RAILROAD ACCIDENT REPORT

SOUTHERN PACIFIC RAILROAD COMPANY
FRUITRIDGE ROAD GRADE CROSSING
SACRAMENTO, CALIFORNIA
February 22, 1967.

RELEASED: January 15, 1968

U. S. NATIONAL TRANSPORTATION SAFETY BOARD
Department of Transportation
Washington, D C
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FEBRUARY 22, 1967

TABLE OF CONTENTS

FOREWORD

This accident investigation proceeding was instituted by the Interstate Commerce Commission on its own motion, pursuant to the Accident Reports Act, 36 Stat. 350; 45 U.S.C. 38. The order of the Commission instituting this investigation assigned it to an examiner for hearing, and a hearing was held commencing March 15, 1967, at Sacramento, California.

The Department of Transportation Act, 80 Stat. 931, became effective on April 1, 1967. Under its provisions, it became the duty of the National Transportation Safety Board (Board) to determine the cause of probable cause of the railroad accident involved in the proceeding, to report the facts, and to make recommendations to prevent the recurrence of similar accidents. The Department of Transportation Act further provides that the Board shall make public its accident reports and recommendations. The Board's report of the facts, conditions and circumstances of this accident and its determination of cause or probable cause is subject to the limitation that such report, or any part thereof, shall not be admitted in evidence or used for any purpose in any suit or action for damages, as provided by Section 4 of the Accident Reports Act, 45 U.S.C. 41.

NATIONAL TRANSPORTATION SAFETY BOARD
Department of Transportation

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Adopted: December 27, 1967 Released 1/15/68

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SYNOPSIS

On February 22, 1967, at 12 05 p.m., a station wagon traveling east on Fruitridge Road in Sacramento, California collided with a Southern Pacific Company freight train traveling north at the intersection of the Southern Pacific Company railroad tracks and Fruitridge Road. Fruitridge Road is a Sacramento city street. Immediately prior to and after the collision, the flashing lights and bells of the automatic railroad crossing warning devices were functioning properly. In addition, the engineer was sounding the locomotive's horn and bell in the prescribed manner, and the locomotive's regular and oscillating headlights were functioning.

The station wagon was destroyed and its nine occupants were fatally injured. The train was not derailed, the train crew suffered no injuries and there was only minor damage to the lead locomotive.

The probable cause of this accident was failure of the driver

of the 1961 Ford station wagon to stop his vehicle short of the railroad-highway grade crossing and to remain clear of the tracks until the approaching train had passed as required by California State law. The reasons for the failure to stop cannot be positively determined.

Although the reason for the failure to stop cannot be definitely determined, the Board finds circumstantial evidence which suggests that the driver had gradually come to believe that there was little risk in proceeding to cross despite the flashing red lights and inconvenient and possibly unwarranted loss of time would result if he did not cross. Because of their bearing on the nationwide problem of grade crossing accidents, these circumstances are analyzed in the body of the report.

The Board also notes existing circumstances in the Federal funding of grade crossing safety improvements which are highlighted by this accident. The crossing involved was scheduled for crossing gates under a State assistance program, but the installation had not been completed. Had Federal funding been legally applicable to this crossing, there is a possibility that the accident would not have occurred.

The Board recommends that the Department of Transportation, The Association of American Railroads, The Railway Labor Executives Association, The American Trucking Association, Inc , The National

Safety Council, and all other associations and public interest groups include in their current and future studies the problem of "booby-trap" * crossings. The Board also recommends that law enforcement agencies consider adequate enforcement at grade crossings to be as important as enforcement at highway intersections, paying special attention to potential "booby-trap" crossings.

The Board recommends that the Federal Highway Administration study the problem of questionable audibility of external sound signals within motor vehicles, both in relation to grade-crossing signals and train horns, and to all other audible warnings which can assist a driver. Such a study should be aimed toward creating a unified system of warnings and reliable reception which could be made effective through Federal and State cooperation.

Further, the Board recommends that the Department of Transportation accelerate its attempt to develop absolute criteria for grade-crossing protection needs in order to formalize comparisons of the grade-crossing values on a broader basis than local surveys.

The Board recommends that Congress and the Department of Transportation consider the problem of minimal use by States of Federal funds authorized for grade crossing improvements and

determine the degree to which this use of the funds is limited because the funds are usable only on the Federal Highway System, and the degree to which States prefer to use the funds for general highway expansion. The Board believes it appropriate to consider whether the safety benefit of these funds to all motorists makes it appropriate to extend the use of funds beyond the Federal Highway System by legislation.

* For the purpose of this report, "booby-trap" crossings are those crossings where the warning devices frequently have a wide variation in warning times, false warnings, and unclear and misleading warnings sometimes supplemented by a general industrial and railroad-yard atmosphere.

I. FACTS AND CIRCUMSTANCES

A. Description of the Accident

Extra 6335 West, a freight train consisting of three diesel-electric units, 46 cars and a caboose, left the Fresno Railroad Yard at 9:02 a.m. on February 22, 1967. The engineer and the brakeman were seated on the right and lefthand, respectively, of the control compartment of the first diesel-electric unit, and the conductor and flagman were in the caboose.

When the train reached a point about 2500 feet from the Fruitridge Road crossing, the railroad crossing warning devices were activated. The regular and oscillating headlights of the locomotive were functioning and its bell was ringing continuously. As the engine passed the whistle board located 1370 feet south of the crossing, the engineer began to sound the prescribed signal on the locomotive's horn continuing the signal until the locomotive struck the station wagon.

When the train was approximately 300 feet from the crossing, the engineer initiated a service application of the brakes to reduce speed as required by the restrictive aspect displayed by a block signal situated approximately 1/4 mile ahead. About the same time, the brakeman thought he heard the engineer address a remark to him and turned his head in his direction. The brakeman then looked forward and caught a glimpse of an eastbound station wagon entering the crossing on Fruitridge Road only a second before the collision occurred. Neither the engineer nor the brakeman could see eastbound auto traffic until it was within 33 feet of the main track because of a fence surrounding the lumber yard located in the southwest angle formed by the intersection of Fruitridge Road and the Southern Pacific right-of-way. The engineer at no time saw the station wagon involved in the collision.

At 12:05 p.m. when the collision occurred, the engineer immediately initiated an emergency brake application bringing the train to a stop with the locomotive approximately 4500 feet beyond the crossing with the caboose blocking Power Inn Road crossing by three carlengths. Upon radio instructions from the conductor on the caboose, the engineer moved the train ahead far enough to clear Power Inn Road crossing.

None of the train equipment was derailed, no crew member was injured and the front of the first diesel-electric unit sustained only minor damage. The station wagon was demolished and the wreckage scattered. The driver, retired Air Force Sergeant Herbert R. Hill, 42 years of age, his wife and seven of their twelve children ranging in age from three years to ten years were all killed. The wreckage of the station wagon was available for inspection by investigating officials, and was inspected to the degree possible.

The Hill's 1961 Ford station wagon was observed shortly before the collision traveling east on Fruitridge Road in the curb lane of that road. As the vehicle approached the crossing, it passed a pickup truck and a passenger car which were stopped short of the crossing in the curb lane. There were conflicting statements concerning the station wagon's speed as it approached the crossing; however, several said that it appeared to slow down momentarily and then increase its speed until it collided with the train.

B. Description of the Accident Site (See Appendices I and II)

1. The Public Highway. Fruitridge Road is a four-lane public highway in the general area of the railroad crossing, and is located

in the southeast quadrant of the City of Sacramento approximately one mile from the city line. The area in the vicinity of the crossing is industrialized. The train was proceeding in a direction approximately 15° west to north. The station wagon was proceeding to cross in a direction approximately due east (See Appendex II). Including the shoulders the approach to the crossing is about 65 feet wide with eastbound and westbound lanes separated by a traffic island. The island is formed by double yellow lines painted on the road and is about seven feet wide. The lanes, shoulder and island are surfaced with bituminous material. The crossing is 72 feet wide and is surfaced with bituminous material level with the tops of the rails. The approaches and crossing are in good condition and practically level.

2. The Railroad Right-of-Way. (Appendix II) The accident occurred on part of the San Joaquin division of Southern Pacific Co. extending between Fresno and Polk, California, a distance of approximately 163 miles. In the accident area, this is a single-track line with centralized traffic control where trains are operated by signal indications. The Southern Pacific timetable shows train directions as eastward and westward, but the track actually runs geographically northward and southward. The geographic directions are used in this report.

The side track which serves the lumber yard originates 167 feet north of Fruitridge Road and crosses the road about 15 feet west of the main track Side tracks serving Proctor & Gamble's plant and the Sacramento Army Signal Depot are also in the vicinity, but do not cross Fruitridge Road. Prior to the installation of the approach predictors after the accident, the railroad crossing warning devices were activated whenever any of the switches in the mainline serving these side tracks were opened. The main track is virtually straight and level for at least 1000 feet southward from the crossing.

3. Highway-Railroad Grade Crossing Warning Signals and Signs

Approximately 500 feet west of the grade crossing Fruitridge Road intersects Power Inn Road, another public highway in the city. Traffic movements at this intersection are controlled by a conventional traffic light hung overhead at approximately the center of the intersection Proceeding eastward on Fruitridge Road from this intersection the first traffic sign encountered is a rectangular speed limit sign in a position 400 feet to the west of the crossing This sign bears the inscription "SPEED LIMIT 35 MPH" painted in white on a black background. The next sign encountered is a circular advanced railroad crossing warning sign for eastbound traffic located adjacent to the south side of Fruitridge Road in a position 318 feet west of the main track at the crossing The sign bears two intersecting diagonal stripes, and the letters "RR" painted in black on a yellow background. At this sign and at a point eastward, white stripes are painted across the eastbound lanes. Between these stripes the letters "RR" are painted in white on each eastbound lane

The next traffic sign encountered while still proceeding eastward on Fruitridge Road toward the crossing is a rectangular speed limit sign located in a position 218 feet west of the main track. This speed limit sign is painted identically to the one previously described, and bears the inscription "SPEED LIMIT 45 MPH."

The mast of an automatic railroad crossing warning signal of the flashing red-light type with bell, is adjacent to the south side of Fruitridge Road, 13 and 33 feet west of the spur track and the main track, respectively. At this location, two white stripes are painted across the surface of the eastbound lanes. The mast of the automatic railroad crossing warning signal is 27 feet high. Two pairs of red lamps are attached

to the mast, back-to-back, 8 feet 3 inches above the surface of the road. A crossbuck, bearing the words "RAILROAD CROSSING," in black letters on a white background, is attached to the mast a few feet above the two pairs of red lamps, and a bell is attached to the mast a few feet above the crossbuck. A cantilever is fixed to the top portion of the mast. It extends northward 12 feet, to a point over the south side of the eastbound curb lane of Fruitridge Road. Two pairs of red lamps are attached, back-to-back, to the free end of the cantilever, 18 feet 10 inches above the surface of the road. A similar automatic railroad crossing warning signal, for westbound highway traffic, is adjacent to the westbound lanes of Fruitridge Road in the northeast angle of the crossing.

The circuits are so arranged that when a northbound train on the main track reaches a point 2530 feet from the crossing, the red lamps of the automatic railroad crossing warning signals start to flash and the bells of the signals begin ringing. A northbound train traveling 70 miles per hour activates the warning devices about 24 seconds before its locomotive occupies the crossing (29 seconds at 60 miles per hour; 43 seconds at 40 miles per hour). In addition, the warning devices are activated when any of the mainline switches within the limits of the crossing protection track circuits are opened even though no cars may be present.

A whistle board sign for northbound trains is adjacent to the main track, 1370 feet south of the crossing. This sign requires the engineer to make the standard crossing whistle signal.

4. Obstruction to Vision at the Grade Crossing. As eastbound traffic approaches the crossing on Fruitridge Road, view of northbound trains approaching from the south is restricted until a vehicle reaches a point 33

feet from the main track. A vehicle must also advance to this point before the engineman or brakeman in the cab of a northbound locomotive can see it. After an eastbound auto on Fruitridge Road crosses Power Inn Road, trains to the north of the crossing can be seen without obstruction. Westbound highway traffic has a sufficient view of a train from either direction unless there are freight cars standing on the sidetracks in the Proctor and Gamble plant adjacent to the crossing on the east side of the mainline.

5. Weather Conditions. At the time of the accident, the skies were clear, the sun was directly overhead, and all the relevent road surfaces were dry and clear.

C. Condition of Highway-Railroad Grade Crossing Warning Signals, Train and Station Wagon

1. Crossing Warning Signals and Signs. The flashing red light warning signals at the crossing are inspected once a week by employees of the railroad company. The most recent inspection prior to the accident was made on February 20, 1967, at which time the warning signals and bells were found to be in proper working condition. Shortly after the accident, the crossing warning signals were inspected and it was found that the warning lights were in proper focus and intensity for distances ranging from 300 feet westward of the intersection to 50 feet from the railroad tracks. Similarly, the railroad circuit which activates these lights was tested and it was found to be operating properly. The audible signals could be clearly heard by persons standing near the crossing.

2. The Freight Train. Shortly before the train left the Fresno yard at 9:02 a.m. on the day of the accident, its airbrakes and its operating components were tested and inspected and found to be in proper

operating order Shortly after the accident, the train and its airbrakes were again inspected and tested and found to be in proper condition. The only discrepancy noted in any of the working components was that the speedometer read 70 miles per hour when the actual train speed was 60 miles per hour Similarly, when the speedometer read 60 miles per hour, the actual speed was 50 miles per hour. This discrepancy was discovered by the engineer who used his standard railroad watch and mileposts adjacent to the track to ascertain the true train speed A test made at the railroad company's machine shops of the speedometer, several days after the accident, revealed that the speedometer registered 60 miles per hour at a time when the train had an actual speed of 54 miles per hour. The discrepancy between the registered and actual speed is of no consequence in this accident because, as subsequently shown, the question is whether the train was actually traveling within the speed limit at either 60 or 54 miles per hour.

3. The Station Wagon. Indications are that the 1961 station wagon involved in this accident was in acceptable mechanical condition, so far as could be determined. Its brakes had been checked and relined approximately two months before the accident and the car had recently been inspected by a mechanic who found it to be in good condition. The brake system and brakeshoes were inspected shortly after the crash and found to be in proper condition At the time the vehicle approached the grade crossing, all but two front vent windows and possibly the rear window were closed and the radio was turned on.

D. The Operating Experience of the Engineer, Brakeman, and Motor Vehicle Driver

1 Engineer and Brakeman The engineer, Calvin C. Cearley, is 56 years of age and has been employed 33 years by the Southern Pacific Rail-

road Company. He has operated trains over the Fruitridge Road grade crossing since 1951. The brakeman, Edwin E. Mitchell, had acted as a brakeman on trains operating in the territory for 16 years and is thoroughly familiar with the Fruitridge Road grade crossing.

2. Driver of the Station Wagon. The deceased driver of the station wagon had been driving for many years prior to the accident. All witnesses familiar with his driving habits asserted he was a careful driver. Since he went to Mather Air Force Base regularly, it is reasonable to assume that he had used Fruitridge Road crossing frequently; Mrs. Lillis Thomas, his mother-in-law, lives on 38th Street; George Hall, a close friend with whom he played cards the night before he was killed, lives on El Cerrito Way, Margaret Stevenson, a friend whom he gave a ride home on the morning of the accident lives on Roosevelt Street. All of these locations are on the normal route from Mr. Hill's residence on Hardy Drive to Mather Air Force Base by way of Fruitridge Road. Mr. George Hall testified that Fruitridge Road would be a normal route for Mr. Hill to use from his home to the air base.

E. Health of the Engineer, Brakeman, and Driver.

1. The Brakeman and Engineer. Both the engineer, who is 56 years of age, and the brakeman, whose age is not stated in the record, were in excellent health at the time of the accident. They had served a 6-1/2 hour tour of duty on the day preceding the accident, and each had had 8 hours of sleep before returning to duty at 8:35 a.m. on February 22, 1967.

2. The Driver. As previously stated, Mr. Hill was 42 years of age and a retired Air Force Sergeant. Mr. Hill retired from the Air Force after 22 years of service.

Air Force medical records disclosed that as late as 1965 he received a thorough examination and checkup, and appeared to be in good health. During the course of this examination, he had electrocardiograms taken, and of his heart, it is stated that "thrust size rhythm sound is indicated as normal" and the "EKG is also indicated as normal." A 1958 examination discloses that Mr. Hill was in good health except for a large perforation of his left eardrum. However, friends testified that Mr. Hill was not noticeably deaf.

A pathologist, who performed a post-mortem examination of certain organs of the deceased removed at autopsy, testified that Mr. Hill had an 85% blockage of the coronary artery and that this diseased condition could have contributed to the accident, in that Mr. Hill could have experienced a sudden chest pain and blackout immediately prior to the collision.

The record also discloses that Mr. Hill played cards at a friend's home a considerable distance from his residence, from 4 p m on the evening of February 21, 1967, until 4 a.m. the following morning. Mr Hill visited a sick neighbor at 10 a.m the following morning. Thus it would appear that, at best, the deceased driver had only had four hours sleep before he left for Mather Air Force Base.

F. Enforcement at the Grade Crossing

At the time of the accident and prior to the installation in June, 1967, of approach predictors for the Fruitridge Road crossing, the opening of any mainline switches within the circuit activated the warning devices. The industries served by the railroad in this vicinity receive cars switched from the mainline regularly six days a week.

In switching to either the lumber yard or the Army Signal Depot, from 4 to 6 movements over the crossing are required. While the crossing is not occupied constantly for more than 5 consecutive minutes, the flashing lights and bell may operate much longer during the switching operation. The local freight averages about 40 minutes a day switching in the vicinity of the crossing and it is possible for the flashing lights and bells to be operating during the entire time. There is considerable evidence that motorists using this and other mainline crossings frequently cross the tracks while the warning devices are working and trains are moving on the mainline in the vicinity of the crossing. While many of these crossings without stopping constitute violations of applicable traffic laws, police officers rarely issue citations to motorists. The California Motor Vehicle Code requires a driver to stop if the warning devices are operating, but he "need not remain standing if he can proceed in safety" (Appendix I) Testimony indicates that if the motorist gets across without being struck, police officers consider this safe as far as complying with that portion of the code.

G. Incidence of Accidents at the Grade Crossing

The average daily traffic volume at the Fruitridge Road crossing consists of 29 trains and 11,000 highway vehicles. Since January 1, 1926, there have been nine accidents at the grade crossing (excluding the instant one) in which three persons were killed and five persons were injured. The California Public Utility Commission in October, 1966, recommended that automatic gates be added to the existing warning devices at this crossing. Based on a study of 113 crossings in northern California at

which automatic gates were installed (reported by the California Public Service Commission in 1965), it was apparent that the number of accidents when compared with those under previous protection was reduced by more than 75 percent. A study made by William J. Hedley, Assistant Chief Engineer, Wabash Railroad Company, involving 389 crossings for a 23-year period on the Wabash Railroad indicates that the change from flashing lights to crossing gates reduced fatal accidents by about 70 percent.

H. Train Speeds, Crossing Blockage and Warning-Time Experience at the Grade Crossing

Most of the trains which cross the Fruitridge Road grade crossing are freight trains, however, there are two scheduled passenger trains daily, one in each direction. The maximum authorized speed of freight trains is 65 miles per hour, and 70 miles per hour for passenger trains. Most of the trains move over the crossing at speeds between 35-60 miles per hour; however, the passenger trains may be running at their maximum authorized speed of 70 miles per hour. This variety of speeds for through trains generates warning times on the crossing warning devices which vary from about 25 seconds for 70 miles per hour to 49 seconds for 35 miles per hour. A 100-car freight train traveling 35 miles per hour would obstruct the crossing for 98 seconds; therefore, if the warning time is included, this could mean a delay to a motorist of 147 seconds or approximately two and one-half minutes.

Included in the freight-train count is a northbound local freight which switches the local side tracks between 7 p.m. and 10 p.m. every day except Saturday. While switching these side tracks, cars are left on the main track, and a minimum of four movements across the crossing is required to switch the lumber company or the Army Signal Depot. Each

time the crossing is blocked, it is for a minimum of two minutes, and often for as much as five minutes at a time. The average time required for switching each day is 40 minutes. During the time that the local freight is switching in the vicinity of the crossing, it is not customary to turn off the signal and have train-crew members manually direct highway traffic on Fruitridge Road.

Regularly once a week signalmen check the operation of the warning devices. During this time the lights are flashing and the bells sounding without the arrival of a train. Motorists are left to their own devices to interpret the meaning of the signals while these tests are being made

"Lack of respect for flashing light signals by the motoring public" is cited as one reason for upgrading crossing protection in the annual report of the California Public Utilities Commission dated one month prior to this accident.

I. Applicable Law, Rules and Regulations

Under the existing rules, the railroad sets its speed limits and has established maximum authorized speeds in this area of 70 miles per hour for passenger trains and 65 miles per hour for freight trains. Railroad rules require that while approaching highway grade crossings the locomotive's regular and oscillating headlights must be functioning and its bell ringing. The engineer must sound the prescribed signal on the locomotive horn beginning at the whistle board, located 1370 feet from the crossing, and continuing until the train reaches the crossing.

Federal regulations specify the maximum time train and engine crews can work in a 24-hour period and the amount of rest required before resuming duty.

Under the pertinent provisions of the California Motor Vehicle Code, Section 22451, the operator of a vehicle on a highway approaching a railroad grade crossing, when a clearly visible electronic or mechanical signal device gives warning of an approaching train, must stop but need not remain standing if he can proceed in safety.

J Background Circumstances of the Crossing Protection

Automatic flashing light warning signals were installed at this crossing in 1949, and the number of lights was increased in 1963 when the road was widened. In October 1966, four months prior to the accident, the California Public Utilities Commission recommended to the City of Sacramento and the Southern Pacific Company that automatic crossing gates be installed at the crossing. On November 15, 1966, the City of Sacramento agreed to participate in funding the installation of the gates. At the time of the accident, this matter was still under study by the Southern Pacific Company. However, about three weeks after the accident, the Southern Pacific Company agreed to participate with the City of Sacramento in the installation of the crossing gates on a 50-50 cost sharing basis. The gates were installed in June 1967, after the accident, together with a predictor which minimizes false warnings. A predictor measures the speed and position of a train and operates gates at a fixed time before a train appears. Predictors are installed on many grade crossings on the Southern Pacific, but were not installed on this one prior to the accident. Prevention of traffic delay, rather than safety, is the reason for use of the predictors as cited by the California Public Utilities Commission.

Funding for crossing gate installation originates in appropriations by the California State Legislature. State funds are used to

assist cities or counties in paying a legislatively determined 50 percent share of grade crossing improvement costs. The other 50 percent is paid by the railroad. A feature of the sharing method is a sequential decision process by State, local authority, and railroad involving surveys, studies and decisions as to each grade crossing by each group. Hearings are held by the California Public Utilities Commission to consider construction of grade crossing overpasses or underpasses, and a priority list is prepared after the hearings. There is no evidence of a State-wide priority list for automatic crossing gates.

Selection of grade crossings for automatic gate installation is made individually, based on a number of factors, and surveys are made periodically in a number of cities and counties. After a recommendation is made by the California Public Utilities Commission, five years may elapse before the funding assistance implied by the recommendation expires. A time of one year before installation is regarded as normal by the California Public Utilities Commission.

The California State Legislature has appropriated approximately $4,000,000 to its grade crossing protection fund since 1953 and allocations of $2,671,363 of State funds had been made through June 30, 1966. Due to the sharing method, the total value of installations was almost $13,000,000. During 1965, protection was improved at 180 crossings in California.

Federal funds usable by California are also in the background of this accident, since crossing gates are a known superior form of protection, and large amounts of Federal Funds for such crossing improvements are not being used. Under applicable Federal laws, States may employ up to 10 percent of their Federal highway assistance funds for grade cross-

ing improvements. This fund source requires no matching or any local funds whatsoever, and, under one restriction, the decision of where the funds will be spent is left to the State. The restriction is that these funds may be employed only at grade crossings on the Federal Highway System. Fruitridge Road was not on the Federal Highway System.

At the end of Fiscal Year 1966, California had available within its 10 percent limitation a total of $129 million authorized for grade crossing improvements. This relatively large authorization had accumulated over a period of several years as the availability in 1964 and 1965 for grade crossings went unused for that purpose. From this large authorization, California had obligated approximately $1.2 million during 1966, which will be entirely repaid from the Federal source. Among all the States, an average of only 25 percent of the available 10 percent funds for grade crossing improvements is being committed at the present time

States are not required to expend any of these funds for grade crossing improvements and funds not used for grade crossings can be employed for highway construction When used for highway construction, the same funds pay 90 percent or 50 percent of the cost to the States in different circumstances.

II. ANALYSIS

The train was in acceptable mechanical condition. There is no evidence that there was any defect in the station wagon that contributed to the accident. Weather conditions were excellent and all road surfaces dry. The crew members, in the control compartment of the locomotive, were in good health and were thoroughly experienced in their duties, and familiar with all the physical aspects of the grade crossing located at Fruitridge Road.

The record discloses that the crossing warning lights and bells were in operation and that the lights could be seen. Other cars had already stopped when Mr. Hill's station wagon proceeded past them. Mr. Hill must have seen these cars because he steered past them. There is a possibility that Mr. Hill did not hear the crossing bell because of the radio playing in the car or because of closed car windows. This is discounted as a determining causative factor because of the visual advisories provided by the flashing lights and stopped cars.

The horn and bell of the locomotive were also operating. The Board is unable to determine whether Mr. Hill heard them, or whether he may have heard them and did not interpret the sound properly. There is a possibility that Mr. Hill did not hear the horn due to partially closed windows and the known distractions of the radio.

In any event, the effectiveness of a train's horn as a warning preceivable within an automobile is highly uncertain. The loudness of sound signals required of horns and other audible signals is generally stated in terms of what must be heard in open air, and even then is not

stated as an objective measurement. There are no regulations concerning external sounds required to be audible within an automobile such as locomotive horns and automobile horns and no controls respecting window positions, use of radio or other interior distractions. Most States license drivers who are completely deaf. Thus, in existing practice, a train horn or bell, even when all regulations are met, is not a reliable warning system. Horns and bells are no more than assisting devices which could have an effect on part of the vehicle traffic at any given grade crossing or any given weather condition.

The physical health of the driver was a possible factor two ways, (a) a perforated eardrum, and (b) severe cardiovascular disease found at autopsy, but not indicated in any other way. There was no specific evidence of a heart attack. There is a theoretical possibility that the driver suffered a heart attack at some moment just prior to crossing the track, but lacking objective evidence, the probability is small.

The speed of the train at the intersection (60 miles per hour) was within the speed limits authorized by the company. The record reflects that all the expert witnesses were of the opinion at that time that excessive speed was not the cause of the accident. The record discloses that the brakeman was momentarily distracted from a continuing watch of the intersection just before impact. This in no way contributed to the accident because, at that moment, there was no possibility that further application of the airbrakes could have reduced the speed of the train prior to impact. The engineer was on watch.

There is no question that the fence around the lumber yard prevents eastbound motorists from seeing northbound trains until the auto is within about 30 feet of the mainline. Had the driver stopped at the white stripe opposite the flashing lights as required by law, he could have seen the approaching train in spite of the lumber yard. The train was visible from that point. If the driver had stopped as required by law, it is unlikely that the collision would have occurred.

The significant problem of cause in this case is the question of why the driver did not stop. The available evidence does not completely rule out the possibility of malfunctions within the vehicle and, for this reason alone, it is not possible to determine beyond doubt why the driver did not stop.

The Board wishes to review and emphasize the possibility that the driver thought there was little risk in proceeding and little meaning in the flashing lights.

Mr. Hill was familiar with this crossing. It was on one of two possible routes from the center of Sacramento to Mather Air Force Base. Mr. Hill's mother-in-law and several of his close friends lived in an area adjacent to Fruitridge Road, one of the two normal routes between the Hill residence and Mather Air Force Base. Mr. Hill had probably visited this area on his way to or from the Base. He had done this on the day of the accident. Mr. Hill had been stationed at the Base prior to his retirement and had privileges to buy stores at the Base Commissary. It then appears probable that Mr. Hill had more than a casual familiarity with the Fruitridge Road crossing and the operation of the warning devices, and had observed the train conditions at various times.

There is also evidence that the operational meaning of the signals to drivers in the community was blurred, although the legal meaning was that the driver must stop. The warning devices at Fruitridge Road crossing frequently operated when no train passed over the crossing within a reasonable time During the regular switching operation, which was carried on six days a week, the flashing lights and bells were working for long periods of time without a train passing over the crossing. At times, an engine could partially enter the crossing at low speed, possibly using its horn, but stop and reverse and not proceed across the highway entirely. Motorists regularly crossed the tracks while the engine was moving in the vicinity of the crossing during these low speed switching movements. This switching movement involved both the lumber yard and the Sacramento Army Depot. Railroad yards and standing cars were visible on both sides of Fruitridge Road to the east of the crossing, contributing to an impression of an area of slow movement.

Through trains passed the crossing 29 times a day. Their possible speeds, reported by the railroad, ranged from 35 to 70 miles per hour, with signal warning times varying between 25 and 49 seconds. Nearly all of these trains were freights, tending toward slower speeds, and there was only one passenger train in each direction. The delay to a driver required to stop at the crossing could range up to five minutes, and would be even longer if freight train speeds were below 35 miles per hour. Drivers passing this crossing would receive widely variable impressions of its hazards, dependent upon the events occurring at that time. The exact pattern of Mr. Hill's experience is unknown. He may or may not have been aware that some high speed trains used the crossing He may or may not have been aware that stopping when the lights were flashing was not vigorously enforced.

The hypothesis suggested by these circumstances is that Mr. Hill, approaching the crossing from a distance, noticed the lights begin to flash and reacted according to some built-up knowledge of the degree of risk and expectation of probable delay if he stopped. In proceeding without stopping, he actually reached the crossing 10 to 20 seconds before one of the frequent slower freight trains would have arrived. However, this particular train was a "hot-shot" moving at 60 miles per hour, and the collision ensued. The hypothesis does not extend to the role of the train's horn, since it is not determinable whether he heard it. The hypothesis does not require that any reduction of the driver's skill or judgment be assumed because of his lack of sleep, which is unassessable. The hypothetical explanation does not require any assumption about the driver's mental attitude other than that implied by his decision to proceed through the warning signal (as he and others had probably done before), rather than to obey a discredited requirement of the State law. This hypothesis could apply to any normal driver.

This accident has revealed a variety of factors that can develop at grade crossings legally protected by flashing lights which do not actually afford protection to people who use the crossing. In some respects the signals were definitely false warnings, or unclear, or misleading. The hypothesis above, though undeterminable as cause, is reported and discussed here within the framework of the Board's function of reporting the significant circumstances related to the accident.

The deduction that this accident could have been in part caused by certain characteristics of signals and train operations is a sufficiently definite finding to warrant scientific attention to the problems revealed.

The Board considers it unlikely that such grade crossing problems as discussed here could ever be proven to have a definite causative role in a post-accident investigation under existing limitations of investigatory technique. Evidence of human factors causation is difficult to obtain, even from surviving witnesses. The problems can, however, be studied and evaluated by research methods, and the findings may indicate a path for preventing similar highway grade crossing accidents.

The circumstances of the decision to install protection at this crossing indicate that there are delays occasioned by complex administrative procedures. The delays in this case were not unusual or unexpected, given the multisided decision process which existed. Such a broad, sequential, and slow process may be a necessity where funds are collected from several sources and each source has rights to safeguard. The Board believes that the necessity of surveying and evaluating individual crossings on a technical basis is an additional source of delay. Where crossings are surveyed by counties or cities, local judgments may apply and the varying finances of localities will be a factor. There is no assurance that funds will be employed most economically from the standpoint of obtaining the greatest reduction in fatalities.

If Federal funds had been legally available for the crossing in this case and had been applied to grade crossing by State decisions, there is a possibility that the additional crossing gate protection would have been accelerated to a time before the date of the accident. Unused Federal funds for California limited to crossings on the Federal Highway System were several times larger in 1964 and 1965 than the total cost of State-financed grade crossing improvements since 1953.

Availability of these added funds might have resulted in the correction of this particular crossing, since it was already recommended and therefore, committed from the lesser State funds.

The Board notes that the fullest availability of Federal funds for grade crossing improvements on non-Federally financed highways would provide for a significantly increased grade crossing-improvement program. Since grade crossing-improvement funds are centrally administered in each State, the States might, if they had Federal funds available for non-Federal highways, be encouraged to create a more efficient decision process and, therefore, get going more quickly with the job of improving grade crossing safety.

The Board also notes that where Federal funds are made available either for building highways or improving grade crossing safety, the grade crossing improvements are running a poor second to highway construction. States must select between highway improvements in general and grade crossing improvements for safety, and it seems clear from past experience that the funds available for grade crossing safety are being devoted predominantly to highway construction.

CONCLUSIONS

The Board concludes that:

1. The 1961 Ford station wagon driven by Mr. Herbert Hill moved onto the main track immediately in front of the approaching train This action violated Section 22451, Subsection A, of the California Motor Vehicle Code requiring a motorist to stop before crossing a railway grade crossing when a signal device gives warning of an approaching train.

2. The Southern Pacific freight train was being operated in conformity with all applicable rules and regulations.

3. The automatic highway-railroad grade crossing warning signals were functioning properly and were indicating the approach of the train.

4. The use of a train horn and bell and/or bells at the crossing to warn motorists is not systematically effective because driver practice does not assure that a driver can hear the warnings. On the surface, existing regulations appear to create an audible warning system, but that system is spotty and defective.

5. The automatic highway-railroad grade crossing warning signals met all applicable standards but failed to prevent the fatal accident.

6. Wide variation in warning times, false warnings and unclear and misleading warnings caused by switching operations existed from time to time at this crossing. Taken with the general industrial and railroad yard atmosphere, the result was a potential "booby-trap" for motorists.

7. Motorists frequently proceeded, without stopping, across the grade crossing against properly operating warning devices.

8. There are many grade crossings where the railroad operating

conditions cause a wide variation in signal warning times, false warnings, and unclear and misleading warnings. This results in motorists becoming excessively familiar with low-risk conditions that may change quickly, creating a "booby-trap" situation. Familiarity breeds contempt for such warning devices and may encourage the motorists to make unsafe decisions to cross in the path of oncoming trains.

9. Based on the circumstances of the accident and the past record where crossing gates supplement flashing lights, there is a possibility that this accident would not have occurred if the grade crossing had also been protected by crossing gates and a predictor.

10. Substantial work to upgrade crossing protection is being performed in California, using State and local funds. Though it would have been desirable to place automatic gates at this crossing earlier, the large amounts of Federal funds available could not have been used under existing laws because the grade crossing involved was not on the Federal Highway System.

PROBABLE CAUSE

The probable cause of this accident was failure of the driver of the 1961 Ford station wagon to stop his vehicle short of the railroad-highway grade crossing and to remain clear of the tracks until the approaching train had passed as required by California State Law The reasons for the failure to stop cannot be positively determined.

RECOMMENDATIONS

1. The Board recommends that the Department of Transportation include in its current and future study and action programs and expedite review of the significant problem of "booby-trap" crossings which may cause grade crossing accidents.

2. The same recommendation is made to the Association of American Railroads, the Railway Labor Executives Association, the American Trucking Association, Inc., the National Safety Council and all other associations and public-interest groups. Even awareness and publicizing of the critical "booby-trap" phenomenon would pay dividends by reducing such accidents.

3. The Board recommends that agencies for law enforcement at grade crossings consider adequate enforcement at grade crossings to be as important as enforcement at signals governing highway intersections; and that special enforcement attention be paid to potential "booby-trap" crossings.

4. The Board recommends that the Federal Highway Administration study the problem of questionable audibility of external sound signals within motor vehicles, both in relation to grade crossing signals and train horns, and to all other audible warnings which can assist a driver. Such a study should be executed in cooperation with the Federal Railroad Administration, and should be aimed toward creating a unified system of warnings and reliable reception which could be made effective through Federal regulations and State laws.

5. The Board recommends that the Department of Transportation proceed apace to prepare broadly acceptable grade crossing hazard ratings or other objective criteria of grade crossing protection needs so as to formalize comparisons of the grade crossing values on a broader basis than local judgments and local surveys. The existence of such broadly recognized criteria would speed the consideration of optimum use of funds on a statewide or nationwide basis.

6. The Board recommends that the Congress and the Department of Transportation consider the minimal use of Federal funds for grade crossing safety protection by the States. Investigation should determine the degree to which these funds are not being employed because they are limited to Federal Highway System; and also the degree to which these funds are not being employed because States prefer to use the funds for general highway expansion or improvements. Since these funds are intended to reduce grade crossing fatalities as a safety benefit to all motorists, it would therefore be appropriate to consider whether legislation should extend the use of these funds beyond the Federal Highway System.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

Joseph J. O'Connell Jr., Chairman — Date

Oscar M. Laurel, Member — 12/27/67 — 9:40 A.M. — Date

John H. Reed, Member — 12/26/67 — 5:05 P.M. — Date

Louis M. Thayer, Member — 12/27/67 — 3 pm — Date

Francis H. McAdams, Member — 12/26/67 — 3:35 p.m — Date

APPENDIX I

Southern Pacific Company Operating Rules

14. ENGINE WHISTLE SIGNALS

Note: The signals prescribed are illustrated by "o" for short sounds, "___" for longer sounds.***

***

	SOUND	INDICATION
***		
(1)	___ ___ o ___	Approaching public crossings at grade, *** to be commenced sufficiently in advance to afford ample warning, but not less than one-fourth mile before reaching a crossing, and prolonged or repeated until engine has passed over the crossing

***

17. The headlight must be displayed to the front of every train day and night ***

30. The engine bell must be rung *** while approaching public crossings at grade ***

31. The whistle must be sounded at all places where required by rule or law, ***

California Motor Vehicle Code

Section 22451

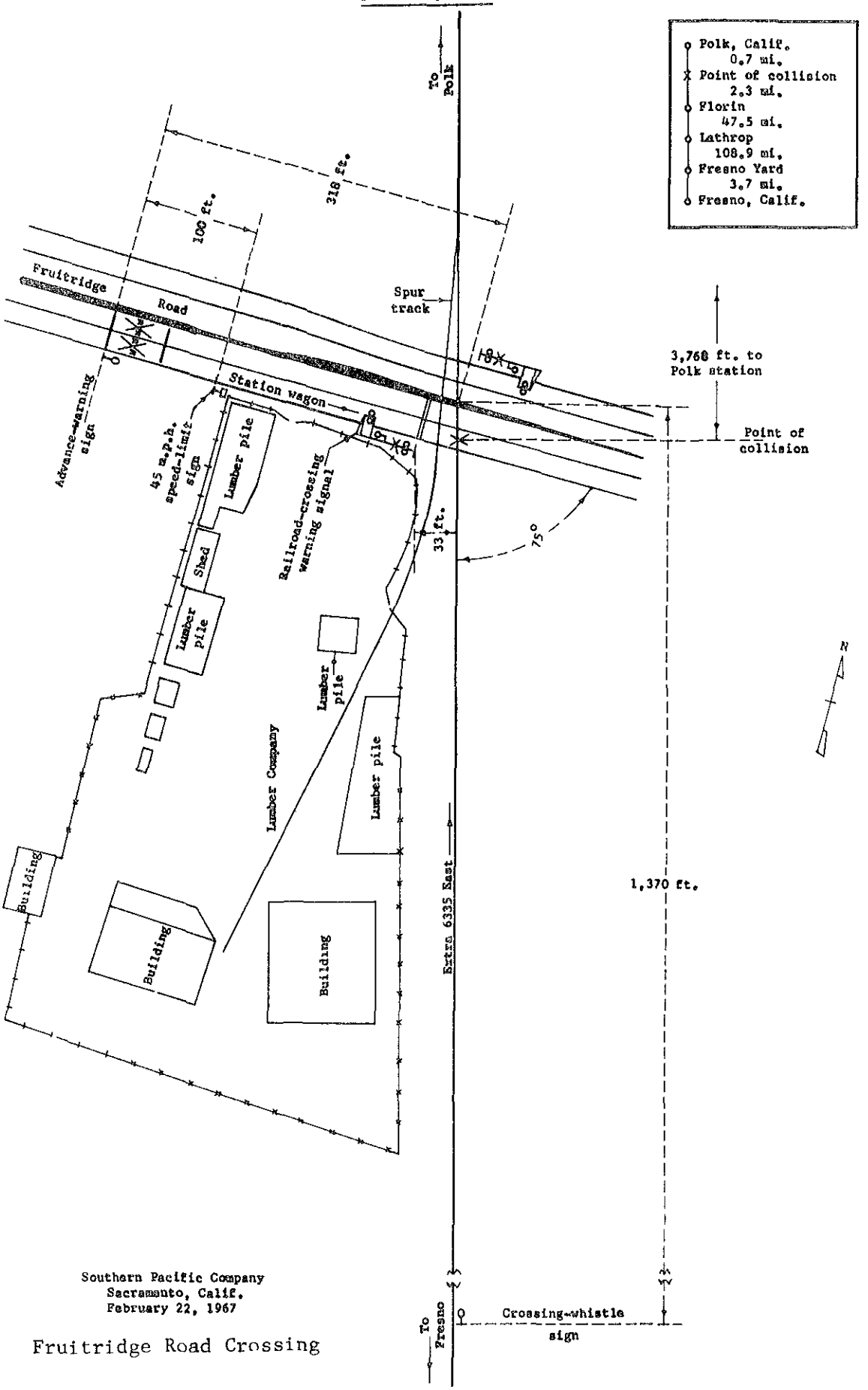
"(a) Whenever any person driving a vehicle upon a highway approaches a railway grade crossing and a clearly visible electric or mechanical signal device gives warning of the approach of a railway train or car, the driver of the vehicle shall stop within 50 feet but not less than 10 feet from the nearest track of the railway but need not remain standing if he can proceed in safety."

***

Other Factors

The maximum authorized speed for the train involved in the accident area was 65 miles per hour, as prescribed by the railroad carrier's timetable

APPENDIX II



Southern Pacific Company
Sacramento, Calif.
February 22, 1967

Fruitridge Road Crossing