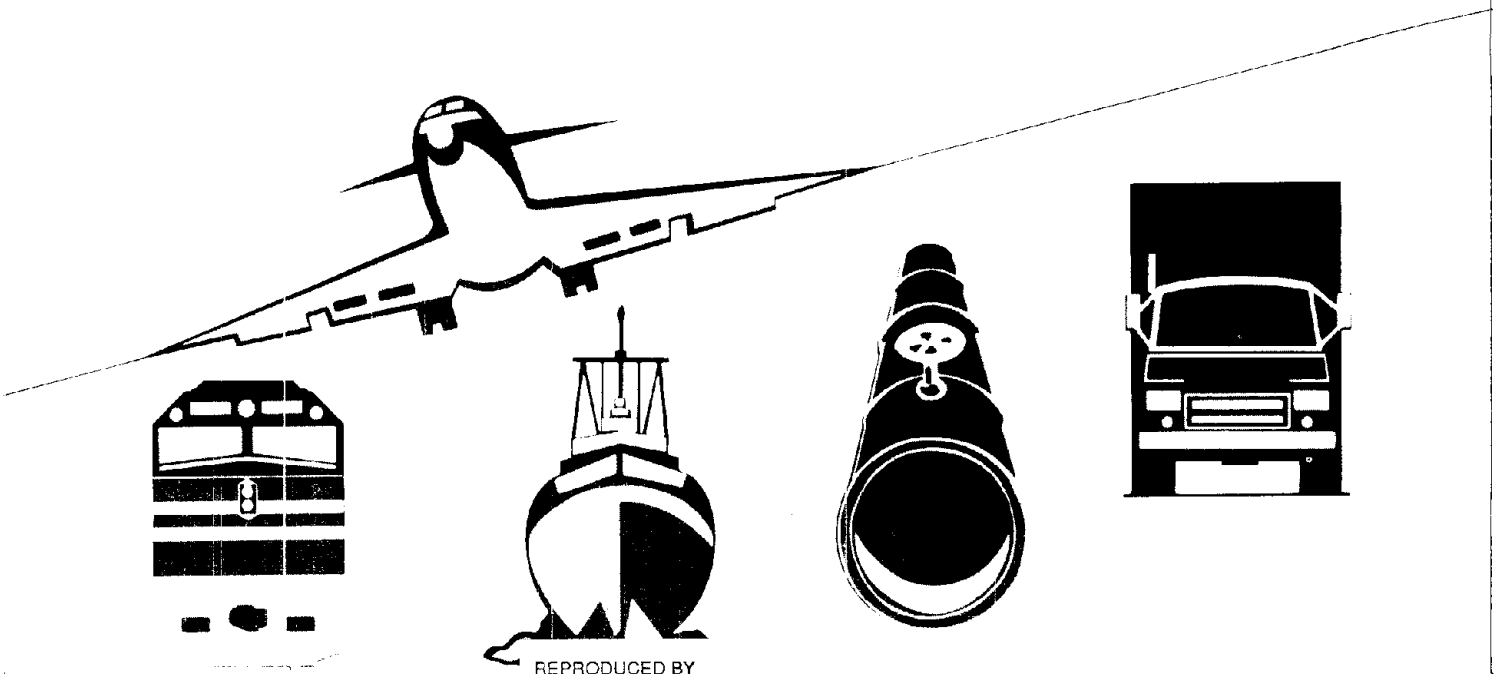
NATIONAL TRANSPORTATION SAFETY BOARD

RAILROAD/HIGHWAY ACCIDENT REPORT

CONSOLIDATED RAIL CORPORATION TRAIN COLLISION WITH ISLAND TRANSPORTATION CORPORATION TRUCK ROOSEVELT AVENUE GRADE CROSSING NEAR LAFAYETTE STREET CARTERET, NEW JERSEY DECEMBER 6, 1988



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16. Abstract

This report explains the collision of a train and a truck at a grade crossing. The safety issues discussed are the truckdriver's failure to stop, flagging protection, warning devices, operating rule compliance, toxicological testing, hazardous materials truck operations, and crossing maintenance.

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EXECUTIVE SUMMARY

At 6:20 a.m. on December 6, 1988, a tractor-semitrailer combination operated by Island Transportation Corporation (Island) and loaded with 8,800 gallons of gasoline collided with a Consolidated Rail Corporation (Conrail) train at the Roosevelt Avenue grade crossing near Lafayette Street in Carteret, New Jersey. The truck overturned and caught fire.

The truckdriver died - - no other persons were injured. The tractor-semitrailer, a pickup truck, and two houses southwest of the crossing were destroyed in the fire. At least three other unoccupied vehicles, other buildings, one locomotive, and several vehicles parked nearby were damaged.

The National Transportation Safety Board determines that the probable cause of this accident was the conductor's failure to flag the crossing and the truckdriver's failure to stop his vehicle between 15 and 50 feet of the grade crossing as required. Contributing to the accident was the failure of the engineer to set the headlight of the locomotive facing the crossing on bright.

The safety issues discussed in this report include:

- o whether the truckdriver failed to stop his vehicle and determine that it was safe before proceeding over the crossing;
- o whether a member of the traincrew provided flagging protection at the crossing as required by the railroad's timetable special instruction;
- o whether the engineer failed to sound the train's bell and whistle, and whether the engineer failed to set the headlight of the locomotive facing the crossing on bright, as the train approached the crossing.
- o Conrail's failure to test traincrew compliance with operating rule or timetable special instructions regarding protection at grade crossings;
- o deficiencies in the Federal rule regarding toxicological testing of traincrews involved in grade crossing accidents;
- o deficiencies in the Federal rule which permits hazardous materials trucks to proceed over a grade crossing if the crossing is used "exclusively for industrial switching purposes;" and

- the lack of New Jersey Department of Transportation (NJDOT) procedures to notify local jurisdictions responsible for the maintenance of grade crossing signs and pavement markings of deficiencies found during NJDOT grade crossing inspections.

As a result of its investigation, the Safety Board issued safety improvement recommendations to Conrail, the NJDOT, the Federal Railroad and the Research and Special Programs Administrations of the U. S. Department of Transportation, and the National Tank Truck Carriers, Inc., of the American Trucking Associations.

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD/HIGHWAY ACCIDENT REPORT

CONSOLIDATED RAIL CORPORATION TRAIN COLLISION WITH ISLAND TRANSPORTATION CORPORATION TRUCK ROOSEVELT AVENUE GRADE CROSSING NEAR LAFAYETTE STREET CARTERET, NEW JERSEY DECEMBER 6, 1988

INVESTIGATION

Events Preceding the Accident

Traincrew Activities.--At 10:30 p.m. the evening of December 5, 1988, three members of a Consolidated Rail Corporation (Conrail) traincrew, a conductor, an engineer, and a brakeman, reported for duty at Conrail's Port Reading, New Jersey, yard. After they received their work assignment, they took their train to the Carteret, New Jersey, area to begin delivering and picking up freight cars. The traincrew spotted freight cars near a plant south of Roosevelt Avenue in Carteret for later delivery, then operated the train over Roosevelt Avenue and delivered and picked up freight cars at plants located north of there.

After completing their work north of Roosevelt Avenue, the traincrew could not finish their work assignment until about 7:00 a.m. when the plant near where they had spotted freight cars south of the Roosevelt Avenue crossing opened, so the traincrew decided to eat. At that time the train consisted of two locomotives which were configured with the crew compartment of the northern locomotive, No. 8142, facing north, and the crew compartment of the southern locomotive, No. 2266, facing south.

About 4:20 a.m. the engineer stopped the two locomotives with the south end of locomotive 2266 located about 180 feet north of the Roosevelt Avenue crossing in Carteret. The engineer and the conductor reported they got off the train and entered the Food, Machinery and Chemical Corporation (FMC) plant near the tracks to buy food. The brakeman remained in the cab of locomotive 8142.

While in the FMC plant, the engineer found he could not get enough change to buy all his food from the vending machines located there. The conductor and the engineer stated they decided to go north to the Lafayette Street grade crossing and buy the rest of their food from a coffee truck which usually arrived near that crossing about 6:00 a.m. each day.

About 5:30 a.m. the conductor and the engineer returned to the train. The engineer got on locomotive 8142 and the conductor got on locomotive 2266. The engineer then operated the train north to the south side of the railroad grade crossing at Lafayette Street, where the traincrew waited for the coffee truck. After the coffee truck arrived, the brakeman reported he entered Lafayette Street on foot and determined that it was safe to proceed ("flagged the crossing") and the engineer then operated the train north across Lafayette Street and stopped near the coffee truck.

The engineer and the brakeman stated they got off locomotive 8142 and bought coffee for themselves and the conductor, who remained in the cab of locomotive 2266. The brakeman boarded locomotive 8142 while the engineer delivered coffee to the conductor who he said was seated in the engineer's seat in locomotive 2266. The engineer then returned to the cab of locomotive 8142.

The traincrew next intended to move the train south over the Lafayette Street and Roosevelt Avenue crossings, pick up the freight cars which they had spotted earlier in their shift, and deliver these cars to a consignee whose plant was located south of Roosevelt Avenue. The engineer stated that when he re-entered the cab of locomotive 8142 in preparation to move the train south, he switched the headlight selector switch so that the headlight on the south end of locomotive 2266 was set on bright.

The conductor stated he then got down from the cab of locomotive 2266, entered Lafayette Street on foot, flagged the crossing, and radioed the engineer that it was safe to proceed. As the train began to move south over the Lafayette Street crossing, the conductor stated he boarded the west steps of the south end of locomotive 2266 when the steps were about in the center of Lafayette Street. He stated he rode on these steps all the way to the Roosevelt Avenue crossing.

The conductor and the brakeman stated they could not recall if the headlight on the south end of locomotive 2266 was set on bright or dim as the train moved south toward Roosevelt Avenue. The conductor could not recall if the bell was ringing, but both the engineer and the brakeman reported that it was. The conductor reported that the train did not sound its whistle as it approached the Roosevelt Avenue crossing.

The engineer and the brakeman reported that they heard the conductor radio to stop the train as it approached Roosevelt Avenue. The conductor reported that the engineer stopped the train so that the south end of locomotive 2266 was at the crossing about even with the north curb line of Roosevelt Avenue.

The brakeman stated he was riding in the crew compartment on the west side of locomotive 8142. The first time he was

interviewed by the Safety Board, the brakeman said that when the train arrived at the Roosevelt Avenue crossing the conductor crossed over to the west side of locomotive 2266 before he entered the Roosevelt Avenue crossing to flag it. Later under oath the brakeman testified that after the train crossed Lafayette Street he saw the conductor riding on the south steps on the west side of locomotive 2266 as the train approached Roosevelt Avenue, and that the conductor got off these steps and entered the crossing.

Conrail's road foreman reported that when he interviewed the conductor about 7:30 a.m. the morning of the accident the conductor had stated to him that he was in the crossing, had seen no traffic either east or west of the crossing, and had already told the engineer "Okay on the crossing" when he again looked to the east and first saw a truck approaching. The day after the accident and later under oath the conductor stated to the Safety Board that he first saw a truck approaching from the east as he was getting off the steps of locomotive 2266.

The conductor stated to the Safety Board that the truck had its lights on and that it was about 425 feet away traveling toward him up the hill when he first saw it. He reported that he then walked about six or seven feet into the westbound lane of Roosevelt Avenue with his electric lantern in his left hand to flag the crossing.

He stated to the Safety Board that after he entered the roadway he looked west, east, then west again, saw no traffic approaching from the west, and then waved his lantern to the east at the approaching truck. Thinking that the truck was going to stop and that he had time to bring the train safely over the crossing, he radioed the engineer that it was "Okay in the crossing." Both the brakeman and the engineer stated they heard this radio transmission. The conductor stated that an automobile passed east over the crossing seconds before he brought the train ahead.

The conductor stated that as the train began to move south, he again saw the truck when it was about 10 to 20 feet away and was making a swerve to its left. He estimated that about two or three seconds after he radioed the crossing was clear he then radioed the engineer to stop the train. The engineer estimated that about six to eight seconds elapsed between the time the conductor radioed to proceed and the time he radioed to stop the train.

The conductor stated that several seconds later he radioed the engineer to pull north fast. He stated he then panicked because he saw a collision was imminent, and ran north along the west side of the train away from the crossing. He reported that he heard but did not see the collision. (See figure 1.)

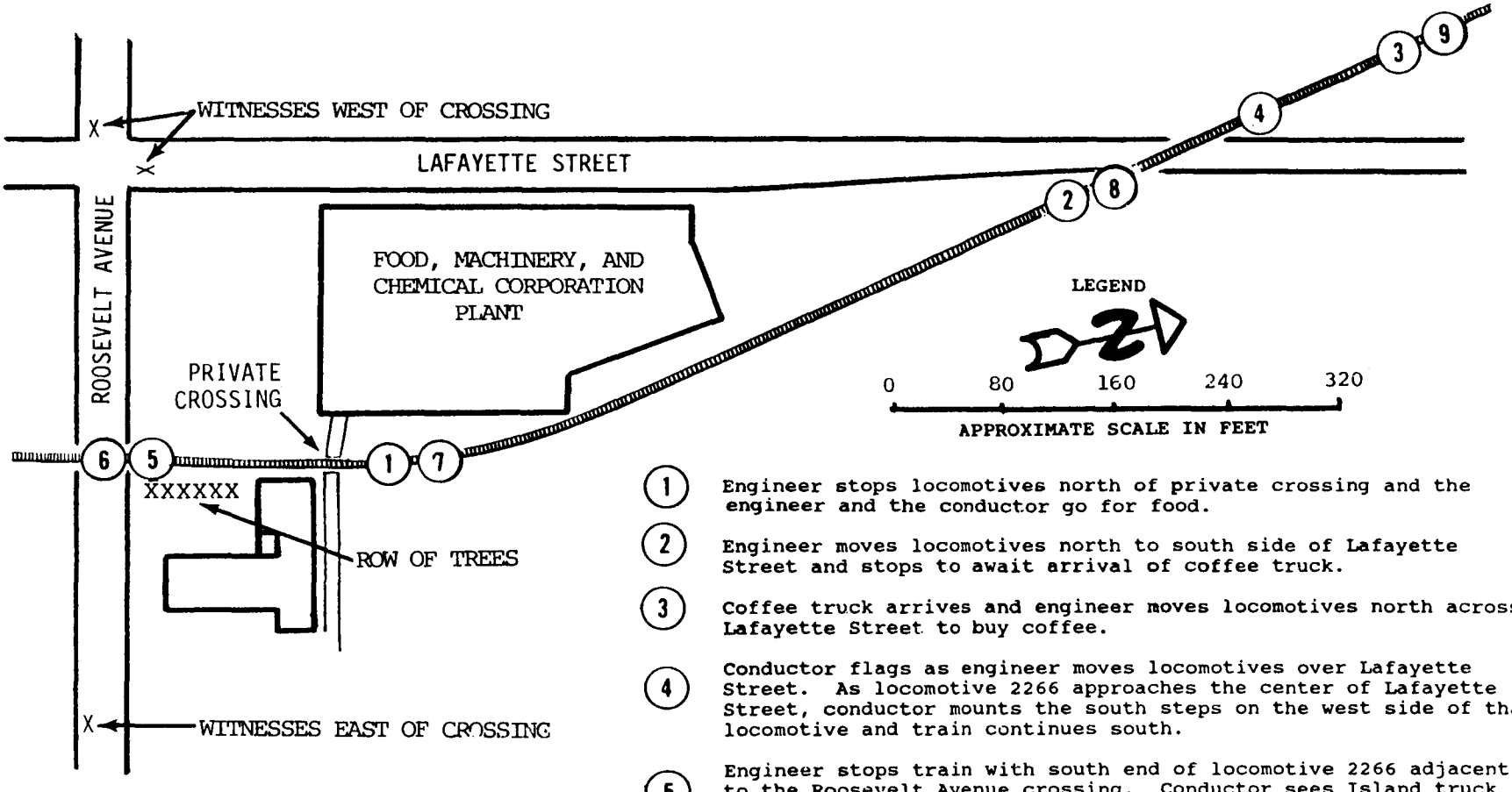


Figure 1.--Train movements reported by the traincrew.

Other Witnesses.--Events preceding the accident as reported by the traincrew differed from events as reported by other witnesses. Two truckdrivers who stated they were stopped in their vehicles at the intersection of Roosevelt Avenue and Lafayette Street about 220 feet west of the crossing stated that they saw a truck with its headlights illuminated approaching them from the east.

It appeared to them that the truck was loaded and was traveling up the grade approaching the crossing in second or third gear. Although there was no communication between them, they each decided as a courtesy to let the truck pass by them before making their respective turns at the intersection.

One of the truckdrivers was on Roosevelt Avenue with his truck's headlights illuminated facing east toward the crossing. He reported he saw an automobile traveling eastbound with two occupants visible to him approach and then cross the tracks ahead of him about five to ten seconds before the collision. It appeared to him that the automobile driver saw the approaching train and accelerated across the tracks.

The truckdriver whose truck was facing east stated that the headlight of the locomotive which was facing south was not illuminated but he could see a beam from the headlight on the northern locomotive shining north as the train was traveling south toward the crossing. He estimated the truck and the train speeds at about 10 to 15 mph as each entered the crossing. The truckdriver whose truck was facing south could not state whether the headlight of the locomotive facing south was illuminated, but if so, it was "extremely dim because it didn't light up the road ahead of it."

Both truckdrivers stated that they had their windows open in their respective vehicles. One reported he could hear the sound of the train's engine and the other reported he could hear the sound of the train as it was traveling on the tracks. He also reported that he could hear the sound of the truck's engine as it was approaching the crossing. The other truckdriver could not recall hearing the truck's engine.

Both truckdrivers stated they did not hear a whistle or bell sound as the train approached the crossing. Although in their opinion there was enough light at the crossing that they would have been able to see someone on foot, they did not see anyone on foot on or near the crossing.

They also stated that the truck slowed as it approached the crossing. One reported that it sounded as if the approaching truckdriver had taken his foot off the accelerator for a short period before the truck reached the tracks and then re-applied it and began to cross the tracks without stopping. The other reported that the truck made a "rolling stop" before entering the

crossing. Both reported that the train did not stop or slow down before entering the crossing.

As an automobile traveling eastbound on Roosevelt Avenue approached the crossing with its headlights illuminated, the passenger told the driver that a train was approaching the crossing. When the automobile crossed the tracks at a speed the driver estimated to be about 30 to 35 mph, the two occupants saw the truck approaching the crossing from the east and the train approaching the crossing from the north. They saw no one on the train or on foot near the crossing.

The automobile driver stated he would have stopped before going over the crossing if someone had been standing there, and that he had traveled over this crossing each work day for the past five years at about the same time. The day of the accident was the first time he had seen a train at the crossing.

Both automobile occupants stated that the truck's headlights were illuminated and that the locomotive had one "small" light illuminated on the front. The driver said he did not believe the small light he saw on the train was the headlight, but when he was shown a photograph of the front of locomotive 2266 he identified the "small" light as the headlight.

The passenger stated that he told the driver, "I think that train is going to hit the truck." The driver stated that he first slowed and then stopped his automobile about 100 to 150 feet east of the crossing, and looked back toward the crossing in his rear-view mirror. The passenger stated he turned in his seat and also looked back. It did not appear to them that the truck stopped or slowed down before entering the crossing.

According to Conrail, an occupant of a house at the southwest corner of the crossing stated to Conrail investigators the day after the accident that he heard the train screeching its brakes, and he looked out his window and saw the truck trying to come around the train. He further stated, "He (the truck) was coming up at a fast speed, I'm not exactly sure how much speed he was going, but I know he was trying to beat the train because he had no option but to try to beat it because if he would have slammed his brakes he would have got clipped, hit anyway. So he tried to come around them and that's when the train hit him."

When this person was interviewed by the Safety Board, he stated that during the interview with Conrail investigators he was shaken up and was not sure what he said. He stated to the Safety Board that he did not see the collision.

Two residents on the second floor of an apartment house about 80 feet west and overlooking the crossing reported that they were awake at the time of the accident with their windows open, and that they heard no bells or other warning sounds from

the train prior to the collision. They said that in the past they had witnessed trains cross Roosevelt Avenue without a flagman first entering the crossing to flag traffic.

Truckdriver Activities.--On the morning of the accident the truckdriver left for work about 4:30 a.m. He arrived at Island Transportation Corporation's (Island) terminal in Port Reading about 5:15 a.m. The Island dispatcher on duty reported he was in a good mood, that he joked with the dispatcher before leaving the terminal, and that nothing seemed unusual about his behavior.

According to shipping documents, the truckdriver loaded the accident shipment of 8,800 gallons of gasoline at the Shell Oil Company tank farm in Sewaren, New Jersey, between 5:46 a.m. and 5:59 a.m. The accident occurred about 20 minutes later.

The Accident

About 6:20 a.m. on December 6, 1988, the westbound Island tractor-semitrailer and the train collided at the Roosevelt Avenue grade crossing. The train did not derail.

The truckdrivers west of the crossing both stated that the truck was in the westbound lane of Roosevelt Avenue at the time of the collision. One stated that the truck did not appear to take any evasive action. The other said that the truck had just started to make an evasive maneuver to its left when the collision occurred.

They stated that the train contacted the truck somewhere between the front and the center of the Island semitrailer and that the force of the collision first pushed the truck to its left and then picked the truck up in the air "like a missile." The truck then did a half roll and slammed down onto the street. The occupants in the automobile east of the crossing stated that when the truck was struck by the train the truck tipped over "like slow motion."

The driver of the automobile who was stopped east of the crossing got out of his vehicle after he witnessed the collision. He estimated that 8 to 10 seconds elapsed from the time he crossed the tracks to the time he got out of his car.

The brakeman on locomotive 8142 reported that he saw the front of the truck when it flipped over in a north-to-south direction. The conductor stated that the train may have been moving south at a crawl when the collision occurred. The engineer believed that the locomotives were stopped when contact was made with the truck and that he saw the truck roll over in a north-to-south direction. One truckdriver reported that it appeared to him that the truck rolled over in a south-to-north direction.

Both truckdrivers stated that during the rollover they could see the Island truckdriver fall out of his seat and get thrown about in the cab. They stated they then saw liquid leaking from the overturned Island semitrailer. The witnesses both east and west of the crossing on Roosevelt Avenue stated that after the rollover the train then continued to travel south across Roosevelt Avenue, pushing the overturned truck ahead of it.

After the collision the Island truck came to rest overturned in the eastbound lane of Roosevelt Avenue lying generally in an east-west direction across the railroad tracks. The part of the semitrailer resting over the tracks was between 15 and 21 feet from the front of the semitrailer and about 27 feet south of the north curbline of Roosevelt Avenue. (See figure 2.)

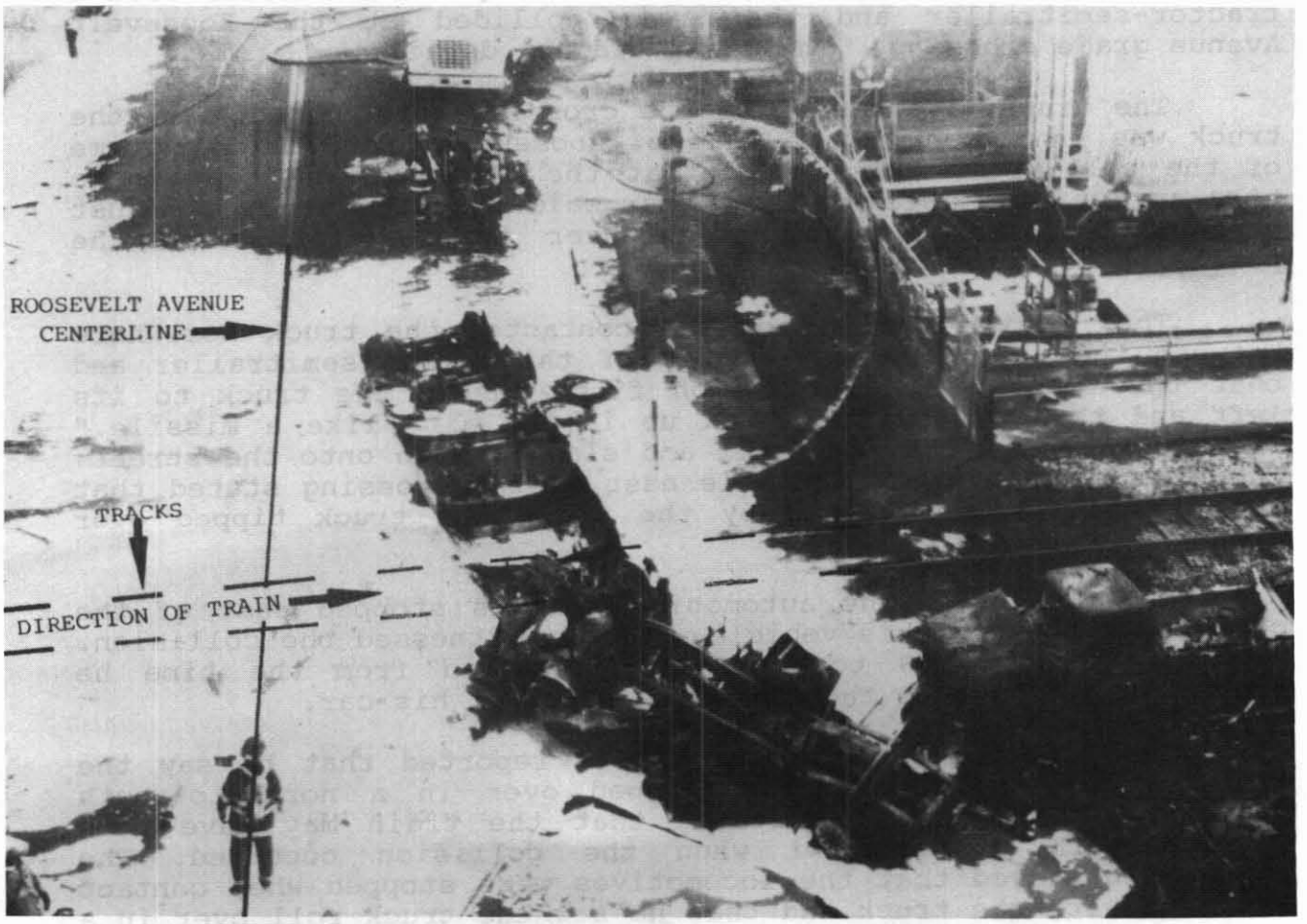


Figure 2.--Final rest position of the Island truck.
(Photo courtesy of the Carteret Police Department)

The truckdrivers west of the crossing saw liquid begin to leak from the overturned semitrailer. The truckdriver who was stopped facing east stated he then left his truck and began to run toward the overturned Island truck. As he was running toward the crossing, he heard the engines of the locomotives "rev up" and he then saw the train separate from the overturned truck and begin backing north.

He stated that when he was about 55 feet west of the grade crossing the leaking liquid ignited and "exploded." The force of this ignition knocked him back and to the ground.

The other truckdriver reported that he did not see the truckdriver knocked down in the street. He thought the fire broke out before the train began to back away from the truck.

The fire engulfed the truck and the south end of locomotive 2266. After the gasoline caught fire, the truckdriver who had been running toward the crossing described the crossing area as being lit up like it was daylight. He thought, but was not certain, that he saw three persons in the cab of the northern locomotive. He did not see anyone in the cab of the southern locomotive.

The conductor stated that as he was running north away from the crossing he looked back and saw the flames. After the train passed him traveling north, he crossed over to the east side of the tracks. The brakeman stated that as the train was backing north after the fire broke out he got off locomotive 8142 about 125 feet north of the crossing and ran from the scene.

The fire spread to the front of two houses located southwest of the crossing, and the 16 occupants of these two houses escaped through the rear doors with no serious injuries. The truckdriver sustained fatal injuries. The three members of the traincrew were not injured.

The truck was destroyed in the collision and fire and the front of locomotive 2266 was damaged. The two houses southwest of the crossing and a pickup truck parked between the tracks and the houses were destroyed in the fire. (See figure 3.) A third house west of the crossing was damaged. At least three other unoccupied vehicles, other buildings, electrical utility poles and light fixtures in the vicinity of the crossing were destroyed or damaged. The accident resulted in an estimated $250,000 property damage.

Emergency Response

After the engineer reversed direction and operated the locomotives north away from the truck, he stopped the locomotives at a point he estimated to be about 260 feet north of the crossing. He shut down locomotive 2266 and used fire



Figure 3.--Left side of Island semitrailer with house destroyed by fire in background. (Photo courtesy of the News-Tribune.)

extinguishers from the locomotives to extinguish the fire on that locomotive. The engine on locomotive 8142 began to run erratically and then stopped.

At 6:20 a.m. an unidentified person telephoned the Carteret Police Department (CPD) and reported the accident. Radio notification of an emergency is routinely given to Carteret emergency response personnel by transmitting two radio frequency tones followed by a verbal message. The dispatcher on duty had transmitted the two tones and was about to transmit the verbal message notifying of the nature and location of the accident when electrical power at the CPD was disrupted, rendering the radio inoperative. Telephone service to the CPD also was lost at about the same time.

After hearing the two tones with no follow-up message, firemen began calling each other by telephone and battery-powered hand-held radios and learned of the fire. Some firemen who lived

in the area also reported they saw the glow from the fire in the sky and responded to the scene.

The fire at the accident site had destroyed overhead wires, which caused the disruption of the electrical and telephone service to the CPD. A back-up generator that was intended to supply power for the radio and lights at the CPD in case of such a disruption was out of service for routine maintenance. CPD personnel obtained another generator from a local business and electrical power was restored within 20 minutes of the outage.

The first two fire engines to arrive on scene were privately employed by a petrochemical plant located near the crossing. Firemen on duty at the plant observed the fire and arrived in about one minute. At 6:22 a.m. the first Carteret fire engine arrived on scene, and a second Carteret fire engine arrived three minutes later. The chief of the Carteret Volunteer Fire Department was on his way to work when he saw the smoke from the fire. He arrived on scene at 6:32 a.m. and assumed command of the emergency response.

About 23 minutes later, as the fire began to spread north, emergency response officials who had arrived at the scene then requested that the two locomotives be moved farther north out of danger. A representative of the Carteret Fire Department reported that at the time this request was made the south end of locomotive 2266 was about 164 feet north of the north curb of Roosevelt Avenue. The engineer re-started the engine of locomotive 8142 with the help of the conductor and operated the train north. The engineer stated the conductor flagged the train across Lafayette Street and the engineer then shut locomotive 8142 down. (See figure 1.)

A total of 15 fire engines and 21 other vehicles (quick response, ambulances, and hazardous materials incident response vehicles) responded to the scene from Carteret, Woodbridge Township, Perth Amboy, and three local fire companies from private industrial plants located near the crossing.

Six of the fire engines were actually used to extinguish the fires. The truck and house fires were declared under control at 7:23 a.m. and at 10:30 a.m., respectively.

Meteorological Information

At the time of the accident, surface observations by the National Weather Service at Newark, New Jersey, about ten miles north of the accident site, were partly cloudy skies, 15 miles visibility, a temperature of 32 degrees F, winds south to southwest at 8 mph, and barometric pressure of 30.15" Hg. Observation by Safety Board investigators at the accident site two days after the accident, at the same time of day and under similar visibility conditions, indicated the eastern sky was lit

by the rising sun but the area where the accident occurred was still dark.

Traincrew Information

All three members of the accident traincrew had worked the Carteret assignment the week before the accident occurred. Before reporting for duty at 10:30 p.m. on December 5, the traincrew had been off duty since 6:00 a.m. on Saturday, December 3. The trainmaster on duty when the traincrew reported for work on December 5 said that he talked briefly with them before they began their work assignment, and "all seemed normal."

Brakeman.--The 45-year-old brakeman was hired by the railroad on March 26, 1969. He attended and passed his last operating rules and air brake instruction class on April 18, 1988, and passed his last medical examination on March 28, 1988.

He held a valid New Jersey driver's license. His driving record indicated that he had been convicted of one speeding violation which had occurred on August 4, 1986, and he had been involved in one accident for which he was not assessed points against his driving record.

After getting off work on Saturday morning, he went home, slept until about 11:00 a.m., and went bowling in the evening. He went to bed about 11:00 p.m. On Sunday he got up about 8:00 a.m., ate breakfast, went bowling in the morning, ate supper about 7:00 p.m., watched a football game on television in the evening, and went to bed about midnight.

On Monday he got up about 9:00 a.m., ran some errands, and ate supper about 6:00 p.m. After supper he napped until about 9:30 p.m. when he got up to report for work. He did not eat again before reporting for work, but stated he brought fruit with him which he ate during his shift. He reported he enjoyed working at night, and that the workload the night of the accident was about the same as usual.

Engineer.--The 51-year-old engineer was hired by the Central of New Jersey Railroad (CNJ) in 1967 and was re-hired by the Penn Central Railroad on June 14, 1971. Both the Penn Central and the CNJ subsequently became part of the Conrail system. He was promoted to engineer on July 1, 1974. He attended and passed his last operating rules and air brake instruction class on June 12, 1988, and passed his last medical examination on March 10, 1988. He held a valid New Jersey driver's license, with no accidents or moving violation convictions.

The engineer spent a lot of his time at home, had much time for sleep, and stated he had grown accustomed to working at nights which he enjoyed during the summer months because it was

cool at night. In the winter he was "up on a warm engine." He had worked the Carteret assignment frequently and he reported that traffic over the Roosevelt Avenue crossing was usually light until about 5:30 a.m. "when the trucks started to roll."

After getting off work on Saturday morning, the engineer stopped for breakfast at a fast food restaurant, went home and watched television for several hours, and slept until about 2:30 p.m. Most of his remaining off-duty time Saturday evening and all day Sunday was spent relaxing at home and watching television. On Monday, December 5, he napped from about 6:00 p.m. to about 9:45 p.m., and left his house about 10:15 p.m. to go to work.

Conductor.--The 48-year-old conductor was hired by the CNJ on October 10, 1962. He was promoted to conductor on April 16, 1974. He attended and passed his last operating rules and air brake instruction class on April 17, 1988, and passed his last medical examination on July 5, 1988. He held a valid New Jersey driver's license, with no accidents or moving violation convictions.

He reported that he had worked the Carteret assignment off and on for the past several years. It was his belief that trains went over the accident crossing only at night unless some special job was scheduled. He reported that there was no highway traffic at all when the train crossed Roosevelt Avenue about 1:20 a.m. the morning of the accident.

Although he stated that he had not previously been involved in any grade crossing accidents, the conductor stated that in the past five years he had been involved in several railroad derailment accidents, including one that occurred several weeks before the accident at Carteret. When the derailment occurred, he provided the railroad with blood and urine samples for toxicological testing. These tests were negative for alcohol and illicit drugs.

He stated that he liked working night shifts, preferring them to day shifts because he slept better during the day when no one else was around his house, and because "at night there's not that many bosses around . . . they can't interfere with your moves." The trainmaster on duty at the time the conductor reported for work the night of the accident praised the conductor as an employee who "makes moves that save time" and who "sees the big picture and breaks it down . . . and minimizes moves."

The conductor stated that on Friday, December 2, he arrived at work about 10:30 p.m. and worked until 6:00 a.m. Saturday morning. After getting off work on Saturday, he slept, went shopping, and went to bed about 9 or 10:00 p.m. On Sunday he awoke about 6:30 a.m., watched a football game in the afternoon,

and helped his wife cook dinner. He watched another football game and a movie in the evening, and went to bed about 10:00 p.m.

On Monday, December 5, he stated he awoke about 7:00 a.m., showered, ran errands, and spent the afternoon at home. He ate dinner about 5 or 5:30 p.m.

When he was first interviewed by the Safety Board, he stated that after dinner he went to a club, played racketball, returned home, ate some fruit, and then left for work about 9:45 p.m. Later he testified under oath that he took a 3-hour nap before he went to play racketball.

He stated that he reported for work on time at 10:30 p.m. At the time of the accident, he was wearing dark coveralls and a dark blue hooded parka.

Train Information

The train was identified as Conrail YJPR-60, a local. Both locomotives were painted a non-reflective blue with a contrasting white reflective Conrail logo and lettering on the sides and front, were equipped with dual sealed-beam headlights and marker lights, a locomotive horn (whistle), and a bell.

Conrail reported that, if the accident train was being operated from the cab of locomotive 8142, only the bell on that locomotive would sound if activated by the engineer. Conrail also advised that it was possible for the accident train to have the headlights on both ends of the train set on either bright or dim at the same time.

Locomotive 8142 is a 2,000-horsepower model GP 38-2 diesel-electric locomotive manufactured by the Electromotive Division of the General Motors Company in March 1973. It is a four-axle drive locomotive that is 59 feet 2 inches long between the coupler pulling faces, is 10 feet 3 inches wide, and weighs 264,000 pounds. At the time of the accident, it was being operated with the cab containing the controls (head end) of the locomotive at the north end of the train. There was no reported damage to this locomotive.

Locomotive 2266, the locomotive that made contact with the truck, was operated over the accident crossing with the head end at the south end of the train. No. 2266 is a 2,500-horsepower model GP 35 diesel-electric locomotive manufactured by the Electromotive Division of the General Motors Company in May 1964. It is a four-axle drive locomotive that is 56 feet 2 inches long between the coupler pulling faces, is 10 feet wide, and weighs 261,510 pounds.

Inspection after the accident indicated that contact damage to locomotive 2266 was confined to the left four feet at the

front and included damage to the left front stanchion and handrail which was displaced to its right and rearward about 1 1/2 feet at the top of the rail. The electrical multiple unit receptacle at the bottom of the stanchion was also damaged, as was the latch at the middle of the stanchion and the air brake pipe support bracket adjacent to the coupler draft gear.

The coupler sustained no remarkable damage other than some external scorching. The paint on both sides of No. 2266 at the head end was discolored due to obvious flame and smoke damage but the paint was not blistered.

Conrail estimated that this locomotive sustained about $1500 damage. An inspection of the locomotives after the accident by both Conrail and the Federal Railroad Administration (FRA) failed to disclose any defects that may have caused or contributed to the accident.

As a result of its inspection, Conrail's Technical Services Laboratory (TSL) concluded in a preliminary report:

> The slight damage to the locomotive on both sides is noteworthy. The lack of coupler damage is also significant. These characteristics, along with the condition of the handrails, indicate that contact was made at an angle, as opposed to head-on. . . . The kind and location of locomotive damage indicates that, at impact, the tank truck formed an approximate 45-degree angle with the locomotive pilot plate. It is the understanding of the Laboratory that the tank truck rolled over prior to the collision due to evasive maneuvering by the driver. Most of the tank truck momentum was probably absorbed by friction as the truck slid over the road surface after capsizing. The locomotive was reported to have been traveling less than 5 mph. The slight physical locomotive damage confirms that the collision occurred at a relatively low speed. The facts and opinions are based on certain assumptions and are preliminary.

After additional investigation the TSL entered on its report:

> It appears (the) locomotive may have been stopped at impact. (The) tank truck maneuver may have drawn it back into (the) engine.

Event Recorder Information

Locomotive 2266 was not equipped with an event recorder.

Locomotive 8142 was equipped with an event recorder that was connected to the second set of drive wheels behind the head end of that locomotive. Based upon dimensional drawings of the locomotives submitted by Conrail, the distance from the event recorder wheel to the coupler pulling face at the south end of this locomotive was 42 feet 1 inch, and the total distance from the south coupler pulling face on locomotive 2266 to the event recorder wheel on locomotive 8142 was 98 feet 3 inches as the locomotives were configured at the time of the accident. Conrail reported that the event recorder on locomotive 8142 would not operate if the locomotive's engine was not running.

The event recorder in use on locomotive 8142 was not programmed to show the direction of travel (forward or reverse) of any movement the event recorder wheel made. The recorder measured elapsed time by continuously recording a constant, analog signal. In addition, the recorder measured distance traveled, within certain limits explained below, by placing a signal on a magnetic recording tape each time the event recorder wheel completed 1.60 wheel revolutions.

The accuracy of determinations of distances traveled by the event recorder wheel between each time the wheel stops is limited because the actual distance traveled by that wheel may be as much as 1.59 additional wheel revolutions at the beginning and ending of each wheel movement. The length of this distance is not recorded and this possible additional wheel travel can therefore result in an error in determining the distance traveled.

Conrail's division road foreman stated that when he arrived at the accident site the train was stopped north of Lafayette Street. He removed the event recorder's magnetic tape cartridge from locomotive 8142 at 7:36 a.m. the morning of the accident. After removal, he stated he marked the cartridge with the distance from the witness groove on the event recorder wheel to the outside edge of the wheel. He stated that after printing a stripchart of the data, a copy of which was supplied to the Safety Board on December 8, 1988, he kept custody of the original magnetic tape cartridge until he delivered it to the Safety Board on December 15, 1988.

Using the mark on the tape cartridge made by Conrail's road foreman, the Safety Board determined that the event recorder wheel circumference on locomotive 8142 was 119.8 inches. With an event recorder wheel circumference of 119.8 inches, the possible distance readout error mentioned above can be as much as (1.59 X 2 X 119.8) 383 inches, or about 32 feet.

The last 13 activities recorded on the tape supplied to the Safety Board by Conrail are listed below in chronological order. The last activity listed is the last one recorded before recording stopped. The distance in feet of each movement is expressed as a minimum and maximum to compensate for any

additional partial wheel revolutions that may not have been recorded. When the activity is listed as being "stopped," the speed at some point during the stop was zero and the event recorder wheel made less than 1.6 wheel revolutions during the times listed. The duration of each movement or period when "stopped" is expressed as time in minutes and seconds.

Activity (Stopped or Moving)	Distance (Feet) (Min.)	(Max.)	Time in Min. & Sec.	
1. Moving	1,533.44	1,565.44	2	8.2
2. Stopped	N/A		88	29.7
3. Moving	399.3	431.3	1	12.0
4. Stopped	N/A		14	13.9
5. Moving	287.5	319.5	0	44.5
6. Stopped	N/A		8	54.9
7. Moving	846.6	878.5	1	36.3
8. Stopped	N/A		0	8.6
9. Moving	16.0	47.9	0	12.3
10. Stopped	N/A		0	9.3
11. Moving	271.6	303.5	0	38.3
12. Stopped	N/A		Unknown	
13. Moving	814.6	846.6	2	11.5

Traincrew Communications

Although they reported that on other occasions they may have used visual signals, according to the traincrew, communications among them at the time of the accident was accomplished by means of a stationary Motorola type R43RTH two-way radio mounted in the cab of locomotive 8142 and used by the engineer, and two hand-held Motorola type HT-600 radios used by the brakeman and the conductor. After the accident, these radios were tested by Conrail and their transmission and reception capabilities were found to be clear, audible, and free from defects.

Track Information

Officials for Conrail advised that the types of tracks used in its system are designated in a hierarchy. The highest category of track, a "main" track, is one with an automatic signal system. Next lower is a "secondary," a track with a manual block system of signals. Next lower is a "running" track, which may or may not have signals on it. If a running track does not have signals, trains operating on it are required to operate at restricted speed. The lowest category are "yard" or "industrial" tracks, which are sidings that actually lead into shippers' and consignees' places of business.

The grade crossing where the accident occurred is located on Conrail's Reformatory Running Track at Roosevelt Avenue, in Conrail's Eastern Region, which at the time of the accident was

in Conrail's New Jersey Division. This crossing has existed for at least 85 years and, although Conrail owns the rail and track material through the crossing, the real estate at the crossing is owned by the Boro of Carteret.

The single running track through the crossing consists of two 100-pound/yard rails spiked to the ties through double-shoulder tie plates. The ties are resting in stone ballast.

The crossing at grade is 36 feet wide and is paved with asphaltic concrete. At the crossing, the generally north-south track is straight (tangent), crosses Roosevelt Avenue at a 90 degree angle, and is an average 1.34 percent downgrade for trains traveling south. Trains using the track at the accident site are required to operate at restricted speed (must be able to stop within one-half the range of vision) with a maximum speed of 10 mph. The track between the Lafayette Street and Roosevelt Avenue crossings is about 780 feet long. The track over the Lafayette Street crossing is about 53 feet long. (See figure 1.)

Railroad Method of Operation

At the time of the accident, trains using the Reformatory Running Track were required to be operated in accordance with Conrail's Timetable No. 1, Eastern Region, effective October 1, 1988, and rules of the Northeastern Operating Rules Advisory Committee (NORAC), effective September 1, 1988.

All Conrail operating employees are required to comply with the operating rules and timetable special instructions, and knowledge of these rules and instructions and compliance with them must be demonstrated before promotion can occur.

Sounding the Train's Whistle.--There was a railroad whistle post located about 328 feet north of the accident crossing on the west side of the tracks facing north. NORAC's Rule 14 provided that the engine whistle or horn signal must be sounded when approaching a public crossing at grade and at a whistle post, and that this signal is to be prolonged or repeated until the engine or train is on the crossing.

However, the conductor and the trainmaster on duty when the accident traincrew reported for duty stated that it was an established practice not to sound a train's whistle as it approached the Roosevelt Avenue crossing because of complaints from the Carteret police and local residents.

In addition, a representative of the United Transportation Union stated that "approximately 20 years ago," when he was a conductor on the same job as the traincrew on duty at the time of the accident, local residents complained about the train noise in the vicinity of the Roosevelt Avenue crossing. It was his recollection that the Boro of Carteret passed an ordinance

prohibiting trains from sounding their whistles as they approached the Roosevelt Avenue crossing from about 9:00 p.m. to 9:00 a.m.

Representatives of the Carteret Police Department (CPD) were unable to locate any record of such an ordinance, and they reported that at the time of the accident no such ordinance was in effect. The CPD also reported that, although it was possible there may have been some contact between a member of the CPD and a traincrew concerning sounding a train's whistle at the crossing, no record of any such contact existed.

Sounding the Train's Bell.--NORAC's Rule 30 provided:

> When equipped, the engine bell must be sounded when an engine is about to move, when running through tunnels, while approaching and passing public crossings at grade, when passing a train standing on an adjacent track and in an emergency.

Flagging Protection.--NORAC's Operating Rule 105 required:

> When an employee is required to provide protection at a highway crossing, he must use a red flag or fusees by day and fusees or a white light at night to give stop signals to pedestrian and highway traffic.

Timetable special instruction 105-2 specified that:

> On all Industrial, Yard and Industry Tracks on all Divisions the following instructions must be followed to provide protection: Approach all crossings protected by automatic protection prepared to stop and if protection fails to operate do not proceed until crew member provides protection. Crew member must provide protection at all crossings not protected by automatic protection.

Conrail officials advised that the track being used at the time of the accident is a "running" track, rather than an "industrial, yard, or industry track" as mentioned in the above special instruction. Therefore, special instruction 105-2 in effect at the time of the accident did not require the traincrew to flag the crossing over Lafayette Street, even though that crossing was not provided with automatic protection devices. Conrail subsequently changed its requirements and specified that a member of a traincrew must flag the Lafayette Street crossing.

Special instruction 105-5 specified that for Roosevelt Avenue where the accident occurred:

> Trains or engines must stop before passing over highway crossing and a member of crew must protect the crossing in advance of each movement.

The conductor stated that traincrew compliance with special instruction 105-5 required a crew member to enter the crossing, make sure there was no traffic coming, and then tell the engineer to proceed. According to the conductor, if traffic was approaching it was to be stopped before moving the train unless the traffic was far enough away that it was safe to move the train into the crossing.

The trainmaster on duty when the crew reported for work the evening before the accident stated that in order to be in compliance with the flagging rule in effect for the Roosevelt Avenue crossing, the train's movement would have to be stopped short of the crossing, a qualified member of the crew (not a trainee) must go out onto the crossing and position himself in the traveled portion of the roadway if there was traffic, and flag the traffic until the crewmember had an indication that the traffic was being controlled and that the oncoming vehicle was going to stop. An indication that an approaching vehicle was going to stop would be an obvious decrease in speed or something of that nature, or a vehicle going slow enough so that it could easily stop upon viewing the flagman or the train.

The conductor reported that as a general practice traincrews used a white light at night to flag the accident crossing and that fusees were not used either day or night because of the proximity of large quantities of flammable chemicals being used or stored nearby by several businesses.

Federal Requirements for Rule Compliance Testing

Title 49, Code of Federal Regulations, Part 217, Railroad Operating Rules, administered by the FRA requires that each railroad subject to those regulations file a copy of its code of operating rules, timetables, and timetable special instructions, as amended, with the FRA.

Each railroad is also required to conduct tests and inspections periodically to determine the extent of compliance with its code of operating rules and timetables in accordance with a program filed with the FRA. This program shall:

> (1) Provide for operational testing and inspection under the various operating conditions of the railroad,

(2) Describe each type of operational test and inspection adopted, including the means and procedures used to carry it out,

(3) State the purpose of each type of operational test and inspection, and

(4) State, according to operating divisions where applicable, the frequency with which each type of operational test and inspection is conducted.

Each railroad shall keep a record of the date and place of each operational test and inspection performed in accordance with its program. Each record must provide a brief description of the operational test or inspection, including the characteristics of the operation tested or inspected and the results thereof. These records must be retained for one year and be made available to representatives of the FRA for inspection.

To ensure that each railroad employee whose activities are governed by the railroad's operating rules understands those rules, each railroad must periodically instruct each such employee on the meaning and application of the railroad's operating rules in accordance with a program filed with the FRA. Before March 1 of each year, each railroad subject to Part 217 must file with the FRA a written report of its previous year's activities including:

(1) The total number of train miles which were operated over its tracks,

(2) A summary of the number, type, and result of each operational test and inspection, stated according to operating divisions where applicable,

(3) The number of operational tests and inspections conducted as required per 10,000 train miles, and

(4) The number, type and result of each test and inspection related to enforcement of the railroad's rule on alcohol and drug use.

The rule does not specify which operational tests and inspections a railroad must perform, nor does it specify how often each employee shall be tested.

The Conrail CORPS Program

CORPS.--CORPS is an acronym for Conrail Operating Rules Promote Safety, which is a computerized system used by Conrail to comply with the requirements of 49 C.F.R 217, as well as to

supply various levels of railroad management with information concerning the results of tests for compliance with the railroad's operating rules made on operating personnel. In addition, CORPS maintains dates that employees received their last operating rules examination, as well as their last air brake instruction class, when applicable.

The CORPS program is designed to monitor on a monthly basis the number of tests per 10,000 train miles in order to comply with the FRA reporting requirements and to ensure consistent testing throughout the Conrail system. Guidelines given to Conrail supervisors state that they should perform about seven efficiency tests a day, or about 150 tests in an average month. The system goal of the program is to observe and test each employee at least twice annually, and to perform an average of 200 tests per 10,000 train miles in each of Conrail's operating divisions.

During the months of September, October, and November 1988, the five divisions (New Jersey, Philadelphia, Harrisburg, Albany, and the Southern Tier) in Conrail's eastern region performed a total of 51,897 tests and operated a total of 2,635,688 train miles, for an overall ratio of 196.9 tests/10,000 train miles. The New Jersey Division, where the traincrew involved in the accident were domiciled, performed a total of 9,529 tests and operated a total of 500,799 train miles, for a ratio of 190.2 tests/10,000 train miles for the same time period.

During calendar year 1988, Conrail supervisors systemwide performed 756,071 efficiency tests, of which 26,215 resulted in failures, for a failure rate of 3.4 percent. During the same period supervisors in Conrail's New Jersey Division performed 47,652 efficiency tests, of which 2,478 resulted in failures, for a failure rate of 5.2 percent.

Conrail supervisors responsible for performing oversight of employees' compliance with the operating rules are provided a booklet, Conrail Publication CT 1871, which gives instructions concerning testing policy, the reasons for the CORPS system, instructions for reporting efficiency tests, and instructions on how to prepare data input forms for subsequent processing. This booklet also includes a listing of the operational tests to be performed, and the corresponding computer code (test number) for each efficiency test, which usually is keyed to the number of the specific operating rule.

Test Methods.--There are two methods of CORPS testing allowed. These are the surprise test, where an employee is unaware of the test being made, and the on-board trip or field observation test. Conrail supervisors are instructed to make tests in a positive manner and those tests that are made are to provide the situations, conditions, or probable incidents that

require rule knowledge, application, and execution on the part of the employee being tested.

Selection of Rules for Compliance Testing.--As mentioned above, Federal regulations do not specify which efficiency tests must be performed. Managers of each of Conrail's operating divisions meet about twice a year to determine what efficiency tests should be performed during the next testing period based upon what operational problems the railroad is presently encountering in that division. Conrail reported that determining compliance with operating rules and special instructions pertaining to signals and speed are generally given the highest priority.

Conrail's director of operating rules reported that there was no record of any efficiency tests performed by Conrail supervisors in the last five years to determine traincrews' compliance with NORAC Operating Rule 105 or Timetable No. 1 special instruction 105-5 pertaining to traincrew protection of grade crossings. He stated that Conrail managers did not perceive traincrews' compliance with grade crossing protection requirements to be a problem.

Discipline.--Conrail's director of operating rules stated that personnel who fail efficiency tests are disciplined as follows:

a) they may be given a verbal reprimand for minor infractions,

b) they may be issued a letter of caution for infractions the railroad deems more serious,

c) they may be given a letter of suspension for serious infractions. The employee is placed on probation for six months, and

d) if any further infractions occur while the six month probation is in effect, the employee is suspended without pay for a period of time based upon with the seriousness of the offense.

Traincrew Rule and Special Instruction Compliance History

Brakeman.--During the 18 months before the accident, the brakeman received 35 efficiency tests. He failed one test for failing to originate a radio call with "Conrail," he failed one test for failing to properly protect his radio from loss, and he failed one test for not having a copy of a summary bulletin order in his possession. He received verbal reprimands for these infractions.

Engineer.--During the 18 months before the accident, the

engineer received 120 efficiency tests. He failed one test for failing to move a train in accordance with a signal or at restricted speed after receiving permission. He received a letter of caution for this violation. He also failed one test for failing to originate a radio call properly with "Conrail," one test for not identifying himself by name, occupation, and location on the radio, and one test for failing to use "over" when expecting a reply on the radio. He received verbal reprimands for these infractions.

Conductor.--During the 18 months before the accident, the conductor received 41 efficiency tests. He failed one test pertaining to having a copy of a summary bulletin order in his possession. He received a verbal reprimand for this infraction. (See appendix B.)

Toxicological Testing of the Traincrew

The Conrail "MAP" Program.--In January 1983 Conrail instituted a Management Awareness Program (MAP) to counteract possible alcohol and illicit drug use by Conrail operating personnel. Under the MAP program, Conrail supervisors and employee union representatives are given a 16-hour training course to:

a) provide information about alcohol and drug abuse,

b) demonstrate the effects and how to recognize the symptoms of alcohol and drug usage, and

c) provide information concerning procedures to follow when there is reasonable cause to suspect alcohol abuse or illicit drug usage by Conrail operating personnel.

Conrail also makes available a 4-hour refresher course to provide persons previously trained in the MAP program with the latest information and procedures to be followed.

Federal Requirements.--Section 202 of the Federal Railroad Safety Act of 1970 (45 USC 431) requires the FRA to "prescribe as necessary . . . appropriate rules, regulations, orders, and standards for all areas of railroad safety . . . ." After a review of accidents investigated by the Safety Board and the FRA that identified alcohol and drug impairment as a causative factor in several railroad accidents, on July 5, 1983, the FRA published an Advance Notice of Proposed Rulemaking (ANPRM) in the Federal Register soliciting information and views on the problem of alcohol and drug use by employees engaged in railroad operations.

After a review of the comments on the ANPRM, on June 12,

1984, the FRA published a Notice of Proposed Rulemaking (NPRM) that would require the toxicological testing of blood samples obtained from traincrew members who are involved in certain types of accidents. The NPRM included a provision that stated:

> However, no test shall be required in case of a collision between railroad rolling stock and a motor vehicle or other conveyance at a rail/highway grade crossing or in the case of a train incident consisting solely of a fatality or injury to a trespasser.

In its August 15, 1984, comments on the NPRM, the Safety Board stated:

> The proposed (grade crossing accident) exclusion should not extend to accidents involving fatalities or serious injuries. The failure of a traincrew to observe slow orders or to sound appropriate warnings has contributed to grade crossing accidents which resulted in deaths or serious injuries.

The NPRM also included a proposal to test "for cause" an employee who has been directly involved in a reportable accident or incident (See 49 C.F.R. Part 225) or an employee who has been involved in a violation of any operating rule or other written directive that directly affects the movement of a train and that could result in an accident.

On August 2, 1985, the FRA issued its final rule concerning toxicological testing of certain railroad employees. In the preamble to the final rule, the FRA stated:

> FRA recognizes that the acts and omissions of engine crews and train crews may at times contribute to grade crossing accidents to some extent. However, in the vast majority of cases railroad employees can only be viewed as additional victims of these tragedies.

The final rule retained the provision exempting traincrew members involved in grade crossing accidents from mandatory blood and urine testing. [See 49 C.F.R. 219.201(b).] The final rule also modified the proposed "for cause" breath or urine testing rule. In the case of reportable accident involvement, an employee must be tested only if a supervisor has a reasonable suspicion that the employee's acts or omissions contributed to the occurrence or severity of the accident.

In addition, the provision proposing testing employees involved in a violation of any operating rule or other written directive that directly affects the movement of a train and that could result in an accident was deleted from the final rule. The

final rule instead listed six specific rule violations in which "reasonable cause" urine or breath testing was required. Failure to flag a grade crossing as required by an operating rule or timetable special instruction was not one of these six instances. [See 49 CFR 219.301(a)(2) and (3).]

After the rule went into effect, Conrail issued a pocket-sized two-sided card to Conrail supervisors. This card outlines the provisions of the rule and Conrail's policies concerning toxicological testing of employees subject to the rule.

The side of the card highlighted in red printing outlines those circumstances when toxicological testing of blood and urine samples is mandated by the provisions of the rule. The side of the card highlighted in blue printing outlines those circumstances for which there is reasonable cause to obtain breath or urine for alcohol or drug testing. (See figure 4.)

Although it has no legal authority to order it, the Safety Board routinely requests that survivors involved in accidents the Board investigates submit samples of blood and urine for alcohol and drug testing, and did so of the traincrew involved in this accident. The traincrew voluntarily supplied blood samples the afternoon after the accident, and tests performed were negative for the presence of alcohol or illicit drugs.

Conrail's director of operating rules subsequently advised the Safety Board that the traincrew would not have been required by either Conrail or the FRA rule to supply the blood samples, and the samples were supplied only in an effort to cooperate with the Safety Board, because he believed:

a) the FRA rule requiring mandatory testing specifically exempts traincrew testing after involvement in a grade crossing accident,

b) "for cause" testing was not indicated because none of the railroad operating rules violations specified in the FRA rule appeared to have occurred, and

c) Conrail supervisors on scene, based upon the traincrews' statements, had no reason to suspect that a traincrew member's acts or omissions contributed to the accident.

Grade Crossing Protection and Accident History

There were no automatic train-activated warning signals at the crossing. For westbound highway vehicles, the crossing was marked with a silver-reflectorized railroad crossing (crossbuck) sign with black lettering located 15.5 feet from the center of

CONRAIL POLICY FOR

REASONABLE CAUSE TESTING AUTHORIZED BY FRA

Urine samples must be taken, within 8 hours of the incident, from certain Hours of Service employees under any of the circumstances listed below, and employees must also be offered the opportunity to give blood samples.

1. ACCIDENTS/INCIDENTS

When an employee is involved in an FRA reportable accident or incident and a supervisor has reasonable suspicion that an employee's acts or omissions contributed to the occurrence or severity of the accident or incident.

2. RULE VIOLATIONS

When an employee is directly involved in any of the following rules violations.

A. Occupying a Manual Block without authority.

B. Passing a Stop Signal (Rule 292) without authority.

C. Passing a Stop and Proceed Signal (Rule 291) without stopping.

D. Crossing a railroad crossing at grade without authority.

E. Failing to provide Rule 102 protection (against trains on adjacent tracks) for a train in emergency in multiple track territory.

F. Operating a train at a speed that exceeds maximum authorized speed by at least 10 MPH, or by 50% when maximum authorized speed is less than 20 MPH.

G. Opening a main track switch without permission of Train Dispatcher or Operator.

H. Operating a switch under a train.

I. Running through a switch improperly lined.

J. Failing to apply or stop short of a derail as required.

K. Failing to secure a hand brake or failure to secure sufficent hand brakes, when required.

L. Issuing a train order, CT 401 or establishing a route that fails to provide proper protection for a train.

3. REASONABLE SUSPICION OF DRUG USE

When two Supervisors (at least one of whom has received MAP Training) have reasonable suspicion that an employee is under the influence of, or impaired by a controlled substance, based upon specific personal observations by the Supervisors of the employee's appearance, behavior, speech or body odors.

4. SAMPLES

Samples for reasonable cause testing are to be placed in a Conrail preaddressed shipping kit and sent US mail.

Employees giving samples are to be advised as to where their samples are to be tested.

Do not send reasonable cause samples to Utah.

Conrail Rules Department July 20, 1987

CONRAIL

Blue Printing- Reasonable Cause Testing

MANDATORY FEDERAL RAILROAD ADMINISTRATION

POST ACCIDENT TESTING

Blood and urine samples must be taken, as soon as possible, from certain Hours of Service employees, and body fluid and/or tissue samples must be taken from the remains of all fatally injured on-duty railroad employees under any of the circumstances listed below.

A. Train Accident Involving

1. A fatality to any person
2. A Hazardous Materials release with

   An evacuation or

   A reportable injury from the product
3. Damage of $500,000 or more to railroad property
4. Impact (collision etc.,) with

   A reportable injury or

   $50,000 damage or more to railroad property

B. Train Incident Involving

5. A fatality to an on duty railroad employee

Exception:
No test shall be required after an accident or incident involving a collision between railroad rolling stock and a motor vehicle at a rail/highway grade crossing.

In categories 1, 2 and 3 all crew members must be tested, and any other covered employees (dispatcher, operator, signalman, etc.,) directly involved in the accident.

In categories 4 and 5, the same employees as in categories 1, 2 and 3 must be tested, except that employees must be excluded from testing if the railroad officer at the scene determines that such employee(s) had no role in the cause of the accident/incident.

Samples are to be placed in an FRA shipping kit and sent by prepaid air freight or other means (to arrive within 24 hours) to the:

Center for Human Toxicology
University of Utah
Room No. 38, Skaggs Halls
Salt Lake City, Utah 84112
Telephone No. (801) 468-3434

DEFINITIONS

Train Accident—A passenger, freight, or work train accident, including a switching movement, involving a collision, derailment, fire, explosion, act of God or other event involving the operation of on-track equipment that results in damages to railroad property greater than the current reporting threshold ($5,200 in 1987).

Train Incident—An event involving the movement of railroad on-track equipment that results in a casualty but in which railroad property damage does not exceed the current reporting threshold ($5,200 in 1987).

Railroad Property Damage—Damage to railroad on-track equipment, signals, track, structures, and roadbed, including labor costs and other costs for repair or replacement in kind.

Red Printing- Mandatory Testing

Figure 4.--Pocket-sized card outlining Conrail's policies for testing traincrews for alcohol and drugs.

the tracks and 10 feet north of the north curbline of Roosevelt Avenue.

The westbound lane of Roosevelt Avenue was also marked with an advance railroad pavement marking about 215 feet east of the crossing. This advance marking was faded and nearly illegible. There also was no railroad advance warning sign for westbound traffic when the Safety Board examined the scene. There was a railroad pavement marking and railroad advance warning sign, but no crossbuck sign, at the crossing for eastbound traffic.

The FRA/Association of American Railroads (FRA/AAR) grade crossing inventory identifies the accident crossing as number 171639B. The average daily traffic count at the crossing is 20,000 vehicles per day, of which twenty percent are trucks. According to the FRA/AAR, this crossing has had no reported accidents since the FRA began to keep records in 1975. The CPD also had no record of any previous accidents at the crossing.

The New Jersey Department of Transportation (NJDOT) attempts to inspect all grade crossings in the State once each year. The last inspection of the accident crossing was performed on February 11, 1987, and the inspection noted the missing eastbound crossbuck and that the advance pavement markings needed repainting. At the time of this inspection, the advance warning sign for westbound traffic was in place. Although the inspection findings were forwarded to the FRA for use in the FRA/AAR grade crossing inventory system, the NJDOT did not report the condition of the pavement markings or the fact that the eastbound crossbuck was missing to Middlesex County (New Jersey), the political subdivision in the State responsible for maintenance of the advance pavement markings and signs at the crossing.

There were no signs posted at the accident crossing indicating that the crossing was "exempt" from requirements that trucks transporting hazardous materials must stop before traveling over the crossing.

Highway Information

At the crossing Roosevelt Avenue is a two-lane undivided east-west roadway separated by a double-yellow centerline with additional parking lanes for vehicles outboard of the travel lanes. The roadway at the crossing is about 36 feet wide. The speed limit for westbound vehicles approaching the crossing is 25 mph.

At a point about 540 feet east of the crossing, Roosevelt Avenue changes direction 90 degrees to the left from a generally northbound to a generally westbound roadway. Immediately after this directional change, the westbound roadway begins an ascending grade as follows:

Distance East of Tracks (feet)	Percent Grade
500	3.72
450	6.04
400	5.74
350	5.50
300	4.68
250	4.72
200	2.16
150	1.44
100	1.02
50	1.44

Utility poles equipped with 400-watt mercury vapor lamps were located 44 and 180 feet west of the crossing along the north curbline of Roosevelt Avenue. According to several of the witnesses, these lamps were illuminated at the time of the accident. The lamp located 44 feet west of the crossing was damaged in the fire and was not replaced after the accident. Instead, another lamp was installed on a utility pole located 23 feet east of the crossing.

At the southeast corner of the crossing there were two 250-watt mercury vapor lamps, as well as three 400-watt mercury vapor lamps on the south end on the FMC building about 170, 190, and 220 feet from the center of the crossing. The FMC plant was open at the time of the accident and these lamps were observed to be illuminated two days after the accident when Safety Board investigators were at the accident site at the same time of day as when the accident occurred.

East of the accident crossing, both sides of Roosevelt Avenue are occupied by industrial plants for about 3,200 feet. West of the crossing there is a parking lot for FMC employees on the north side of Roosevelt Avenue to its intersection with Lafayette Street. West of the crossing four private residences or residential apartments were located on the south side of Roosevelt Avenue west to its intersection with Lafayette Street.

At the time of the accident, the truckdriver was traveling from the Shell Oil Company's tank farm located in Sewaren, New Jersey, en route to Hillside, New Jersey, about 47 miles away, via Roosevelt Avenue in Carteret to Entrance 12 of the New Jersey Turnpike. The route from the tank farm to the turnpike entrance is 5.7 miles long and goes through a mixture of industrial and residential areas in Sewaren, Port Reading, and Carteret. The truckdriver had completed 4.5 miles of that route when the accident occurred.

Island has used this route regularly, and the accident truckdriver had driven this route regularly since Island employed him in 1984. According to Island, the Roosevelt Avenue route is the shortest and only authorized truck route through Carteret -

other possible routes in Carteret prohibit through truck traffic. Island officials advised that the only alternate route to the New Jersey Turnpike presently available to trucks is 15 miles long.

A new highway, "Carteret Industrial Road," that will accomodate through truck traffic in Carteret is under construction. When completed, this road will divert through truck traffic from Roosevelt Avenue and eliminate the need for through truck traffic to cross any railroad tracks. The first phase of this project, construction of one lane in each direction, is scheduled for completion in 1991.

Truckdriver Information

The 53-year-old truckdriver had been employed by Island since November 23, 1984. According to his job application, he had been operating tractor-semitrailer combinations since at least 1972, and his regular job assignment with Island was to deliver gasoline in bulk to service stations in the northern New Jersey area. His usual time for reporting for work was 5:00 a.m., and he usually completed checking in at Island's terminal and left for his first delivery assignment about 5:30 p.m.

The truckdriver lived with his wife and her four grown children in a multi-unit apartment building where he served as superintendent when he was not driving for Island. Before 1972, he was the owner of a hardware store.

He held a valid New Jersey driver's license which qualified him to drive tractor-semitrailer combinations. His driving record indicated three moving violation convictions: a December 1985 conviction for speeding 70 mph in a 55 mph zone; a July 1987 conviction for failure to observe a traffic control device; and an October 1987 conviction for speeding 69 mph in a 55 mph zone.

The record also indicated that he had been involved in two accidents in 1986, neither of which resulted in the assignment of points against his driving record. One of these accidents appeared to have occurred while he was driving an Island truck. A 50-State check revealed no additional driving licenses issued in his name, and the National Driver Register indicated no previous suspensions or revocations in other driver licensing jurisdictions.

His last physical examination to determine his qualification to drive commercial motor vehicles in interstate commerce was performed on March 10, 1987. This examination disclosed no physical defect, disease, or impairment likely to interfere with safe driving, and he was certified as being physically qualified to drive commercial vehicles with no restrictions. Although his family reported he used glasses for reading, his physical examination indicated that his distance vision was 20/20 in each eye without corrective lenses.

When he was hired, Island gave him eight hours of classroom training, then required him to drive a unit transporting gasoline shipments under the supervision of a driver-trainer for five days. He had driven the tractor involved in the accident since it was placed in service new in December 1986, and had operated with the accident semitrailer for several months.

Records on file with Island indicated the following disciplinary actions taken against the truckdriver: in August 1985, he received a one-day suspension for a spill; in February 1986, he received a warning letter for excessive absenteeism; in April 1986, he received a two-day suspension for a spill; in December 1986 he received a three-day suspension for being involved in a preventable accident; in May 1987, he received a warning letter for failure to observe posted speed limits; in December 1987, he received a one-day suspension for failing to report damage to an unloading hose; and in July 1988, he received a warning letter for overloading a compartment which resulted in a spill.

The truckdriver's normal work schedule was from 5:00 a.m. to about 2:00 or 3:00 p.m., Tuesdays through Saturdays. He also sometimes worked on his scheduled days off. He operated within a 100-mile radius of Island's Port Reading, New Jersey, terminal, and was off duty at home each night.

On Friday, December 2, and Saturday, December 3, the truckdriver was on duty from 5:00 a.m. to 3:00 p.m. making gasoline deliveries in the area. His wife said they watched television together and the truckdriver went to bed at his normal time between 10:30 and 11:00 p.m. on both evenings.

On Sunday, December 4, a scheduled day off, he worked an overtime day from 5:00 a.m. to 2:00 p.m. making deliveries to Teaneck and Linwood, New Jersey. After he returned home from work on Sunday, he went to church to rehearse for a wedding until about 7:00 p.m., then came home, watched television, and went to bed at his normal time.

On Monday he went shopping with his wife and spent most of the day installing tile and repairing plumbing in the apartment house where he was superintendent until about 7:00 p.m. After watching television, he fell asleep between 10:30 and 11:00 p.m. Examination of records on file with Island indicated that he had been on duty for Island 59 1/4 hours during the eight consecutive days to the time of accident, and he had been on duty about 1 1/4 hours since his last 8 or more hours off duty when the accident occurred.

Toxicological tests performed after the accident determined that the truckdriver had no alcohol or illegal drugs in his system at the time of his death. Based upon a postmortem examination, the Middlesex County (New Jersey) Medical Examiner

determined that the cause of the truckdriver's death was extensive burns received as a result of the accident.

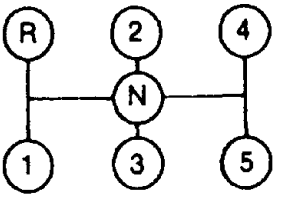
Motor Vehicle Information and Damage

The Island truck consisted of a 1987 conventional cab 3-axle Mack truck-tractor operated in combination with a 1986 2-axle Heil 5-compartment tank semitrailer. The total length of the vehicle combination was 55 feet 8 inches. Both the tractor and semitrailer were equipped with drum-type air-mechanical service brakes. The four drive wheels on the tractor and all wheels on the semitrailer were equipped with spring-loaded parking brakes. Island reported that the minimum practical turning radius for the vehicle combination was 50 feet.

The tractor was equipped with an EM6-250L Mack diesel engine that was designed to deliver 250 HP at 1700 rpm, and a Mack model T2050 manual 5-speed transmission with a floor-mounted shift lever with the following gear ratios in each forward gear:

1st gear - 5.24:1
2nd gear - 3.05:1
3rd gear - 1.73:1
4th gear - 1.00:1
5th gear - 0.60:1

The transmission's shift pattern is shown below:



The tractor was equipped with a tachograph which recorded the vehicle's speed, engine on/off, and elapsed time. The tractor's drive wheels were equipped with 295/75R22.5 tires which had a rolling radius of 19.6 inches. The tractor's fuel pump was governed at 1700 rpm, but could, according to Island, experience as much as a 10 percent maximum sustained overrun and operate at 1,870 rpm. Island also reported that the normal rpm for shifting was 1000 rpm, but that a shift could possibly be forced at about 900 rpm. Using these data, the tractor's minimum and maximum speeds in each forward gear are calculated as follows:

Gear	Speed at 900 rpm (mph)	Speed at 1000 rpm (mph)	Speed at 1700 rpm (mph)	Speed at 1870 rpm (mph)
1st	3.61	4.02	6.83	7.51
2nd	6.21	6.90	11.73	12.90
3rd	10.91	12.16	20.67	22.74
4th	18.94	21.04	35.77	39.34
5th	31.56	35.07	59.61	65.57

The semitrailer was 44 feet long, 7.97 feet wide, and an average of 10.25 feet high. The semitrailer tank was made of aluminum with a 9,400-gallon capacity and, according to a certificate of compliance on file at Island, was designed, constructed, and tested in accordance with U. S. Department of Transportation specification No. MC-306AL, which authorized the use of the semitrailer to transport flammable liquids. According to the shipping document, at the time of the accident the semitrailer was loaded with 8,800 gallons of unleaded gasoline as follows:

Compartment No.	Gallons
1	3,000
2	1,100
3	1,100
4	950
5	2,650

Using these data, the Safety Board calculated that the gross weight of the vehicle combination at the time of the accident was between 78,921 and 79,801 pounds. The manufacturer of the semitrailer calculated that the height of the center of mass of the vehicle as it was loaded at the time of the accident was 5.93 feet.

Island made a routine inspection of the vehicle combination three days before the accident, and the truckdriver made an inspection the morning of the accident. No defects were reported.

Examination of the truck tractor after the accident disclosed no evidence of contact damage to components on the right side of the tractor, including the right door and the exhaust pipe shield. There also was no contact damage visible on the tractor's front, rear, or left side. The left door was missing. The roof of the cab was crushed down to within about 14 inches of the bottom of the window sill on the right side and down to the metal frame of the seatback on the driver's side, and was displaced about 2 feet to the right when viewed from the rear as the vehicle was overturned.

The interior of the cab was destroyed by fire, and the position of gauges and controls could not be determined. The tachograph also was destroyed. The bottom of the transmission housing was melted away, and direct examination of the gear positions in the transmission determined that the transmission was in fourth gear.

Approximately the bottom two-thirds of the semitrailer's aluminum tank was melted. On the part of the semitrailer that remained, four-inch-wide contact damage was noted along the right

side of the tank beginning at a point seven feet from the front and at a point 36 inches below the top walkway. (See figure 5.)

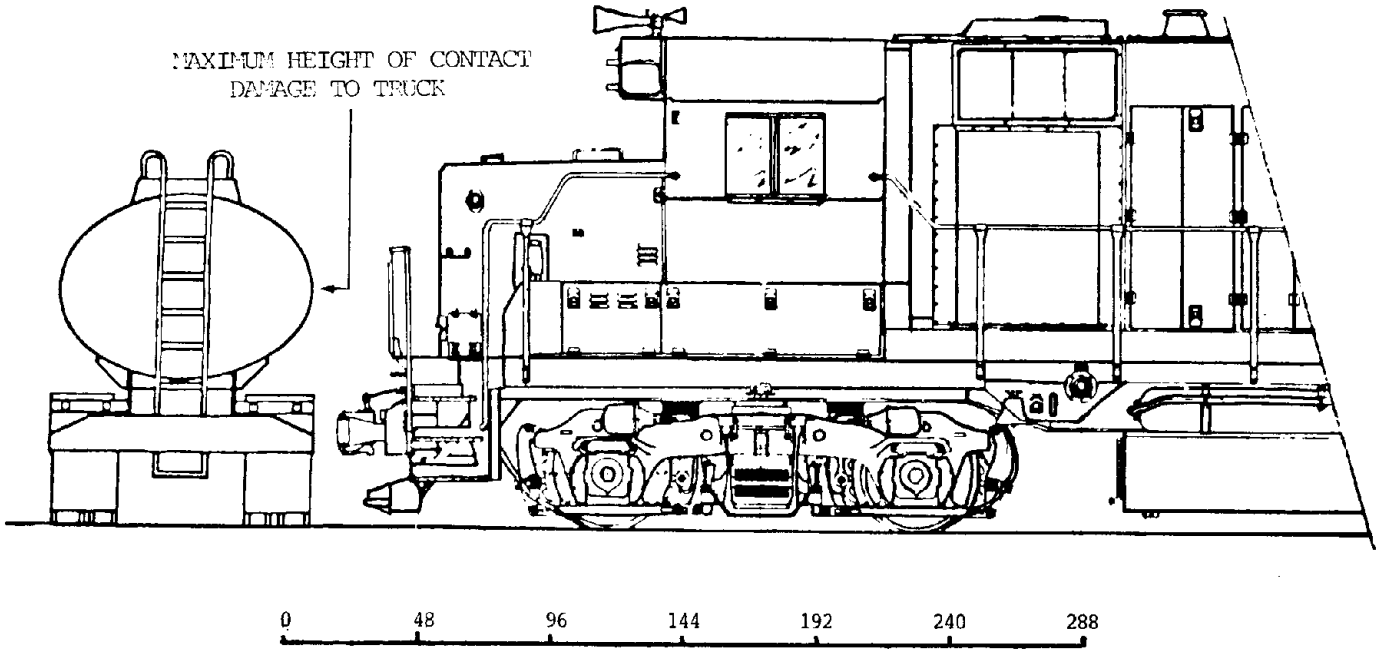


Figure 5.--Location of maximum height of contact damage to right side of Island semitrailer, and rear of semitrailer and left side of locomotive 2266 to same approximate scale.

Part of the tank forward of this damage was melted away above a height of 36 inches below the top walkway. The damage which could be seen, with three gaps where the tank material was melted away above the general location of the damage, extended on the right side of the remaining tank material to a point 19 feet from the front and 49 inches below the top walkway.

Motor Carrier Information

Island Transportation Corporation is authorized by the Interstate Commerce Commission (ICC) to perform transportation in interstate commerce as a common carrier by motor vehicle of commodities in bulk between points in 16 eastern States. In addition, Island possesses ICC authority to operate as a for-hire contract motor carrier transporting general commodities in the 48 contiguous States. Island also transports intrastate shipments of bulk petroleum products, principally gasoline, in four eastern States.

Island operates four terminals: one in Connecticut; two in New York; and one in Port Reading, New Jersey, where the accident truckdriver was domiciled. Island owns 59 trucks, 95 truck-tractors, and 224 semitrailers, and employs 277 truckdrivers who are paid based upon a trip mileage and an hourly "down-time" rate.

Island operates a safety department staffed with a full-time safety director, three safety supervisors, and one delivery supervisor. All truckdriver applicants are required to successfully complete a carrier-administered training course which, at the time the accident truckdriver was hired, consisted of eight hours classroom and five days over-the-road training under the supervision of a driver-trainer.

Island also requires its truckdriver employees to attend a bimonthly safety meeting that usually lasts 20 minutes. Island's director of personnel and safety could not recall if any of these meetings dealt specifically with stopping at railroad grade crossings, but stated that drivers for Island are instructed to stop at all railroad grade crossings. He was not aware of any instances on-the-road observations by Island safety supervisors that disclosed a driver failing to stop at a railroad grade crossing.

He also stated that he was unaware that the accident truckdriver held a part-time job serving as superintendent of the apartment house where the truckdriver lived, and that Island's truckdrivers are not permitted to have other jobs if they wish to continue to drive for Island.

Federal Motor Carrier Safety Regulations

As a motor carrier transporting hazardous materials and operating in interstate or foreign commerce, Island is subject to the requirements of the Federal Motor Carrier Safety Regulations (FMCSR) administered by the U.S. Department of Transportation's Federal Highway Administration (FHWA) contained in Title 49, Code of Federal Regulations, Parts 390 to 397.

Section 392.10(a) of the FMCSR, "Railroad Grade Crossings; Stopping Required," provides that the driver of every cargo tank, whether loaded or empty, used for the transportation of any flammable liquid shall not cross a railroad track or tracks at grade unless he first:

a) stops the vehicle within 50 feet of and not closer than 15 feet to the tracks, and

b) listens and looks in each direction along the tracks for an approaching train and ascertains that no train is approaching.

When it is safe to do so, the driver may drive the vehicle across the tracks in a gear that permits the vehicle to complete the crossing without a change of gears. The driver must not shift gears while crossing the track(s).

Section 392.10(b) provides that a stop need not be made at a streetcar crossing, or railroad tracks used exclusively for industrial switching purposes, within a business district as defined in 390.12 of the FMCSR. The FMCSR do not further define what are "railroad tracks used exclusively for industrial switching purposes." This section also provides that a stop need not be made at an industrial or spur line railroad grade crossing marked with a sign reading "Exempt." Such "Exempt" signs shall be erected only by or with the consent of the appropriate State or local authority.

Section 390.12 defines a business district as "the territory contiguous to and including a highway when within any 600 feet along such highway there are buildings in use for business or industrial purposes, including but not limited to hotels, banks, or office buildings, railroad stations, and public buildings which occupy at least 300 feet of frontage on one side or 300 feet collectively on both sides of the highway."

Section 392.2 of the FMCSR, Applicable Operating Rules, provides that "Every motor vehicle must be operated in accordance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated." However, if a Federal regulation imposes a higher standard of care than a local law, ordinance, or regulation, the Federal regulation must be complied with.

One of the truckdrivers who witnessed the accident, and who also frequently drives trucks transporting hazardous materials in the accident area, stated that it was his understanding that the FMCSR do not require a stop at the accident crossing because it is an exempt industrial crossing. The director of safety and personnel for Island stated that he was not sure whether hazardous materials trucks were required to stop at the accident crossing.

New Jersey Grade Crossing Requirements for Trucks

Section 39:4-128 of the Motor Vehicle and Traffic Laws of New Jersey states that the driver of any vehicle carrying flammable liquids as cargo, before crossing at grade any track or tracks of a railroad shall stop within 50 but not less than 15 feet from the nearest rail, and while stopped shall listen and look in both directions for any approaching train.

The stopping requirement does not apply to crossings which have been appropriately marked as being abandoned, or to crossings marked with a sign reading "Exempt Crossing." New Jersey's requirements do not contain an exemption permitting

vehicles transporting hazardous materials to cross without stopping if the crossing is used for industrial switching purposes unless that crossing has been marked as being exempt from the stopping requirement.

Tests and Research

On December 8, 1988, the Safety Board conducted sight-distance, audibility, and acceleration tests using locomotive 8142 and a locomotive similar to locomotive 2266 supplied by Conrail and manned by the traincrew involved in the accident. Island supplied a similar tractor with the same type engine and transmission and a similar semitrailer. The vehicle combination was driven by an Island driver trainer. The test semitrailer was loaded with water to approximate the weight of the gasoline. The actual gross weight of the test truck was 83,240 pounds.

Truck Speed Tests.--The first test run made by the truck started on northbound Roosevelt Avenue beyond the 90-degree turn from a stopped position. By the time the test truck approached the right angle curve where the truck's direction changed from northbound to westbound, the driver had shifted into third gear. Going around the curve, he downshifted to second, shifted up into third gear, and then shifted into fourth gear going up the grade. The test driver did not slow the truck as he approached the crossing. He downshifted into third gear as he crossed the railroad grade. The test truck's time to reach the crossing from a point 400 feet east was 22 seconds. When it went over the crossing the test truck's speedometer registered 17 mph. According to radar the truck was traveling at 14.5 mph when it reached the crossing.

On another run the test truck started from a stopped position on the grade 400 feet from the crossing. The driver shifted into second gear about 300 feet from the crossing, downshifted to first and upshifted again to second about 100 feet from the track and remained in second as he crossed the tracks. His indicated speed when crossing the tracks was between 10 and 15 mph.

Truck Research.--The Safety Board estimated that the friction coefficient between the accident truck's tires and the highway at the accident site was about 0.55 1/ According to research by the University of Michigan, the rollover threshold of the current 2-axle 9,000-gallon-capacity MC-306 tank-semitrailer presently used in the United States is 0.34 g's of lateral acceleration. 2/

1/ Baker, J. Stannard, "Traffic Accident Investigation Manual," 1975 edition, p. 210.

2/ Ervin, Robert D., "Safer Gasoline Tankers for Michigan," University of Michigan Highway Safety Research Institute, March-April 1981, Volume 11, Number 5.

Using the exterior dimensions of the semitrailer, the Safety Board determined that the minimum distance the semitrailer had to travel laterally in a 180-degree rollover was 24 feet. (See figure 6.)

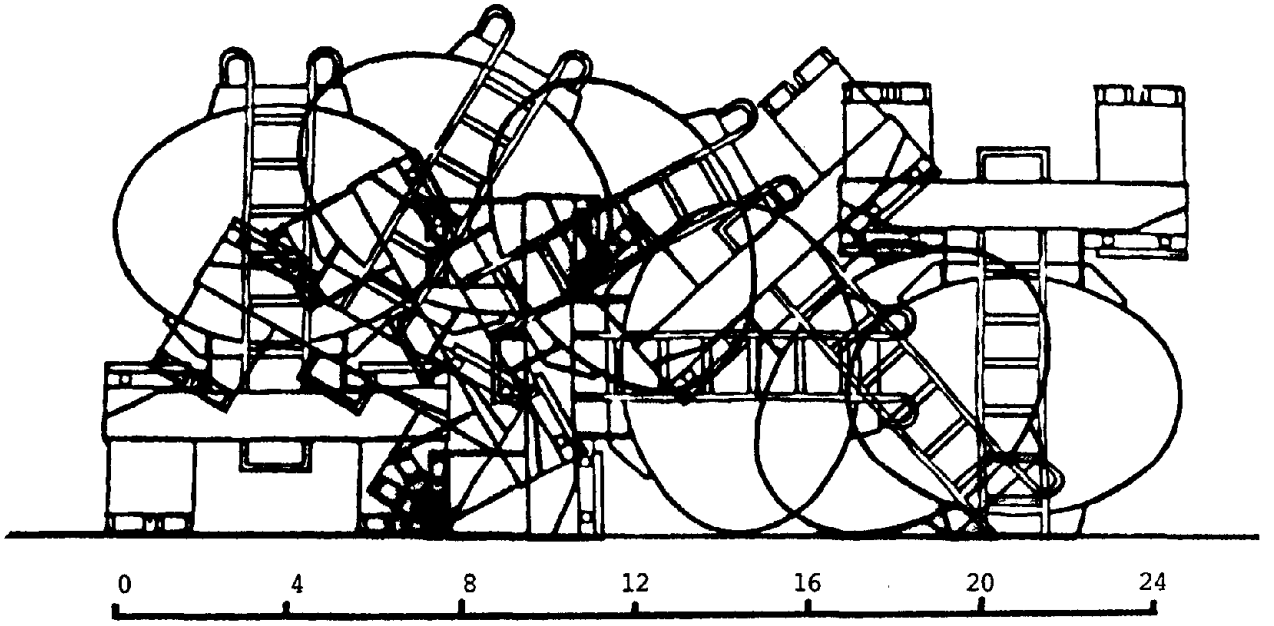


Figure 6.--Minimum lateral distance for semitrailer to roll over 180 degrees.

Visibility Tests.--Night visibility tests were not performed because the street lamp located 44 feet north of the crossing that was damaged in the fire was not replaced. With the head end of the test locomotive stopped even with the north curbline of Roosevelt Avenue, visibility tests performed in clear daylight indicated that when the test truck was about 425 feet east of the crossing utility poles on the north side of Roosevelt Avenue partially obstructed the test truckdriver's view of the head end of the test locomotive. (See figure 7.)

However, from a point about 240 feet east of the crossing or closer there were no obstructions to the test truckdriver's view of at least the front 16 feet of the test locomotive. (See figure 8.) The rear of the test locomotive and locomotive 8142 were partially obscured from the test truck's view by a row of evergreen trees planted parallel to the tracks at the northeast corner of the crossing. The two trees closest to the crossing were removed after visibility tests were performed. (See figure 1.)

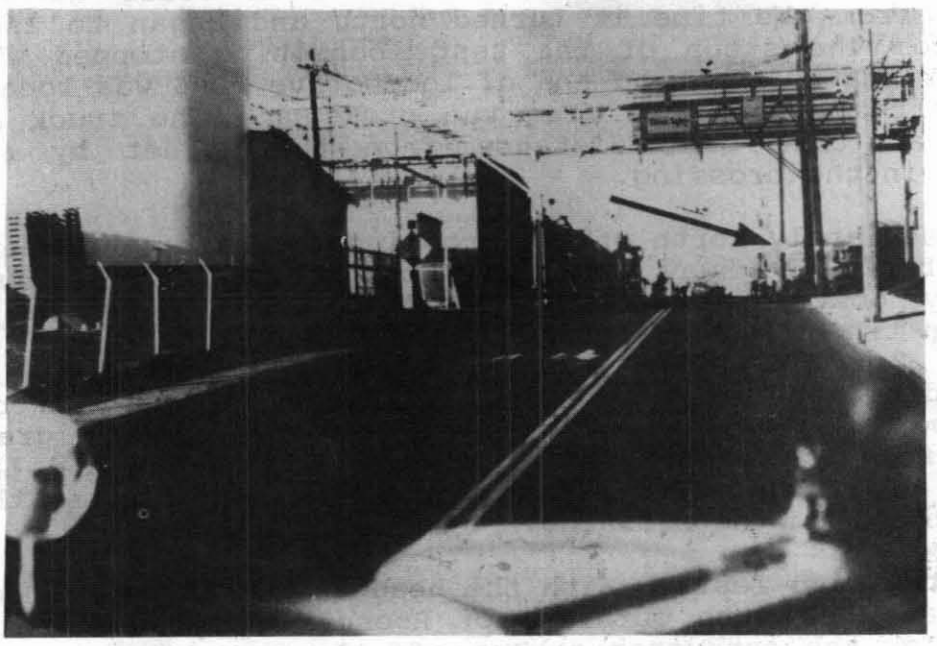


Figure 7.--View of the locomotive (arrow) from the test truck 400 feet east of the crossing.

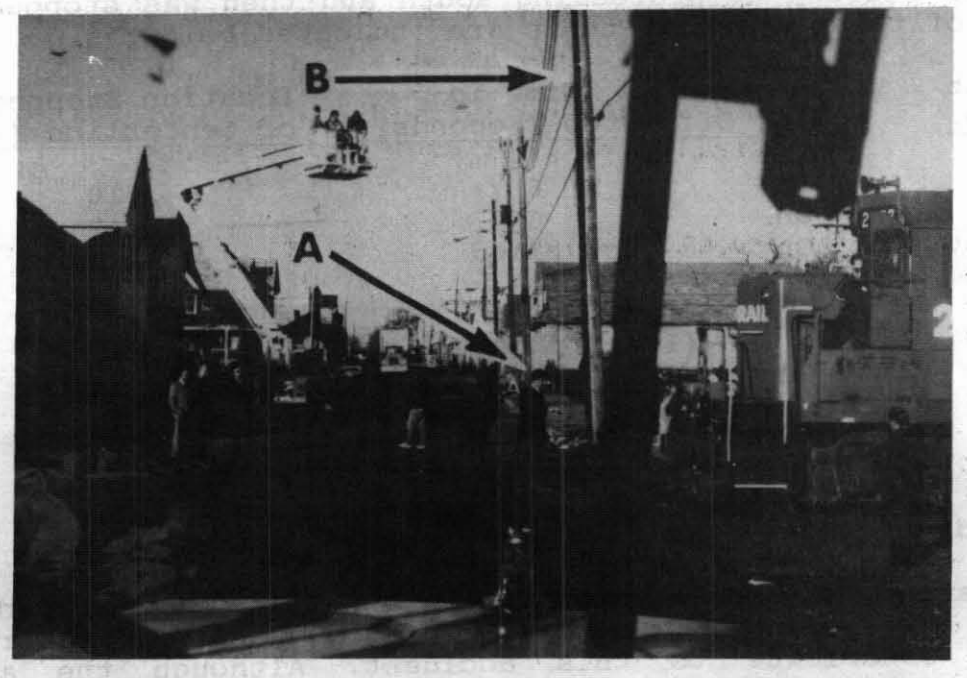


Figure 8.-- View of locomotive and position of conductor (arrow A) from truck 100 feet east of the crossing. Arrow B indicates the location of the 400 watt street lamp which was destroyed.

The test truck was visible in both clear darkness and daylight from the time it turned north and began to ascend the grade from the steps of the test locomotive stopped where the conductor stated the head end of locomotive 2266 was located when he got off the train to flag the crossing. The truck also was visible at that same distance from the street by a person standing in the crossing.

Immediately north of the crossing a traincrew member's view of westbound highway traffic approaching the crossing is partially obstructed by the FMC building and by the row of evergreen trees. (See figures 9 and 10.)

Audibility Tests.--During the tests the train's bell and the sound of the test truck's engine pulling the grade were audible from the intersection of Roosevelt Avenue and Lafayette Streets. The sound of the test truck's engine pulling the grade was audible from the crossing.

Detraining Tests.--With the head end of the test locomotive stopped at the north curbline of Roosevelt Avenue, it took six seconds for the conductor to get off the west steps of the test locomotive and walk to the center of Roosevelt Avenue.

Train Stopping Tests.--With the head end of the test locomotive stopped at the north curbline of Roosevelt Avenue, the train was started up proceeding south and then was stopped. The results of these stopping tests are indicated below:

Test No.	Brakes On or Off	Time To Stop (Seconds)	Location Stopped North of Centerline (Feet)
1	On	6	10
2	On	6	12
3	On	Not timed	11
4	Off	10	4
5	Off	7	5
6		(Invalid test)	
7	Not Recorded	8	4

ANALYSIS

The Accident

Weather, Track, and Roadway.--The Safety Board concludes that the weather and the condition of the track at the crossing did not contribute to this accident. Although the advance pavement marking located 210 feet east of the accident crossing was in extremely poor condition and the railroad advance warning sign was missing when the Safety Board examined the accident site, the truckdriver had used Roosevelt Avenue as his usual route to the entrance onto the New Jersey Turnpike since he was

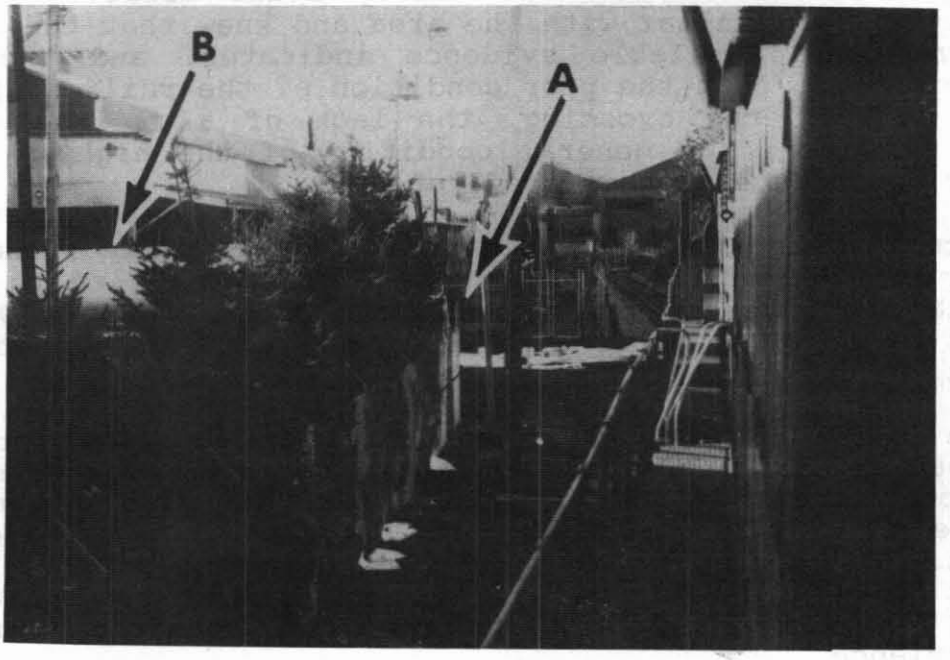


Figure 9.--View of train's approach to the crossing from locomotive 8142. View of tractor (arrow A) and semitrailer (arrow B) is partially obstructed by trees.

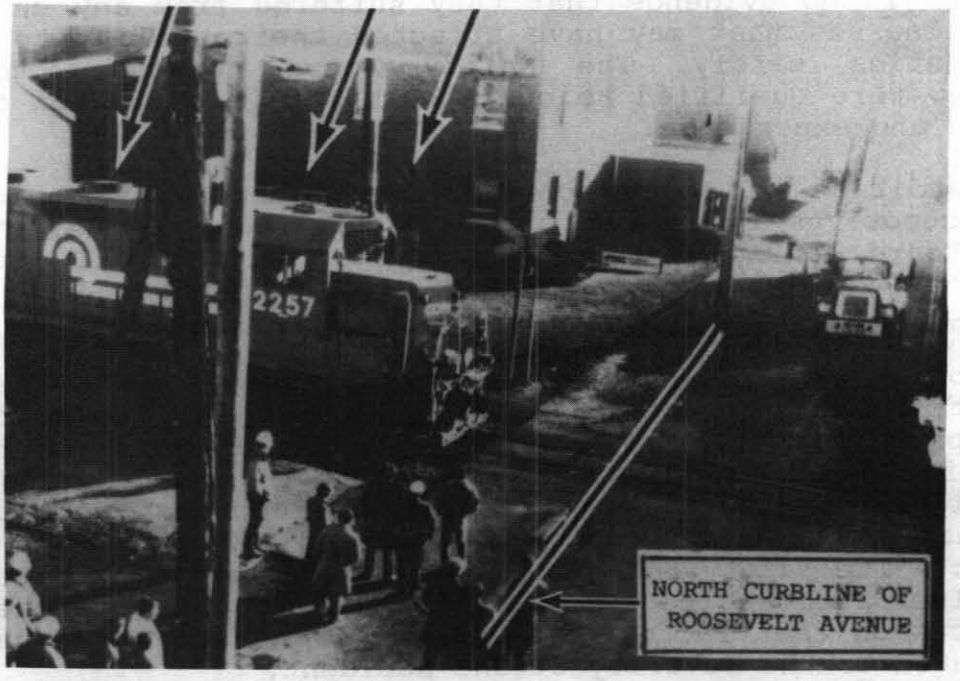


Figure 10.--FMC building and row of evergreen trees (arrows) partially screen truck's view of train.

of the witnesses, was between 14 and 17 mph and the test truckdriver downshifted from fourth to third gear as the test truck reached the first rail. It is possible that the "rolling stop" the accident truck reportedly made may have been done in conjunction with a downshift from fourth to third gears.

A post-accident inspection of the accident truck disclosed that the transmission was in fourth gear. Calculations determined that the minimum and maximum possible speeds for the accident truck in fourth gear were 18 and 39 mph, and the most likely speed range was from 21 to 35 mph.

The test with a similar truck indicated a speed between 14 and 17 mph in third gear as the vehicle reached the crossing, and an evaluation of the likely in-gear speed of between 21 and 35 mph in fourth gear leads the Safety Board to believe that the accident truck probably was not in fourth gear when the collision occurred.

Witnesses west of the crossing reported that they could see the truckdriver's body being tossed about the interior of the cab as the vehicle overturned. It is possible that the collision and rollover may have caused the truckdriver's body to strike the floor-mounted shift lever and push it to the right and up back into fourth from the third gear position while the vehicle was overturning or when the cab struck the pavement.

In another test the test truck was accelerated from a stopped position 400 feet from the tracks. The test truck was not shifted higher than second gear and was in that gear as it crossed over the tracks at a speed of between 10 and 15 mph.

Given the possible minimum in-gear speeds computed and the fact that the accident truck was ascending a 1.44 percent grade, the test data indicate and the Safety Board believes that it was not possible for the accident truck to accelerate from a full stop to a speed that would enable the transmission to be shifted into either third or fourth gear in a distance of between 15 and 50 feet from the tracks. Witnesses both east and west of the crossing reported, and the Safety Board concludes, that the truck did not come to a complete stop at a distance of between 15 and 50 feet from the tracks before proceeding over the crossing.

Truck Movements at Time of Collision.--At its final rest position, the forward 4 feet of the contact damage on the right side of the semitrailer was west of any point where the 10-foot-wide locomotive could have possibly contacted it without derailing. Several of the witnesses reported that the truck was moving at the time of the collision. The Safety Board concludes that the truck was moving westbound at the time the first contact was made with the train, and that the truck continued to move west a minimum of 10 feet during the collision sequence.

The only damage attributable to contact with the locomotive which could be seen on the truck began 7 feet aft of the front of the semitrailer on the right side and was visible as it extended aft, with several gaps where the tank was melted away, for an additional 12 feet. The Safety Board believes that before the tank melted this damage was continuous.

There was no visibile contact damage to the right side of the truck-tractor, particularly the saddle-mounted fuel tank, the right door to the cab, and the exhaust system shield. When the test truck was aligned with the test locomotive, these components on the right side of the tractor's cab were at a height where they would have been contacted by the knuckle at the front of the test locomotive if these respective components had been allowed to make actual contact during the tests. The lack of any contact damage to these components on the accident truck leads the Safety Board to conclude that the cab of the truck-tractor was west of the center of the rails when the first contact with the locomotive occurred.

Damage to components located below the handrail on the left front of the locomotive is evidence that these components contacted the semitrailer during the collision. However, corresponding evidence of contact on the semitrailer was destroyed when the tank melted.

If the truck was traveling straight ahead at the time the train first made contact with the semitrailer, the Safety Board believes that contact damage would probably have extended across the entire front of the locomotive. However, visible contact damage on the front of the locomotive was limited to components located on the left four feet of the locomotive.

The Safety Board believes that the existence of only four feet of contact damage confined to the left front of the locomotive confirms what the conductor and one other witness reported, and the Safety Board believes that this damage is evidence that the semitrailer was angling away from the locomotive to the left at the time of the collision. The Safety Board concludes that the truckdriver made an evasive steering maneuver to the left immediately before or possibly during the collision.

The engineer reported that he believed that the locomotives were stopped when contact was made with the truck. Conrail's Technical Services Laboratory's understanding was that the truck rolled over before the collision due to evasive maneuvering by the truckdriver, and that this maneuver may have drawn the truck back into the locomotive.

The truck came to rest inverted. Therefore it did rotate laterally at least 180 degrees during the collision sequence. Research by the University of Michigan indicates that trucks with

tank semitrailers similar to the Island semitrailer can reach a rollover threshold when subjected to 0.34 g's of lateral acceleration.

The estimated coefficient of friction between the truck's tires and the pavement surface was about 0.55. The Safety Board believes that since the friction coefficient exceeded 0.34, it was possible for the Island truck to roll over before being contacted by the locomotive, given a sufficiently small turn radius and a sufficient rate of speed.

The manufacturer of the semitrailer calculated that the height of the center of mass of the Island vehicle was 71.2 inches. To determine possible speeds at which the truck could roll over, the Safety Board used a center of mass height range 5 inches both above and below this calculated height to compensate for reasonable error.

Island reported that the minimum practical turning radius for the accident vehicle was 50 feet. To determine possible rollover speeds the Safety Board assumed that the minimum possible turning radius was 44 feet - the length of the semitrailer. Using a center of mass height of 71.2 to 76.2 inches, and a minimum turning radius of 44 feet, the Safety Board calculated that it was theoretically possible to roll the accident truck over at a speed of 15 or more mph.

The Safety Board believes that an evasive steering maneuver to the left would have been a logical maneuver by the truckdriver if he was attempting to avoid a train he perceived to be approaching from his right side. Such a steering maneuver could possibly induce a left-to-right rollover.

However, to roll over 180 degrees, the semitrailer needed a minimum lateral distance of 24 feet, disregarding the longitudinal distance the Safety Board has concluded the truck traveled west while rolling over. In order for the truck to roll over left-to-right and then slide into the stopped locomotive, the rollover maneuver would have to have been initiated when the truck was at least 24 feet south of its final rest position.

This position, which does not allow for any additional lateral distance the truck may have slid on the pavement, would necessarily place the truck south of the 36-foot-wide east-west roadway at the time rollover began. If the truck had been in or near such a position, it probably would have collided with the eastbound automobile that went over the crossing seconds before the collision occurred. The Safety Board concludes that the truck did not roll over left-to-right 180 degrees and then contact the locomotive.

Train Movement at Time of Collision.--None of the witnesses reported that the truck started to roll over before

contact was made with the train, and the location of the contact damage to the train and the right side of the semitrailer is consistent with the truck being in an upright position at the time first contact was made. The Safety Board attributes the contact damage noted on the right side of the semitrailer to contact with the handrail on the locomotive. (See figure 5.)

The fact that the height of the contact damage to the semitrailer at the last point where it could be seen was 13 inches lower than where it was at the point where it started leads the Safety Board to believe that, at the rearmost point where damage was visible, the right side of the semitrailer was beginning to rise up at the start of a north-to-south rollover.

Although it is possible that this damage could have been caused by the semitrailer riding up and over the locomotive's front platform while the locomotive was stopped, in order for this to have occurred the truck would had to have been turning to the right and back into the locomotive. The Safety Board believes that a steering maneuver to the right would probably be the least likely maneuver the truckdriver would attempt, and witnesses reported the truck was either moving straight ahead or had just started an evasive maneuver to the left.

The Safety Board believes that the decrease in height of the contact damage on the right side of the semitrailer is evidence that the locomotive was pushing the right side of the semitrailer up and off the pavement. Witnesses west of the crossing reported that when the collision occurred the truck was picked up in the air where it did a half roll and slammed down onto the street. Although the exact lane position of the semitrailer before the collision is unknown, the crash dynamics as described by the witnesses and indicated by the physical evidence would account for the probability that during the collision the truck took less than 24 lateral feet to roll over 180 degrees.

The available physical evidence is consistent with the statements of the witnesses east and west of the crossing, and the Safety Board concludes that the train was moving toward the truck at the time of the collision.

Event Recorder Data Analyses

The Safety Board believes that the first of the last 13 events listed previously is the movement of the train from plants north of the Lafayette Street crossing to the FMC plant where the engineer and the conductor stopped for about 88 minutes for food. The Safety Board believes that the subsequent events depict when the train was moved north to Lafayette Street, where it stopped for about 14 minutes, then was operated north of Lafayette Street, where it again stopped for about 8 minutes while the engineer and the brakeman purchased coffee at the coffee truck.

The Safety Board believes that the next 846- to 878-foot long movement was made south over Lafayette Street toward the Roosevelt Avenue crossing. At the end of this movement, the train stopped for a maximum of 8.6 seconds.

The Safety Board believes that the collision occurred during the next 16- to 47-foot-long movement, after which the locomotive stopped for a maximum of 9.3 seconds. The Safety Board believes that the next 271- to 303-foot-long movement was made north to the point where the engineer stopped the train and extinguished the fire on the front of locomotive 2266. Since the engine on locomotive 8142 stopped running during this stop, the event recorder also stopped recording. Based upon statements by emergency response personnel and the traincrew, the Safety Board believes that this stop lasted about 23 minutes.

The Safety Board believes that the last 814- to 846-foot-long movement was made north over the Lafayette Street crossing where the locomotives were finally stopped and where the event recorder tape was removed.

At its final rest position, the semitrailer was blocking the tracks 27 feet south of the north curbline of Roosevelt Avenue. Since the tracks were blocked, 27 feet from the north curbline is the farthest south the train could have traveled during the movement when the collision occurred.

Witnesses east and west of the crossing reported that after the truck rolled over it was pushed by the train. The Safety Board therefore believes that the train's movement when the collision occurred stopped when the head end of locomotive 2266 was either against or was very close to the side of the semitrailer.

Given the inherent inaccuracy of the distance recorded by the event recorder, the train's collision movement could have been a minimum of 16 feet. However, if this movement was the minimum 16 feet, the head end of locomotive 2266 would have been about 11 feet into the crossing when the collision movement started. None of the witnesses reported that this occurred.

The Safety Board therefore believes that the 8.6-second stop made before the collision movement was probably made at some distance greater than 16 feet, but not more than 47.9 feet, north of the final rest position of the semitrailer. The place where the Safety Board believes that the 8.6-second stop was made is discussed later in this report.

Visibility at the Crossing and Time-Distance Analysis

At the time of the accident, a 400-watt mercury vapor street lamp was mounted on a utility pole 44 feet west of the crossing.

In addition, the crossing was illuminated by the accident truck's headlamps, the headlamps of the truck facing east toward the crossing at Lafayette Street, and other lamps near the crossing.

Both of the truckdrivers north of the crossing reported that there was enough light at the crossing to see anyone who was on foot in the vicinity of the crossing. The truckdriver facing east was able to determine that there were two occupants in the automobile he saw go over the crossing seconds before the collision. The witnesses west of the crossing also reported that they could see the body of the truckdriver being tossed about the interior of the truck's cab during the overturn.

If one witness could see the number of occupants in the automobile and both could see the truckdriver from inside their respective vehicles, the Safety Board believes that the witnesses also could have seen the conductor walk out into the street if he had done so. The available evidence indicates that, even though the conductor was dressed in dark clothing, there was sufficient artificial light at the crossing to enable the witnesses to have seen the conductor on the roadway if he was there.

In his statement to the road foreman about an hour after the accident, the conductor reported that he had entered the crossing, had seen no traffic either east or west of the crossing, and had already radioed the engineer that it was safe to proceed when he again looked to the east and saw the truck approaching.

However, sight-distance tests with the front of the test locomotive stopped where the conductor reported the head end of locomotive 2266 was located when he detrained indicated that the Island truck, which had its headlights illuminated, was visible at all points from the bottom of the grade during both darkness and daylight both from the steps on the front of the test locomotive and from the crossing. Therefore, if the conductor was either on the steps or in the crossing he should have been able to see the approaching truck if he had made a proper scan for traffic.

When he was interviewed by the Safety Board, the conductor stated that he first saw the truck when it was about 425 feet away and while he was getting off the steps of the locomotive. Tests indicated that a similarly loaded truck took a total of 22 seconds to travel the last 400 feet to the crossing. Tests also indicated that it took the conductor six seconds to walk from the steps of the locomotive stopped at the north curbline of Roosevelt Avenue to the center of the street.

If the conductor did in fact walk from the stopped locomotive into the crossing, a total of 13 or more seconds elapsed from the time the conductor was in the crossing until the

cab of the truck passed over the tracks and the collision occurred.

The conductor stated he saw an automobile pass east over the crossing seconds before he brought the locomotives ahead. The truckdriver facing east toward the crossing estimated that about five to 10 seconds elapsed from the time he saw an automobile pass over the crossing to the time of the collision. The Safety Board believes that the automobile the conductor and the truckdriver reported they saw is the one containing the two witnesses the Safety Board later interviewed.

The driver of the automobile reported he stopped his vehicle east of the crossing, and both he and his passenger looked back, saw the collision, and he then got out of his automobile. He estimated that 8 to 10 seconds elapsed between the time he crossed the tracks and the time he got out of his automobile after the collision.

If the automobile driver's and truckdriver's estimates of the elapsed time(s) are reasonably accurate, the conductor would have already been standing in the crossing for about 6 seconds when the automobile passed him, and the automobile, with its headlights on, would have passed within 15 to 16 feet of where the conductor said he was standing. Neither automobile occupant saw anyone on foot on or near the crossing.

Tests showed that with the south end of the train stopped at the north curbline of Roosevelt Avenue the train could have pulled forward and then stopped within 4 or 5 feet of the centerline of the street in 7 to 10 seconds. The event recorder data showed that the train stopped for a maximum of 8.6 seconds before beginning the movement when the collision occurred. A 8.6-second stop and a subsequent movement and a stop 4 or 5 feet from the centerline therefore would have taken a maximum of about 15 to 18 seconds.

When stopped at the north curbline of Roosevelt Avenue, the sight-distance tests indicated that the test truckdriver had an unobstructed view of about the first 16 feet of the test locomotive from any point 240 feet or closer to the nearest rail as the test truck approached the crossing. At that position the rear of the body of the test locomotive was partially obstructed by a row of evergreen trees parallel to and east of the tracks.

The Safety Board calculates that at speeds between 15 and 20 mph the Island truck could have come to a complete stop in a distance between 16 and 24 feet on the grade immediately east of the crossing after the driver had perceived an obstruction or a possible danger ahead. Assuming that 240 feet was the maximum distance that the truckdriver had an unobstructed view of the front of locomotive 2266 stopped at the north curbline of Roosevelt Avenue, at speeds between 15 and 20 mph the Safety

Board calculates that the truckdriver had between 7.3 and 10.2 seconds to perceive and react to the presence of the train and stop his vehicle before it reached the tracks.

However, if the train began to pull forward from the curbline after stopping 8.6 seconds, the utility poles which obscured the truckdriver's view of the train as it was moving out into the crossing would no longer interfere with the truckdriver's view, thus increasing the amount of time that the truckdriver had available to perceive the train entering the roadway to about 13 seconds.

The truckdriver would also have had a longer amount of time to perceive the presence of the conductor out in the roadway, particularly if the conductor was waving a white light toward him. Tests indicated that when the conductor stated he first saw the truck it was about 22 seconds away from the crossing, and that tests also indicated that it took six seconds for the conductor to detrain and walk into the crossing. The truckdriver's available time to see the conductor and react to his presence would therefore have been about 18 seconds.

The truckdriver had just successfully negotiated a 90-degree left turn and was shifting gears and steering the vehicle as it ascended the grade and approached the crossing. The truckdriver was therefore engaged in several different activities which demanded his attention.

The truckdriver probably saw the truck facing east toward him on Roosevelt Avenue, and he may have seen the other truck facing south stopped on Lafayette Street. He may also have perceived that these trucks were waiting for him to pass before they made their respective turns, and his attention may have been temporarily focused on one or both of these vehicles.

However, this focus of attention on an ordinary occurrence such as waiting traffic would not in the Safety Board's view cause the truckdriver to fixate on the trucks waiting for him, and in any event would not preclude the truckdriver from perceiving objects or potential obstructions in the roadway in the near or middle distances ahead of him. The Safety Board therefore believes that there is no evidence of inattention on the part of the truckdriver.

There also is no evidence that the truckdriver was operating with illicit drugs or alcohol in his system, that he had defective vision, or that he was otherwise physically or mentally impaired. If the witnesses west of the crossing could see the train 220 feet away, it is clear that the truckdriver also could have seen it at distances of 240 feet or less if the head end of locomotive 2266 was even with the north curbline of Roosevelt Avenue. The Safety Board therefore believes that the truckdriver's failure to perceive either the locomotive stopped

at the north curbline of Roosevelt Avenue or the conductor waving his lantern at him from the roadway must be attributable to some other factor(s).

The Safety Board concluded in its analysis of the event recorder data that the movement into the crossing when the collision occurred began when the head end of locomotive 2266 was at some distance greater than 16 feet, but not more than 47.9 feet, north of the final rest position of the semitrailer. The sight-distance tests indicated that if the head end of locomotive 2266 was more than 16 feet from the north curbline of Roosevelt Avenue, or 43 feet north of the final rest position of the semitrailer, the head end of locomotive 2266 would have been at least partially obscured from the truckdriver's view by a row of evergreen trees east of and parallel to the tracks.

The Safety Board believes that the most logical explanation of why the truckdriver failed to see the train is that when the locomotives stopped for a maximum of 8.6 seconds before entering the crossing the head end of locomotive 2266 was at least partially obscured by the row of evergreen trees, and was therefore farther back from the crossing than where the conductor said it was stopped.

Witnesses east and west of the crossing reported that they did not see anyone on foot in the vicinity of the crossing before the collision. Although analyses indicate that the truckdriver could have seen the conductor in the roadway ahead of him and that he could have stopped his vehicle when he was as close as 60 to 80 feet from the crossing, the truckdriver apparently did not perceive a danger until he was almost on the crossing when he initiated an evasive move to the left.

The preponderance of the evidence indicates, and the Safety Board concludes, that before the collision the conductor was not in a position where he could have been seen by the approaching truckdriver, and the conductor therefore did not effectively flag the crossing.

Operator Vigilance and Fatigue

The truckdriver had obtained about 6 hours' sleep the night before the accident and had been on duty about 1 1/4 hours since his last 8 or more hours off duty when the accident occurred. Island was not aware that the truckdriver worked as superintendent at the apartment complex where he lived.

Although a part-time job could adversely affect an employee's full-time job performance, in this case it does not appear that the truckdriver was sleep-deprived at the time of the accident. The Safety Board concludes that truckdriver fatigue was not a causal or contributing factor in this accident.

Unlike the truckdriver, who had just begun his work day, the traincrew had been on duty about eight hours when the accident occurred. The accident occurred just before sunrise, at one of the major times of day for fatigue-related accidents to occur. 3/ The traincrew had worked at night the week before the accident. However, the accident shift was the first after the traincrew had been off duty two days, during which time the brakeman and the conductor slept at night.

The conductor, the member of the traincrew most directly involved in the accident, reported that he awoke about 7:00 a.m. on December 5. The first time he was interviewed by the Safety Board he said he ate dinner about 5 or 5:30 p.m. that day, went to a club and played racketball, returned home, and left home to report for work about 9:45 p.m. Later under oath he reported he took a three-hour nap before he went to play ball, which, if true, would have left about 1 hour 15 minutes to go to the club, play ball, and return home before he left home to report for work.

The Safety Board believes that the conductor obtained little, if any, rest after he awoke at 7:00 a.m. the morning before the accident, and therefore had obtained no significant rest for almost 24 hours at the time of the accident. This lack of rest may have affected the conductor's judgement and therefore may have contributed to his failure to properly place himself in a position where he could have been seen by the approaching truckdriver.

It is also possible that the conductor's failure to properly flag the crossing may indicate a poor operating practice which developed over time when the conductor worked this particular job assignment. Without further information, the Safety Board could not conclude that conductor fatigue was a causal factor in this accident.

Sounding the Train's Bell

The truckdrivers west of the crossing reported they could hear the sound of the train rolling over the tracks, and one reported he could hear the sound of the truck's engine pulling the grade. During the tests, the train's bell could be heard from the intersection of Lafayette Street and Roosevelt Avenue.

The truckdrivers and the occupants of the apartment overlooking the crossing reported that they did not hear the train's bell ringing before the collision occurred. The Safety Board believes that if the train's bell was sounding, these witnesses could have been able to hear it.

3/ Mitler, M. M., Carskadon, M. A., Czeisler, C. A., Dement, W. C., Dinges, D. F. and Graeber, R. C. "Catastrophes, Sleep, and Public Policy: Consensus Report," Sleep, 11, pp. 100-109, 1988.

In spite of the fact that one or more of the traincrew reported that the bell was ringing, the Safety Board concludes that the preponderance of the evidence from independent witnesses indicates that it was not.

Sounding the Train's Whistle

The truckdrivers and the building occupants west of the crossing did not hear the train's whistle as the train approached the crossing, and the conductor stated that the whistle was not sounded.

In addition, Safety Board audibility tests have repeatedly indicated that in a truck with its windows up the engine noise alone will usually mask a train's whistle until the train and the truck are so close to the crossing that a collision cannot be avoided. In a 1986 study, the Safety Board concluded that a train's warning whistle has become an ineffective warning device for large commercial vehicles unless the truckdriver stops, idles the engine, turns off all radios, fans, wipers, and other noise-producing equipment in the cab, lowers the window, and listens for a train's whistle before entering a grade crossing. 4/

Even if the truckdriver involved in this accident had done all of the above, he would not have heard a whistle because the traincrew did not sound it. In this case, effective flagging of the crossing by a member of the traincrew therefore became essential.

The conductor and the trainmaster on duty when the traincrew began their shift reported that it was an "established practice" not to sound the whistle for the Roosevelt Avenue crossing, even though NORAC's Rule 14 required it, because of alleged complaints by local residents and contacts by the Carteret police.

The Safety Board believes that simply establishing a practice not to sound a whistle in apparent violation of an operating rule because of complaints from local residents gives that practice at best a dubious legitimacy. If in fact such complaints or contacts were made, prudence would dictate that responsible management officials of the railroad should be advised of such contacts or complaints.

The Safety Board is aware that several local jurisdictions have passed legislation prohibiting the sounding of trains' whistles in the interest of noise abatement. The Safety Board does not believe that so-called "blanket" legislation prohibiting

4/ NTSB Safety Study: "Passenger/Commuter Train and Motor Vehicle Collisions at Grade Crossings (1985)," NTSB/SS-86/04, 1986.

the sounding of a train's whistle at any crossing within a city's limits is a sound safety practice. 5/

Provided that certain factors, including but not limited to provisions of local laws and ordinances, automatic protection devices, a low speed limit for highway vehicles, a restricted speed for trains, traincrew flagging requirements, a low traffic count at night, sufficient illumination at the crossing, and sufficient sight distance were present at a particular crossing, a railroad, in cooperation with the local jurisdiction, may determine there may not need to be a requirement that a train's whistle be sounded.

However, if that determination is made, the fact that the whistle need not be sounded at a given crossing should be specified by a rule or special instruction. The Safety Board believes that Conrail should determine if there are other crossings in the Conrail system where trains' whistles are not regularly sounded even though rules or special instructions in effect require that they be sounded, and take action either to enforce the requirement or establish appropriate rule or special instructions that a train's whistle need not be sounded after evaluating the feasibility of such changes and their possible impact on safety at a particular crossing.

The Headlight on the Train

One of the truckdrivers west of the crossing could not see if the headlight on the south end of locomotive 2266 was illuminated, but if it was it didn't light up the track in front of it. Both the occupants of the automobile saw the train as they approached and then went over the crossing seconds before the accident occurred. They both reported that there was one "small" light illuminated on the south end of locomotive 2266. Although these two witnesses probably didn't know exactly what they were describing, the Safety Board concludes that what they saw was the headlight on the south end of locomotive 2266 set on dim.

Although the engineer stated that the headlight on the south end of locomotive 2266 was set on bright, the preponderance of the evidence indicates, and the Safety Board concludes, that the headlight on the south end of locomotive 2266 was set on dim at the time the collision occurred.

One of the truckdrivers west of the crossing reported that as the train approached the crossing he could see a headlight

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5/ Conrail's director of operating rules advised the Safety Board that "blanket" ordinances prohibiting a train from sounding its whistle exist in Grand Rapids, MI, South Bend, IN, Syracuse, Rochester, and Buffalo, NY, and Framingham, MA, among other cities.

beam shining north. No headlight beam was reported shining south. The Safety Board believes that it is reasonable to assume that, had the headlight on the south end of the train been set on bright, the accident truckdriver could have seen a similar beam shining over the accident crossing and reflecting from structures south of the approaching train.

The bright headlight beam shining over the crossing on the south end of locomotive 2266 would have provided highway traffic near the crossing with additional warning that the train was near the crossing, and probably would have assisted in alerting the approaching truckdriver to the presence of the train. The Safety Board concludes that the failure to set the headlight on the south end of locomotive 2266 on bright contributed to the truckdriver's apparent failure to recognize the presence of the train until it was too late to avoid the collision.

Flagging Other Crossings

Conrail advised that the traincrew was not required to flag the Lafayette Street crossing because it was a "running" track. Although the traincrew technically may not have been required by special instruction 105-2 to flag the Lafayette Street crossing, the Safety Board believes that crossings without automatic warning lights and/or gates near tank farms or other facilities with a high volume of hazardous material truck traffic need to be protected regardless of the railroad classification of the track.

After the accident, Conrail instituted a change in requirements and required that the Lafayette Street crossing be flagged. The Safety Board believes that Conrail should evaluate other crossings without automatic protection in the Conrail system near tank farms or other facilities with a high volume of hazardous material truck traffic to determine if other such crossings should be required to be protected by flagging.

Conrail CORPS Testing

According to Conrail's director of operating rules, there is no record of any CORPS tests to determine traincrew compliance with traincrew flagging requirements performed in the last five years. Traincrew compliance with rules and special instructions concerning flagging protection at grade crossings was not perceived to be a problem by Conrail management.

The Safety Board is at a loss to understand how compliance with flagging requirements was determined not to be a problem if no tests were performed to determine traincrews' compliance with flagging protection requirements. Conrail should identify job assignments in its system which require one or more of the grade crossings on that assignment to be flagged by the traincrew, and periodically conduct surprise efficiency tests to determine

traincrew compliance with rules and special instructions pertaining to flagging of grade crossings.

Grade Crossing Accidents and Toxicological Testing

The traincrew involved in this accident was not required by present FRA rules or Conrail's procedures to supply blood, urine, or breath samples after the accident, and the traincrew supplied blood samples only after the Safety Board requested them.

Although the traincrew involved in this accident tested negative for alcohol or illicit drugs, the traincrew could have refused to supply any samples. Since local authorities lacked sufficient probable cause, they also could not require the traincrew to supply any samples, and the fact that the crew was alcohol- and drug-free would not have been determined.

Given the circumstances of this accident, under the present FRA rule the only way a member of the traincrew could have been required to supply samples of blood, breath, or urine for toxicological testing would have been if a Conrail supervisor on scene had reason to believe that a traincrew member's act or omission caused or contributed to the accident. The Safety Board doubts that a traincrew member would voluntarily admit to such an act or omission against his own self-interest.

The Safety Board believes that the FRA should amend the rule pertaining to toxicological testing of certain railroad employees to require that traincrew members supply samples of blood and urine for toxicological testing if they are involved in a reportable accident at a grade crossing where the traincrew is required by an operating rule, special instruction, or local ordinance to provide flagging protection at the crossing.

Maintenance of Highway/Grade Crossing Warning Devices

Although the NJDOT determined in February 1987 that the advance pavement marking east of the accident crossing needed repainting and the crossbuck sign east of the crossing was missing, these findings were not forwarded to Middlesex County, the political subdivision in the State responsible for maintenance of signs and other warning devices at the crossing.

Although in this case the evidence indicates that the accident truckdriver was familiar with the crossing and that therefore the advance pavement marking's condition and the missing advance warning sign did not cause or contribute to the accident, the Safety Board believes that the NJDOT should institute procedures to identify and notify jurisdictions responsible for the maintenance of railroad grade crossing warning signs and other devices if deficiencies are found during NJDOT inspections.

Federal Motor Carrier Safety Regulations

The driver of the eastbound automobile reported that he had been over the accident crossing every work day for the last five years and the day of the accident was the first time he had seen a train there. Since the accident truckdriver usually got on the road around 5:30 a.m., he probably went over the crossing on trips where he used the New Jersey Turnpike at about the same time the automobile driver was going the other way, and the Safety Board believes that the accident truckdriver probably also seldom, if ever, saw a train at the crossing. Because he seldom saw a train at the crossing, the truckdriver may have acquired the habit of slowing, but not stopping, for the crossing.

One of the truckdrivers who witnessed the accident believed that the provision of the FMCSR that exempted "industrial switching" crossings exempted the accident crossing from the requirement that hazardous materials trucks stop for it. Island's director of safety and personnel did not know whether hazardous materials trucks were required by 392.10 of the FMCSR to stop at the crossing.

Although company policy and New Jersey law required the truckdriver to stop at the crossing, the Safety Board believes that the "industrial switching" exemption in Section 392.10 of the FMCSR is vague. To determine if the crossing in fact was exempted, in addition to reaching a decision as to what constituted "industrial switching purposes" and a "business district," a truckdriver approaching a crossing perhaps for the first time would also have to know if the State or local jurisdiction required that a stop be made.

This exemption also is unnecessary. If after evaluation it is determined that a stop need not be made at a particular grade crossing, the provision already contained in the FMCSR that it may be marked as being "exempt" by or with the consent of the local jurisdiction will assist any hazardous materials truckdriver approaching the crossing in reaching a determination whether he is required to stop.

The examption may also have misled the truckdriver, in spite of company policy and New Jersey law, to believe that Federal requirements did not require him to stop at the crossing. The Safety Board believes that the provision in Section 392.10(b) of the FMCSR which provides that certain vehicles transporting hazardous materials need not stop for grade crossings used exclusively for industrial switching purposes should be eliminated.

On October 8, 1986, the Federal Highway Administation (FHWA) notified the Safety Board that Section 206 of the Motor Carrier Safety Act of 1984 (49 USC app. 2505) prohibits the modification or elimination of any regulation relative to the

transportation of hazardous materials unless and until an equivalent or more stringent regulation has been promulgated under the Hazardous Materials Transportation Act (PL 93-633). The FHWA also advised the Safety Board that the Secretary of Transportation has delegated the responsibility for the development and promulgation of such regulations to the Department of Transportation's Research and Special Programs Administration (RSPA). A safety recommendation to eliminate the industrial switching exemption in the FMCSR will therefore be directed to the RSPA instead of the FHWA.

The Safety Board also believes that the National Tank Truck Carriers, Inc. of the American Trucking Associations should notify its members of the facts and circumstances of this accident, and request that their members advise their drivers of hazardous materials trucks not to cross over any grade crossing without stopping unless the crossing is marked as being "exempt."

Operation Lifesaver

The Safety Board has had a longstanding commitment to improve drivers' awareness of the extreme hazards of grade crossings. Motor vehicle drivers often disregard approaching trains for many reasons. Sometimes poor line of sight or the difficulty of hearing trains' warning systems inside of a truck cab make it difficult to improve drivers' recognition of danger at these locations. Safety studies completed by the Board have addressed the hazards posed by routing trucks over grade crossings with only passive warning systems. 6/

There is no simple way to improve drivers' awareness of grade crossing hazards. One program that the Safety Board has long supported is the national voluntary "Operation Lifesaver" grade crossing safety program. This program is now operated under the auspices of Operation Lifesaver, Inc., a nonprofit organization with the following purposes:

- o Develop and conduct a nationwide program to assist in the education of the public and transportation industry on grade crossing safety;
- o Develop, produce, and distribute grade crossing safety educational materials; and
- o Provide assistance and coordination to State and local grade crossing safety education and public information programs.

6/ "Railroad/Highway Grade Crossing Accidents Involving Trucks Transporting Bulk Hazardous Materials," NTSB/HZM-81/2; "Railroad/Highway Grade Crossing Review - - Calendar Years 1983 and 1984," NTSB/SS-85/05.

Both Conrail and the State of New Jersey participate as members of the New Jersey "Operation Lifesaver" program. This program has provided speakers and safety information addressing grade crossing safety in the State since 1984. Conrail has a 45-foot mobile safety training van that contains training materials for use by States' "Operation Lifesaver" programs. This van also contains equipment to display video cassette recordings of actual grade crossings collisions, computer simulations dealing with grade crossing safety questions, and a simulator that allows a participant to operate a locomotive in various grade crossing accident scenarios.

Conrail's director of community relations indicated that this van could be made available to trucking companies transporting bulk hazardous materials in Conrail's operating area for safety and educational programs directed at grade crossing safety.

In the Safety Board's passenger/commuter grade crossing safety study, the Board recommended that Operation Lifesaver, Inc.:

> R-86-60
>
> Expand the "Operation Lifesaver" program to deal specifically with the problems of trucks carrying bulk hazardous materials, especially petroleum products, over grade crossings.

On October 10, 1987, Operation Lifesaver, Inc. responded to this recommendation and advised that it was developing a new brochure, "Truck Safety," which contains grade crossing safety information on the unique safety and operational considerations required of truckdrivers transporting bulk hazardous materials over grade crossings. This brochure will be available by 1990, and Safety Recommendation R-86-60 has been classified as "Open - -Acceptable Action."

CONCLUSIONS

Findings

1. The weather and the condition of the track at the crossing did not contribute to the accident.

2. The poor condition of the advance pavement marking east of the crossing, the lack of a railroad advance warning sign, and the general condition of the highway did not cause or contribute to the accident.

3. The truckdriver was qualified to operate the truck by reason of his physical condition, training, and experience.

4. The traincrew were qualified to operate the train by reason of their training and experience.

5. There were no mechanical defects on the locomotives or the truck which caused or contributed to the accident. The truck's headlights were illuminated at the time of the collision.

6. The truckdriver failed to bring his vehicle to a complete stop at a distance of between 15 and 50 feet from the tracks before proceeding over the crossing.

7. The truck was moving westbound and the train was moving southbound at the time of the collision.

8. The cab of the truck-tractor was west of the center of the rails at the time of the collision.

9. The truckdriver made an evasive steering maneuver to the left immediately before or possibly during the collision.

10. There was sufficient artificial light at the crossing to enable witnesses to have seen the conductor on the roadway, had he been there.

11. There is no evidence of inattention on the part of the truckdriver.

12. The conductor did not flag the crossing.

13. Truckdriver fatigue was not a factor in this accident.

14. The train's bell was not sounding at the time of the collision.

15. The train's whistle was not sounded as the train approached the crossing.

16. The headlight on the south end of locomotive 2266 was set on dim as it approached the crossing.

17. The Federal rule that permits hazardous materials trucks to cross over railroad tracks used for industrial switching purposes without stopping is vague and unnecessary.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the conductor's failure to flag the crossing and the truckdriver's failure to stop his vehicle between 15 and 50 feet of the grade crossing as required. Contributing to the accident was the failure of the engineer to set the headlight of the locomotive facing the crossing on bright.

RECOMMENDATIONS

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

--to the Consolidated Rail Corporation:

Determine if there are other crossings in the Conrail system where trains' whistles are not regularly sounded even though rules or special instructions require it, and take action either to enforce the requirement or establish a rule or special instruction that a train's whistle need not be sounded after evaluating the feasibility of such a change and its possible impact on safety at the crossing. (Class II, Priority Action)(R-89-62)

Evaluate other running track grade crossings in the Conrail system near industrial areas where hazardous materials trucks are likely to be encountered, and determine if other such crossings should be required to be protected by flagging. (Class II, Priority Action)(R-89-63)

Identify job assignments in the Conrail system which require one or more of the grade crossings on the assignment to be flagged by the traincrew, and periodically conduct surprise efficiency tests to determine traincrew compliance with rule and timetable special instructions pertaining to flagging protection at crossings where it is required. (Class II, Priority Action)(R-89-64)

--to the Federal Railroad Administration:

Amend the rule pertaining to toxicological testing of certain railroad employees to require that traincrew members supply samples of blood and urine if they are involved in a reportable accident at a highway grade crossing where the traincrew is required by an operating rule, special instruction, or local ordinance to provide flagging protection at the crossing. (Class II, Priority Action)(R-89-65)

--to the New Jersey Department of Transportation:

Institute procedures to identify and notify jurisdictions responsible for the maintenance of railroad grade crossing warning signs and other devices if deficiencies are found during NJDOT inspections. (Class II, Priority Action) (H-89-35)

--to the Research and Special Programs Administration:

Delete the provision contained in section 392.10(b) of the Federal Motor Carrier Safety Regulations which permits certain vehicles transporting hazardous materials to cross railroad grade crossings used exclusively for industrial switching purposes without stopping and determining that it is safe to proceed. (Class II, Priority Action)(H-89-36)

--to the National Tank Truck Carriers, Inc. of the American Trucking Associations:

Notify your membership of the facts and circumstances of the train/truck collision which occurred in Carteret, New Jersey, on December 6, 1988, and request your members to advise their hazardous materials truck drivers not to cross over any grade crossing without stopping unless the crossing is marked as being exempt. (Class II, Priority Action)(H-89-37)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Acting Chairman

/s/ Jim Burnett
Member

/s/ John K. Lauber
Member

/s/ Joseph T. Nall
Member

/s/ Lemoine V. Dickinson, Jr.
Member

October 24, 1989

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

Investigation

The National Transportation Safety Board was notified of this accident at 9:00 a.m. on December 6, 1988, by the news media.

Accident investigators dispatched from the Safety Board's New York, New York, regional office arrived on scene at 10:00 a.m., and investigators dispatched from the Safety Board's headquarters office in Washington, D.C. arrived on scene at 4:30 p.m. on December 6, 1988.

Participating in the investigation were representatives of Island Transportation Corporation, Consolidated Rail Corporation, the Carteret Police and Fire Departments, the Middlesex County (New Jersey) Prosecutor's Office, the United Transportation Union, and the Federal Railroad Administration.

Deposition and Hearing

On May 18 and 19, 1989, Safety Board investigators took depositions from representatives of Island Transportation Corporation, Consolidated Rail Corporation, the traincrew involved in the accident, and other witnesses to the accident.

APPENDIX B

TRAINCREW EFFICIENCY TEST RESULTS

(C)= TEST OF CONDUCTOR
(B)= TEST OF BRAKEMAN
(E)= TEST OF ENGINEER

TEST NUMBER	SUBJECT	DATE(S) OF TESTS	FAILURES UNDERLINED
0021	POSSESSION OF RELIABLE WATCH; COMPARISON WITH STANDARD CLOCK.	12/29/87(C), 10/26/87(B), 12/29/87(B)	
0071	POSSESSION OF FLAG AND SIGNAL APPLIANCES IN PROPER ORDER READY TO USE.	10/26/87(B)	
0181	HEADLIGHT DISPLAYED TO FRONT AND REAR DAY OR NIGHT.	8/31/87(E), 12/29/87(E), 12/29/87(E), 1/28/88(E)	
0741	SIGNING REGISTER WHEN REPORTING FOR DUTY; EXAMINING BULLETIN BOARD.	12/29/87(C), 3/25/88(C) 5/24/88(C), 7/23/87(B), 7/28/87(B), 10/26/87(B), 12/29/87(B), 3/25/88(B), 5/24/88(B), 5/24/88(E)	
0755	HAS COPY OF SUMMARY BULLETIN ORDER.	12/29/87(C), 5/24/88(C), 10/26/87(B), 12/29/87(B), 5/24/88(B), 5/24/88(E)	*
0756	HAS ALL GENERAL ORDERS INSERTED IN TIMETABLE.	10/29/87(E), 11/19/87(E)	
0931	RECEIPT OF PROPER AUTHORITY TO PROCEED AND MOVING AT RESTRICTED SPEED.	8/14/87(B)	
1031	CREW MEMBER POSITIONED ON END OF LEADING CAR.	7/23/87(B)	
1041	RESTORING SWITCHES TO NORMAL POSITION AFTER USE.	6/16/87(C), 2/23/88(C), 5/23/88(C)	
1042	LINING ALL SWITCHES BEFORE STARTING MOVEMENT.	2/23/88(C), 5/23/88(C) 8/31/87(E), 12/28/87(E), 12/29/87(E), 1/28/88(E)	

APPENDIX B (CONTINUED)

1043	OBSERVING SWITCHES AND DERAILS NEAREST ENGINE.	8/31/87(E), 12/28/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E)
1111	OPERATE AT RESTRICTED SPEED.	3/25/88(C), 3/25/88(B)
1121	MOVEMENT IN ACCORDANCE WITH SIGNAL OR AT RESTRICTED SPEED AFTER RECEIVING PERMISSION.	8/26/87(E), 8/26/87(E) *
1131	OPERATING AT RESTRICTED SPEED.	6/16/87(C), 10/26/88(C), 7/23/87(B), 8/5/87(B), 8/14/87(B), 8/31/87(E), 12/28/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E), 3/30/88(E)
1301	NOT COUPLING TO CARS UNTIL OBSTRUCTIONS OR SIGNS INDICATING TANK CAR LOADING ARE CLEAR.	6/16/87(C), 7/23/87(B)
1311	REFRAIN FROM EXCESSIVE USE OF SAND.	8/31/87(E)
1321	UTILIZING SAFETY FEATURES; DEAD MAN PEDAL NOT BLOCKED.	6/16/87(C), 12/29/87(E) 1/13/88(E), 3/30/88(E)
2631	PERMISSION OBTAINED FROM DISPATCHER OR OPERATOR.	2/23/88(C)
2711	VERBAL AUTHORITY RECEIVED FROM DISPATCHER OR OPERATOR AND PROPERLY RECORDED.	5/23/88(C), 10/26/88(C)
2712	AUTHORIZATION FOR MOVEMENT PROPERLY RECORDED	5/23/88(C)
2851 & 2933	COMMENCE REDUCTION TO MEDIUM SPEED BEFORE ENGINE PASSES SIGNAL.	10/26/88(C), 12/28/87(E)
2852	PROCEED NOT EXCEEDING MEDIUM SPEED.	12/28/87(E)
2853	BE PREPARED TO STOP AT NEXT SIGNAL.	12/28/87(E)

APPENDIX B (CONTINUED)

2901	PROCEED AT RESTRICTED SPEED.	8/24/87(E), 8/25/87(E), 8/31/87(E), 12/28/87(E), 12/29/87(E),12/29/87(E), 1/28/88(E)	
2911 & 2921	STOP.	8/25/87(E), 8/31/87(E), 12/29/87(E), 12/28/87(E), 12/29/87(E), 1/28/88(E)	
2933	SEE RULE 2851.		
3261	TRAIN MUST BE REPORTED CLEAR.	2/23/88(C), 5/23/88(C)	
5021	PERMISSION RECEIVED TO FOUL MAIN TRACK, OPERATION THEN MADE AT RESTRICTED SPEED.	8/5/87(B)	
7031	NOT TRANSMITTING UNTIL CHANNEL IS FREE.	6/16/87(C), 8/31/87(E), 12/29/87(E), 12/29/87(E), 1/28/88(E)	
7041	ORIGINATING RADIO CALL WITH "CONRAIL."	7/23/87(B), 8/24/87(E), 8/25/87(E), 8/31/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E)	*
7042	IDENTIFYING NAME OF BASE STATION ON RADIO.	2/23/88(C)	
7044	IDENTIFYING BY NAME, OCCUPATION, AND LOCATION ON RADIO.	1/28/88(E)	*
7045	USING "OVER" WHEN EXPECTING A REPLY.	8/24/87(E), 8/25/87(E), 8/31/87(E), 12/29/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E)	*
7046	USING "OUT" WHEN NO REPLY IS NECESSARY.	8/24/87(E), 8/25/87(E), 8/31/87(E), 12/29/87(E), 1/13/88(E)	
7051	MAKING VOICE TEST WHEN TAKING CHARGE OF RADIO.	10/26/87(B)	

APPENDIX B (CONTINUED)

7052	RADIO TUNED AND ADJUSTED TO HEAR ALL CALLS.	5/23/88(C), 10/26/87(B), 8/24/87(E), 8/25/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E)
7053	PROMPTLY ACKNOWLEDGING ALL RADIO CALLS.	2/23/88(C), 5/23/88(C) 7/29/87(B), 8/24/87(E), 8/25/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E)
7071	KEEPING IN CONTINUOUS RADIO CONTACT.	6/16/87(C)
7101	PERSONALLY RECEIVING COMMUNICATION PERTAINING TO MOVEMENT OF TRAIN OR CAR.	1/28/88(E)
7102	COMMUNICATION FULLY UNDERSTOOD BEFORE BEING ACTED UPON.	1/28/88(E)
7151	NOT USING UNNECESSARY OR INDECENT LANGUAGE.	8/31/87(E), 1/28/88(E)
7202	PROPERLY PROTECTING RADIO FROM LOSS.	6/16/87(C), 8/5/87(B) *
9105	PRESENCE OBSERVED DURING TOUR OF DUTY.	12/29/87(C), 3/25/88(C), 12/29/87(B), 3/25/88(B) 8/24/87(E), 8/25/87(E), 8/31/87(E), 12/29/87(E), 1/28/88(E), 1/28/88(E), 1/28/88(E), 3/30/88(E)
9106	PRESENCE OBSERVED AT END OF TOUR OF DUTY.	10/26/88(C), 3/30/88(E)
9111	OBSERVED TO BE FIT FOR DUTY.	6/16/87(C), 12/29/87(C), 3/25/88(C), 5/24/88(C), 10/26/88(C), 6/17/87(B), 7/23/87(B), 7/28/87(B), 12/29/87(B), 1/18/88(B) 3/25/88(B), 5/24/88(B), 8/24/87(E), 8/25/87(E), 8/31/87(E), 12/28/87(E), 12/29/87(E), 1/13/88(E), 5/24/88(E)
9199	NO UNAUTHORIZED PERSONS AT WORK STATION.	7/16/87(E)

APPENDIX B (CONTINUED)

9271	ENGINEER OBSERVES AND COMPLIES WITH ALL SIGNALS.	8/24/87(E), 8/31/87(E), 12/29/87(E), 12/29/87(E), 1/13/88(E), 1/28/88(E), 3/30/88(E)
9272	ENGINEER SAFELY REGULATES SPEED OF TRAIN.	8/24/87(E), 8/31/87(E), 12/29/87(E), 12/29/87(E), 1/28/88(E), 3/30/88(E)
9273	ENGINEER CHECKS ACCURACY OF ENGINE SPEED INDICATOR.	3/30/88(E)
9291	ENGINEER TAKES RESPONSIBILITY FOR VIGILANCE AND CONDUCT OF OTHER EMPLOYEES ON ENGINE.	12/29/87(E), 3/30/88(E)
9292	ENGINEER ALLOWS ENGINE TO BE OPERATED ONLY BY FIREMAN OR STUDENT ENGINEER UNDER HIS SUPERVISION.	12/29/87(E), 3/30/88(E)
9311	ENGINEER ACCEPTS NOTIFICATION OF INSPECTION PERFORMED BY MECHANICAL FORCES.	3/30/88(E)
9321	ENGINEER ASSURES THAT ALL ENGINES HAVE BEEN INSPECTED AS PRESCRIBED.	12/28/87(E), 12/29/87(E)
9371	PROPERLY INSTRUCTING CREW ON DUTIES AND RULES.	6/16/87(C)
9421	TAKING ACTION TO AVOID TRAIN DELAYS.	6/16/87(C)
9461	DISPLAYING MARKERS, PROVIDING REQUIRED PROTECTION, HANDLING SWITCHES, COUPLING AND UNCOUPLING CARS, ASSISTING CONDUCTOR AND ENGINEER.	7/29/87(B)
9602	CHECK TAPE OF ENGINE	10/26/88(C), 4/6/88(E)

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