RAILROAD ACCIDENT REPORT

TEXAS AND PACIFIC WORK EXTRA 523/ MISSOURI PACIFIC EXTRA 1902 EAST HEAD-ON COLLISION TAFT, LOUISIANA FEBRUARY 21, 1973

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20591
REPORT NUMBER: NTSB-RAR-73-6

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15. Supplementary Notes

This report contains Railroad Safety Recommendations R-73-38 through R-73-41.

16. Abstract

This report describes and analyzes a head-on collision which occurred at Taft, La., on February 21, 1973. At 3:30 a.m., westbound Texas and Pacific Work Extra 523 passed beyond its planned stopping point on an industrial siding, made an unauthorized entry onto the main track, and was struck by eastbound Missouri Pacific Extra 1902 East. The three locomotive units of Extra 1902 East, the locomotive unit of Work Extra 523, and 16 cars were derailed as a result of the collision. Three crewmembers on Extra 1902 East were killed, probably in a fire which engulfed the locomotive units; two other crewmembers were injured.

The National Transportation Safety Board determines that the probable cause of the collision was the unauthorized intrusion of Work Extra 523 onto the main track, which resulted from the engineer's failure to brake the train in time to stop on the siding. Contributing to the collision were (1) the absence of protective devices to guard against the unplanned intrusion of a train from another track onto the main track and (2) operating practices and work patterns which did not adequately control switching movements. The absence of crash-injury protection in the locomotive units and caboose of Extra 1902 East contributed to the fatalities and injuries.

The report contains recommendations to the Federal Railroad Administration and to the Missouri Pacific Railroad Company intended to prevent this type of accident.

17. Key Words	18. Distribution Statement
Railroad Accident, Head-On Collision, Derailment, Crashworthiness, Fire in Cab of Locomotive, Crew Training and Experience, Operating Rules, Operating Procedures, Safety Appurtenances for Railroad Equipment, Clearance Point, Fouling Circuit	This document is available to the public through the National Technical Information Service, Springfield, Va., 22151.

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FOREWORD

The accident described in this report has been designated as a major accident by the National Transportation Safety Board under the criteria established in the Safety Board's regulations.

This report is based on facts obtained from an investigation conducted by the Safety Board, in cooperation with the Federal Railroad Administration. The conclusions, the determination of probable cause, and the recommendations are those of the Safety Board.

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TEXAS AND PACIFIC WORK EXTRA 523/MISSOURI PACIFIC EXTRA 1902 EAST HEAD-ON COLLISION TAFT, LA. FEBRUARY 21, 1973

I. SYNOPSIS

At 3:30 a.m., on February 21, 1973, westbound Texas and Pacific Railway Company Work Extra 523 passed beyond its planned stopping point on an industrial siding in Taft, La., made an unauthorized entry onto the main tract, and collided head on with eastbound Missouri Pacific Extra 1902 East. The three locomotive units of Extra 1902 East, the single locomotive unit of Work Extra 523, and 16 railroad cars derailed as a result of the collision. Three crewmembers on Extra 1902 East were killed, probably in a fire which engulfed the locomotive units; two other crewmembers were injured.

The National Transportation Safety Board determines that the probable cause of the collision was the unauthorized intrusion of Work Extra 523 onto the main track, which resulted from the engineer's failure to brake the train in time to stop on the siding. Contributing to the collision were (1) the absence of protective devices to guard against the unplanned intrusion of a train from another track onto the main track and (2) operating practices and work patterns which did not adequately control switching movements. The absence of crash-injury protection in the locomotive units and caboose of Extra 1902 East contributed to the fatalities and injuries.

II. FACTS

The Accident

Work Extra 523. Texas and Pacific Railway Company (T&P) Work Extra 523 originated at Avondale, La., on February 20, 1973. The crew, which consisted of an engineer, a conductor, and two brakemen, was called for 6 p.m., and the train departed for Taft, La., one hour later. At Taft, work extras perform switching services for the Hooker Chemical Corporation, the Argus Chemical Company, and the Union Carbide Corporation. Designation of a train as a work extra allows more flexibility in movement than would otherwise be possible. 1/

1/ Work extras on this type of assignment are known locally as "dodgers."

Work Extra 523 was authorized to operate on the main track between Avondale and Johnson, La., a station west of Taft, until 5:30 a.m., on February 21, if all applicable rules were followed. However, once having cleared the main track, Work Extra 523 could not re-enter the track without the permission of the dispatcher. Once the train order was fulfilled or expired, the train could only re-enter the main track with a new train order.

When Work Extra 523 arrived at Taft, the conductor reported to the dispatcher that the train had cleared the main track. Shortly before 3:30 a.m., the train was operating on a business track parallel to the main track at Taft. This business track was known locally as the drill track. The single locomotive unit of Work Extra 523 coupled to 34 loaded tank cars and moved toward the west end of the drill track. The cars, which were handled without any difficulty, were then moved eastward onto the Hooker lead track. (See Figure 1.) After two empty cars were added to the train, the assembly was complete. The airbrakes on the 36-car draft were not charged.

On a signal from one of the brakemen at the rear of the train, the engineer of Work Extra 523 pulled the 36 cars westward. This movement was part of a classification process. The engineer was positioned on the north side of the locomotive cab; the short end of the locomotive was toward the west. Since the airbrakes on the cars were not charged, train movement was controlled entirely by the locomotive unit.

Train movement in switching operations at Taft is controlled by means of voice instructions or hand signals given to the engineer by one of the other crewmembers. Radios are not used to control switching movements. Various hand signals are prescribed in the operating rules, and the engineer intended to stop the train on the proper signal from one of the brakemen when the caboose cleared the Hooker storage switch. The engineer did not know how many cars were coupled to the locomotive, nor was he required to be given this information. There was no system of marking the number of carlengths between various points of reference.

The crewmembers estimated that when the engineer was given the signal to proceed westward, he accelerated the train to 3 to 5 m.p.h. The conductor boarded the locomotive and occupied the seat on the south side of the cab. At this time, the train was being operated in accordance with established work practices. The crew considered the speed of the train to be a safe speed, based on experience.

When the locomotive was about midway between the Hooker storage switch and the Shell Road crossing, the conductor told the engineer that a train was approaching from the west on the main track and suggested that the headlight of Work Extra 523 be extinguished.

The engineer extinguished the headlight and placed the throttle in the No. 1 position, while he looked eastward for a stop signal from his

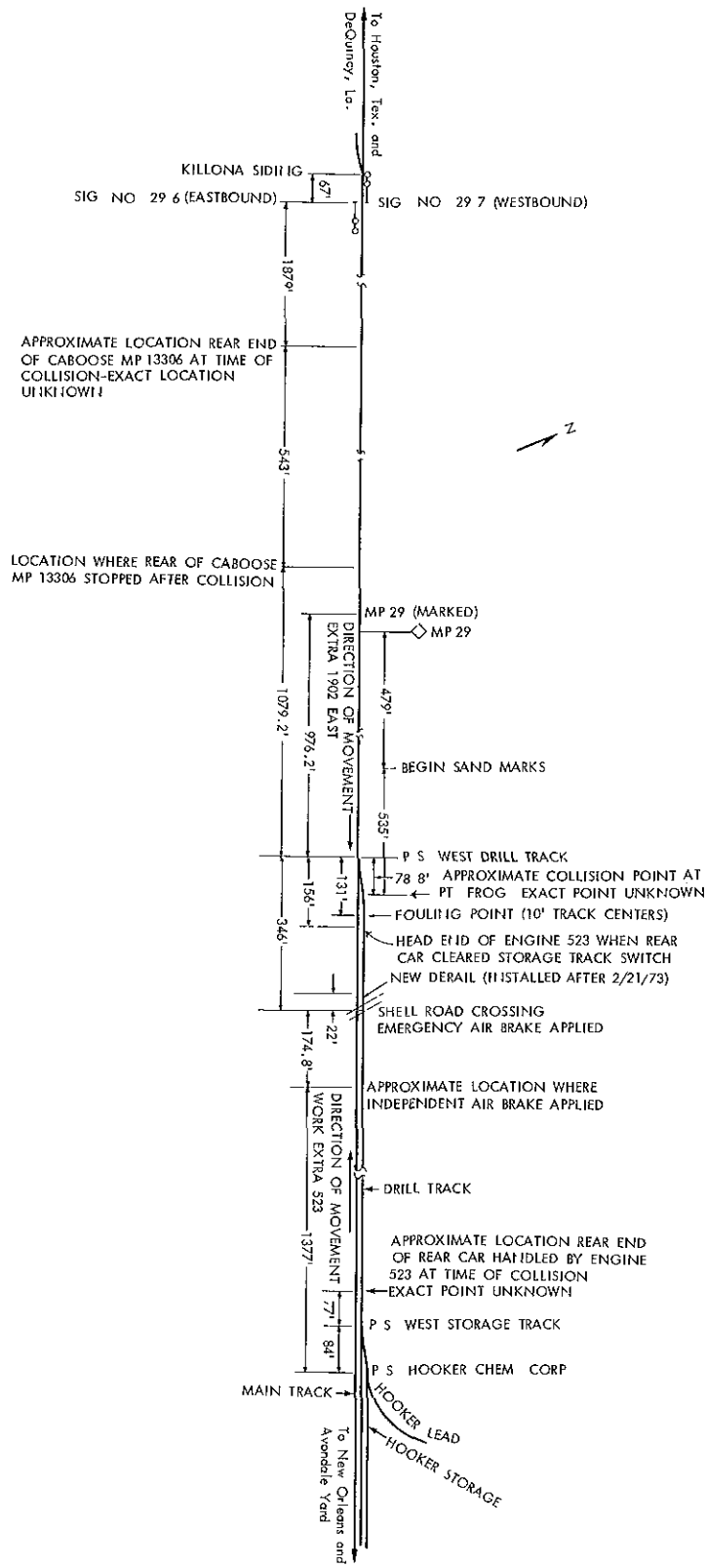


Figure 1. Accident site.

brakeman. The train continued westward for about 10 car lengths; no stop signal was received from the brakeman. Despite the lack of a signal, the engineer placed the throttle in the idle position, and applied the independent brake. The effectiveness of the brake application was indicated by train slack run-in which was observed by the engineer, the conductor, and the brakemen at the rear of the train. The conductor also heard the hissing of air while the engineer manipulated the brake lever. At approximately the time of initial braking, according to the engineer and conductor of Work Extra 523, the headlight of the approaching mainline train was extinguished briefly and was then turned back on bright.

As Work Extra 523 approached the Shell Road crossing, the engineer expressed concern to his conductor about the effectiveness of the braking. When the locomotive reached the Shell Road crossing, the engineer placed the locomotive automatic brake in the emergency position and warned the conductor of a possible collision with the approaching train. Work Extra 523 continued to move forward and the engineer twice said to the conductor, "We are going to have to get off."

As the locomotive entered the turnout to the main track, the engineer left the cab through the door behind the control stand, swung under the handrail along the walkway, and dropped to the ground. The conductor immediately followed. The engineer ran north approximately 50 yards from the point of detrainment. The conductor ran northeast away from the train.

While running, both men heard the two trains collide. They turned around and saw sparks and possible electrical arcing as the locomotives impacted. The engine of Work Extra 523 was raised upward, and fire erupted. As the engineer and conductor started to move farther north, they felt the heat from a fireball on their backs.

Extra 1902 East. The eastbound train that collided with Work Extra 523 was Missouri Pacific Railroad Company (MP) Extra 1902 East. The train originated at Houston, Texas, on February 20. The traincrew was changed at DeQuincy, La., for continued movement of the train to New Orleans. The incoming crew consisted of an engineer, a fireman, a conductor, and two brakemen. The conductor and the engineer each received a copy of the train order which authorized Work Extra 523 to work on the main track between Avondale and Johnson until 5:30 a.m., on February 21. The train's brakes were used several times en route to stop the train for work and to slow the train in compliance with slow orders. In all instances, the brakes performed satisfactorily.

The train departed Addis, La., the last stop before the accident site, with three locomotive units, 21 loaded cars, 17 empty cars, and a caboose. The first locomotive unit was unit 1902, the second was unit 540, and the third was unit 117. The engineer, the fireman, and one

brakeman were in unit 1902, the other brakeman was in unit 540, and the conductor was in the caboose. The engineer operated the train from the south side of the cab, the fireman sat on the north side, and the brakeman occupied the middle seat.

Extra 1902 East entered Killona, La., which is slightly more than one mile west of the accident site, at a speed of approximately 45 m.p.h. The locomotive headlight was shining brightly as the train passed through Killona. The engineer stated that the headlight remained on bright until the collision. The enginecrew and the conductor observed the eastbound wayside signal (No. 29.6) at the east end of Killona, the train-order signal at Taft, and the first wayside signal east of Taft in the clear position.

The engineer of Extra 1902 East had first seen the headlight of Work Extra 523 as his train rounded a curve west of Killona. While Extra 1902 East was in the vicinity of Killona, the engineer saw that the headlight of Work Extra 523 was extinguished, and he therefore assumed that the train was stopped clear of the main track. As Extra 1902 East proceeded eastward, the engineer continued to watch the westbound train's classification lights. Only when locomotive unit 1902 was in the vicinity of milepost 29 did the engineer realize from the movement of the classification lights that Work Extra 523 had entered the main track.

As soon as he perceived the hazard, the engineer of Extra 1902 East reduced the throttle to idle and simultaneously placed the automatic brake valve in emergency. The conductor noted that he felt the emergency brake application at 3:30 a.m. The engineer alerted the brakeman and the fireman of the impending collision, and he then raised his legs to brace himself against the front of the cab.

The engineer of Extra 1902 East stated that he approached Taft at a speed about 10 m.p.h less than the 50 m.p.h. maximum authorized speed on the main tra , because he was aware of the possibility that Work Extra 523 might be using the main track in a switching movement. Sand deposits on the rail indicated that emergency braking began about 535 feet west of the impact point. Since the brakes must be applied for approximately 5 seconds before effective deceleration begins, Extra 1902 East traveled 330 feet before it started to decelerate. Even then, brake cylinder pressure would not have had time to develop in all cars before the collision. Therefore, Extra 1902 East probably collided with Work Extra 523 at a speed of approximately 37 to 40 m.p.h.

Extra 1902 East struck slightly to the left of the coupler of Work Extra 523. (See Figures 2 and 3.) At impact, the first locomotive unit of Extra 1902 East veered southward. As the second locomotive unit underrode the frame of unit 1902, the rear truck of unit 1902 was forced against and subsequently punctured the first unit's fuel tank. The left battery box of unit 1902 was struck and destroyed. Heavy

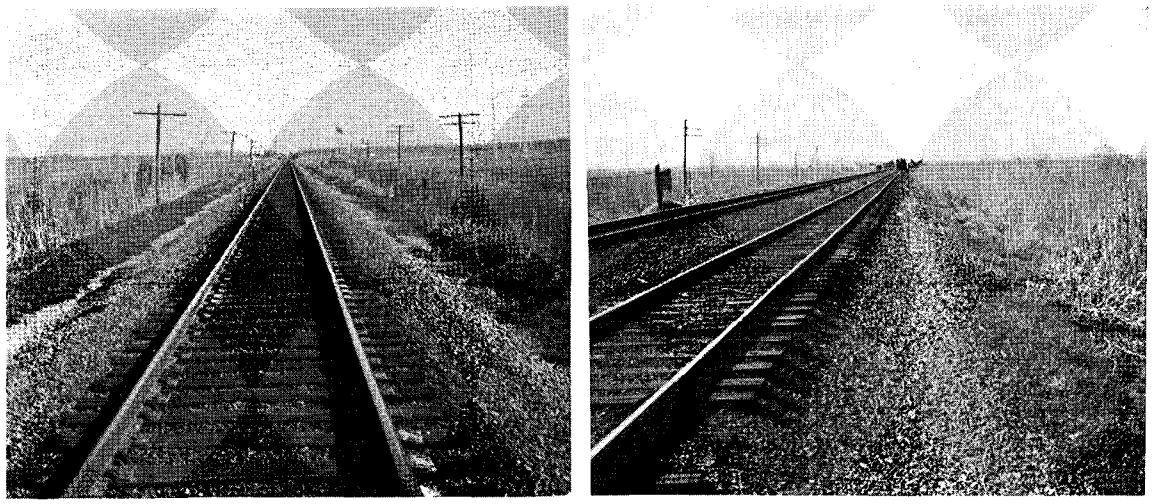
Figure 2. Aerial view of accident site.

Figure 3. Locomotive unit 1902 after collision.

electrical arcing could have occurred during the destruction of the battery box. Diesel fuel which spilled from the punctured tank ignited, and fire spread to the head cars of the train.

Accident Site

At the accident site, the railroad consisted of a straight and nearly level single-track line which extended in an east-west direction. (See Figure 4.) The adjacent drill track intersected the main track



a. Westbound approach. b. Eastbound approach.

Figure 4. Approach to Taft on main track.

976 feet east of milepost 29. The main track and the drill track were built on 15-foot centers. The switch, which was hand operated, had an unlighted switch target and was interconnected into the signal system. Thus, when the switch was aligned for movement between the main track and the drill track, opposing signals east and west of Taft displayed stop aspects.

The drill track was not equipped with any kind of derail protection. The Hooker storage track diverged from the drill track 1,468 feet east of Shell Road, a private road which crossed both the main track and the drill track 346 feet east of the switch point. The Hooker lead track diverged from the Hooker storage track as shown in Figure 1.

At the time of the accident, the switch was lined for the main track and locked with a switch padlock. The weather was clear and dry, and a moderate-to-strong wind was blowing from the north.

Method of Operation

Train operations on the main track through the accident site were controlled by train order, timetable, and automatic-block signals. The train dispatcher was located in Houston, Texas. Maximum authorized speed for the main track was 50 m.p.h; restricted speed was authorized for the drill track according to the operating rules. 2/ Once clear of the main track, a work extra needed no authority to operate within the limits of the industrial facilities or on business tracks other than the authority which authorized the assignment.

T&P, which is part of the MP lines, relied on the training and experience of the crews on the work extras to ensure compliance with the rules which prohibit entry onto the main track without proper authorization and protection. Traincrews working on the business tracks were expected to stop their trains short of the signal-fouling circuits in the tracks. The beginning of the fouling circuit on the drill track at Taft was not conspicuously marked.

T&P provided no criteria which would limit the number of cars to be handled by a locomotive without connecting airbrakes or which would specify a method of braking to be used.

Train Equipment

Work Extra 523. Locomotive unit 523 was a diesel-electric GP-18, manufactured by the Electromotive Division (EMD) of General Motors. The 248,000-pound unit developed 62,000 pounds of tractive power at 25-percent adhesion and was equipped with a 26L brake system. The speedometer did not register below 10 m.p.h.; an operable radio and a fire extinguisher were carried on the locomotive. Flagging appliances were also available on the locomotive. However, there were no seatbelts or other safety protective apparel or devices. The locomotive fuel tank had a capacity of 2,000 gallons; an estimated 1,200 gallons of fuel remained in the tank at the time of the collision. The unit was not equipped with an emergency oscillating light or any other means of indicating an emergency brake application.

A review of the locomotive inspection reports prepared by the railroad gave no indication of a brake-system failure during the 30 days prior to the accident. When the engineer examined the locomotive unit at the beginning of his assignment, the only exceptions he took were that the throttle stuck in all positions, particularly above position three, and that the brake-feed-valve pressure was set at 90 p.s.i., which he reduced to 80 p.s.i.

2/ "RESTRICTED SPEED -- Proceed prepared to stop short of train, engine, obstruction, or switch not properly lined." Uniform Code of Operating Rules, Effective June 2, 1968.

At the time of the accident, the overall length of Work Extra 523, including the locomotive, was 1,670 feet. Additional details concerning the train consist are presented in Appendix A.

Extra 1902 East. The lead locomotive unit of Extra 1902 East was an EMD carbody type F-7, equipped with a radio but with no external visual device to indicate an emergency brake application. The fuel tank had a capacity of 1,200 gallons; at the time of the accident, about 400 gallons of fuel were in the tank. The unit had a 24 RL brake system, and was equipped with a fire extinguisher. There were no seatbelts, protective padding, or similar emergency equipment or apparel on the locomotive.

The second locomotive unit, unit 540, was a type GP-18 similar in most respects to locomotive unit 523. Its fuel tank contained an estimated 800 gallons of fuel at the time of the collision.

The third locomotive unit was an EMD GP-7. At the time of the accident, the unit's fuel tank contained about 1,600 gallons of fuel.

The cupola-type caboose of Extra 1902 East was radio-equipped. It was not equipped with seatbelts or a fire extinguisher. Appendix B presents the consist of Extra 1902 East, the ladings, and other pertinent information.

Damage

Work Extra 523. Although locomotive unit 523 incurred considerable crash and fire damage and was a total loss, its fuel tank incurred little crash damage. (See Figure 5.) The head three cars of the train were either derail or damaged in the accident.

Extra 1902 East. The three locomotive units of Extra 1902 East were destroyed by crash and fire damage. The lead locomotive unit was severely impacted just to the left front of the coupler; the nose door was torn from its hinges. The nose cowling tore at its point of attachment to the still section of the locomotive. The structure of the cab, however, was not invaded. The wooden floor of the cab was consumed by the postimpact fire. The fuel tank of the unit was punctured.

Unit 540, after underriding the frame of unit 1902, pivoted and came to rest approximately parallel to unit 1902. Unit 540 was extensively damaged by the crash and the fire. The roof of the cab was separated from its vertical support members. Crash forces caused the inward collapse of the sides of the cab.

The first ten cars on Extra 1902 East were derailed or damaged in the pileup at the point of initial impact. An internal collision within the train derailed the 17th, 18th and 19th cars and the lead truck of the 20th car. One of these cars was a tank car which contained

Figure 5. Locomotive unit 523 after collision.

sulphur. The car collapsed at its center and some sulphur was spilled. The caboose was not damaged. (See Figure 6.)

Several other tank cars on both trains were fractured or punctured. The lading of one tank car was adipic acid, a powder which will burn with a violant reaction if thrown into fire.

Other damage. A 10-inch waterline adjacent to the right-of-way was crushed. The track in the accident area was destroyed. The railroad poleline, which carried a.c. power and communication lines, was torn down.

Injuries and Fatalities

None of the crewmembers of Work Extra 523 was injured.

Three crewmembers of Extra 1902 East were killed, and two were injured. The bodies of the fireman and head brakeman were found in the cab of unit 1902. The body of the second brakeman was found in the cab of unit 540. The engineer was extensively burned, either as a result of fire within the cab or of fire outside the cab through which he may have passed in his escape. The conductor received head and back injuries.

Autopsies were not performed. The report of the medical examiner indicated only that death was the result of the crash and postimpact fire. Thus, there was no direct medical evidence to indicate whether death was caused by crash injuries or by fire.

Postaccident Activities

Work Extra 523. After the collision, the engineer and conductor of Work Extra 523 continued to move away from the accident area until they arrived at an old storage building. Personnel of the Hooker Chemical Corporation drove them to a public telephone, the means by which they reported the accident to railroad authorities.

They then returned to the scene of the accident. The conductor obtained a gas mask and approached to within about 10 feet of unit 1902. Since he did not see anyone moving within the cab, he returned to a safer place. The conductor helped the crew of another work extra clear the undamaged cars of Work Extra 523 away from the road crossing. The engineer was in a state of shock and did not participate in the postaccident activities. After a short time, the conductor and his crew were returned to Avondale and relieved from duty.

After the collision, the two brakemen of Work Extra 523 ran to the nearby Taft telegraph office and attempted to contact the train dispatcher. Although contact was prevented because of the loss of the poleline, they did contact Avondale by commercial telephone. They were

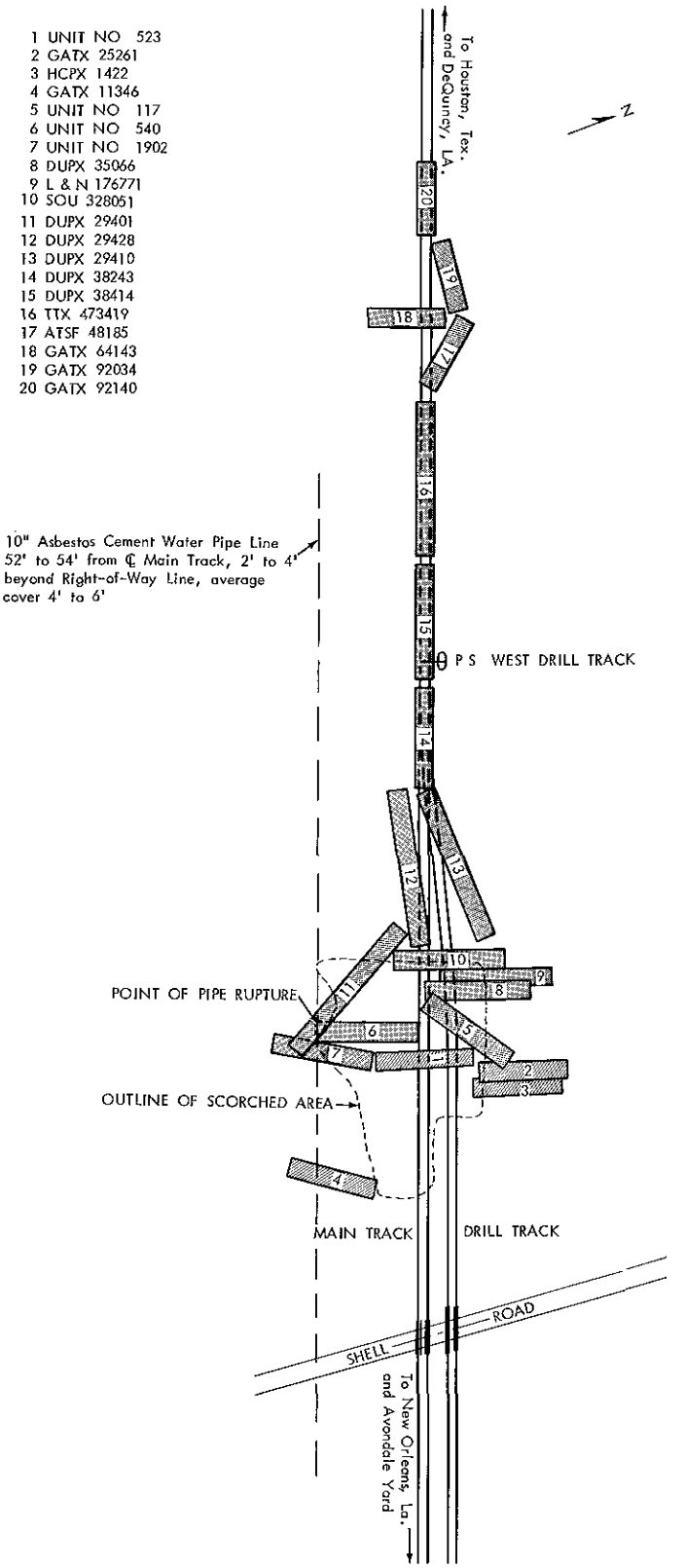


Figure 6. Position of derailed locomotive units and cars after collision.

told that the accident had already been reported. The two men returned to the drill track where they assisted their conductor and the other work extra in pulling the cars away from the accident site.

Extra 1902 East. When locomotive unit 1902 stopped, all of the cab lights were out. Immediately thereafter, the locomotive was struck forcibly. The engineer believes that, when the jostling had ceased, he saw a fire in the electrical cabinet at the rear of the locomotive cab. He almost simultaneously became aware that his right foot was caught. He pulled his foot free, climbed upward toward the fireman's side, opened the door inward, and exited onto the side of the locomotive. He then fell to the ground on the left side of the locomotive and lay there for a short time. When he became aware of a tank car burning just to the rear of his engine, he realized that he had to move away from the locomotive. He also realized that he could not get back into the locomotive to assist his fellow crewmembers. Though severely burned, he made his way to a position between two tank cars at the Shell road crossing. He saw the headlights of an approaching automobile, and he called to the occupants for assistance. They helped him climb over the couplers between the cars and drove him to the Hooker plant, where he was transferred to an ambulance and taken to the hospital.

The conductor of Extra 1902 East was thrown forward as a result of the rapid deceleration of the train and was momentarily stunned when he struck the front wall of the caboose cupola. When he regained consciousness, he attempted in vain to contact his engine crew by radio and then started to broadcast "MAYDAY", the international distress signal. His call was overheard by a following train and by the yardmaster at Avondale. He advised the yardmaster of the accident and of the need for emergency assistance.

The conductor then walked toward the front of Extra 1902 East in order to assist the engine crew. As he neared the head of the train, someone warned him to turn back because of the danger from fire and hazardous materials. When he realized that there was nothing that he could do to help, the conductor walked back to his caboose and reported to Avondale by radio what he had been able to determine about the accident. He then was assisted into a pickup truck and was driven to the Hooker plant, transferred to an ambulance, and removed to the hospital.

Railroad personnel at Avondale called fire and rescue units. The fire departments of Hahnville and Luling, La., responded to the call; they were joined by the police from St. Charles Parish and by State Police officers. The Bureau of Explosives of the Association of American Railroads was notified and sent an investigator. Plant personnel from the nearby chemical plants also assisted. The Bureau of Explosives representative and plant personnel determined that the accident site was safe for the emergency and rescue personnel, and the fire was extinguished.

Crew Training and Experience

The engineer of Work Extra 523 was first employed by the railroad on March 29, 1969, as a switchman. He worked as a switchman until February 10, 1971, when he was transferred to engine service as a locomotive fireman. The transfer marked the beginning of his training as an engineer. He worked as a hostler/hostler helper for 1½ years and as a fireman for 6 months. While working as a fireman, he was allowed to operate locomotives at the discretion of the engineers in charge. The amount of time which he spent actually operating locomotives and the quality of his training and supervision while he was a fireman have not been determined by the Safety Board. On July 28, 1972, after completing the on-the-job training and passing a company examination, he was promoted to engineer. Most of his experience as an assigned engineer before the accident was in yard service.

Locomotive engineers on the MP and the T&P must meet the joint requirements of the two railroads. The engineer of Work Extra 523 was trained under the Operating Instructions (OI) program. This program required that a trainee study a company home-study textbook, Progressive Examinations for Locomotive Engineers. After the trainee successfully completed the three series of examinations in the text, he was examined on the operating and safety rules. None of the written materials, examinations, or instructions, however, related directly to the maximum number of cars without airbrakes that a locomotive can safely control in a switching operation.

In addition to the text, which was required reading, the trainee was given several books covering the design and operation of the mechanical and electrical components of locomotives and of the airbrake system. The trainee was encouraged to consult operating officers, master mechanics, electricians, and other specialists for assistance.

The T&P has a mobile Airbrake Instruction Car which is designed to aid in teaching the fundamentals of the airbrake system. Although a trainee did not have to attend a session at the Airbrake Instruction Car, it was suggested that he avail himself of the instruction. When this formal training was completed, the trainee was expected to continue his training by gaining as much operating experience as possible.

Prior to the OI program, an employee was required to work as a fireman for at least 4 years before he could be promoted to engineer. The OI program allowed a fireman to become an engineer after only 2 years. On August 1, 1972, a new program was instituted for the training of engineers. Under this program, a man can be promoted to engineer after 6 months. The trainee, who is hired as a fireman, is sent to school at Little Rock, Ark., for 2 weeks of classroom training which consists of lectures, textbook material, and visual aids. He is then assigned to a qualified locomotive engineer for 5 months of instruction in train

handling. After 5 months, he returns to Little Rock for an additional 2 weeks of classroom instruction and for his final examination for promotion to engineer. The instruction does not cover other areas of railroad operations that do not relate to the position of engineer.

The remaining members of the crew of Work Extra 523 were trained in accordance with T&P standards and were qualified to accept assignments for Work Extra 523 on the day of the accident. The conductor had worked as a brakeman for 12 years before he was promoted to conductor, about a year before the accident. One brakeman had worked as a switchman for 17 years and as a brakeman for 17 months. The other had been hired as a brakeman and had worked in that capacity for 26 months. The qualifying experience of the two brakemen included working in a training capacity for about 7 days under senior crewmembers in the district to which they were to be assigned.

Applicable Standards

The drill track at Taft, the signal system through the area, and the protection afforded the main track met all standards of the railroad. Federal track standards do not require a mechanical means of preventing an unauthorized intrusion onto the main track by uncontrolled cars or by a switching movement.

Federal regulations require that locomotives will be designed, inspected, and maintained in accordance with the provisions set forth in 49 CFR 230. The standards, however, do not include specifications for the design and configuration of locomotive front ends, pilots, or operating compartments. Neither speedometers nor emergency-brake-application warning systems are required to be installed on all locomotives. The location, design, and crashworthiness of fuel tanks are not addressed in the Federal regulations. The standard concerning locomotive design configuration does not specify how the controls of the locomotives should be arranged, what fire-retardation systems will be present, or what emergency escape procedures will be used. Fire-retardation standards for materials used in the cab are not specified.

Tests and Research

It was not possible to duplicate the switching movement of Work Extra 523 using the same equipment for test purposes. Therefore, in lieu of tests using actual equipment, the MP used a computer analysis to simulate the switching movement. The computer program took into account the physical parameters of a train similar to that of Work Extra 523, as well as all other known variables and conditions. The program assumed an emergency braking application. This type of computer simulation has been found to be reasonably accurate in similar instances in the past in which computers were used to simulate stopping-distance tests.

The results of the computer simulation were as follows:

Speed (m.p.h.)	Stopping Distance (feet)
3	79
5	265
6	353
7	492
7.25	530
8	645
10	969

Operating Rules

At the time of the accident, employees of the T&P and the MP were governed by the Uniform Code of Operating Rules -- Effective June 2, 1968. Excerpts from the Code which are pertinent to the accident are contained in Appendix C. Particularly pertinent to the accident was Rule 17, which states, in part:

> 17. Headlights. -- * * * * *
>
> When a train turns out to meet another train, the standard headlight must be burning brightly until entire train is clear of main track; it will be dimmed while train is moving on siding entirely clear of main track, and must be extinguished when train has stopped entirely clear of main track.
>
> "Winking" or "blinking" of headlights for any purpose is prohibited
>
> * * * * *
>
> It must be dimmed (except when approaching public crossings at grade:
>
> * * * * *
>
> (4) When on other than main tracks, in clear of main track.
>
> Outside of CTC territory, when headlight is displayed by train on siding at meeting point, opposing train must proceed at Restricted Speed until main track is seen to be clear.

The MP/T&P differentiates between a siding and a business track such as the drill track at Taft by pointing out that a siding is used to meet trains traveling in opposite directions or to pass trains traveling in the same direction. A business track is never used to meet or pass trains and is therefore not equipped with a departure signal.

III. ANALYSIS

Operation of Work Extra 523

The computer analysis performed by the MP indicates that if the speed estimate given by the crewmembers of Work Extra 523 is accurate, then the train should have stopped before it entered the fouling circuit. Since the train did not stop in time, either the speed of the train was greater than the speed estimated by the crew, or the brake applications occurred at points closer to the west switch than the crew remembered, or the brakes were not functioning as effectively as possible.

Although the brakes did not fail, the engineer of Work Extra 523 stated that the deceleration of the train was less effective than had been the case on similar occasions earlier that morning. This feeling, however, might have reflected anxiety brought on by the engineer's realization of the immediate threat posed by the approaching train. Any effect of the reduction of the feed-valve setting from 90 to 80 p.s.i. must be discounted, because 80 p.si. was the normal setting for a switching movement. Furthermore, the engineer had been braking successfully before the accident.

Since he was relying on hand signals from one of the brakemen at the rear of the train, the engineer might have been too close to the west switch before he finally decided to brake without having received a hand signal. Although in switching operations an engineer must comply with hand signals, he must at all times be aware of possible conflicts. Because proper resolution of conflicting requirements depends to a large extent on training, experience, and constant presence of mind, it appears that the engineer's lack of experience might have contributed to his failure to stop the train short of the main track. This lack of experience was evidenced by the engineer's willling acceptance of the conductor's suggestion to extinguish the locomotive headlight, in violation of Rule 17.

Operating Procedures

Inadequate operating procedures compensated for by good performance of experienced employees are often exposed by inadequately trained or inexperienced employees. Since the MP had no guidelines regarding the number of cars which could be handled safely by a locomotive without train airbrakes, the undertrained and inexperienced engineer of Work Extra 523 had to use his own judgment in determining the proper speed at which to operate and in determining where to apply the brakes to stop a draft of unknown weight short of a poorly defined fouling point.

If the engineer of Work Extra 523 had been given definite guidelines and had been informed of the number of loaded and empty cars that the locomotive was switching, and if there had been instructions as to

the number of carlengths between the Hooker lead and the fouling point of the main track, the engineer would have had a logical basis on which to determine speed/distance relationships. He might have then been able to stop short of the main track.

On April 3, 1973, after the installation of a derail 3/ between Shell Road and the fouling point, a train performing a switching movement similar to that performed by Work Extra 523 did not stop soon enough and derailed. These two derailments indicate that switching movements toward a main track should not be made unless protection is provided for main-track movements. This could be done by opening the main track switch to set the adjacent signals at stop before any potentially conflicting movement is begun. Train radio could be used to obtain clearance from the dispatcher or to alert mainline trains when such a conflicting movement is anticipated.

Because the drill track is not considered a siding by the MP management, Work Extra 523 was required only to dim its headlight while on the drill track clear of the main track. The operating rules do not address the significance of an extinguished headlight on a train on "other than main track." Furthermore, since the operating rules do not define business tracks, drill tracks, and "other than main tracks", it appears that the definition of and the rules pertaining to sidings are being applied to all auxiliary tracks adjacent to main tracks. This possibility raises a question as to what action the engineer of Extra 1902 East would have taken if the headlight of Work Extra 523 had been dimmed, as required by rule, instead of extinguished. If the engineer of Extra 1902 East had considered the drill track to be a siding and if Work Extra 523's headlight had been dimmed, Extra 1902 East would have been required to proceed at restricted speed, and the accident might have been prevented or made less severe.

There is conflict in evidence as to whether the engineer of Extra 1902 "blinked" his headlight; however, there is suspicion that he may have extinguished his headlight to reduce glare as a courtesy to the engineer of the work extra. An extinguished headlight on a mainline train is a violation of the operating rules.

Training of the Engineer of Work Extra 523

The OI program under which the engineer of Work Extra 523 trained was deficient, because it did not provide the engineer adequate classroom training or guidance to enable him to avoid an overrun. Because there were no criteria concerning the number of cars which a work extra could safely handle without brakes, a new engineer was left to find this out by trial and error. An engineer should not have to learn important

3/ A derail is a device designed to cause rolling equipment to leave the rails. (AAR Signal Manual Part 55)

safety factors in train operation through trial and error when such factors can be covered in classroom training.

Because many combinations of circumstances can influence the safe operation of a locomotive in road and yard train movements, a short on-the-job exposure realistically cannot adequately prepare a new engineer for his assignment. Normally, one purpose of a training program is to give the new engineer sufficient experience and guidelines to compensate for this lack of exposure. Simulators can be used to expose engineers to a variety of operating conditions and circumstances under the close surveillance of expert teachers. If simulators are unavailable, engineer trainees should be assigned to a variety of specific operations with an assigned teacher and evaluator other than a regular working engineer. Regular engineers, untrained as teachers, may evaluate trainees on the basis of their own individual operating ideas, especially in situations for which detailed operating techniques are not provided.

The Safety Board points out that a computer analysis of the stopping distance could have been made before as well as after the accident. The results of such an analysis could have been used to train engineers.

Use of Derails

The Safety Board could not definitely determine whether the presence of a derail on the drill track would have prevented the collision. A derail, however, almost certainly would have lessened the severity of the collision. The presence of a derail significantly deters an engineer from violating the fouling circuit, because the engineer knows that the device invariably will derail that part of the train which passes over it. Furthermore, properly designed and installed derails should divert the derailed cars away from the main track.

Operation of Extra 1902 East

Since locomotive unit 523 had intruded only a few feet onto the main track at the moment of impact, it is apparent that the engineer of Extra 1902 East had insufficient warning to stop. After Extra 1902 East passed the last signal at Killona, about 4,500 feet from the collision, there was no other device or provision to warn the engineer that the main track was obstructed or occupied. Furthermore, the fact that the engineer of Work Extra 523 extinguished his headlight led the engineer of Extra 1902 East to believe that Work Extra 523 was standing clear of the main track.

When the engineer of Work Extra 523 applied the brakes in emergency, the locomotive of Extra 1902 was estimated to have been about 4,100 feet from the point of impact, based on an average speed of 45 m.p.h. If the conductor or engineer of Work Extra 523 immediately had displayed a lighted fusee or had used radio to warn Extra 1902 East of the impending collision, the collision might have been avoided, or at least the forces of impact would have been greatly diminished.

If unit 1902 had been equipped with cab signals, the engineer would have been alerted when locomotive unit 523 first fouled the signal circuit in the switch turnout. The warning time, however, would have been considerably less than that which would have been available if radio or fusees had been used at the time of Work Extra 523's emergency brake application.

Injuries and Fatalities

The examination of the cab on unit 1902, which was not crushed in the collision, indicated that the crewmembers in the cab were not injured as the result of structural collapse of the cab. They were not restrained, however, and therefore might have been thrown out of their seats upon impact.

The engineer was not able to reconstruct fully the events of the collision. However, since the engineer survived the collision, there is a possibility that the other two crewmembers in the cab of the lead unit survived the crash phase and then perished in the postimpact fire. It appears that if adequate crashworthiness had been designed into the cab interior and operating controls, the initial injuries to the crewmembers might have been less severe. The fact that there were no crash-injury protective devices to assist the crewmembers in remaining conscious reduced their chance of survival.

If seatbelts had been available and fastened, any impact injuries sustained when the crewmembers were thrown against the cab interior may have been avoided. Furthermore, since the crew had approximately 10 seconds to react before impact, they could have entered a "crash refuge," had one been available. 4/ If they had been protected from crash injury, the other crewmembers in the cab might have escaped as the engineer did.

The second locomotive unit of Extra 1902 East, unit 540, also impacted with the locomotive of Work Extra 523. The crash forces deformed the cab of unit 540 to the extent that escape by the brakemen probably would have been substantially hampered, if he was not already incapacitated.

The rapid deceleration of the caboose caused the unrestrained conductor to be hurled forward, strike the front wall of the cupola, and fall backward between the seats. A properly fastened seatbelt might have prevented his injuries.

4/ A "Crash refuge" is a survival compartment, smaller than the entire cab, available to crewmembers in time of impending crash or overturn. When it is not practical to provide crash strength for the entire cab, such a "crash refuge" might be used for survival protection.

IV. CONCLUSIONS

1. The program of training and qualification for the engineer of Work Extra 523 did not provide him with specific knowledge of the hazard associated with controlling heavy cuts of cars without airbrakes. The T&P/MP relied instead on on-the-job training and experience, which resulted in unnecessary risk.

2. The operating rules and documented work procedures did not include specific guidelines or information which could have been used to teach safe, efficient switching operations prior to an engineer's entrance into service.

3. The brakes of locomotive unit 523 did not fail, but they were not adequate to stop the 36-car draft in the distance available.

4. The switching procedures at Taft, La., lacked safeguards to prevent trains involved in switching movements from threatening mainline operations. The use of such safeguards for the main track when a train was approaching or the use of a derail on the drill track might have prevented the accident or lessened its severity.

5. Federal regulations do not require use of a derail or other positive protection to prevent unauthorized intrusion onto a main track.

6. An open radio-communication system with procedures which would have permitted direct contact between Work Extra 523 and Extra 1902 East would have provided a means of warning Extra 1902 East of the hazard ahead.

7. Extra 1902 East was operating in compliance with existing operating rules and instructions.

8. The crew of Extra 1902 East was not forewarned sufficiently of the intrusion onto the main track by Work Extra 523 to be able to stop prior to the collision.

9. The crash damage to the cab of locomotive unit 1902 was not sufficient to have produced the fatal injuries.

10. The absence of occupant restraint or other crash protection devices prevented control of impact injuries to the non-surviving crewmembers in Extra 1902 East, which probably inhibited the crewmembers' escape from the burning locomotive.

11. Train-handling characteristics can be taught with the assistance of computer-analyzed data.

12. The engineer of Work Extra 523 was not told the number of cars that he was handling, and the procedures did not require that he be told.

13. The 10-second reaction time available to the crewmembers in locomotive unit 1902 was more than enough time for them to have donned restraints or to have entered a crash refuge area had either been available.

V. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of the collision was the unauthorized intrusion of Work Extra 523 onto the main track, which resulted from the engineer's failure to brake the train in time to stop on the siding. Contributing to the collision were (1) the absence of protective devices to guard against the unplanned intrusion of a train from another track onto the main track and (2) operating practices and work patterns which did not adquately control switching movements. The absence of crash-injury protection in the locomotive units and caboose of Extra 1902 East contributed to the fatalities and injuries.

VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

1. The Federal Railroad Administration incorporate in the Federal Regulations on operating practices requirements which will govern the physical protection that will be provided main track to guard against unplanned and unauthorized movements onto the main track. (Recommendation No. R-73-38.)

2. The Missouri Pacific Railroad Company review critically the qualifications of the engineers who received training and experience similar to that received by the engineer of Work Extra 523, and compensate for their lack of on-the-job training and experience by a specific continuing program of supervisory monitoring and counseling. (Recommendation No. R-73-39.)

3. The Missouri Pacific Railroad Company revise its operating rules and definitions to clarify the requirements regarding the use of locomotive headlights on trains on other tracks auxiliary to the main track, as differentiated from sidings. (Recommendation No. R-73-40.)

4. The Missouri Pacific Railroad Company review its operating procedures relating to switching and provide documented guidelines to crewmembers to assist in the decision making regarding stopping distances when handling large drafts of cars without train airbrakes. (Recommendation No. R-73-41.)

The Safety Board made the following recommendation to the Illinois Central Gulf Railroad in its report on a commuter train accident which occurred at Chicago on October 30, 1972. We believe that this recommendation is applicable to this accident and should be considered by the Missouri Pacific:

The National Transportation Safety Board recommends that:

1. The Illinois Central Gulf Railroad ensure that its employees understand and comply with its operating rules. In order to do this, the ICG should improve their training program by developing:

(a) Books of standard interpretations of its rules in situations met both routinely and only occasionally to provide a basis for better use of the rule book in instruction; and

(b) A system of regularly testing the ability of employees to interpret actions required in specific operating situations.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

October 25, 1973

APPENDIX A

CONSIST OF WORK EXTRA 523

Car and Initial	Kind	Contents	Weight
MP 523	Engine		256,520
HCPX 1422	Lt	Caustic Soda	192,000
GATX 11346	ET		61,300
GATX 25261	ET		70,900
HCPX 1114	LT	Chlorine	179,120
HCPX 1136	LT	Chlorine	179,100
ACFX 88639	ET		64,500
ACFX 6665	LT	Chlorine	183,300
GATX 74478	LT	Caustic Soda	189,500
UTLX 78697	LT	Caustic Soda	269,300
HCPX 1245	LT	Caustic Soda	260,600
GATX 24408	LT	Chlorine	260,300
HCPX 1283	LT	Chlorine	261,300
HCPX 1074	LT	Chlorine	178,600
GATX 74470	LT	Caustic Soda	191,800
ACFX 89294	LT	Caustic Soda	261,900
GATX 50957	LT	Caustic Soda	261,400
GATX 72197	LT	Chlorine	188,800
HCPX 1138	LT	Chlorine	178,900
GATX 57646	LT	Caustic Soda	262,600
GATX 74474	LT	Caustic Soda	191,980
HCPX 1469	LT	Caustic Soda	264,000
ACFX 89566	LT	Caustic Soda	261,500
HCPX 1442	LT	Caustic Soda	183,500
HCPX 1236	LT	Chlorine	261,100
PPGX 1515	LT	Chlorine	261,900
ACFX 89577	LT	Chlorine	263,180
HCPX 1153	LT	Chlorine	179,000
HCPX 1172	LT	Chlorine	175,140
UTLX 85957	LT	Caustic Soda	191,520
HCPX 1133	LT	Chlorine	179,300
TIDX 216070	LT	Caustic Soda	273,700
RTMX 13501	LT	Sulfamond Chlo.	235,820
UTLX 78810	LT	Caustic Soda	261,800
HCPX 1484	LT	Caustic Soda	264,000
GATX 57696	LT	Caustic Soda	260,380
GATX 57647	LT	Caustic Soda	274,920

APPENDIX B

CONSIST OF EXTRA 1902 EAST

Car and Initial	L/E	Kind	Contents	Off Road	Destination or Consignee	St.	Tons
CAB 13306	L	Z	Crew				31
CNW 44351	L	B	Machy		MORKNUDHO		49
SP 698578	L	DF	Beer		ANBUSCH		75
LN 175094	E	B			AGT LNRR		30
TTKX 905169	E	TL			GMC		30
TTRX 962824	E	TK			GMB		30
NATX 71176	L	T	CSOIL		HUNWESFOO	DS	130
MP 580913	L	H	Stone		LOUCONPRO		125
PSPX 33566	L	T	LP Gas	SOU	BROHAVEN	GA	100
PSPX 33516	L	T	LP Gas	ICG	NCOLUMBUS	MS	100
TTBX 905878	E	DF		SOU	GMC		30
BTTX 911788	E	DF		SOU	GMC		30
SSW 84618	E	DF		SOU	GMC		30
ATSF 84360	E	DF		SOU	FORD		30
TTKX 800670	E	DF		SOU	FORD		30
TTKX 800286	E	DF		SOU	AGT CGRR		30
LN 82917	E	H		LN	AGT LNRR		30
LN 139132	E	H		LN	AGT LNRR		30
LN 134711	E	H		LN	AGT LNRR		30
MKT 11630	L	B	Brick	LN	GULFPORTM	S	120
KCS 27130	E	G					30
GATX 70847	L	T	Acid	LN	CHARLOTTE	NC	75
LN 106047	L	DF	LINTERS	LN	LUMBERTON	NC	85
GATX 92104	L	T	Sulph	LNFL	GREENBAY	FL	120
GATX 92066	L	T	Sulph	LNFL	GREENBAY	FL	120
GATX 92128	L	T	Sulph	LNFL	GREENBAY	FL	120
GATX 92140	L	T	Sulph	LNFL	GREENBAY	FL	120
GATX 92034	L	T	Sulph	LNFL	GREENBAY	FL	120
GATX 64143	E	T		LNFL	PIERCE	FL	30
ATSF 48185	L	B	Fertz	LNFL	LAKELAND	FL	75
TTX 473419	L	F	TOFC	LNFL	POMPOMABE	FL	50
DUPX 38414	L	CH	Acid	LN	LUGOFF	SC	75
DUPX 38243	L	CH	Acid	LN	LUGOFF	SC	75
DUPX 29410	L	T	Chemical	LN	LUGOFF	SC	75
DUPX 29428	L	T	Chemical	LN	LUGOFF	SC	75
DUPX 29401	L	T	Chemical	LN	LUGOFF	SC	75
SOU 328051	E	G		SOU	N.Orleans	LA	30
LN 176771	E	G		LN	N.Orleans	LA	30
DUPX 35066	L	CH	Plastic	LN	Jack'ville	FL	75

APPENDIX C

EXCERPTS FROM
UNIFORM CODE OF OPERATING RULES
EFFECTIVE JUNE 2, 1968

GENERAL RULES

* * * * *

B. Employes must have a proper understanding and working knowledge of and obey all rules and instructions in whatever form issued, applicable to or affecting their duties. If in doubt as to their meaning, employes must apply to proper officer for an explanation.

When properly authorized, rules may be cancelled, superseded or changed by:

(1) General order.
(2) Special instructions in the timetable or in pamphlet form.

* * * * *

1. Constant presence of mind to insure safety to themselves and others is the primary duty of all employes and they must exercise care to avoid injury to themselves or others. They must observe the condition of equipment and the tools which they use in performing their duties and when found defective will, if practicable, put them in safe condition, reporting defects to the proper authority.

They must inform themselves as to the location of structures or obstructions where clearances are close.

When employes are on or near tracks, they must expect the movement of trains, engines or cars at any time, on any track, in either direction.

* * * * *

DEFINITIONS

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MAIN TRACK--A track extending through yards and between stations, upon which trains are operated by timetable or train order, or both, or the use of which is governed by block signals.

* * * * *

MAXIMUM SPEED--The highest speed authorized for the operation of trains and engines on main track except as otherwise restricted by yard limits, train orders, speed restriction signs, general orders, special instructions, or other restrictive conditions.

RESTRICTED SPEED--Proceed prepared to stop short of train, engine, obstruction, or switch not properly lines.

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OPERATING RULES

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SIGNALS AND THEIR USE

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17. Headlights--The standard white headlight must be displayed brightly to the front of every train and engine by day and by night.

In addition, yard engines must display standard white headlight to rear by day and by night. When not provided with a headlight at the rear, a white light must be displayed. The headlight may be extinguished on the end coupled to cars.

Road engines without cars, standing or moving on other than a main track, or on main track within yard limits, in addition, must display a white light on trailing end.

When a train turns out to meet another train, the standard headlight must be kept burning brightly until entire train is clear of main track; it will be dimmed while train is moving on siding entirely clear of main track, and must be extinguished when train has stopped entirely clear of main track.

"Winking" or "blinking" of headlights for any purpose is prohibited.

An extinguished headlight does not relieve train on main track from complying with Rule S-89 (a).

It must be dimmed (except when approaching public crossings at grade):

(1) Approaching and passing head end and rear end of trains, and engines standing or moving on adjacent tracks.

(2) Approaching signals indicating train orders.
(3) When standing on main track awaiting arrival of an opposing train.
(4) When on other than main tracks, in clear of main track.

Outside of CTC territory, when headlight is displayed by train on siding at meeting point, opposing train must proceed at Restricted Speed until main track is seen to be clear.

17(a). White Oscillating Headlight--On engines equipped with a white oscillating headlight:

It must be displayed by day and night.

It must be extinguished when the standard white headlight is dimmed or extinguished.

* * * * *

34. Calling of Signals--All members of engine and train crews must, when practicable, communicate to each other by its name the indication of each signal affecting the movement of their train or engine.

Signal indications (except audible signals) must be seen before being communicated to each other.

34(a). Keeping Lookout--Engineers must, and other members of crew on engine will, when practicable, keep a constant and vigilant lookout for signals or any condition that may affect the movement of their train or engine.

Trainmen and enginemen must observe indication of train order signals.

35. Flagging Signals--The following signals will be used by flagmen:

Day signals	(A red flag, (Torpedoes and (Red fusees.
Night signals	(A white light, (Torpedoes and (Red fusees.

* * * * *

HANDLING OF SWITCHES

NOTE--Rule 104 (not including Rules 104(a) to 104(f), inclusive) applies only to hand operated switches.

When spring or dual control switches are operated by hand, they are then hand operated switches and rules governing hand operated switches apply.

104. Hand Operated Switches--

* * * * *

(5) A train or engine must not foul a main track or other track until switches connected with the movement are properly lined. Switches must not be lined when conflicting movement is closely approaching switch. Spring switches; and automatic switches identified by letter "V", or bowl or stand painted yellow; may be trailed through when lined either for or against movement, provided it has been ascertained there is no conflicting movement on or closely approaching switch. At least one truck must have trailed through an automatic switch lined against movement before a reverse movement is made.

When waiting to cross from one track to another and during the approach or passage of a train or engine on tracks involved, all switches connected with the movement must be secured in the normal position.

Main track switches must not be restored to normal position until the movement is completed or clear of the main track involved.

* * * * *

105. Movement on Other Than Main Tracks--Trains and engines using a siding, or any track other than a main track, must proceed at Restricted Speed.

Sidings of an assigned direction must not be used in a reverse direction unless authorized by the train dispatcher, or in an emergency under flag protection.

Cars must not be left on sidings when possible to avoid it.

When a siding is obstructed, the train dispatcher must be notified at once.

When there is a possibility of fouling main track, trains must not take slack on sidings or other tracks adjacent to main track, nor make reverse movement, without proper protection, when necessary.

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353. Entering Block Between Signals.--A train or engine entering block between signals must be protected as required by the rules and must proceed at Low Speed to the next signal.

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