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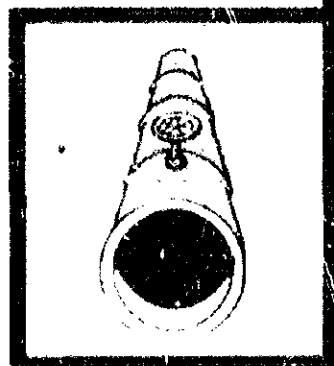
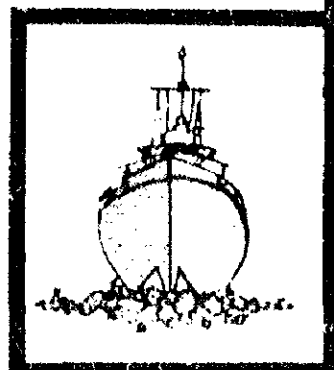
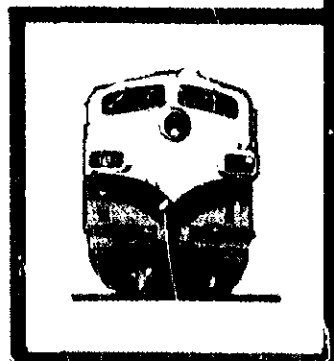
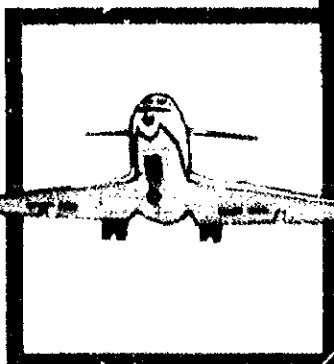
RAILROAD ACCIDENT REPORT

REAR-END COLLISION OF TWO
UNION PACIFIC FREIGHT TRAINS
RAMSEY, WYOMING
MARCH 29, 1979

NTSB-RAR-79-9

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16. Abstract About 2:41 a.m., m.s.t., on March 29, 1979, Union Pacific Railroad (UP) freight train Extra 3449 West struck the rear of UP unit coal train Extra 3055 West as it was moving from the No. 1 main track into a siding at Ramsey, Wyoming. Two train crewmembers were killed and three crewmembers were injured. The 3 locomotive units of Extra 3449 West and 23 cars were derailed. Total damage was estimated to be \$1,121,000. The National Transportation Safety Board determines that the probable cause of the accident was the failure of the engineer of Extra 3449 West to comply with a series of restrictive wayside signals, repeated by locomotive cab signals, including a "stop-and-proceed" aspect 6,303 feet from the point of collision. Contributing to the accident was the unauthorized muting of the cab signal warning whistle, so that it could not alert the engineer when a more restrictive signal was passed.			
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RAILROAD ACCIDENT REPORT

Adopted: August 16, 1979

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RAILROAD FREIGHT TRAINS
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SYNOPSIS

About 2:41 a.m., m.s.t., on March 29, 1979, Union Pacific Railroad (UP) freight train Extra 3449 West struck the rear of UP unit coal train Extra 3055 West as it was moving from the No. 1 main track into a siding at Ramsey, Wyoming. Two train crewmembers were killed and three crewmembers were injured. The 3 locomotive units of Extra 3449 West and 23 cars were derailed. Total damage was estimated to be \$1,121,000.

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the engineer of Extra 3449 West to comply with a series of restrictive wayside signals, repeated by locomotive cab signals, including a "stop-and-proceed" aspect 6,303 feet from the point of collision. Contributing to the accident was the unauthorized muting of the cab signal warning whistle so that it could not alert the engineer when a more restrictive signal was passed.

INVESTIGATION

The Accident

On March 28, 1979, westbound UP unit coal train Extra 3055 West, consisting of 5 locomotive units, 121 empty cars, and 2 cabooses, departed Cheyenne, Wyoming, at 9:30 p.m. for Hanna, Wyoming. At about 2:20 a.m., on March 29, the dispatcher contacted the engineer by radio and instructed him to stop his train in the north running track at Ramsey. At the time of this transmission, Extra 3055 West was running on the No. 1 main track and was about 9 miles east of Ramsey. The engineer and head brakeman were in the lead locomotive unit, and the conductor and rear brakeman were in the rear caboose.

According to the engineer and head brakeman of Extra 3055 West, the last two intermediate signals approaching the home signal at Ramsey continuously dis-

played "advance approach" and "approach diverging" aspects, 1/ respectively, as their train approached them, and the aspects were properly repeated by the locomotive cab signals. The home signal properly displayed a "diverging approach" aspect 2/ when Extra 3055 West passed it at 2:34 a.m. About 1 minute earlier, the rear of the train had cleared the last intermediate signal 8,134 feet east of the home signal. Without stopping, Extra 3055 West entered the turnout to the north running track at a speed of about 10 mph. About 2:42 a.m., the rear caboose of Extra 3055 West was struck by the lead locomotive unit of westbound UP freight train Extra 3449 West at a point 6,303 feet west of the last intermediate signal and 3,340 feet east of the turnout.

Extra 3449 West had departed Cheyenne at 11:50 p.m., March 28, for Rawlins, Wyoming. En route the train stopped and picked up a car at Lookout, 44 miles east of Ramsey. Thereafter, Extra 3449 West consisted of 3 locomotive units, 43 loaded cars, and 1 caboose. The engineer and head brakeman were in the lead locomotive unit which was operated by the engineer from the right side, and the conductor and rear brakeman were in the caboose.

Extra 3449 West departed Lookout on the No. 1 main track at about 2:02 a.m., on March 29, and reached its maximum authorized speed of 65 mph within 4 miles. When the train was about 23 miles east of Ramsey, the engineer, conductor, and rear brakeman heard the dispatcher instruct the crew of Extra 3055 West by radio to stop their train in the north running track at Ramsey. Extra 3449 West passed two eastbound trains at about 2:18 a.m. and 2:24 a.m., and the engineer dimmed the headlight for both trains. When Extra 3449 West reached Medicine Bow, 14 miles east of Ramsey, at 2:28 a.m., the control signal there displayed a "clear" aspect, 3/ and the route was aligned for track No. 1. The first two of the six intermediate block signals between Medicine Bow and Ramsey also displayed "clear" aspects as the train approached, but the third signal (6299-1) displayed an "advance approach" aspect. (See figure 1.) About the time Extra 3449 West passed this signal, Extra 3055 West had cleared the second block east of Ramsey. As a result, the fourth signal (6319-1) also displayed an "advance approach" aspect for Extra 3449 West. This aspect indicated that the third block ahead of the signal was occupied and that Extra 3449 West would have to reduce its speed to 40 mph by the time the train reached the fifth signal (6345-1). Because Extra 3055 West still occupied the block east of the home signal at Ramsey, signal 6345-1 would have been displaying an "approach" aspect 4/ requiring the engineer to immediately reduce speed to 30 mph and be prepared to stop the train short of the sixth, and

1/ "Advance approach" requires that train speed not exceed 40 mph when the next signal is reached; "approach diverging" allows a train to proceed prepared to take a diverging route beyond the next signal at a prescribed speed.

2/ "Diverging approach" allows a train to proceed on a diverging route prepared to stop at the next signal.

3/ "Clear" requires that a train proceed at authorized speed.

4/ "Approach" requires that a train's speed be immediately reduced to 30 mph and that the train stop short of the next signal.

last, signal (6367-1) east of Ramsey. This signal would have displayed a "stop and proceed" aspect. ^{5/}

Extra 3449 West passed signal 6345-1 at 2:37 at a speed of about 62 mph, as indicated on the locomotive speed recorder tape, and passed signal 6367-1 at 2:40 a.m. at a speed of about 52 mph. About 90 seconds later, the train struck the rear of Extra 3055 West. At the time, Extra 3449 West was running in full throttle at about 48 mph. No braking action had been initiated.

Signal 6299-1, the third signal west of Medicine Bow, can be seen from a westbound train as soon as the train passes the preceding signal more than 9,400 feet to the east. Due to track curvature and terrain, the last three intermediate signals approaching Ramsey -- 6319-1, 6345-1, and 6367-1 -- are first continuously visible to a westbound train at distances of about 3,300, 2,300, and 2,500 feet, respectively. The point of collision could first be seen from a westbound train 2,300 feet to the east. Beyond that point, a pole line south of the main track partially obscured the location. Beginning at signal 6367-1, a westbound train on the No. 1 track moves through a tangent for 1,512 feet, followed by a 2-degree, left-hand curve for 1,174 feet, a tangent of 1,289 feet, and a 1-degree, left-hand curve for 1,597 feet. The remaining 731 feet to the point of collision is tangent. Over the entire distance the grade ascends at the rate of 0.70 percent except for the last 300 feet which is 0.26 percent descending westbound. (See figure 2.)

All of the progressively more restrictive signal aspects would have been repeated by cab signals in the cab and would have required acknowledgement by the engineer. His failure to acknowledge would have resulted in the continuous sounding of a warning whistle in the cab. The engineer of Extra 3449 West stated that the wayside signals approaching the accident location were "clear" and his cab signal was clear at all times. The engineer also stated that the rear brakeman first saw and called attention to the caboose on the rear of Extra 3055 West when it was about 1,400 feet ahead. However, the engineer did not apply his train's brakes, reduce throttle, or sound the whistle. The engineer stated that he had heard instructions being given by radio to a train near Ramsey a few minutes before Extra 3449 West passed signal 6299-1.

The conductor and rear brakeman of Extra 3449 West stated that they passed an eastbound train 4 or 5 miles east of Ramsey and that the conductor went to the rear caboose platform to inspect the train. Three days after the accident, the conductor of Extra 3449 West could not remember having seen any of the signals which should have displayed restrictive aspects. Later, he said he saw a "clear" aspect on signal 6345-1. Finally, he stated he saw a "clear" aspect only on signal 6319-1. The rear brakeman originally stated he saw "clear" aspects on signals

^{5/} "Stop and proceed" requires that the train be stopped short of the signal, and then proceed at a restricted speed through the entire block beyond the signal.

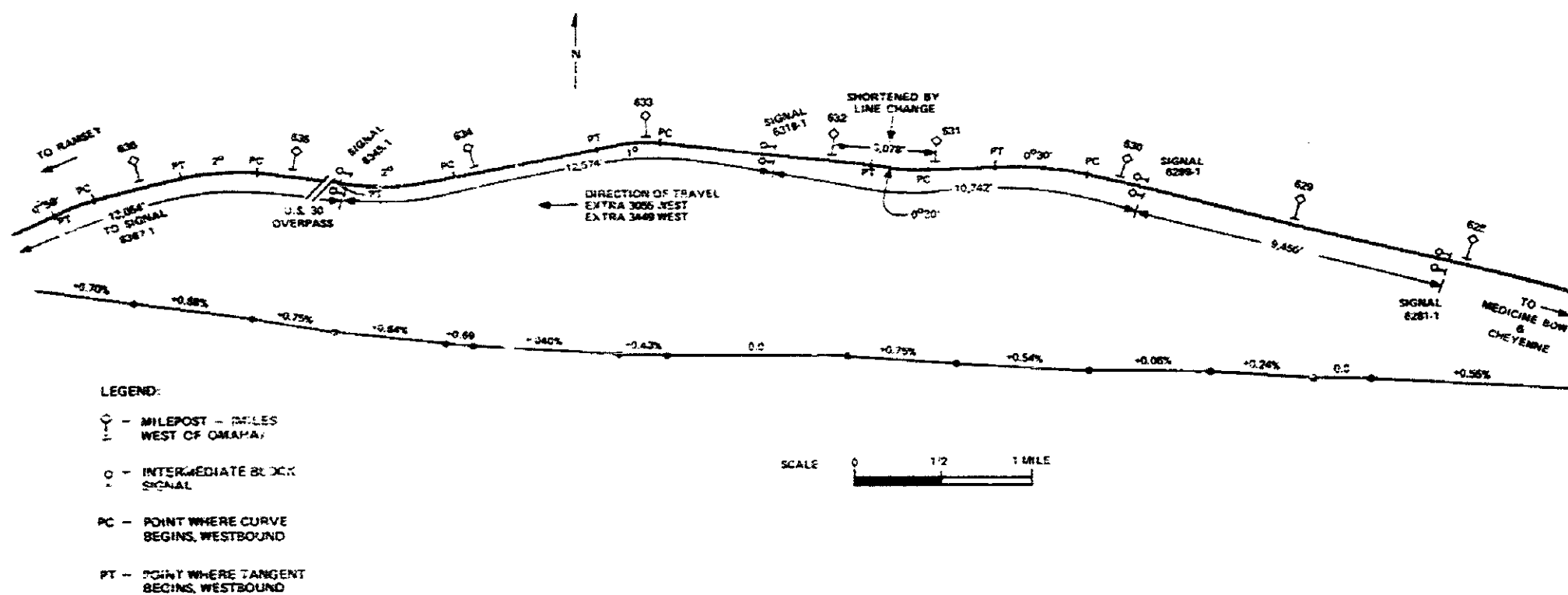


Figure 1. Diagram and profile of approach to accident location from signal 6281-1 to section shown in Figure 2.

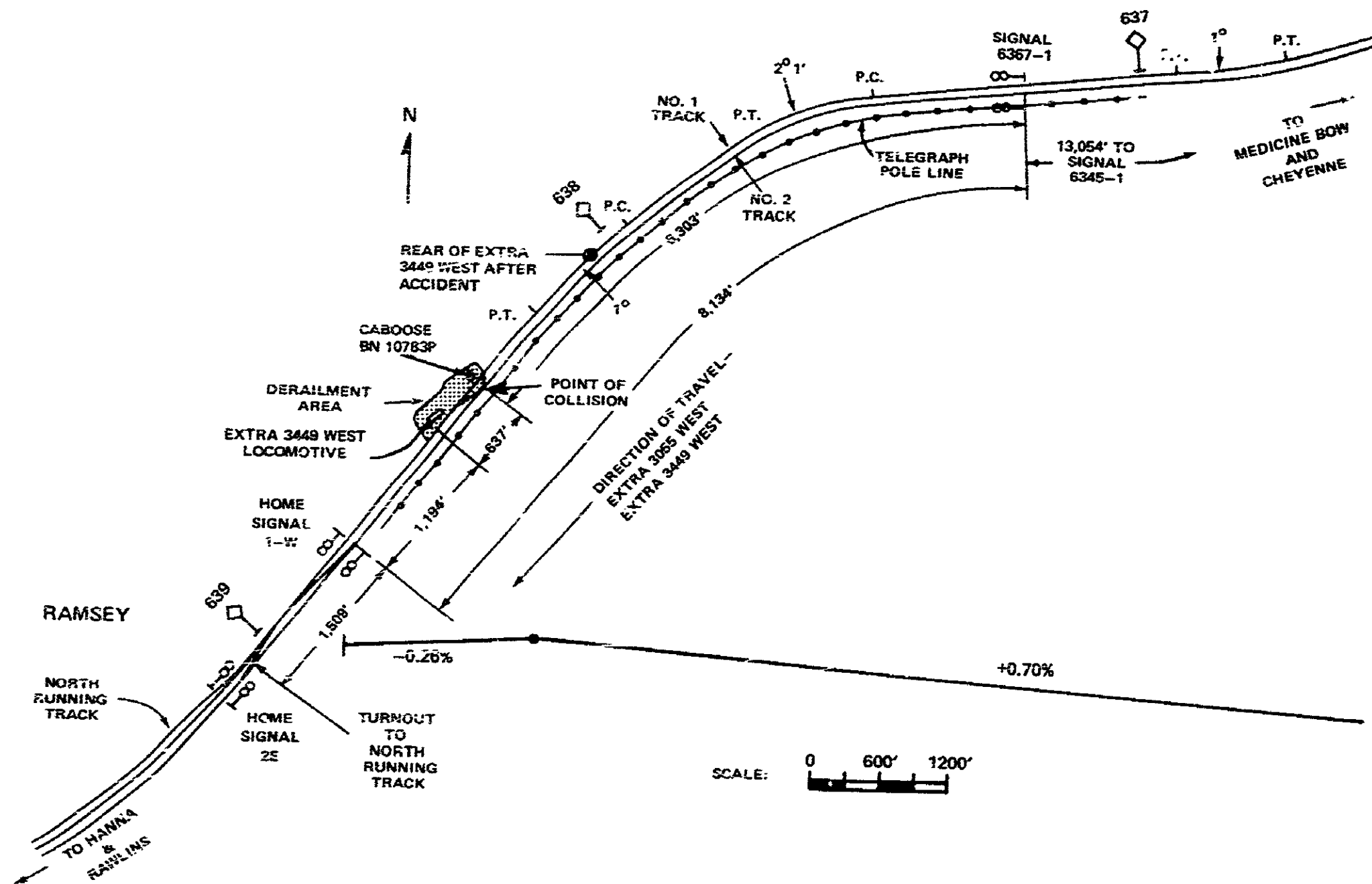


Figure 2. Diagram and profile of accident location and approach from signal 6367-1.

6319-1, 6345-1, and 6367-1 approaching Ramsey from his seat in the caboose cupola. Later, he testified that he actually saw a "clear" aspect on signal 6367-1, may have seen only the reflection of a "clear" aspect on signal 6345-1, and did not see signals 6299-1 and 6319-1.

Injuries to Persons

	Extra 3055 West Traincrew	Extra 3449 West Traincrew
Fatal	1	1
Nonfatal	1	2
None	2	1

Damage

The two cabooses and six rear cars of Extra 3055 West were derailed. Much of the collision force was absorbed by the rear caboose which had its center sill driven forward about 8 feet, both platforms demolished, and the car body separated from the trucks. However, the car body was relatively intact and came to rest upright, north of the No. 1 track near the point of collision. The forward caboose was completely demolished. Of the six derailed hopper cars, four were destroyed and one was damaged.

The 3 locomotive units and head 15 cars of Extra 3449 West were derailed. The locomotive units left the track alignment to the north but remained upright and parallel to the track. The lead unit stopped 636 feet west of the point of collision, still coupled to the unit behind it but with its lead truck about 40 feet beyond it. There was substantial damage to the forward hood and operator compartment of the lead unit from being overridden by the rear caboose of Extra 3055 West. The roof of the operator's compartment was crushed downward, and a wheelset from the caboose was lodged crosswise in the left side of the cab. The trailing units had only minor damage. Twelve of the 15 derailed cars were destroyed. About 400 feet of track No. 1 were destroyed. Derailed cars blocked the No. 2 track, disturbed the alignment, and shunted the signal circuitry.

Damage was estimated to be as follows:

Train Equipment	\$ 575,000
Train Lading	475,000
Track	15,300
Communications	40,700
Salvage and Wrecking	15,000
Total	<u>\$1,121,000</u>

Crewmember Information

Each of the trains involved in the accident had an engineer, conductor, and two brakemen. All were qualified under UP operating rules without restrictions. (See appendix B.)

The crewmembers of Extra 3449 West reported for duty at 11:10 p.m. on March 28 and had been on duty 3 hours 31 minutes when the accident occurred. Except for the conductor, an extra man working a temporary vacancy, all were regularly assigned to the Cheyenne-Rawlins through-freight pool. The engineer had 10 years service as a fireman and engineer and had been qualified as an engineer on the Cheyenne-Rawlins territory in September 1975. Prior to reporting on March 28, the engineer had been off duty 41 hours 25 minutes. He stated that on March 28 he awoke after a full night's sleep at 8:00 a.m., napped in the afternoon, and ate a full evening meal at the home of friends. After the accident the engineer submitted to a toxicological scan of his blood which was negative for alcohol and drugs. The head brakeman had 6 years service and had last worked on March 21. He lived alone in Laramie, 60 miles from Cheyenne. On March 28, he spent the day working on a home improvement project, had an evening meal with friends, and drove to Cheyenne to report for duty. A postmortem toxicological examination was negative for alcohol and drugs.

The conductor and rear brakeman of Extra 3449 West had been off duty for 45 hours and 71 hours, respectively, prior to reporting. The conductor noticed nothing unusual about the engineer's behavior at the time they reported. The rear brakeman was well acquainted with the head brakeman and had ridden with him from Laramie to Cheyenne, to report for duty that night. He stated that he noticed nothing unusual about the other man's condition or behavior during the trip.

The crewmembers of Extra 3055 West had reported for duty at 7:05 p.m., March 28, and had been on duty 7 hours 36 minutes when the accident occurred. The engineer had been off duty more than 21 hours prior to reporting; the other crewmembers had been off duty for more than 50 hours.

Train Information

Extra 3449 West originated in North Platte, Nebraska, and, except for the car picked up at Lookout, the original makeup of the train was never altered. At the time of the accident, the train consisted of 3 General Motors Model SD40-2 diesel-electric locomotive units, 43 cars, and a caboose. Extra 3449 West had a maximum authorized speed of 65 mph which was noted on the clearance card given to the crew at Cheyenne. The nominal length of the train after it left Lookout was 3,150 feet. The lead locomotive unit had the short hood forward and was equipped with functioning dual sealed-beam headlight, speed indicator and recorder, overspeed control, floor-mounted deadman pedal, and cab signals with acknowledging lever and warning whistle. The whistle was mounted on the forward cab wall in a conspicuous location. The caboose was a standard UP type with cupola. Both lead unit and caboose had functioning permanent radios using the UP frequency.

Extra 3055 West consisted of 5 locomotive units, 121 empty hopper cars, and 2 foreign line cabooses. The lead unit was a General Motors Model SD40 equipped with functioning cab signals, UP radio, speed indicator, and speed recorder. The train had a maximum authorized speed of 50 mph and a nominal length of 6,636 feet. The rear caboose, Burlington Northern 10783P, had a permanent radio which would not operate on the UP frequency. However, there was a functioning UP portable radio on the caboose. The rear caboose had an electrically-powered red marker light facing to the rear which was lighted prior to and at the time of the accident.

Method of Operation

Trains are operated over the two main tracks between Cheyenne and Rawlins by automatic wayside signals of a centralized traffic control system supplemented by locomotive cab signals. Traincrews are also directed in their duties by radio-transmitted instructions from the dispatcher. The tracks are numbered 1 and 2 from north to south.

Through the use of crossover tracks, the dispatcher can route a train over either main track between control points to allow it to overtake another train. Once the dispatcher has established the route for a train between control points, the intermediate signals governing that route are automatically locked in for that train. The first control point east of Ramsey is Medicine Bow and in the 14-mile section between these points there are six intermediate block signals from 1.6 to 2.7 miles apart. The tracks are signaled in both directions and the intermediate signals are of the approach-lighted, four-aspect color-light type. They are mounted on a low mast to the field side of the track they govern. The signals for a westbound train moving on the No. 1 track are located north of the track; those governing westbound movement on the No. 2 track are south of the track. The intermediate signals do not light until a train passes the preceding signal or the circuitry in the preceding block is otherwise shunted. The aspects for both tracks are displayed regardless of which track is occupied by an approaching train.

If the block beyond an intermediate signal is occupied by a train, the signal will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Red or red over red (with number plate)	Stop and Proceed	Stop before any part of train or engine passes the signal, then proceed at restricted speed through entire block.

I. the block governed by the signal is clear and the block in advance of that block is occupied, the signal will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Yellow	Approach	Proceed prepared to stop before any part of train or engine passes the next signal. Trains exceeding 30 mph must immediately reduce to that speed.

If two blocks in advance of the signal are unoccupied, but the third block ahead of the signal is occupied, the signal will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Flashing yellow	Advance approach	Proceed. Speed passing next signal must not exceed 40 mph.

If three blocks in advance of the signal are unoccupied and the route was established for the train at the last control point, the signal will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Green	Clear	Proceed

The automatic cab signal system (ACS) in the UP locomotives repeats the four basic wayside signal indications — clear, advance approach, approach, and stop — and whenever the cab signal changes to a more restrictive indication, the engineer is required to move the 3-position acknowledging device from "normal" to "acknowledge" position. Failure of the engineer to do this will result in the continuous sounding of a warning whistle located on the front wall of the locomotive cab. UP Rule 464 requires any other member of the crew in the cab to take immediate action to stop the train if the whistle sounds longer than 6 seconds. (See appendix C.) However, the automatic air brake system will not apply, even if the engineer fails to acknowledge as required.

A dispatcher at Cheyenne supervised operations over the territory involved in this accident. He monitored the movement of trains as they reached and passed the control points, represented by lights on the panel of his centralized traffic control console. In addition, the console was equipped with a recording graph that tracked the movement of trains by time and location (see figure 3). The dispatcher was required to check the graph's timing device against the standard clock every 4 hours. On March 29, he first checked the timing device at 12:20 a.m. At that time it was 30 seconds fast and he reset it to the correct time. The dispatcher made a second check at 4:54 a.m. at which time the timing device was 15 seconds fast.

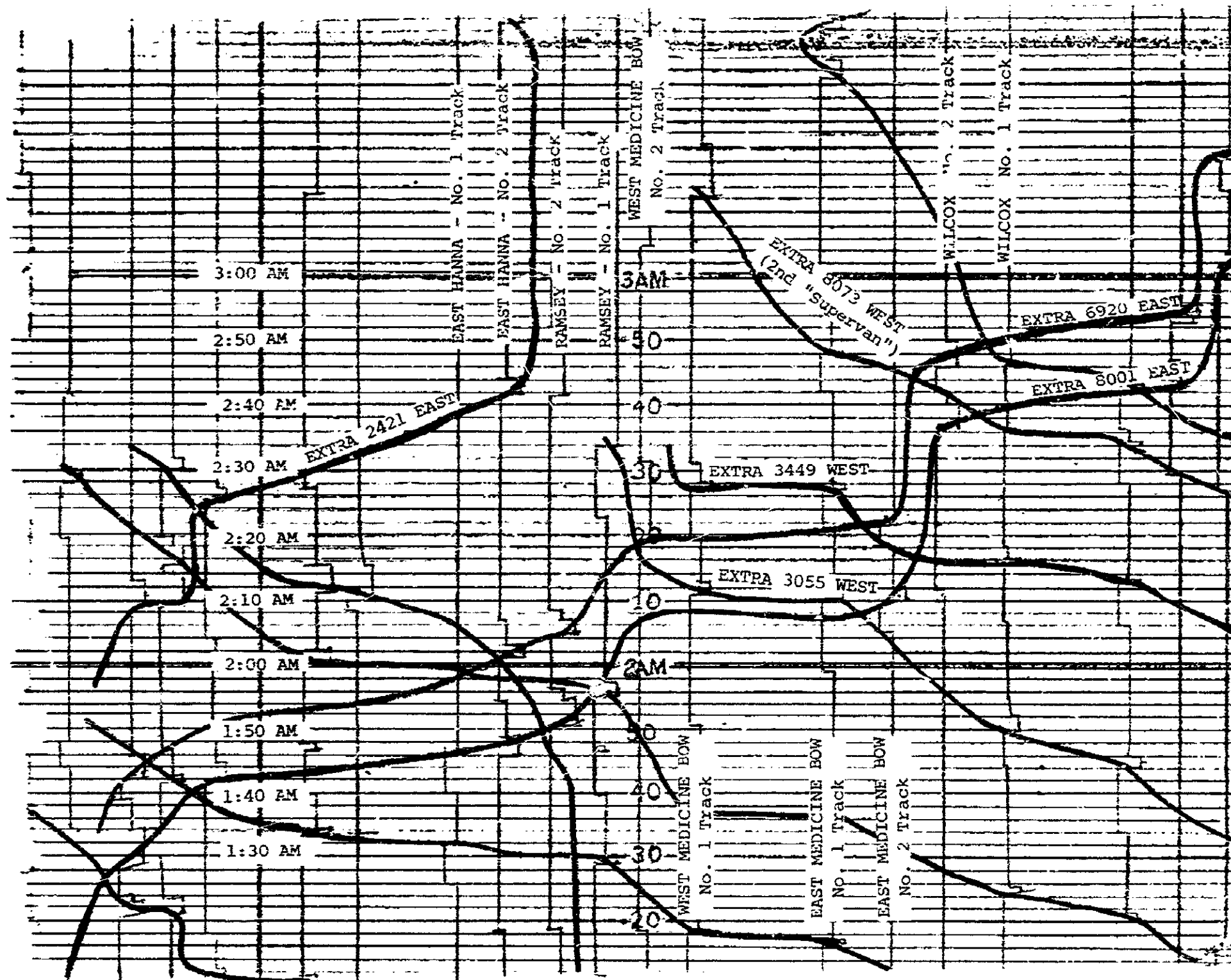


Figure 3. Centralized Traffic Control recording graph for Ramsey-Medicine Bow area from 1:30 a.m. to 3:00 a.m., March 29, 1979. Times, locations, and identification of trains have been superimposed on a copy of the original graph.

A 40-mph slow order was in effect for 11 miles of No. 1 track beginning at Milepost 639, 3,020 feet beyond the point of collision.

Meteorological Information

At 2:35 a.m., March 29, the weather station at Rawlins, 44 miles west of Ramsey, recorded scattered overcast, a temperature of 34° F, ground visibility of 1,500 feet, and northwesterly winds at 9 mph. According to train crewmembers, there was no atmospheric restriction to visibility in the accident location area.

Survival Aspects

The left side, front door, and part of the roof was torn away from the cab of the lead locomotive unit of Extra 3449 West. The head brakeman was found lying face-down and crosswise on the cab floor under a wheelset from the rear caboose of Extra 3055 West. He sustained severe head and chest injuries that were apparently instantly fatal. The engineer was seated in his normal position at the time of the collision. After the accident, the engineer was unable to open the door behind his seat, and he removed the automatic brake valve handle to break out the glass in the right side cab window. He then climbed out through the window and dropped to the ground. The engineer received minor scalp injuries which may have been incurred as he exited the cab.

The conductor of Extra 3055 West saw the headlight of Extra 3449 West as it was moving through the last curve east of the point of collision. The conductor, assuming that the approaching train was overtaking his train on the No. 2 track, went to the rear platform of the caboose to give the other train a rollby inspection. When the conductor realized the following train was on the No. 1 track, he jumped from the platform to the north side and ran east to reach a safe area. The conductor did not have time to warn the rear brakeman who he last saw seated in the rear of the caboose. Immediately after the accident, the conductor returned to the caboose where he found the brakeman inside, apparently dead from multiple head injuries.

The engineer and head brakeman of Extra 3055 West escaped injury despite violent slack action and the emergency application of the train's brakes. They assumed their train had experienced a coupler failure because there had been no warning and they were not aware that Extra 3449 West was following them. An eastbound coal train on the No. 2 track had nearly reached a point beside the locomotive, so the engineer informed the eastbound train that his train was in emergency. The head brakeman of Extra 3055 West also alighted and set out lighted fusees as required. The coal train stopped west of the eastbound home signal which had changed from "clear" to a "stop" indication when derailed cars from Extra 3449 West shunted the track circuitry.

The conductor and rear brakeman of Extra 3449 West were in the caboose cupola when the slack ran in from the collision and their train's brakes were simultaneously applied in emergency. The conductor was uninjured, but the brakeman

received a minor elbow injury. The conductor stated that he was certain his train had derailed, and he and the brakeman immediately went forward to determine the extent of the damage.

Another westbound freight train, the "Second Supervan," with an authorized speed of 70 mph, was approaching Medicine Bow when the collision occurred at Ramsey. The surviving crewmembers of Extra 3449 West testified that they knew this train was close behind them, and the engineer stated that he expected it to overtake his train. The engineer also stated that "When we saw the approach light for Ramsey, we thought we were going to cross over at Ramsey" to let the Supervan by.

The dispatcher first realized something was wrong at Ramsey when a light on his console indicated occupancy of track No. 2 in the block east of the eastbound home signal at 2:41:30. This was followed by the radio transmission from the engineer of Extra 3055 West that his train was in emergency. Although the transmission was also monitored by crewmembers of the Supervan and three eastbound trains, nothing was heard from Extra 3449 West until the conductor of that train transmitted an emergency alert at 3:08 a.m. In the interim, neither the conductor nor rear brakeman did anything to protect track No. 2 as required by UP Rule 102. (See appendix C.)

The dispatcher stopped the Supervan at Medicine Bow at 2:47 and later sent that train's locomotive units to Ramsey on the No. 1 track to get the underdetailed portion of Extra 3449 West standing in the block east of the Ramsey home signal. Intermediate signals 6319-1, 6345-1, and 6367-1 properly displayed "advance approach," "approach," and "stop and proceed" aspects for the Supervan's locomotive units.

Tests and Research

Following the accident an inspection of the cab of Extra 3449 West's lead unit revealed the throttle to be in the No. 8 power position, the automatic brake valve in handle-off position with handle removed and laying on the engineer's seat, and the independent brake valve in the running position. The overspeed and deadman control features were active with the deadman pedal in the up, or active, position. The headlight switch was on "bright" and the radio was operable. The emergency valve on the left side of the cab was in the closed position. The cab signal acknowledging device was in the "normal" position, the cab signal control switch was sealed in the "on" position, and the warning whistle was found with a large rag tied around the port. Subsequently, the head brakeman who had been on Extra 3449 West from North Platte to Cheyenne stated that he had tied the rag on the whistle to mute its sound. (See figure 4.)

The warning whistle was taken to UP's Omaha shop where a series of sound-level tests was made with the whistle installed in a unit of the same model and series as the one involved in the accident. With the cab doors and windows closed, the engine working in the No. 8 throttle position, and the whistle port unblocked, the sound level of the whistle was 28 decibels higher than the sound level of the



Figure 4. Automatic locomotive cab signal warning whistle in the cab of the lead unit of Extra 3449 West as it was found after the collision at Ramsey.

engine. With the port covered by the rag, the decibel value was virtually the same as that produced by the engine alone and it was not possible to perceive any sound from the whistle at any location in the cab.

The recording graph from the dispatcher's CTC machine was inspected and the various passing times for both westbound trains and the last two eastbound trains they passed generally conformed with the times stated by crewmembers of Extra 3055 West and the eastbound trains. The accuracy of the graph was also confirmed by the passing times of the eastbound trains registered by the operator at Hanna, and by analysis of the speed recorder tapes removed from the lead units of Extra 3055 West and Extra 3449 West. (See appendix C.)

About 30 minutes after the accident, the UP's general signal engineer ordered signal department personnel to seal all the instrument cases for the signals approaching Ramsey from the east. Beginning on March 29, qualified UP signalmen accompanied by Federal Railroad Administration (FRA) signal inspectors began removing the seals and tested all controlling relays and circuits for signals 6299-1, 6319-1, 6345-1, 6367-1, and the home signal at Ramsey. All controlling relays were checked by serial number and found to be the same ones in place when UP last tested and inspected the signal installations in August 1977. All relays and

circuits were found free of defect and they functioned as designed with the signals displaying proper aspects. Circuiting for the locomotive cab signals was also tested and found to be operating in accordance with the wayside signals.

ANALYSIS

After passing a clear signal more than 10 miles east of the accident location, the engineer of Extra 3449 West was in a position to observe signal 6299-1, which would have displayed an "advance approach" aspect. While this signal may have changed to a "clear" aspect before Extra 3449 West reached it, the next signal (6319-1) would have continuously displayed an "advance approach." An alert and experienced engineer should have realized that the succession of "advance approach" aspects meant that another westbound train was moving through the signal blocks ahead. The radio transmission which the engineer of Extra 3449 West said he had heard before his train passed signal 6299-1 was also an indication that a train was ahead.

By the time Extra 3449 West reached signal 6345-1, the engineer was required to have reduced his train's speed to 40 mph. Yet the locomotive speed recorder tape indicated that the train passed the signal at 62 mph. The "approach" aspect displayed by signal 6345-1 required immediate reduction to 30 mph and the ability to stop short of signal 6367-1, yet the train passed this signal, which would have displayed a "stop and proceed" aspect, at 52 mph. The red marker light on the rear of Extra 3055 West should have been plainly visible to the engineer and head brakeman of Extra 3449 West when it was still more than 2,000 feet away. Yet Extra 3449 West struck the rear of the slowly moving coal train at a speed of 48 mph. At no time did the engineer take action to reduce from full throttle operation or to initiate any braking action. The gradual deceleration of his train was due entirely to the effect of the long ascending grade approaching Ramsay.

As the head end of Extra 3449 West passed each of the progressively more restrictive signal aspects, they would have been repeated by the locomotive cab signals. Failure to acknowledge these changes of the cab signals would have caused the cab signal warning whistle to sound continuously. But neither the engineer nor the head brakeman could have heard the whistle because it had been muted with a rag before they boarded the train at Cheyenne. The conspicuous location of the whistle on the forward cab wall and the large rag tied around it, as well as the fact that the whistle emitted no discernible sound, make it unlikely that the engineer and brakeman did not know that the whistle had been muted from the time they left Cheyenne. It is unfortunate that because these men had failed to correct the muted whistle, they also deprived themselves of the protection the device was intended to provide.

The engineer contended that all of the signals approaching the accident location displayed "clear" aspects. Even if this were so, his train was moving too fast to have slowed in time to observe the 40-mph slow order beginning 3,020 feet beyond the point of impact. The engineer stated he and the head brakeman saw the caboose of Extra 3055 West when it was still about 1,400 feet ahead. If this were

so and had he immediately applied the brakes in emergency with his train on a 0.70 percent ascending grade, and with Extra 3055 West moving at about 10 mph, such prompt action could have substantially reduced the speed of his train and greatly decreased the effect of the collision. With reduction of speed and an attempt to alert the crew of Extra 3055 West by radio, blowing of the whistle, or on-off manipulation of the headlight switch, both men on the rear of Extra 3055 West might have had time to successfully escape from the caboose. It is inconceivable that an alert and experienced engineer would take no action under the circumstances. Yet the last known action on the part of the engineer of Extra 3449 West was the dimming of his locomotive's headlight for an opposing train 17 minutes before the accident occurred.

The only evidence to support the contention of the engineer of Extra 3449 West that the signals approaching the accident location were "clear" was the inconsistent testimony of the conductor and rear brakeman of his train. Due to the length of Extra 3449 West, the two crewmembers on the caboose could only have seen signals 6299-1 and 6319-1 before their locomotive units passed them. Three days after the accident, the conductor said he didn't see any of the signals. Later, he recalled seeing signal 6319-1 display a "clear" aspect. The rear brakeman originally claimed to have seen a "clear" aspect on signal 6319-1. Ultimately, he admitted he didn't see the signal.

The wayside signals approaching Ramsey displayed the proper aspects for the intended routing and movement of Extra 3055 West, and these were properly repeated by that train's locomotive cab signals. Signals 6319-1, 6345-1, and 6367-1 also operated properly after the accident when the locomotive units of the Supervan train were operated over No. 1 track to the accident location. Post-accident tests conducted in the presence of FRA inspectors failed to reveal any defects in the relays and circuitry that might have caused any signal to display an improper indication. No defects were found in the locomotive cab signal circuitry. Therefore, the Safety Board concludes that the signals were operating properly and were displaying progressively more restrictive aspects which the engineer of Extra 3449 West did not obey.

The insistence of the three surviving crewmembers of Extra 3449 West that they passed the last eastbound train 4 or 5 miles east of Ramsey instead of east of Medicine Bow was not supported by the CTC recording graph, statements of the crewmembers of other trains, and the registered times the eastbound trains passed the open station at Hanna.

It is possible that the last signals the engineer and head brakeman actually observed were the clear signals passed at and immediately west of Medicine Bow. For the last 15 miles of its run, Extra 3449 West was laboring in full throttle. The cab windows and doors were closed and the cab heater was on. The engineer had only napped briefly during the 18 hours preceding the accident and may have dozed off. The mere weight of the engineer's foot on the deadman pedal was sufficient to keep it depressed. The one safety device -- the cab signal whistle -- that could have alerted the men had been effectively muted so that it could no longer serve its intended purpose.

This accident demonstrates that the purpose of the cab signal warning whistle can be easily and effectively eliminated, and that the device, by itself, is an inadequate means of assuring the engineer's compliance with restrictive signal indications. Had the UP's locomotive cab signal system included a provision for automatic penalty application of the automatic brake system when the engineer fails to acknowledge a restrictive cab signal indication, Extra 3449 West would have been stopped long before it reached Ramsey, and the collision would not have occurred.

The engineer and head brakeman of Extra 3055 West did not know what had caused their train to go into emergency and had heard nothing from Extra 3449 West. Yet, the engineer used his radio to warn an oncoming eastbound train while the brakeman alighted and put out fuses as required. The timely action of these men could have been critical in preventing an even greater catastrophe. Had the derailed cars that obstructed the No. 2 track not shunted the signal circuit, the eastbound train would have collided with the wreckage. The head brakeman was new to the UP and the territory, yet he instinctively acted to protect the adjacent tracks. The brakeman's performance was in contrast to that of the experienced crewmembers of Extra 3449 West. Although these men clearly understood that a fast-moving train was not far behind them and could very well have been routed to overtake them, they failed to protect the No. 2 track and maintained absolute radio silence for 27 minutes after the accident.

Although the UP says it requires its engineers and conductors to attend instruction and reexamination classes in the operating rules once every 2 years, the engineer of Extra 3449 West had not received such training since 1973 --prior to his qualification on the Cheyenne-Rawlins territory. The rear brakeman on the same crew, a promoted conductor, had not attended a rules class since 1975.

The speed recorder was very helpful in determining the actual speed of the train as it approached the point of the collision. This in turn provided information of the activities of the crewmembers in the locomotive. However, an events recorder would have been more beneficial in providing this information.

CONCLUSIONS

Findings

1. The wayside block signals and the circuitry for the locomotive cab signal system which governed the movement of Extra 3449 West approaching the accident location functioned as intended.
2. The engineer of Extra 3449 West failed to operate his train in compliance with restrictive aspects displayed by wayside signals 6319-1, 6345-1, and 6367-1, which were repeated by his locomotive cab signals.

3. The engineer of Extra 3449 West failed to take any action to stop his train after he was in a position to see the train ahead, or to use his radio or whistle to warn the crew of Extra 3055 West.
4. The cab signal warning whistle had been muted before Extra 3449 West arrived at Cheyenne, a condition which the crew that boarded the train at Cheyenne failed to correct.
5. The muting of the cab signal warning whistle made it impossible for the engineer and head brakeman to hear it, rendering ineffective the intended purpose of this safety device.
6. Had the UP's locomotive cab signal system included a provision for the automatic penalty application of the automatic airbrake system in the event of the engineer's failure to acknowledge a restrictive cab signal indication, Extra 3449 West would have been stopped short of the preceding train and the accident would not have occurred.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the engineer of Extra 3449 West to comply with a series of restrictive wayside signals, repeated by locomotive cab signals, including a "stop-and-proceed" aspect 6,303 feet from the point of collision. Contributing to the accident was the unauthorized muting of the cab signal warning whistle so that it could not alert the engineer when a more restrictive signal was passed.

RECOMMENDATIONS

During its investigation of this accident, the National Transportation Safety Board made the following recommendation to the Union Pacific Railroad on July 5, 1979.

"Modify its locomotive cab signal apparatus to provide for an automatic penalty application of the automatic airbrake system whenever the engineer fails to acknowledge a more restrictive signal indication within the specified time. (Class II, Priority Action) (R-79-41)"

On January 25, 1976, as a result of its investigation of an accident in Meeker, Louisiana, on May 30, 1975, ^{6/} the Safety Board recommended that the Federal Railroad Administration:

^{6/} "Railroad Accident Report -- Rear-End Collision of two Texas and Pacific Railway Company Freight Trains, Meeker, Louisiana, May 30, 1975" (NTSB-RAR-75-9).

"Promulgate regulations to require an adequate backup system for mainline freight trains that will insure that a train is controlled as required on the signal system in the event that the engineer fails to do so. (R-76-3) (Long-Term Followup)

The FRA has not acted on recommendation R-76-3, and no regulations have been promulgated. The Union Pacific's compliance with recommendation R-79-41 above would accomplish the intent of recommendation R-76-3 for at least that railroad's operations.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

FRANCIS H. McADAMS, Member, did not participate

August 16, 1979

APPENDIX A

1. Investigation

The National Transportation Safety Board was notified of the accident about 9:00 a.m. on March 29, 1979. The Safety Board immediately dispatched an investigator from the Denver Field Office and an investigative team from Washington, D.C. to the scene. The investigation was completed with assistance from Federal Railroad Administration signal specialists, and Union Pacific personnel.

2. Depositions

A 1-day deposition proceeding was held in Cheyenne, Wyoming, at 9:00 a.m. on May 15, 1979. Parties represented at the hearing were the Union Pacific Railroad, Federal Railroad Administration, Brotherhood of Locomotive Engineers, and United Transportation Union. Statements were taken from nine witnesses.

APPENDIX B

TRAIN CREWMEMBER INFORMATION

EXTRA 3449 WEST

Conductor David Eugene Duncan

Conductor Duncan, 25, was employed as a brakeman by the UP on December 19, 1973, and was promoted to conductor on November 3, 1977. Assigned to the conductors' extra board, he worked in freight service between Cheyenne and Rawlins as needed. Duncan passed a company physical examination on November 15, 1977, and was not restricted in any way. His service record was clear of citation or disciplinary action. He last passed an examination on UP operating rules at the time he was promoted to conductor.

Engineer Douglas Wayne Peoples

Engineer Peoples, 34, was employed as a fireman by the UP at Denver, Colorado, on April 10, 1969. On October 10, 1969, he was promoted to hostler and on September 9, 1972, he passed the examination for promotion to engineer. Peoples relinquished his rights on the Colorado Division on June 15, 1975, and established seniority as a fireman the same day between Cheyenne and Rawlins. He was qualified as an engineer on this territory on September 6, 1975.

The only infraction shown on Peoples' service record was an assessment of 30 demerits following the 1972 overrunning of a home signal displaying a "stop" aspect by a train on which he was the fireman. Peoples passed a company physical examination on June 6, 1977, and he was last examined on the operating rules on September 22, 1973. He was not restricted in any way.

Rear Brakeman Louis Charles Crozier

Brakeman Crozier, 42, was employed as a brakeman by the UP on July 22, 1968, and was promoted to conductor on May 10, 1975. Crozier served mainly as a switchman in yard service until March 21, 1972, when he was assigned to train service. At the time of the accident he was regularly assigned to the Cheyenne-Rawlins freight pool.

Crozier passed a company physical examination on May 31, 1974, and he was last examined on the operating rules when he was promoted to conductor. His service record shows dismissal from the service on June 23, 1970, for responsibility in connection with a derailment. He was reinstated on August 16, 1970. On October 13, 1975, he received a spinal injury due to slack action following emergency braking of a train he was riding.

Head Brakeman David Ian Farris

Brakeman Farris, 30, was employed as a brakeman by the UP on May 25, 1973. He had not been promoted. Farris had worked in yard and train service, and at the time of the accident he was regularly assigned to the Cheyenne-Rawlins freight pool. Farris passed a company physical examination on November 30, 1977, and he was last examined on the operating rules when he was hired. He was not restricted in any way.

Farris' service record indicates he was disciplined four times during 1974 and 1975 while working as a yard switchman. He twice received 30 demerits for minor rules infractions, followed by a 30-day deferred suspension for responsibility in the collision of cars being handled by his crew. On May 23, 1975, Farris was dismissed following a collision between his locomotive and a car. At the time, he was the foreman of the crew involved. Farris was reinstated August 11, 1975, and had a clear record thereafter.

EXTRA 3055 WEST

Conductor Richard Eugene Mahlman

Conductor Mahlman, 33, was employed as a brakeman by the UP on November 30, 1966, but worked only briefly in that capacity before being furloughed. He rejoined the UP as an assistant signalman on February 2, 1972, and on January 22, 1973, transferred to the Operating Department as a switchman/brakeman. Mahlman was promoted to conductor on October 21, 1976, and since that time had worked regularly in freight service between Cheyenne and Rawlins. He passed a company physical examination on June 20, 1974, and was last examined on the operating rules at the time of his promotion. Mahlman was not restricted in any way. Mr. Mahlman's service record indicates he was twice assessed 30 demerits for minor rules infractions in 1974 and 1977.

Engineer Virgil Paul Sawicki

Engineer Sawicki, 49, was employed as a clerk/engine dispatcher by the UP on May 21, 1952. Thereafter he worked various clerical assignments until July 8, 1976, when he entered engine service as a fireman. He completed the UP's Engineer Training Program and was qualified as an engineer in road and yard service on the Cheyenne-Rawlins territory on November 15, 1976. He passed a company physical examination on January 30, 1979, and was last examined on the operating rules on July 28, 1976. He was not restricted in any way.

Sawicki's service record indicates he had been assessed 30 demerits on three occasions — for failure to comply with an "advance approach" aspect in 1977, and for twice failing to secure locomotive units against undesired movement during 1978.

Rear Brakeman James Douglas Smith

Brakeman Smith, 28, was first employed as a brakeman by the UP on September 21, 1978. He was not promoted and had worked yard and train service assignments between Cheyenne and Rawlins as needed. Smith passed a company physical examination and was examined on the operating rules when he was employed. He was not restricted in any way and he had not been cited for any infractions of the rules.

Head Brakeman Kirk Dayton Pierson

Brakeman Pierson, 21, was first employed as a student brakeman by the UP on January 2, 1979. He was assigned as a brakeman to the Cheyenne-Rawlins extra board on March 24, 1979, and was working his first assignment on a road freight train at the time of the accident. Prior to being employed by UP, Mr. Pierson had 3 1/2 years service as a brakeman and extra conductor on the Chicago, Milwaukee, St. Paul and Pacific Railroad.



Pierson passed a physical examination when he was hired and was examined on the operating rules on January 20, 1979. He was not restricted in any way.

APPENDIX C

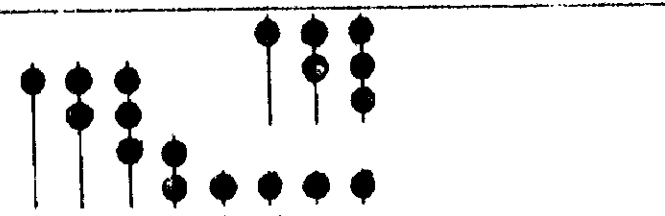
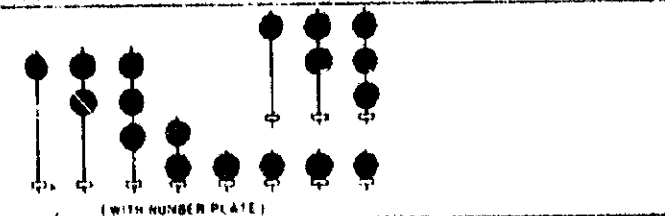
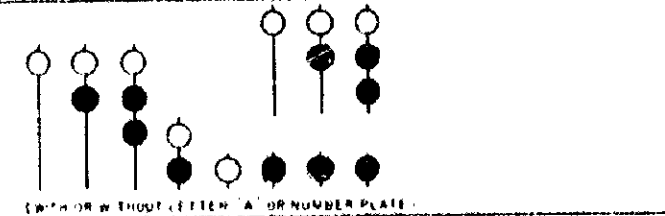
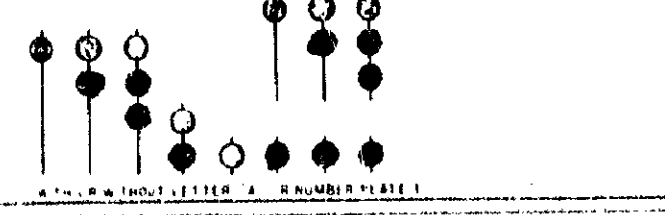
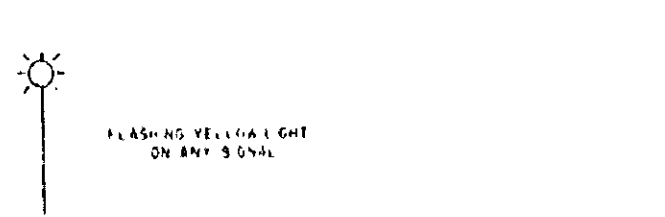
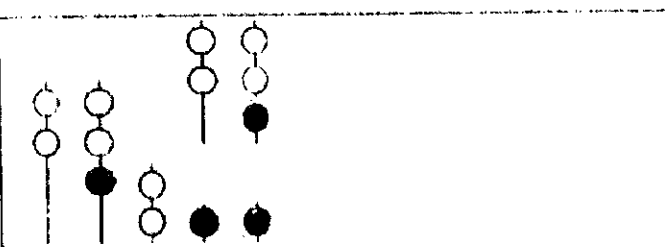
EXCERPTS FROM UNION PACIFIC OPERATING RULES

Block and Interlocking Signal Indications.

Following symbols are used in diagrams of signal aspects:

- To indicate number plate;  ● - RED
- To indicate flashing light;  ○ - YELLOW
- - GREEN

Aspects shown in Rules 240 C through 240 N may be displayed on signals with or without a number plate on signal mast.

RULE	ASPECTS	NAME	INDICATION
240A		Stop	Stop before any part of train or engine passes the signal.
240B		Stop and proceed	Stop before any part of train or engine passes the signal then proceed at restricted speed through entire block.
240C		Approach	Proceed prepared to stop before any part of train or engine passes the next signal. Trains exceeding 30 MPH must immediately reduce to that speed.
240E		Clear	Proceed.
240F		Advance approach	Proceed. Speed passing next signal must not exceed 40 MPH.
240G		Approach Diverging	Approach next signal prepared to proceed on diverging route at prescribed speed.

AUTOMATIC CAB SIGNAL SYSTEM RULES

Note.—Automatic Cab Signal System Rules will be used only in ACS territory specified in the time-table or in special instructions.

ASPECTS

450. NAME — Restricting



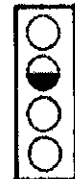
INDICATION — Proceed at restricted speed.

451. NAME — Approach



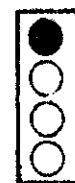
INDICATION — Proceed prepared to stop before any part of train or engine passes the next signal. Train exceeding 30 MPH must immediately reduce to that speed.

452. NAME — Approach limited.



INDICATION — Proceed. Speed passing next signal must not exceed 40 MPH.

453. NAME — Clear



INDICATION — Proceed
104

Rules

454. Automatic Cab Signal System supplements automatic block signals in governing the use of blocks, but does not supersede the superiority of trains, nor dispense with the observance of rules governing the use of automatic block or other signals and rules whenever and wherever they may be required, except as prescribed by Rule 456.

455. When cab signal indication changes to a more restrictive indication, engineer must acknowledge with acknowledging device.

456. When a train is proceeding after having been stopped by a block signal, or is proceeding on a Permissive indication of a block signal, if cab signal changes to a less restrictive indication, train may proceed in accordance with indication received after it has moved its length beyond point where cab signal changed.

Exception: Rule 456 does not apply when proceeding after having been stopped by a Flashing Stop-and-Proceed indication. See Rule 240 (C).

457. When cab signal indication does not correspond with block signal indication, engineer must be governed by the most restrictive indication displayed by either signal, and must report the fact to train dispatcher from first available point of communication, giving signal number and engine number.

When cab signal indication does not correspond with block signal indication for two consecutive blocks, cab signal may be considered inoperative. If previous advice has been received from train dispatcher or by bulletin of inoperative cab signal within designated limits, train must proceed within those limits in accordance with second and third paragraphs of Rule 458.

458. When a cab signal device becomes inoperative, train may proceed in accordance with block signal indications but not exceeding 10 miles per hour to the next available point of communication where report must be made to train dispatcher, who will instruct as to cutting out cab signal devices and further movement of train.

When cab signal devices have been cut out, train may proceed in accordance with block signal indications but not exceeding 79 miles per hour and as much slower as rules or conditions require.

While so proceeding, if train encounters a block signal displaying Stop, Stop-and-Proceed or Permissive indication, or light not burning on a block signal, train must stop. After stopping, train must wait for change of signal indication and if the signal does not change to a less restrictive indication within three minutes, it may be assumed that the block signal is inoperative and the train may proceed complying with the block signal indication.

461. When engineer takes charge of an equipped engine in cab signal territory or enters cab signal territory, he must know that cab signal devices are cut in.

Departure tests must be made by engineer before entering cab signal territory or he must know that Form 2415 is valid.

462. Cab signal devices must not be cut out while in cab signal territory without authority.

On an equipped engine with three-position acknowledging device, use of cut-out position is prohibited while operating within cab signal territory, except when authorized.

When seals on cab signal devices are broken, or found broken or missing, report must be made promptly.

464. If the cab warning whistle sounds longer than 6 seconds, another member of crew in the cab, must go to the engineer immediately and ascertain cause, and when conditions require, must take immediate action to stop train.

465. If cab signal whistle fails to sound when cab signal changes to a more restrictive indication, Rule 458 must be complied with.

102. When a train becomes disabled or is stopped suddenly by an emergency application of the brakes or other causes, a lighted red fusee must be immediately displayed on adjacent track at front and rear of train, and adjacent track as well as tracks of another railroad that are liable to be obstructed must immediately be protected in both directions in accordance with Rule 99 until it is ascertained they are safe and clear for the movement of trains. After lighted fusee has been displayed at front of train, headlight must be extinguished.

In such cases, it must be determined by inspection that the train involved and the track to be used are safe for the train to proceed. Train involved must not proceed nor may flagmen be recalled until engineer has been definitely advised by conductor that it is safe to do so.

A train on an adjacent track must not pass the disabled train unless it is preceded by a flagman or unless definitely assured by the conductor of the disabled train that the track is clear and it is safe to proceed.

UNION PACIFIC RAILROAD COMPANY
 OFFICE OF SUPERINTENDENT
 BULLETIN ORDER

W. S.
 FEB 1979

No. E-14

CHEYENNE, WYOMING - February 2, 1979

TO: TRAINMEN, ENGINEMEN, AND YARDMEN
 TO BE POSTED AT: WYOMING DIVISION BULLETIN BOOKS

The following are maximum speeds for all trains in the locations specified:

<u>LOCATION:</u>	<u>MAXIMUM SPEED</u>
<u>SECOND SUBDIVISION:</u>	
On No. 1 Track between MP 537.25 and MP 541.25	30 MPH
On No. 1 Track between MP 568 and MP 578	50 MPH
On No. 1 Track between MP 639 and MP 650	40 MPH
On No. 2 Track between MP 650.25 and MP 639	40 MPH
On North Running Track between MP 639 and MP 643	20 MPH
On South Running Track between East Switch and MP 642.75	5 MPH
On South Running Track between MP 642.75 and West Switch	10 MPH
At Ramsey through Turnout from No. 1 Track to North Running Track	10 MPH
On Medicine Bow Mine Lead between MP 10.75 and MP 11	10 MPH
At Hanna Through Turnout from Old Rosebud Lead to North Running Track	10 MPH
Through Switch at Center Hanna to North Running Track	5 MPH
Through Switches from North Running Track to Energy Lead and Overhand Throw Crossovers between No. 1 and No. 2 tracks.	5 MPH

EXCERPT FROM UNION PACIFIC TIMETABLE NO. 2, DECEMBER 10, 1978

WYOMING DIVISION

WESTWARD			SECOND SUBDIVISION			EASTWARD		
STATION NUMBER	LENGTH OF SIDINGS FEET	FIRST CLASS DAILY	TimeTable No. 2			MILE POST	FIRST CLASS DAILY	RULE (18)
			STATIONS					
510		2 00PM 2 25PM	DN-R	CHEYENNE N		509.5	3 25PM 3 00PM	FPTXY
				WEST CHEYENNE		510.8		PX
515	900			WYCON (SPUR-E) 46		514.5		P
519	5104 1314			BORIE 75		519.1		PX
529	4173			GRANITE 80		528.6		PX
537	C 5852			BUTLORD 88		536.6		P
540	1250			SHERMAN (SPUR-W) 96		540.4		PY
545	2171			DALE (SPUR-E) 98		541.0		P
				DALE JCT. 99		541.8		PX
548				HERMOSA 101		547.9		PX
554	572			COLORES (SPUR-E) 90		554.0		P
563	519			FORELLE (SPUR-E) 10		563.0		P
566			DN-R	LARAMIE K		566.0		FPXY
578				HERMOSA 89		5547.9		PX
587	5849			RED BUTTES 95		5556.8		P
596			DN-R	LARAMIE K		5560.3		FPXY
510			DN-R	CHEYENNE N		509.5		FPTXY
15-518	C 6489			SPEER 95		519.0		PXY
15-518	C 6489			SPEER 68		519.0		PXY
15-526	6217			EMKAY 84		525.8		P
15-534	6408			LYNCH 85		534.2		P
15-543	6722			HARRIMAN 68		549.5		P
15-550	8134			PERKINS 44		554.3		PX
566		83 50	DN-R	LARAMIE K		566.0	51 40PM	FPXY
				X502 31		582.2		PX
585	C 4301			BOSLER 53		585.3		P
590	753			COOPER LAKE (SPUR-E) 33		590.6		P
594	1585			LOOKOUT (SPUR-W) 14		593.9		PX
605	C 5944			ROCK RIVER 7		605.3		PY
609				WILCOX 139		609.0		PX
623	C 5985		D	MEDICINE BOW ML 16		622.9		PY
				X624 139		624.5		PX
639				RAMSEY 37		639.4		PX
643	11772		DN-R	HANNA MN 7		643.1		PXY
				DURRANT 64		650.2		PX
657	403			EDSON (SPUR-W) 56		656.6		P
662				WALCOTT 89		662.2		PXY
672				BENTON 42		672.1		PX
676				SINCLAIR 65		676.3		P
683	11802 19126	11 45 AM	DN-R	RAWLINS RS		682.8	11 45 AM	FPXY

WYOMING DIVISION

CTC-ACS

TRACKS

TRACKS

TRACKS

TRACKS

(VIA SHERMAN 173.3)
(VIA HARRIMAN 182.6)

Maximum speed between Laramie and Rawlins 90 70

APPENDIX D

SPEED RECORDER TAPES
FROM EXTRA 3055 WEST AND EXTRA 3449 WEST

