

PB82-916203

Highway Accident Report - Pacific Intermountain  
Express Tractor Cargo Tank Semitrailer Eagle/  
F. B. Truck Lines, Inc., Tractor Lowboy  
Semitrailer Collision and Fire, U.S. Route 50  
Near Canon City, Colorado, November 14, 1981

(U.S.) National Transportation Safety Board  
Washington, DC

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16. Abstract <p>About 8:10 a.m., m.s.t., on November 14, 1981, a westbound tractor cargo tank semitrailer loaded with approximately 9,000 gallons of gasoline sideswiped an eastbound tractor-lowboy semitrailer while attempting to negotiate a right-hand curve on a three-lane highway near Canon City, Colorado. When the cargo tank of the westbound vehicle was punctured during impact, fire erupted and rapidly engulfed the two accident vehicles and a passenger car not involved in the impact. In addition to extensive property damage, eight vehicle occupants were killed and two seriously injured as a result of the postcrash fire.</p> <p>The National Transportation Safety Board determines that the probable cause of this accident was the failure of the Pacific Intermountain Express truckdriver to maintain his vehicle within the proper traffic lane during an evasive maneuver in a right curve at a speed in excess of the vehicle's critical overturn stability. Contributing to the driver's loss of control was the driver's cumulative fatigue. Contributing to the accident severity and loss of life were the puncture of the cargo tank and the ignition of the released gasoline cargo immediately following impact.</p>					
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**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**HIGHWAY ACCIDENT REPORT**

**Adopted: June 22, 1982**

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**PACIFIC INTERMOUNTAIN EXPRESS  
TRACTOR CARGO TANK SEMITRAILER  
EAGLE/F.B. TRUCK LINES, INC.,  
TRACTOR LOWBOY SEMITRAILER  
COLLISION AND FIRE,  
U.S. ROUTE 50, NEAR CANON CITY, COLORADO  
NOVEMBER 14, 1981**

**SYNOPSIS**

About 8:10 a.m., m.s.t., on November 14, 1981, a westbound tractor cargo tank semitrailer loaded with approximately 9,000 gallons of gasoline sideswiped an eastbound tractor-lowboy semitrailer while attempting to negotiate a right-hand curve on a three-lane highway near Canon City, Colorado. When the cargo tank of the westbound vehicle was punctured during impact, fire erupted and rapidly engulfed the two accident vehicles and a passenger car not involved in the impact. In addition to extensive property damage, eight vehicle occupants were killed and two seriously injured as a result of the postcrash fire.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the Pacific Intermountain Express truckdriver to maintain his vehicle within the proper traffic lane during an evasive maneuver in a right curve at a speed in excess of the vehicle's critical overturn stability. Contributing to the driver's loss of control was the driver's cumulative fatigue. Contributing to the accident severity and loss of life were the puncture of the cargo tank and the ignition of the released gasoline cargo immediately following impact.

**INVESTIGATION**

**The Accident**

About 8:00 p.m., m.s.t., 1/ on November 13, 1981, an empty Pacific Intermountain Express (PIE) tractor cargo tank semitrailer 2/ departed Gunnison, Colorado, en route to DuPont, Colorado, a distance of approximately 210 miles. The driver of the PIE combination vehicle was accompanied by his wife, who was an unauthorized passenger. The vehicle arrived at the Amoco Oil Company DuPont terminal very early on the morning of November 14, and the cargo tank was loaded with approximately 9,000 gallons of gasoline. At 3:25 a.m., the PIE combination vehicle departed DuPont for the return trip to Gunnison. The PIE combination vehicle had traveled approximately 120 miles south on I-25 to State Route 115 and then turned west onto U.S. Route 50 -- the route from Canon City to Gunnison. (See appendix B.)

1/ All times herein are mountain standard time.

2/ Hereafter referred to as PIE combination vehicle.

The PIE combination vehicle made an interim stop at a restaurant in Canon City about 6:40 a.m. About 7:30 a.m., the vehicle departed the restaurant and continued west on U.S. Route 50. After the PIE combination vehicle traveled about 24 miles, it entered a three-lane section of undivided highway along the Arkansas River with two westbound lanes and one eastbound lane.

A passenger car which had been following and continued to follow a few car lengths behind the PIE combination vehicle moved into the right lane adjacent to the Arkansas River. The PIE combination vehicle remained in the center lane. Both vehicles then entered a 603-foot-radius right curve.

About the same time, an Eagle tractor lowboy semitrailer, <sup>3/</sup> hauling an extra wide load (D9H Caterpillar tractor), was approaching the curve in the eastbound lane from the opposite direction. The driver of the Eagle combination vehicle stated that he was traveling between 30 and 35 mph with his caution lights flashing when he observed the PIE combination vehicle. As the PIE combination vehicle attempted to negotiate the curve, it crossed the highway centerline and entered into the eastbound traffic lane. The driver of the Eagle combination vehicle stated that because the oncoming PIE combination vehicle appeared to be in the wrong lane of travel, he moved his vehicle as far onto the shoulder as possible. However, as the semitrailer of the PIE combination vehicle began to swing over, it initially contacted the driver's side of the tractor cab and then struck the ripper blade of the D9H Caterpillar. (See figure 1.) The ripper blade punctured the cargo tank on the PIE semitrailer and as a result gasoline escaped from the tank. Ignition occurred, and a fire erupted immediately, engulfing both combination vehicles and the passenger car that was traveling slightly behind the PIE combination vehicle in the right westbound lane. All six occupants in the passenger car and both occupants of the PIE combination vehicle died as a result of the fire. The PIE driver died 10 days later from the severe thermal injuries. Both occupants of the Eagle combination vehicle sustained severe thermal injuries.

The driver of the Eagle combination vehicle stated that the fire seemed to spread everywhere after the second impact and that after his vehicle came to rest (see figure 2), he jumped out of his tractor to escape the fire. He stated that he noticed a car in the fire, but he could not determine whether there were any occupants in it. One westbound motorist saw the driver of the PIE combination vehicle climbing over the guardrail and run to the river to extinguish his burning clothes. Another westbound motorist saw the driver and co-driver of the Eagle combination vehicle fleeing the tractor cab. The male driver also ran to the river to extinguish his burning clothes.

Four occupants of a westbound car were traveling about one-quarter mile behind the PIE combination vehicle when the accident occurred. They stated that the PIE combination vehicle and the passenger car involved in the accident had passed them traveling at high speed about a half-mile before the accident occurred. The witnesses also observed the Eagle combination vehicle with flashing lights approaching from the opposite direction. They stated that it appeared this vehicle was attempting to pull off the roadway to avoid impact with the PIE combination vehicle. The witnesses further stated that the passenger car trailing the PIE combination vehicle drove into a wall of flames before coming to rest. They did not observe brake lights on either of the two westbound vehicles involved in the accident.

The counter clerk at the restaurant in Canon City where the PIE driver and his wife had stopped at 6:40 a.m. told Safety Board investigators that the PIE driver was very

3/ Hereafter referred to as the Eagle combination vehicle.

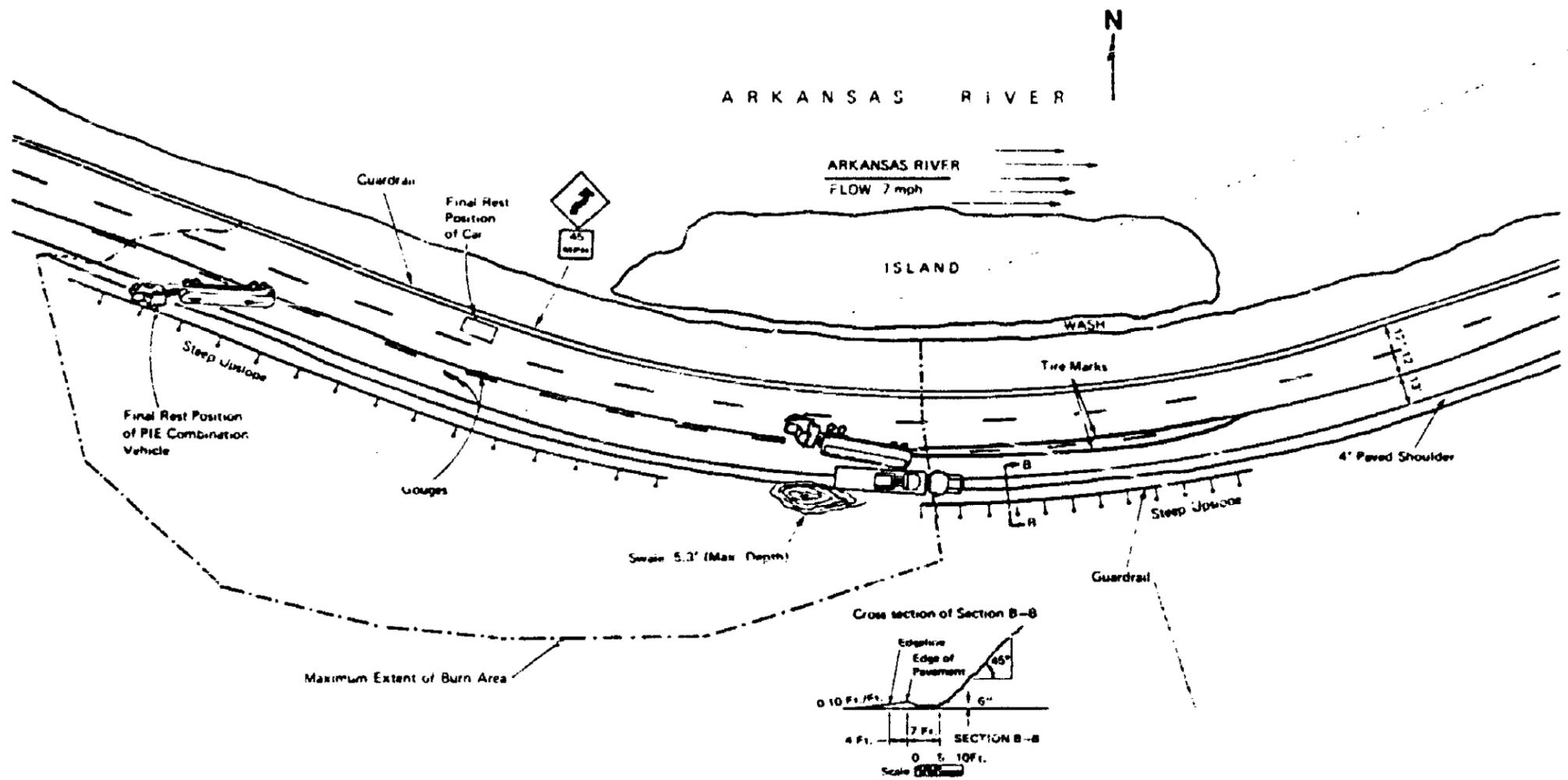


Figure 1.--Plan view of accident site on U.S. Route 50.



Figure 2.-- Westward view of accident site showing the rest position of the Eagle combination vehicle.

pleasant but he appeared to be tired. The clerk stated that his eyes were droopy, as though he had been up very late the night before.

Injuries to Persons

<u>Injuries</u>	<u>Drivers</u>	<u>Passengers</u>	<u>Total</u>
Fatal	2	6	8
Serious	2	0	2
Minor/None	0	0	0
Total	4	6	10

Vehicle Information and Damage

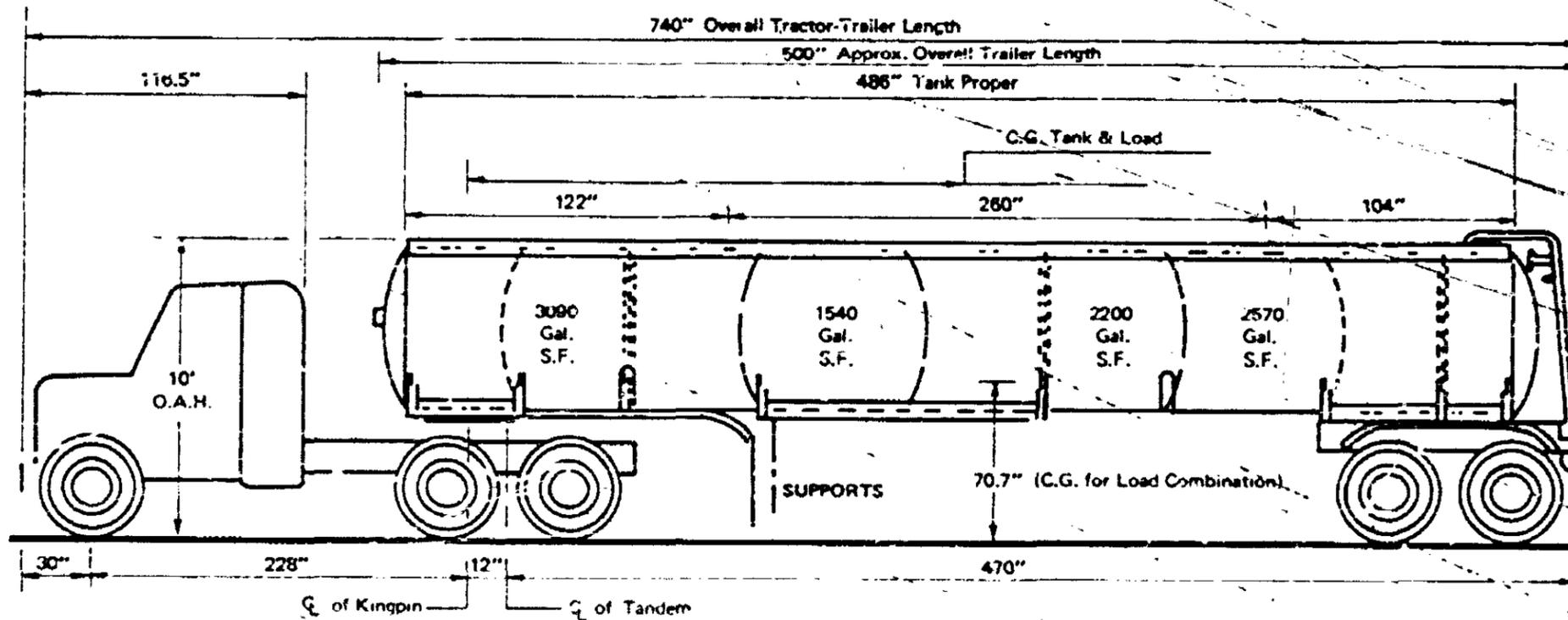
PIE Combination Vehicle.--The PIE combination vehicle consisted of a 1981 Kenworth conventional tractor and a Timpte Beall 42-foot cargo tank semitrailer. The tractor-semi-trailer combination, owned by Universal Leasing Company, was leased to Kimball S. Call of Gunnison, Colorado. Mr. Call was operating under the intrastate carrier authority of Pacific Intermountain Express in the State of Colorado. The three-axle tractor was equipped with a sleeper berth, a Cummins diesel engine (model NTC 400-BC II) governed at 2,100 rpm, a 13-speed Fuller road ranger transmission, 11x24.5 Michelin radial tires, and conventional mechanical air brakes on all axles. A type-1 (lapbelt only) occupant restraint was installed in the driver's seat.

The two-axle semitrailer, VIN D77707101, had a four-compartment aluminum cargo tank designed to Department of Transportation MC-306 specifications. The cargo tank had a 9,400-gallon capacity. The semitrailer was equipped with 11x24.5 Fruehauf bias ply tires and mechanical air brakes on all axles. The estimated gross weight of the tractor cargo tank-semitrailer at the time of the accident was 82,929 pounds. (See figure 3.)

The PIE combination vehicle was essentially destroyed. The tractor cab, all interior components, the right side saddle tank, and the aluminum shell of the cargo tank were consumed in the fire. The only remains of the semitrailer was the rear dual tandem axle assembly. The kingpin and upper coupler plate were still attached to the tractor's fifth wheel. The right side aluminum frame rail of the tractor was bent into an "L" configuration (about a 75° angle). The left side frame rail was consumed by fire. The tractor's engine and transmission were not damaged internally. The shift cover plate was removed, and it was determined that the transmission was in ninth gear. However, Safety Board investigators could not verify whether the position of the transmission shifter had been altered during rescue or wreckage removal operations. The slack adjustments for the service brakes of the combination vehicle were not measured because of the excessive fire damage to all brake components.

Eagle Combination Vehicle.--The Eagle combination vehicle consisted of a 1979 Freightliner conventional tractor and a lowboy semitrailer. The tractor-semi-trailer was owned by Ray Withers of Pearl, Mississippi, and was operating under the interstate authority of Eagle/F.B. (EFB) Truck Lines, Inc., in Birmingham, Alabama. The three-axle tractor was equipped with a sleeper berth, a 13-speed Fuller road ranger transmission, 11x24.5 Kelly Springfield radial tires, and conventional mechanical air brakes on all axles. A type-1 occupant restraint was installed in the driver's seat.

The four-axle steel frame lowboy semitrailer, VIN 112HGF319BT400004, was equipped with 16 10.00x15H tires, airlift suspension, and conventional mechanical air



ACTUAL WEIGHT	
TRACTOR TARE	17623 Lbs
TRAILER TARE	9760 Lbs
CARGO (8988 X 6.18Lbs/gal)	55546 Lbs
<b>Total</b>	<b>82929 Lbs</b>

Figure 3.—PIE combination vehicle.

brakes on all axles. The estimated gross weight of the tractor-semitrailer at the time of the accident was 144,200 pounds. (See figure 4.)

EFB Truck Lines had obtained a special permit, effective November 13-27, 1981, to transport oversize and overweight equipment through the State of Colorado. To warn traffic of the oversize cargo loads, the combination vehicle was equipped with a special external lighting package, which consisted of two revolving yellow beacons on top of the cab; two 4-inch amber/red flashers mounted on the rearview mirrors; and two 9-inch amber flashers on top of the rearview mirrors.

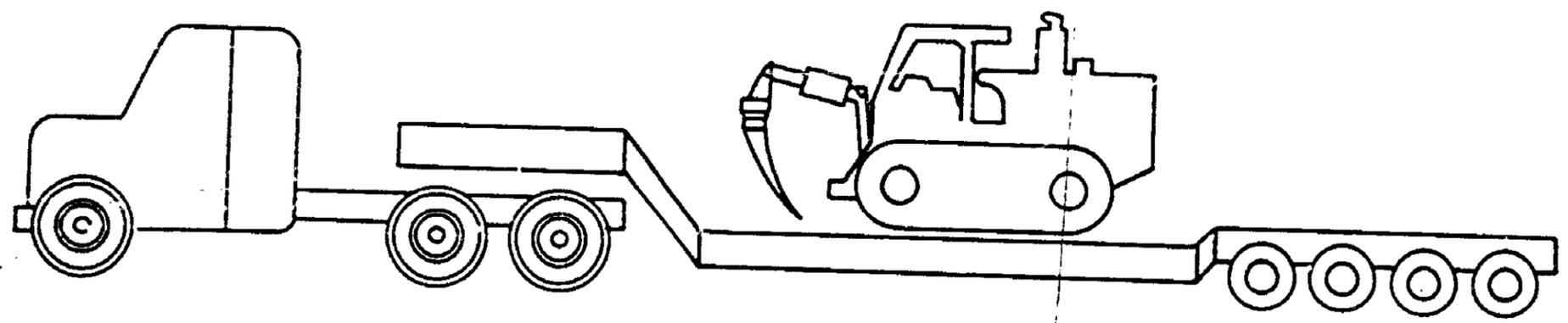
The Eagle combination vehicle was damaged in the postcrash fire. The tractor cab and front end components sustained relatively minor thermal and impact damage. The plastic bug screen, interior upholstery, tractor cab top, and rear fiberglass panels were scorched and charred from excessive heat exposure. Minor indentations were observed on the tractor's left sideview mirror and handrails. (See figure 5.) Components rearward of the sleeper berth sustained extensive heat and fire damage. All rubber and low melting point materials (the tires, suspension bushings, plastic hoses, brake chamber, and diaphragms) were destroyed in the fire. The lowboy semitrailer also was charred extensively, and all 16 tires were consumed in the fire. However, no structural or impact damage was observed on the semitrailer. (See figure 6.)

D9H Caterpillar Tractor.--The D9H Caterpillar tractor was equipped with a multishank ripper blade on the rear, a snovel bucket attachment on the front, and a rollover protection canopy on top of the tractor. The tractor extended approximately 1 foot beyond each side of the lowboy semitrailer. The left side was severely charred during the postcrash fire, and the operator's cockpit gauges, seat cushion, and interior accessories also were damaged from excessive heat exposure. The left rear worklamp was broken and pushed forward during impact, and the left side of the ripper blade support structure had abrasion marks extending from rear to front. (See figure 7.) At the accident scene, the investigating officer of the Colorado State Patrol found a crushed metal object lodged underneath the left side rear, work light housing on the D9H Caterpillar. The metal object was removed and later identified by an official of PIE as a section of the overturn protection roof rail from the top of the aluminum cargo tank semitrailer.

Passenger Car.--The accident passenger car was a 1981 Chevrolet Caprice Classic 4-door sedan equipped with a diesel engine and occupant restraints for all seated positions. All combustible plastic and aluminum materials on the car were destroyed. The engine compartment was gutted completely, with all engine accessories consumed in the fire. The roof, body quarterpanels, hood, and trunk were buckled and distorted from excessive heat damage. The passenger compartment also was totally destroyed, and all of the vehicle's tires were consumed in the fire. There was no apparent impact damage to the vehicle. However, the trunk and hood had been forced open during the rescue operation. (See figure 8.)

#### Driver Information

The 48-year-old driver of the PIE combination vehicle resided in Gunnison, Colorado. As required by the Federal Motor Carrier Safety Regulations (FMCSR), he held a current medical certificate, dated October 12, 1981. His physical examination indicated that he was in good physical condition with no current medical problems. His vision was reported to be 20/20 in both eyes with corrective lenses. A previous injury to the lumbar region of the driver's spine had been corrected by surgery and was not considered an impairment.



ACTUAL WEIGHT	
TRACTOR TARE	15000 Lbs (Approx.)
TRAILER TARE*	24000 Lbs
CARGO	105200 Lbs
<hr/>	
Total	144200 Lbs

\*Approximate Weight

Figure 4.--Eagle combination vehicle.

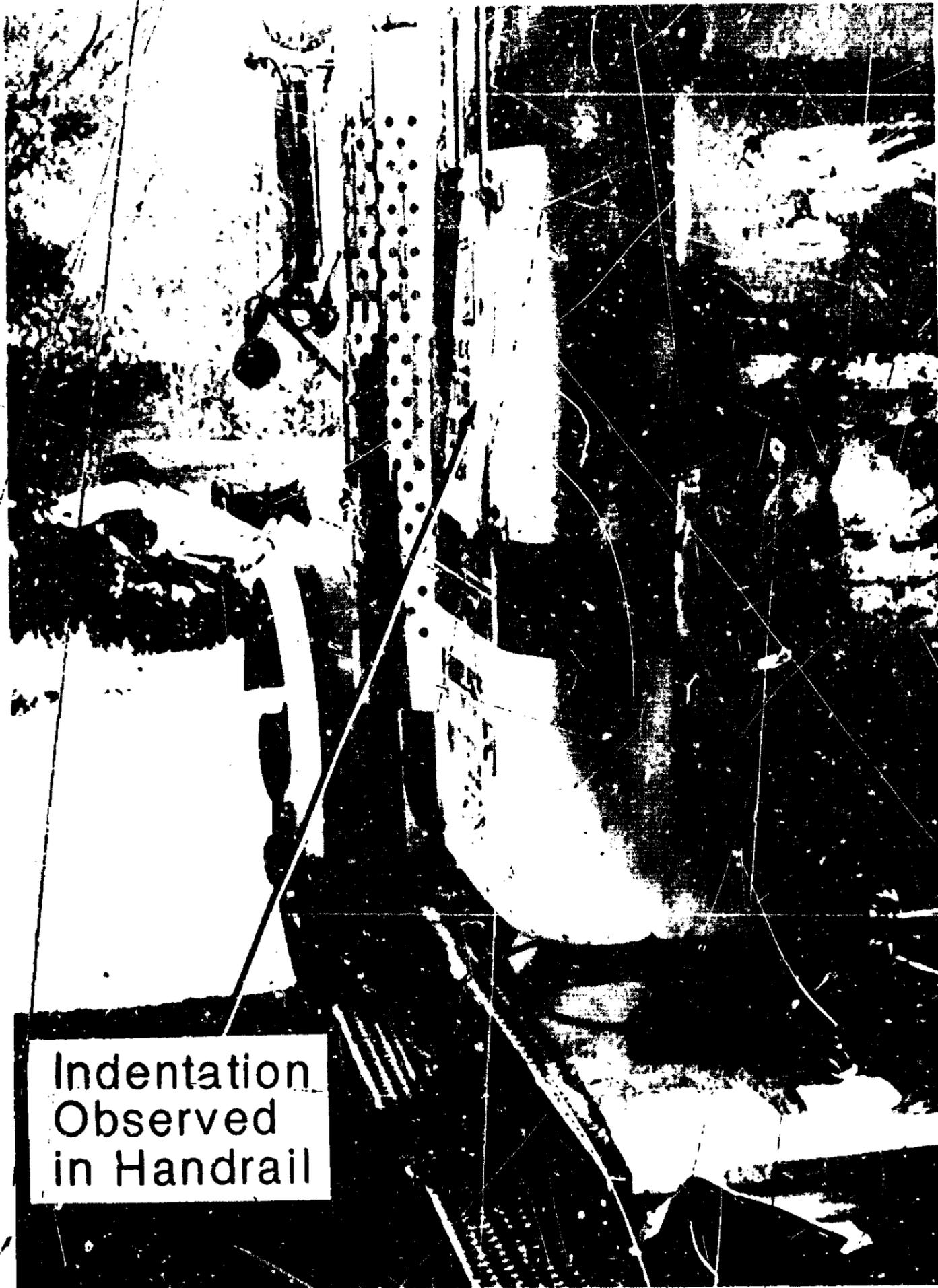


Figure 5.--Impact damage on tractor of Eagle combination vehicle.

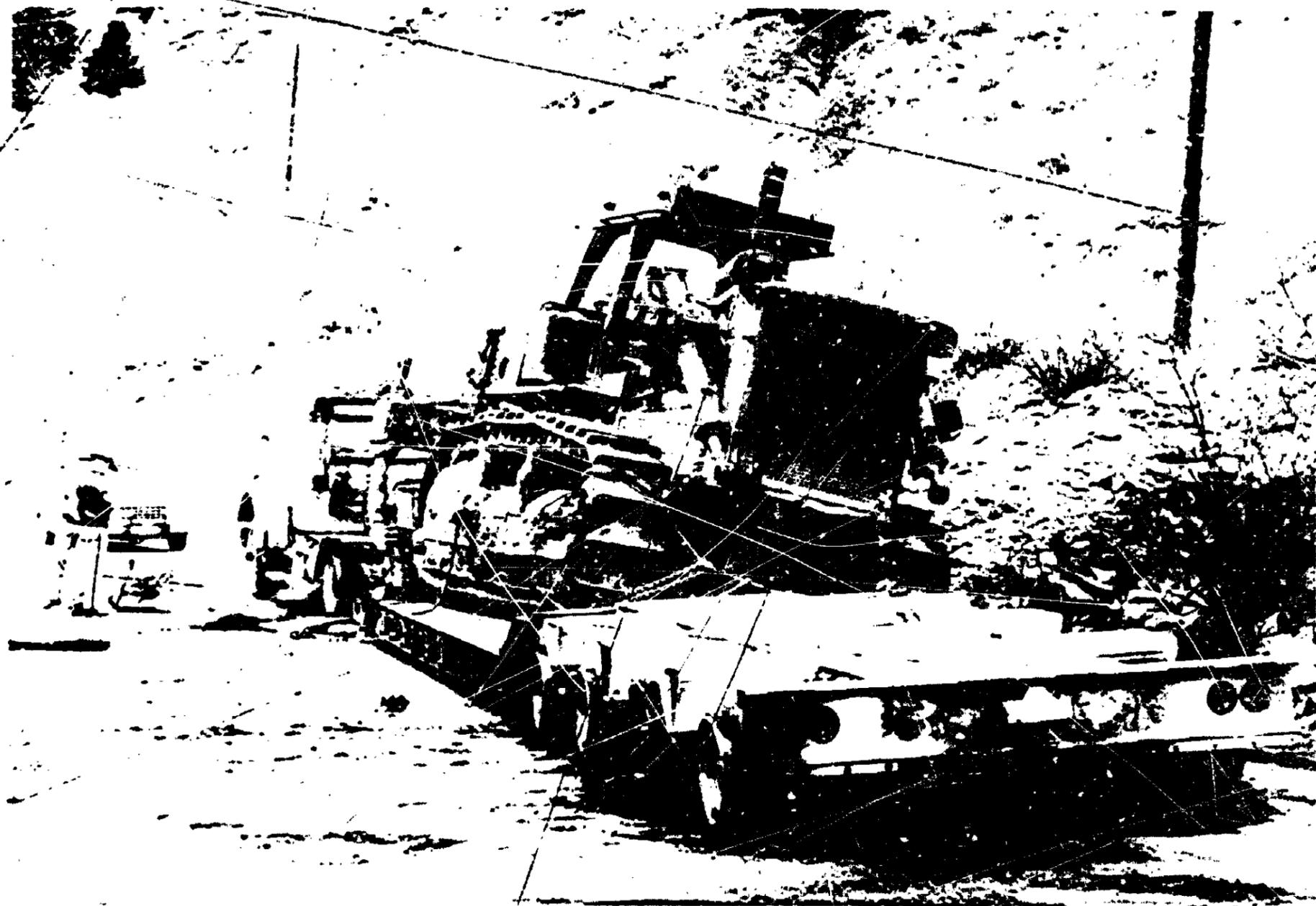


Figure 6.--Condition of Eagle combination vehicle after impact and fire.

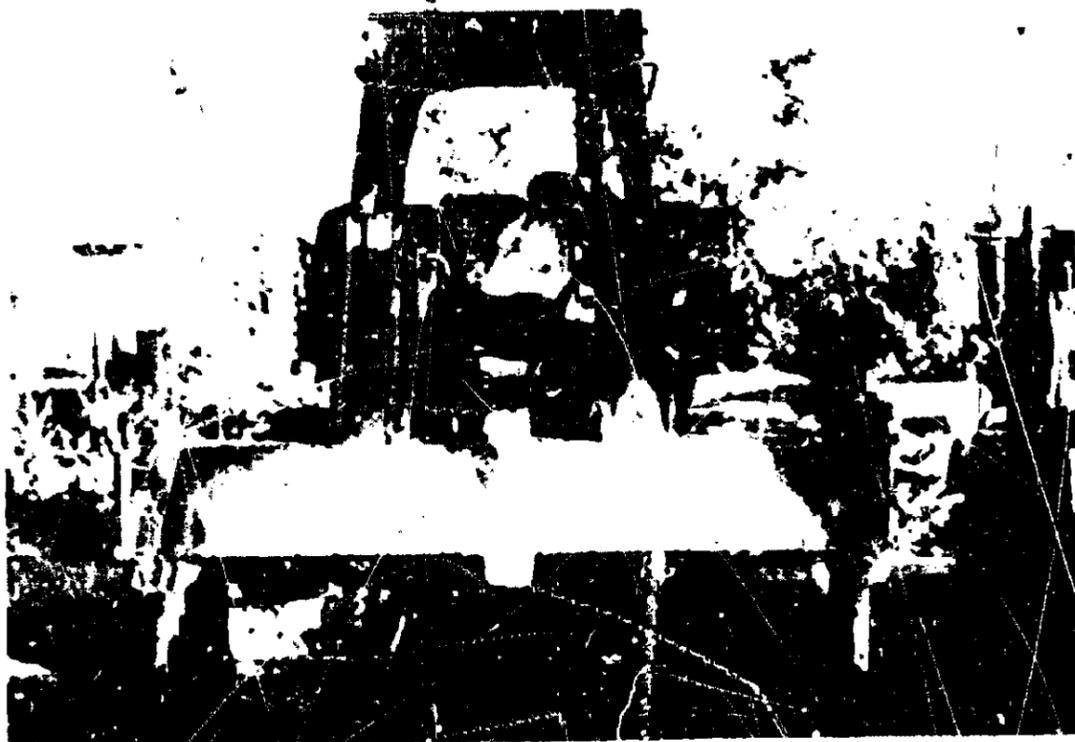


Figure 7.--Rear of D9H caterpillar being transported by the Eagle combination vehicle.



Figure 8.--Postfire condition of the passenger car involved in accident.

The PIE driver had been employed as a part-time truckdriver by Kimbail S. Call 4/ since October 9, 1981. A review of the PIE driver's records indicated that he had made the round trip over the same route on 5 "student" runs and 16 solo runs. By the time he had begun his solo runs, he had received his medical certificate. On the average, he drove two round trips each week from Gunnison to Dupont for which he was paid a fixed fee. He drove approximately 400 miles each trip and made the trips at various times during the week, sometimes on weekends.

Safety Board investigators found that the PIE driver also had been employed full-time with Redlands Construction Co. Inc., since November 2, 1981. At the construction company, he worked as a heavy equipment operator, primarily operating the cable plow and backhoe tractors. His normal working hours were from 8:00 a.m. to 5:00 p.m., Monday through Friday. The job site was located about 20 miles from Gunnison. The job foreman for Redlands told Safety Board investigators that the PIE driver was a good worker and normally punctual, and did not show any signs of fatigue on the job. Redlands Construction was not aware that the PIE driver had a part-time job. The PIE officials were not aware of the driver's full-time job, and the company had no written policy on drivers working additional jobs.

The PIE driver held a valid Oklahoma chauffeur's license and a valid Colorado Class A license. A review of the driver's qualification file revealed that the PIE driver had been employed as a truck driver since 1969 and that he had been involved in one previous accident, in May 1976. His driving record indicated that he had received the following traffic violations: an inspection sticker violation in Oklahoma on April 9, 1978; three speeding violations in Oklahoma on February 29, March 27, and May 3, 1980; and a speeding violation in Colorado on October 16, 1981. The PIE driver received the most recent citation while driving the accident vehicle on U.S. Route 50 near Gunnison. He was clocked traveling at approximately 72 mph in a 55-mph posted speed zone.

The PIE driver reported only the first two of the speeding citations on his PIE employment application, dated October 9. PIE officials were unaware of the last two speeding citations received by the driver until after this accident. The Federal Motor Carrier Safety Regulations (FMCSR), 49 CFR 391, require a motor carrier to conduct appropriate investigations and inquiries on the commercial vehicle operators it employs. The investigation must include inquiries into the employee's driving record for the preceding 3 years. The inquiry to the state agencies on driving records must be made within 30 days from the date of the driver's employment. PIE had hired the accident driver on October 9, 1981, but had not completed the request for the employee's driving record when the accident occurred on November 14, 1981.

The 39-year-old driver of the Eagle combination vehicle resided in Morton, Mississippi. He held a current medical certificate, dated June 1981, and his physical examination revealed no medical problems. His vision was reported to be 20/22 in both eyes with corrective lenses. On March 19, 1981, the driver received an award from Eagle/F.B. Truck Lines for having driven 3 years with the company without an accident. He held a valid Mississippi commercial driver's license.

The Eagle combination vehicle was en route to Truscott, Texas. The driver of the Eagle combination vehicle had stopped at Buena Vista, Colorado, the night before the accident and had departed about 6:30 a.m. on the morning of November 14. He had been on the road about 1.5 hours when the accident occurred.

4/ K.S. Call leased the vehicle from Universal Leasing Company and operated under the intrastate authorization of PIE.

### Highway Information

Colorado State Route 50 (U.S. 50) is a Federal aid primary rural route that extends from the state's eastern border to Grand Junction. The average daily traffic for this roadway is 2,650 vehicles of which 18 percent are estimated to be trucks. Near the accident site, the highway is a three-lane undivided highway with two westbound lanes and one eastbound lane. The three-lane segments along Route 50 are typically 1.5 to 3 miles long, and are generally in areas where climbing lanes are needed. At the accident site, the three-lane segment is 3.1 miles long. Impact occurred about 1.2 miles west into the three-lane segment.

In the accident area, the pavement and shoulders are constructed of a bituminous concrete asphalt, and were last resurfaced in October 1975. The westbound shoulder is 2 feet wide from the edgeline to the guardrail, and the eastbound shoulder is 4 feet wide with a 7-foot earth ditch adjacent to the road edge. Near the point of impact, both westbound lanes are 12 feet wide and the eastbound lane is 13 feet wide.

The accident curve consists of a 603-foot-radius right curve for westbound traffic. The curve is approximately 450 feet long and has a virtually flat grade (0.10 percent) ascending for westbound traffic. (See figure 9.)

The pavement markings on U.S. Route 50 from Canon City to the accident site were painted in May 1981 and were in good postaccident condition, except in the impact area where markings were exposed to fire damage. Solid white edgelines delineate both sides of the road, and the westbound lanes are separated by 10-foot-long dashed lane lines spaced 30 feet apart. The centerline between the east- and westbound lanes is solid yellow for westbound traffic and dashed yellow for eastbound traffic. This combination of yellow centerlines permits eastbound traffic to pass when there is no oncoming traffic in the center lane.

The shoulder width on both sides of the road was limited by topographical constraints (river on north side and steep mountain grade on south side). Because of these constraints, the shoulder widths did not meet the minimum American Association of State Highway and Transportation Officials (AASHTO) specifications. The drainage swale <sup>5/</sup> on the south side of the road was steep (maximum depth of 63 inches) and possibly warranted a guardrail to prevent errant vehicles from dropping into the swale.

Except for the minimum shoulder width, signing, and the drainage swale, U.S. Route 50 near the accident site was in compliance with all applicable AASHTO and Manual on Uniform Traffic Control Devices (MUTCD) regulations.

Original speed limit for this section of U.S. 50 was determined from the construction plans, which indicated that the westbound right curve had a maximum design speed of 60 mph with a stopping sight distance of 475 feet. With a 603-foot-radius curve, a 0.10 ft/ft superelevation, and a side friction value of 0.145, <sup>6/</sup> the advisory speed for

<sup>5/</sup> Drainage swale: A low tract of land into which water is channeled from the surrounding area for drainage purposes.

<sup>6/</sup> The side friction value was extrapolated by the CSDOH from the American Association of State Highway and Transportation Officials' "A Policy on Geometric Design of Rural Highways - 1965". The coefficient of safe side friction varies with speed of the vehicle, type and condition of the roadway surface, and type and condition of the tires. The 0.145 value should accommodate for differences such as wet pavement or vehicles with high centers of gravity.

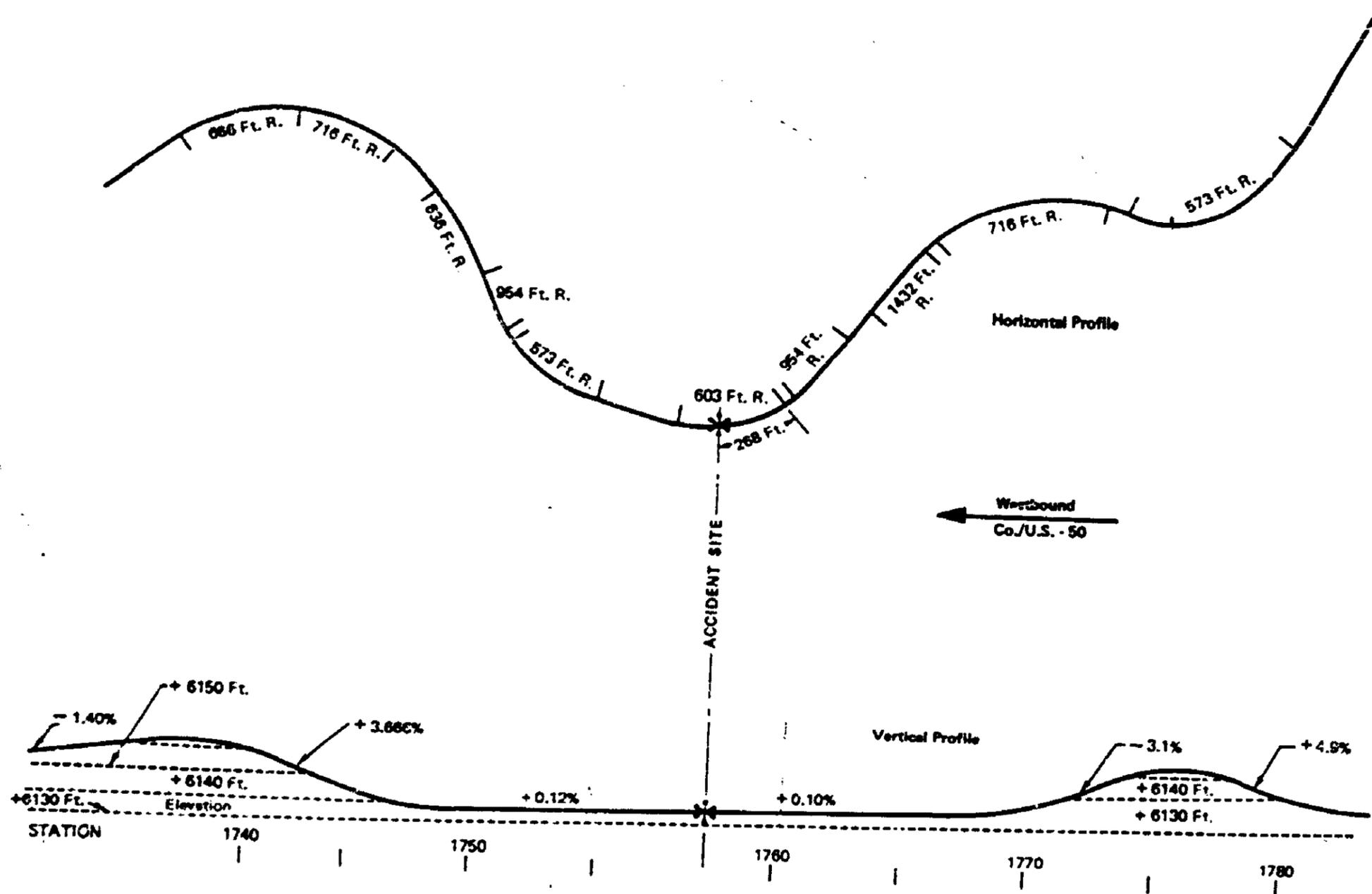


Figure 9.--Horizontal and vertical profile of U.S. Route 50.

this curve was calculated by the Colorado State Department of Highways (CSDOH) to be about 47 mph. The MUTCD states that a curve sign (W1-2R) and perhaps supplemented by an advisory speed plate (W13-1) should be posted when an engineering investigation has shown that the advisory speed on the curve is equal to or less than the speed limit. An advisory speed plate is marked in multiples of 5 mph and the maximum recommended speed posted is determined by using accepted traffic engineering procedures. The speed limit on U.S. Route 50 is 50 mph near the accident site. Speed limit signs are posted about 4 miles east of the accident site and about 2 miles west of the accident site.

In a letter to the Safety Board, dated February 9, 1982, the CSDOH indicated that it was going to reevaluate this section of State Route 50 to determine if changes in the existing signing were necessary. The CSDOH has completed its evaluation and have installed curve warning signs and 45-mph advisory speed plates on the accident curve.

In August 1978, a similar accident occurred about 800 feet west of this accident site. A westbound tractor cargo tank semitrailer loaded with gasoline struck two eastbound vehicles before overturning on its left side. Fire ensued, resulting in three fatalities and one injury.

The CSDOH also provided the Safety Board the following accident profile data on State Route 50 between mileposts 252.50 and 258.75. <sup>7/</sup> (This accident occurred near milepost 254.70.)

<u>Period</u>	<u>Property Damage Accidents</u>	<u>Injury Accident</u>	<u>Fatal Accidents</u>	<u>Total</u>
8-1-78 to 7-31-79	6	1	1	8
8-1-79 to 7-31-80	5	2	1	8
8-1-80 to 7-31-81	2	1	1	4
8-1-81 to 9-30-81	<u>1</u>	<u>2</u>	<u>0</u>	<u>3</u>
Totals (3 years 2 month)	14	6	3	23

<u>By Accident Severity</u>	<u>Accidents</u>	<u>Injuries</u>	<u>Fatalities</u>
Fatal Accidents	3	5	5
Injury Accidents	6	9	0
Property Damage Accidents	14	0	0
Total Accidents	23	14	5

By Accident Type

Ran Off Road	11	9	1
Sideswipe Opposite Direction	3	4	4
Rocks in Roadway	2	0	0
Sideswipe Same Direction	2	0	0
Parked Car	1	0	0
Box fell off trailer	1	0	0
Broadside	1	0	0
Deer hit by vehicle	1	0	0
Right angle accident	1	1	0

<sup>7/</sup> The calculated injury and fatal accident rate for this segment of U.S. 50 was relatively low when compared to the statewide and nation wide rates. See page 23 for further discussion.

### Physical Evidence

Safety Board investigators observed tire marks, scrapes, and gouges in the pavement surface at the accident site. Circular gouges burned into the pavement by the PIE semitrailer wheels indicated the semitrailer's final position after the impact and fire. The Colorado State Patrol (CSP) stated that the passenger car came to rest in the right westbound lane and that the Eagle combination vehicle came to rest on the edgeline of the eastbound lane, about 192 feet east of the position where the passenger car came to rest. The CSP also observed tire marks in the eastbound lane (see figure 10). The marks started 122 feet into the accident curve and then continued about 142 feet in the direction of the accident site. The radius of curvature for the tire marks was determined to be 626 feet. The D9H tractor was found with the left wheel track on the lowboy semitrailer and the right wheel track resting on the eastbound soft shoulder. About 10 feet behind the final position of the D9H tractor, a circular section of the pavement on the edge of the eastbound lane was missing.

### Meteorological Information

On November 14, 1981, the weather was reported to be mostly cloudy with temperatures ranging between 50° and 55° F with no precipitation. The accident occurred during daylight hours at approximately 8:10 a.m. The sight distance from the point of impact for westbound traffic was about 0.25 mile (1,320 feet) and for eastbound traffic about 0.21 mile (1,109 feet). The highway visibility and pavement conditions were good in both directions.

### Medical and Pathological Information

All injuries were thermal injuries incurred during the postimpact fire. The driver and co-driver of the Eagle combination vehicle sustained second and third degree burns over 74 and 50 percent of their bodies, respectively. The driver of the PIE combination vehicle lived for about 10 days before succumbing to his severe thermal injuries. The Denver County coroner's office advised the Safety Board that the driver's hospital medical records revealed no evidence of alcohol involvement in this accident.

The wife of the PIE driver and all the passenger car occupants sustained fatal thermal injuries at the scene. Because of the extent of damage to the bodies, no toxicological evaluations were performed. Body identification and verification was based on witness statements of the occupants' preaccident seating positions in the cars and on remnants of clothing, jewelry, and other personal possessions found with the bodies.

### Survival Aspects

One ambulance responded with the fire units from Canon City; however, all survivors had been removed from the scene by motorists by the time the rescue units arrived.

Motorists attempted to assist the survivors soon after impact. An eastbound motorist helped the injured PIE driver into his car and drove him to a residence about 7 miles from the accident site. The resident called for an ambulance and advised the State Patrol of the accident. The PIE driver was taken by ambulance to a hospital in Salida, Colorado. Emergency treatment was given to the driver by Emergency Medical Technicians (EMT's) in the ambulance. He later was transported by air to the burn unit at St. Anthony's Hospital in Denver.



-17-

Figure 10.--Tire marks in eastbound lane.

A westbound motorist helped the injured victims from the Eagle combination vehicle into her car and took them to the Canon City Fire Department where EMT's administered emergency treatment. The victims were taken by ambulance to a hospital in Canon City and later air evacuated to hospital burn units in Colorado Springs and Denver, Colorado.

There was insufficient evidence to determine whether any of the occupant restraints available in the passenger sedan or tractor-semitrailers were in use at the time of the accident.

#### Hazardous Material Information

The accident occurred in a sparsely populated remote canyon with steep mountainous terrain on all sides. At impact, the cargo tank punctured, spilling gasoline which ignited and burned uncontrolled. The burning fluid flowed to both sides of the road. Witnesses who viewed the burning cargo tank reported that flames extended 20 feet above the punctured tank. Secondary brush fires burned the steep rocky embankment on the south side of the roadway. Burning gasoline ignited approximately 400 feet of wooden guardrail posts lining the north side of the roadway, collected into a 6-foot swale adjacent to the south side shoulder, and drained into a 24-inch culvert extending underneath the roadway before entering the Arkansas River. In addition, a 50-foot section of the roadway was covered with hydraulic fluid released from the D9H Caterpillar during the fire. The entire hazardous material spill was contained within a 400- by 200-foot area.

The dispatch officer of the CSP received initial notification of the accident at 8:14 a.m. from a resident in Cotopaxi. He contacted two CSP units patrolling U.S. Route 50 near the vicinity of the accident and the Canon City Fire Department and dispatched them to the scene.

The first CSP unit arrived on the scene about 8:21 a.m. After assessing the extent of damage and injury, the CSP officer contacted his dispatcher and requested that all cities on the Arkansas River downstream of the accident site be advised to turn off the drinking water drafting operations. The officer also requested that the Civil Defense be contacted to search for victims who may have been swept away from the scene in the fast moving river which had a flow rate of 7 mph.

The firefighters arrived on the scene about 8:40 a.m. and used "light water" to extinguish the fuel fire on the PIE combination vehicle and regular water pumped from the Arkansas River to extinguish the remaining vehicle fires. All hillside fires were brought under control by 11 a.m. The Civil Defense director later patrolled the river to determine if any gasoline contamination had occurred and found no apparent pollution or fish kills.

The Pacific Intermountain Express Company operated under dual unrestricted hazardous material carrier permits in the State of Colorado. The company held a special Colorado intrastate authority under permit No. 730 & 1 for all hazardous material transportation, and also held an unrestricted 48-states interstate authority under ICC Permit No. MC-730, SUB-517F. The accident occurred during the intrastate movement of hazardous material.

#### Tests and Research

On November 19, 1981, skid tests were performed by the CSDOH, using an ASTM skid trailer which was last calibrated to ASTM-E274 standard in March 1981. The tests

were performed at 40 mph on both wet and dry pavement. The left wheel was used to generate longitudinal brake traction coefficient data. The results are tabulated below:

<u>Wet Pavement</u>	<u>Skid Number</u>
Westbound River Lane	63.0
Eastbound Lane	61.4
Westbound Passing Lane	65.1
Westbound River Lane	60.9

<u>Dry Pavement</u>	<u>Skid Number</u>
Westbound Passing Lane	90.9
Westbound River Lane	79.0
Eastbound Lane	73.7

#### ANALYSIS

The Pacific Intermountain Express Company vehicle was being operated under appropriate permits and regulations at the time of the accident. Although the PIE driver had a record of traffic violations, he held a valid chauffeur's license and a valid Class A license. Weather was not considered a factor in this accident.

#### Vehicle Dynamics

There was no evidence of preimpact vehicle mechanical deficiencies which might have contributed to the accident. The PIE combination vehicle and passenger car were traveling westbound in the center lane on U.S. Route 50 about one-half mile before impact. The passenger vehicle which had been trailing the PIE combination vehicle in the center lane moved to the right westbound lane. The PIE combination vehicle remained in the center lane. Both vehicles continued westbound in the same lane orientation until they entered the 603-foot-radius right curve. About the same time, the PIE driver could have observed the Eagle combination vehicle with flashing amber lights approaching in the opposing traffic lane. The lights of the Eagle combination vehicle were on to warn all traffic that it was carrying a wide load. The Safety Board believes that the PIE driver perceived the potential danger and attempted to steer his vehicle into the right westbound lane to avoid impact. At that point, the PIE combination vehicle became unstable because of its high center of gravity (C.G.) and the centrifugal forces acting on the C.G. The PIE combination vehicle began to roll toward its left side and to move laterally into the eastbound lane as indicated by tire scuff marks. The PIE combination vehicle initially contacted the left side rearview mirror and left side handrail on the Eagle tractor and then impacted the ripper blade of the D9H Caterpillar tractor being transported by the Eagle combination vehicle.

Impact probably occurred between the left front corner of the ripper blade and the overturn roof rail across the top of the cargo tank. During postimpact inspection, a large section of the overturn protection roof rail of the cargo tank was found lodged underneath the work light on the D9H tractor. In order for the ripper blade to have contacted the roof rail, the cargo tank semitrailer would have had to have been in a rollover attitude during the impact sequence. The angle of impact between the vertical centerline of the cargo tank and the left rear corner of the D9H tractor was estimated to be 44°. <sup>8/</sup> (See figure 11.)

<sup>8/</sup> Angle of impact based on loaded height of cargo tank semitrailer and ripper blade-to-ground dimension.

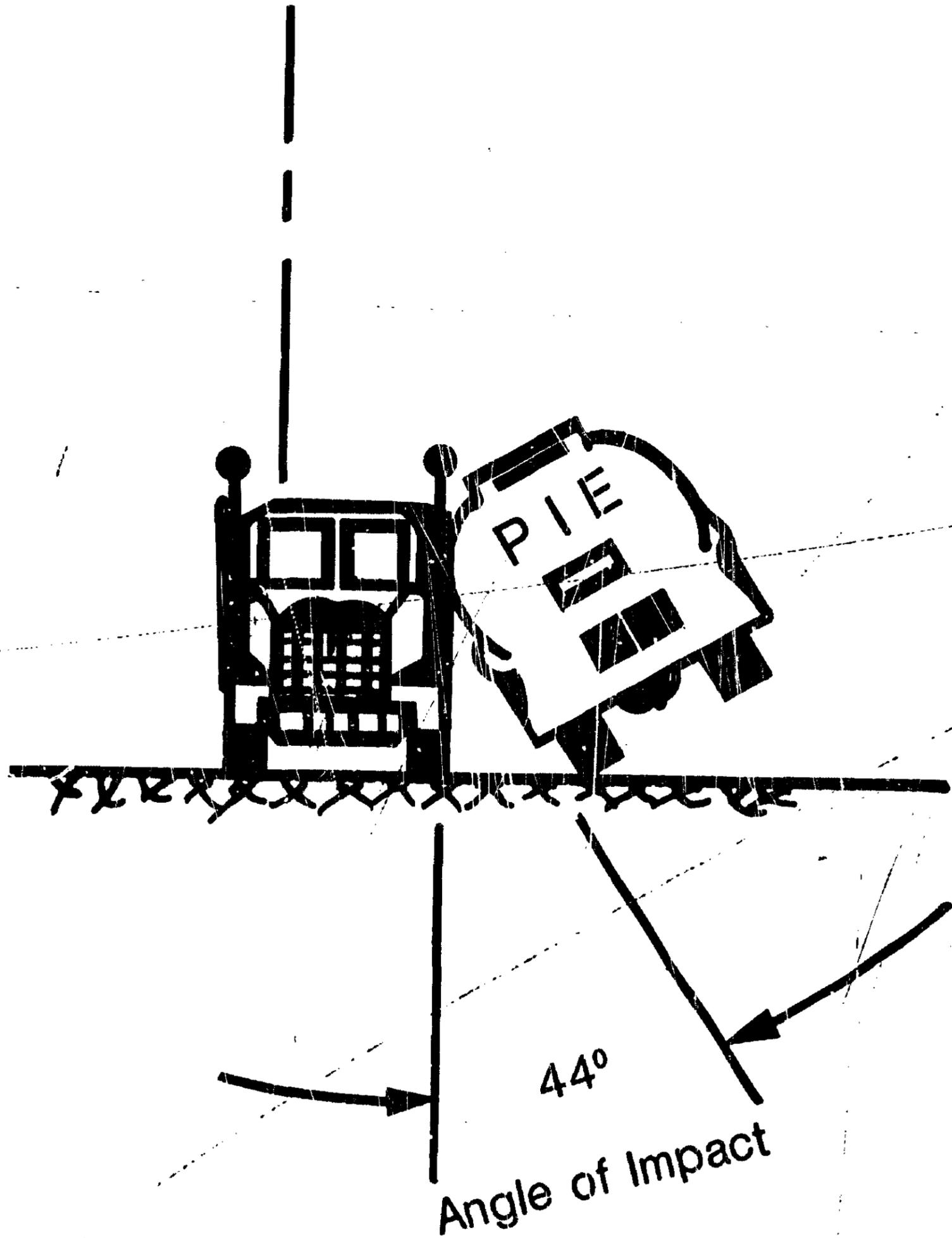


Figure 11.--Vertical angle of impact between the PIE and Eagle combination vehicles.

### Impact Speed

Although the critical speed of upset for a 9,000-gallon conventional MC-306 cargo tank-semitrailer was calculated to be about 64 mph using a curve radius of 622 feet, <sup>9/</sup> a superelevation of 0.10 foot/foot, and a critical side frictional coefficient of 0.34, <sup>10/</sup> the PIE combination vehicle probably would not have been capable of traveling at that speed. The maximum within gear speed for the PIE combination vehicle on the 0.1 percent upgrade where the accident occurred was about 60 mph. <sup>11/</sup> The accident vehicle had negotiated a curve about 0.45 mile east of the accident site that had a tighter radius resulting in a critical speed of upset of 61 mph. After the curve, there was a 500-foot upgrade of 4.9 percent, which should have slowed the accident vehicle. The Safety Board concludes that the PIE combination vehicle was traveling about 60 mph when it entered the accident curve. At that speed, the centrifugal force being exerted on the PIE combination vehicle was approximately 33,000 pounds. However, the lateral force needed to overturn the PIE combination vehicle was about 43,000 pounds at a loaded vehicle C.G. height of about 70.7 inches. The PIE combination vehicle could not have overturned at the estimated speed of 60 mph unless the PIE driver had initiated some action which would have reduced the vehicle's critical speed of upset. The Safety Board believes that the PIE driver, on perceiving the potential danger of the Eagle combination vehicle, attempted to steer his vehicle into the right westbound lane to avoid impact. This maneuver caused the vehicle's turning radius to shorten to something less than the radius for the accident curve, and consequently reduced the vehicle's critical speed of upset for this curve. As a result, the PIE vehicle crossed the highway centerline and began to roll over.

Witnesses who observed the westbound PIE combination vehicle prior to impact did not see any brake lights activate during the impact sequence. The PIE driver apparently did not apply his service brakes either before or after impact.

The PIE combination vehicle traveled approximately 268 feet after entering the accident curve to the point of impact with the Eagle combination vehicle. Assuming that no braking was initiated by the PIE driver and that the only retarding forces acting on the vehicle were air resistance and tire rolling resistance, the Safety Board estimated the speed of impact to be about 56 mph.

The driver of the Eagle combination vehicle stated that he was traveling about 35 mph before impact. His vehicle came to rest about 10 feet after impact primarily because the impact pushed the D9H tractor slightly off the lowboy semitrailer, which dug into the soft shoulder and acted as a large brake on the Eagle combination vehicle.

Visibility in the vicinity of the accident site was not a factor in this accident. The sight distance was at least 0.21 mile (1,100 feet) in both directions near the accident. Assuming the vehicle speeds of the PIE combination vehicle and the Eagle combination

<sup>9/</sup> The curve radius of the left tire was 626 feet. However, the accident vehicle's center of gravity was transversing a 622 foot radius.

<sup>10/</sup> Critical side frictional coefficient was established based on test data from "Safer Gasoline Tankers for Michigan" dated March 1981, published by Highway Safety Research Institute, Vol. II, Number 5. The critical frictional coefficient is the surface coefficient which must exist if the vehicle is to tip (upset) before sliding, and is normally higher than the side frictional coefficient (0.145) for worst case condition as referenced on page 14.

<sup>11/</sup> Speed determination was calculated based on information supplied by Kenworth Truck Company. (See appendix C.)

vehicle were 60 (88 feet/seconds) and 35 mph (51.33 feet/seconds), respectively, both drivers should have had an unobstructed view of each other for at least 12 seconds before impact.

### Highway

The CSDOH reevaluated the section of State Route 50 which included the accident site to determine if changes in signing were necessary. As a result of its evaluation, the CSDOH installed curve warning signs and 45-mph advisory speed plates on the accident curve. Although the existence of these signs might have been desirable at the time of the accident, it is doubtful whether they would have influenced the outcome of this accident. The accident curve was designed to permit vehicles (except those with a high C.G.) to operate at a maximum speed of 60 mph and should have been negotiable on dry pavement at the posted speed of 50 mph. Had both curve signs and both advisory speed plates been in place prior to the accident, they probably would not have caused the PIE driver to slow down. Witness accounts indicate that the driver had passed a similar set of curve signs and advisory speed plates for a much tighter curve about 0.45 mile before reaching the accident site and that he did not reduce speed.

Since vehicle activity before and after impact was confined primarily to the roadway pavement, improvements to widen the shoulders and to install a guardrail in front of the drainage swale probably would not have affected the accident dynamics. Impact occurred in the eastbound lane, and all the accident vehicles came to rest either on the paved surface or straddling the pavement and shoulder. In addition, the topographical limitations in this area -- the river and the steep mountain grade -- probably would not permit such improvements without major reconstruction.

A review of the accident history for U.S. Route 50 revealed that this section is not a high accident location. From August 1978 through August 1981, 23 accidents occurred on a 6.25-mile section of the road of which the accident site is the midpoint. Using the average daily traffic, the combined injury and fatal accident rate for this segment of U.S. Route 50 was calculated to be about 48.28 accidents per 100-million vehicle miles (MVM). This rate is relatively low when compared to the statewide and nationwide <sup>12/</sup> rates that were 65.15 and 79.13 accidents per 100-MVM, respectively, for Federal-aid, other primary, arterial, and rural roads. This accident and two other fatal accidents involved vehicles with high C.G.'s that went out of control and sideswiped oncoming vehicles in the opposing traffic lane. In all three fatal accidents, the vehicle drivers were exceeding the posted speed limit. As a deterrent against speeding, the CSP has increased its enforcement effort along this section of the road since January 1981 and has issued 70 percent more speeding citations on U.S. 50 from Parksdale Bridge to Cotopaxi. At the time of the accident, two CSP units were on this section of U.S. 50 for speed enforcement purposes. Reportedly, one of the two CSP units was issuing a speeding citation to a commercial vehicle when the CSP was notified of the accident.

### Survival Aspects

The PIE combination vehicle slid to rest on its left side about 300 feet from the point of impact. The released gasoline ignited immediately after impact probably because of the sparks generated during the collision with the D9H ripper blade, which was made of high strength heat-treated steel. Released gasoline spread rapidly over a 400-foot section of roadway, with flames extending 20 feet high. (See appendix D.) Fire engulfed

<sup>12/</sup> Fatal and Injury Accident Rates on Federal-Aid and other highway systems/1979, FHWA May 1981.

both combination vehicles by the time they came to rest. Because of the rapid spread of the fire, the driver of the passenger car following the PIE combination vehicle did not have sufficient time to avoid driving into the wall of flames before coming to rest.

The fire resulting from the gasoline release fatally injured eight persons and seriously injured two. The driver and co-driver of the Eagle combination vehicle survived the accident. At the time of impact, the co-driver was asleep in the tractor's sleeper berth. The driver stated that he awoke the co-driver as soon as the vehicle came to rest after impact, and they both jumped from the burning tractor and ran to safety. However, their brief exposure to the intense fire resulted in severe burn injuries.

One occupant of the passenger car involved in the accident managed to get out of the car, but was incapacitated by fire before he could escape to safety. One other occupant was able to get out of the car partially before becoming incapacitated. The remaining occupants perished inside the car. The intense fire prevented witnesses from reaching and rescuing the other victims. The fatally injured would have survived the accident had a fire not erupted after impact. There was no evidence of egress problems or of occupant contact with vehicle structures observed during postimpact inspections. The use or nonuse of occupant restraints did not play a part in this accident because there were no impact related injuries.

The driver of the PIE combination vehicle ran through the fire to the river to extinguish his flaming clothes, but he suffered fatal burns from his brief exposure to the fire. The PIE driver reportedly stated that he had been thrown through the windshield when his vehicle came to rest against a rock outcropping on the south shoulder of the road. However, his reported statement could not be confirmed. Because of extensive burn injuries, no evidence of soft tissue injuries could be found on the driver, nor were there any traces of blood or skin tissue found in the PIE tractor cab wreckage.

The surviving victims were removed from the scene by witnesses and transported to proper medical facilities. The arrangements for the transportation of victims to major burn units in the State were prompt and well coordinated because of the proximity of airports and medivac facilities.

#### Driver Fatigue

The PIE driver was employed by two companies during the period November 2-14, 1981, -- part-time as a driver of commercial vehicles for PIE and full-time as a backhoe and cable plow operator for Redlands Construction Company. Neither company was aware that the accident driver had a second job. He had obtained full-time employment with Redlands Construction Company about 3 weeks after being hired as a truckdriver for PIE.

Table 1 is a summary of the estimated time spent on both jobs from November 9 through November 14, 1981. The table reflects travel time to and from the Redlands construction job site which was located about 20 miles outside of Gunnison. It is not known how far the PIE driver had to travel to pick up the combination vehicle used on his part-time job.

Table 1.--Summary of the estimated time PIE driver spent on both jobs.

<u>Date</u>	<u>Time in Service 13/ PIE (hrs)</u>	<u>Redlands (hrs)</u>	<u>Estimated Travel Time To &amp; From Redlands Job</u>	<u>Estimated Time Last 24 hours</u>
11-9-81	0	9	1	10
11-10-81	7	9	1	17
11-11-81	3*	9	1	13
11-12-81	0*	9	1	10
11-13-81	3	9	1	13
11-14-81	7	0	0	7
	<u>20</u>	<u>45</u>	<u>5</u>	<u>70</u>

Percent of active time =  $70/128 = 55$ ; where 128 = 5 days plus 8 hours.

\*Estimated time based on conversation with PIE supervisor on November 19, 1981.

On the day preceding the accident, the PIE driver had worked at his normal full-time construction job with Redlands. The driver departed Gunnison at 8:30 p.m. that evening on a 5-hour, one-way trip to DuPont, Colorado. He arrived in DuPont about 2 a.m. on November 14, loaded his vehicle with 9,000 gallons of gasoline, and departed DuPont for the return trip to Gunnison about 3:25 a.m. Since it takes about one-half hour to load the cargo tank, there is approximately 1 hour between 2 and 3:30 a.m. where the driver's actions are unaccounted for. The PIE driver would have been able to rest only during two periods within the 24-hour period before the accident -- the 2.5-hour interval between jobs on November 13 and the 1-hour interval in DuPont on the morning of November 14, 1981.

It is estimated that the PIE driver had been active in both jobs about 20 of the last 24 hours. In addition, from November 9, 1981, to the time of the fatal accident, the driver had been active on both jobs for 70 hours out of a total of 128 available hours. This does not take into account any time for performing other daily activities related to his personal and family responsibilities. Thus, it is suspected that the PIE driver rested only minimally during this time period and probably was experiencing fatigue because of insufficient sleep.

The counter clerk at McDonald's indicated that the driver "looked tired." According to the clerk, his eyes were "droopy" as though he had been up very late the night before. The Safety Board believes that because the PIE driver had rested only minimally during the 6-day period preceding the accident he was severely fatigued so as to impair his judgment and motor skills.

The lack of sleep can result in one of two types of fatigue; cumulative or acute fatigue. Cumulative fatigue is the result of incomplete mental and/or physical recuperation between tasks performed over a period of days or weeks. Acute fatigue results from a single prolonged period without sleep. Common symptoms of fatigue include increased reaction time, increased time for visual accommodation, decreased attention span, and increased susceptibility to error. One or more of the above symptoms

13/ Although the data is sketchy, it is suspected that the driver may have worked a similar schedule for the week preceding the time listed in table 1. The table assumes that the PIE driver was driving at all times on his part-time job.

are likely to result in a performance decrement. <sup>14/</sup> In studies conducted by the Federal Aviation Administration and the U.S. Air Force, <sup>15/</sup> it was shown that after at least 24 hours without sleep, test subjects suffered serious decrements in the performance of monitoring and tracking tasks. Both of these tasks are critical to operating commercial vehicles. Another study performed by Human Factors Research, Inc. <sup>16/</sup> indicated that more accidents occurred later in trips, confirming that fatigue affects vigilance performance.

The Safety Board believes that the PIE driver's performance was impaired as a result of cumulative fatigue and aggravated by the total lack of sleep in the 24-hour period just before the accident. Considering the fact that the accident occurred in the last 120 miles of a long haul trip during the early morning hours and that the driver had been active for the last 24 hours leads the Board to conclude that the driver's actions were impaired by fatigue.

#### Driver History and Carrier Policy

A review of the driving history of the PIE driver revealed that he had received four citations for speeding violations from February 1980 through October 1981, the last of which was issued 7 days after the driver was hired by PIE. Three of the four speeding citations were issued when the driver was operating a commercial vehicle. The driver reported two commercial speeding citations on the PIE employment application, dated October 9, 1981. The third commercial speeding citation was issued 7 days after the driver was hired by PIE.

After filing his incomplete application on October 9, 1981, and while his record was being checked, the PIE driver was permitted to drive the bulk hazardous material tractor-cargo tank semitrailer. No Federal regulation disqualified a driver with four speeding convictions from driving a bulk hazardous material commercial vehicle. The Safety Board believes it is essential that carriers be able to promptly verify the information reported on an employee's application in order to identify potentially high-risk drivers and to screen out those applicants considered unacceptable for driving bulk hazardous material vehicles. The Safety Board further believes that motor carriers should establish more rigorous qualifications and standard procedures for selecting new employees, especially bulk hazardous material drivers, and ensure that the established qualifications are met before a driver is allowed to perform driving duties.

Careful monitoring of newly hired drivers is needed to assure that any indication of unsafe driver performance is identified. The company also should develop appropriate written disciplinary policies to correct deficiencies identified in the monitoring program. For example, the PIE driver's manual, given to all new drivers, states that the company speed limit is 55 mph. However, the manual does not specify what number of speeding violations would be considered unacceptable for commercial drivers and does not specify

<sup>14/</sup> Mohler, Stanley R., "Fatigue in Aviation Activities," AM 65-13, Federal Aviation Agency, Office of Aviation Medicine, Civil Aeromedical Research Institute, Oklahoma City, OK., March, 1965

<sup>15/</sup> Collins, William E., "Some Effects of Sleep Deprivation on Tracking Performance in Static and Dynamic Environments," FAA-AM-76-12, Office of Aviation Medicine, Federal Aviation Administration, Washington, D.C.; and, Hauty, G.T., and R.B. Payne, "Fatigue, Confinement, and Proficiency Decrement," Dept. of Experimental Psychology, USAF School of Aviation Medicine, Randolph Air Force Base, Texas.

<sup>16/</sup> Harris, William, "Fatigue, Circadian Rhythm, Truck Accidents," Human Factors Research, Incorporated, Goleta, California.

what disciplinary action would be taken for repeated violations or for delayed reporting of such violations to the company.

In 1980, the Safety Board conducted a study of accidents involving commercial vehicle drivers. <sup>17/</sup> The study reviewed driver disqualification and driver screening requirements of the Federal Motor Carrier Safety Regulations. That study noted that the motor carrier is responsible for determining whether the driver "meets minimum requirements for safe driving," but the minimum requirements are not specified in the regulations. The Safety Board found that the requirement for the motor carrier to "give great weight" to certain violations provides vague and subjective guidance in determining what constitutes "minimum requirements for safe driving." Consequently, the Safety Board recommended that the Federal Highway Administration (FHWA):

Evaluate the need for, and feasibility of, specifying in the Federal Motor Carrier Safety Regulations a threshold level of traffic violations, based upon the total number and relative seriousness of the violations, above which a driver is disqualified to operate a commercial vehicle, and within 1 year publish the findings of the evaluation in the Federal Register for public comment or initiate appropriate rulemaking. (H-80-17)

In its reply to this recommendation, the FHWA stated, on August 21, 1980:

Through the issuance of an Advance Notice of Proposed Rulemaking (ANPRM) the Federal Highway Administration will be seeking information concerning ways to establish disqualification rules aimed at those persons who repeatedly violate existing traffic laws.

The Safety Board has been informed by FHWA officials that the ANPRM project still is active but that it has been placed in a low priority status. Therefore, the Safety Board reiterates and urges expedited action on recommendation H-80-17 issued to the FHWA on February 15, 1980, concerning disqualification rules for drivers of commercial vehicles transporting hazardous materials and other commodities.

## CONCLUSIONS

### Findings

1. The PIE combination vehicle was being operated under appropriate permits and regulations at the time of the accident.
2. The PIE driver held a valid chauffeur's license and a valid Class A license at the time of the accident.
3. There was no evidence of preimpact mechanical deficiencies which might have contributed to the accident.
4. Weather was not considered a factor in this accident.

<sup>17/</sup> Safety Effectiveness Evaluation of Detection and Control of Unsafe Interstate Commercial Drivers Through the National Driver Register, State Driver Licensing Policies and the Federal Motor Carrier Safety Regulations. (NTSB-SEE-80-1, February 15, 1980)

5. The PIE combination vehicle was traveling about 60 mph when the driver perceived the danger of a collision with the Eagle combination vehicle approaching in the eastbound lane and took evasive action. The Eagle combination vehicle was traveling about 35 mph when its driver took evasive steering action to avoid impact.
6. The accident sequence was initiated by impact between the left front corner of the D9H tractor and the overturn roof rail on top of the PIE semitrailer. The vertical angle of impact was estimated to be 44° indicating that the PIE combination vehicle was in an overturn orientation.
7. The lack of curve warning signs and advisory speed plates at the accident curve was not considered a factor in this accident.
8. All fatalities and serious injuries resulted from burns incurred during the postimpact fire. The intense fire trapped victims and prevented witnesses from reaching them.
9. Three of the four speeding citations received by the PIE driver were obtained while operating a commercial vehicle. No Federal regulation disqualified a driver with four speeding violations from driving a hazardous material vehicle.
10. The PIE driver was actively employed in two jobs at the time of the accident. Neither employer was aware that he had a second job.
11. The PIE driver was suffering from cumulative fatigue at the time of the accident.
12. The PIE driver's manual does not adequately define company policy regarding driver disciplinary actions for speeding violations.
13. Pacific Intermountain Express should not allow newly hired employees to perform driving duties until their driving records have been verified.
14. The FHWA rulemaking project to issue an Advanced Notice of Proposed Rulemaking which defines drivers disqualification rules has been placed in a low priority status.

#### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the Pacific Intermountain Express truckdriver to maintain his vehicle within the proper traffic lane during an evasive maneuver in a right curve at a speed in excess of the vehicle's critical overturn stability. Contributing to the driver's loss of control was the driver's cumulative fatigue. Contributing to the accident severity and loss of life were the puncture of the cargo tank and the ignition of the released gasoline cargo immediately following impact.

#### RECOMMENDATIONS

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

--to the Pacific Intermountain Express Company:

Establish qualifications and standard procedures for selecting new hire hazardous material drivers, and insure that the established qualifications and procedures are adhered to before a driver is allowed to perform driving duties. (Class II, Priority Action) (H-82-19)

Incorporate in its Driver's Manual for the Bulk Commodity Division, a requirement for drivers transporting bulk hazardous materials to promptly report the receipt of specified traffic citations, and a statement of company policy as to disciplinary actions which will be taken in the event of speeding or other unsafe driving practices. (Class II, Priority Action) (H-82-20)

to the National Tank Truck Carriers, Inc.

Disseminate to its membership, especially hazardous material carriers, the circumstances of this accident and urge the member companies to establish qualifications and standard procedures for selecting new operators of hazardous material vehicles. (Class II, Priority Action) (H-82-21)

In addition to these recommendations, the Safety Board reiterates and urges expedited action on the previous recommendation made to the Federal Highway Administration on February 15, 1980, concerning disqualification rules for driver of commercial vehicles transporting hazardous materials and other commodities:

Evaluate the need for, and feasibility of, specifying in the Federal Motor Carrier Safety Regulations a threshold level of traffic violations, based upon the total number and relative seriousness of the violations, above which a driver is disqualified to operate a commercial vehicle, and within 1 year publish the findings of the evaluation in the Federal Register for public comment or initiate appropriate rulemaking. (H-80-17)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ G.H. PATRICK BURSLEY  
Member

June 22, 1982

**APPENDIXES**

**APPENDIX A**

**PARTIES TO THE INVESTIGATION**

**Investigation**

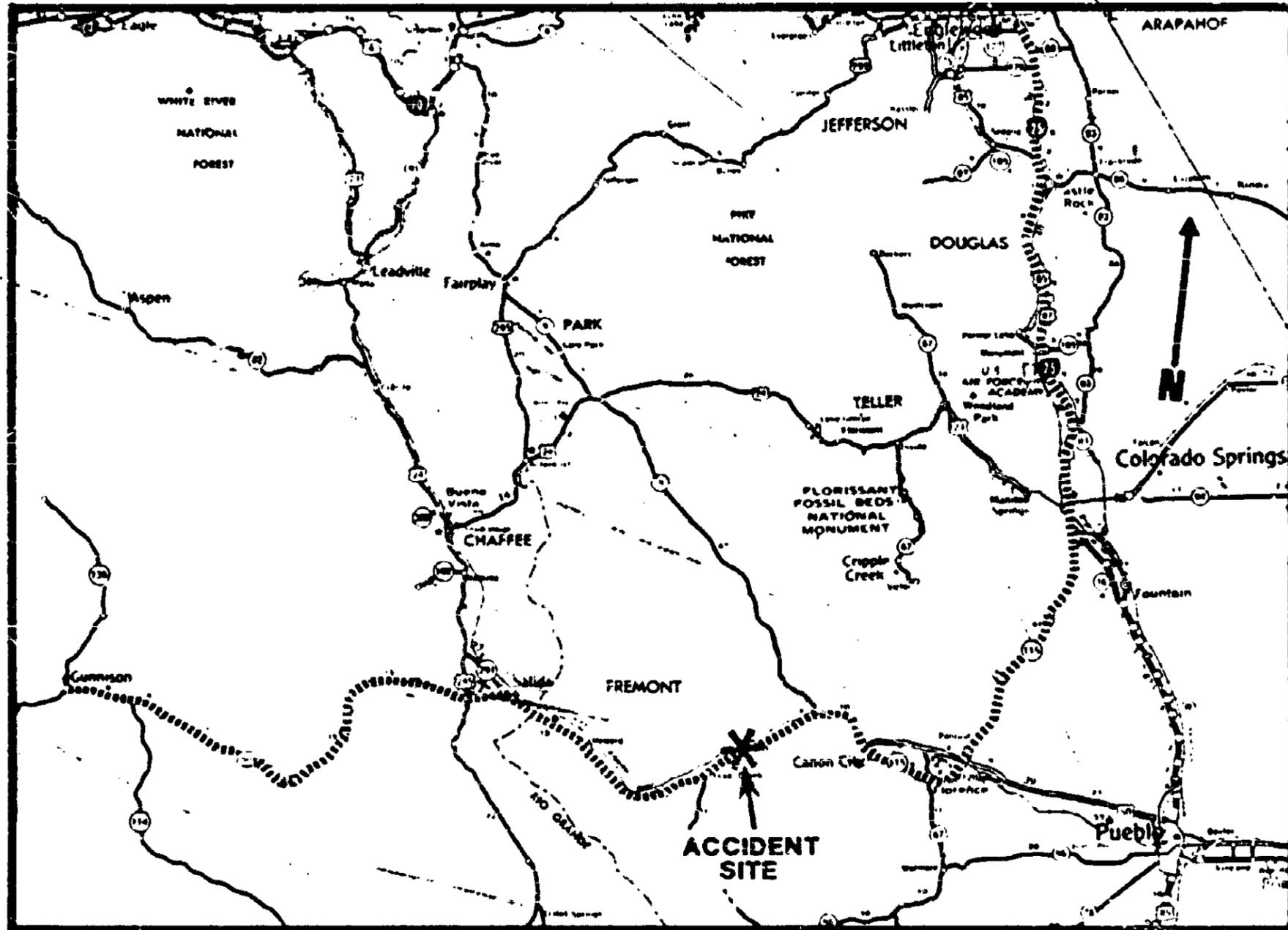
The National Transportation Safety Board was notified of the accident at 2:55 p.m. on November 14, 1981. Investigators were dispatched from the Washington, D.C. Headquarters on November 15, 1981. Safety Board investigators were assisted by representatives of the Colorado State Police, the Office of Motor Carrier Safety, the Colorado Department of Highways, and the PIE Bulk Commodities Division.

**Depositions/Hearings**

There were no depositions taken nor a hearing held in conjunction with this investigation.

APPENDIX B

MAP OF RETURN ROUTE TAKEN BY PIE COMBINATION VEHICLE

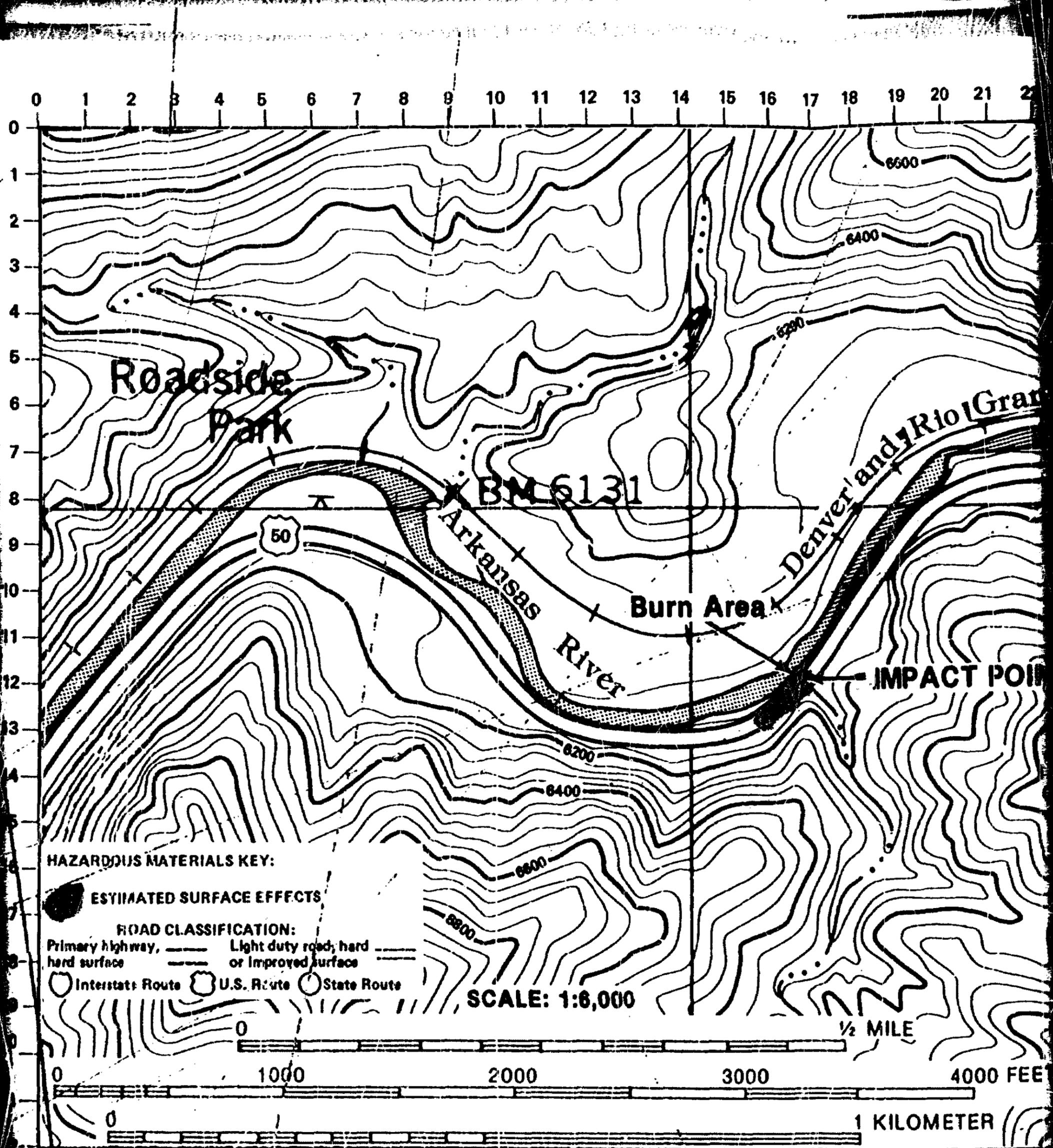


APPENDIX C

GRADEABILITY AND WITHIN GEAR SPEED CHART

GRADEABILITY AND SPEED CHART FOR 193118  
 ENGINE MODEL NTC(C)400 BIG CAM  
 RPM 1300 1400 1500 1600 1700 1800 1900 2000 2100  
 TOR(FT-LBS) 1114 1140 1150 1142 1125 1100 1070 1035 1000  
 TRANSMISSION MODEL RT0-12513  
 REAR AXLE MODEL SQHD RATIO 4.330 FRONTAL AREA 75.0 SQ. FT.  
 TIRES - 479.0 REV/MI. MICHELIN 11X24.5 G  
 GROSS VEHICLE WEIGHT 80000. ALTITUDE CORR. 0.00 ROLLING RES. 1.5 %

TRANSMISSION RATIO	12.500				D/L RPM =	168		RPM DROP =	0
MPH	3.0	3.2	3.5	3.7	3.9	4.2	4.4	4.6	4.9
GRADE	31.1	31.9	32.2	31.9	31.4	30.7	29.8	28.8	27.8
TRANSMISSION RATIO	8.350				D/L RPM =	251		RPM DROP =	697
MPH	4.5	4.9	5.2	5.5	5.9	6.2	6.6	6.9	7.3
GRADE	20.3	20.8	21.0	20.8	20.5	20.0	19.4	18.7	18.1
TRANSMISSION RATIO	6.120				D/L RPM =	343		RPM DROP =	560
MPH	6.1	6.6	7.1	7.6	8.0	8.5	9.0	9.5	9.9
GRADE	14.5	14.8	15.0	14.9	14.6	14.3	13.8	13.3	12.8
TRANSMISSION RATIO	4.560				D/L RPM =	460		RPM DROP =	535
MPH	8.2	8.9	9.5	10.2	10.8	11.4	12.1	12.7	13.3
GRADE	10.4	10.7	10.8	10.7	10.5	10.2	9.9	9.5	9.2
TRANSMISSION RATIO	3.380				D/L RPM =	621		RPM DROP =	543
MPH	11.1	12.0	12.8	13.7	14.5	15.4	16.3	17.1	18.0
GRADE	7.3	7.5	7.6	7.5	7.4	7.2	6.9	6.6	6.4
TRANSMISSION RATIO	2.470				D/L RPM =	850		RPM DROP =	565
MPH	15.2	16.4	17.6	18.7	19.9	21.1	22.3	23.4	24.6
GRADE	4.9	5.0	5.1	5.0	4.9	4.8	4.6	4.4	4.2
TRANSMISSION RATIO	2.140				D/L RPM =	981		RPM DROP =	280
MPH	17.6	18.9	20.3	21.6	23.0	24.3	25.7	27.0	28.4
GRADE	4.0	4.1	4.2	4.1	4.0	3.9	3.7	3.6	3.4
TRANSMISSION RATIO	1.810				D/L RPM =	1160		RPM DROP =	323
MPH	20.8	22.4	24.0	25.6	27.2	28.8	30.4	32.0	33.6
GRADE	3.1	3.2	3.3	3.2	3.1	3.0	2.9	2.7	2.5
TRANSMISSION RATIO	1.570				D/L RPM =	1337		RPM DROP =	278
MPH	24.0	25.8	27.6	29.5	31.3	33.2	35.0	36.9	38.7
GRADE	2.5	2.6	2.6	2.5	2.5	2.3	2.2	2.1	1.9
TRANSMISSION RATIO	1.350				D/L RPM =	1555		RPM DROP =	294
MPH	27.9	30.0	32.1	34.3	36.4	38.6	40.7	42.9	45.0
GRADE	1.9	1.9	1.9	1.9	1.8	1.7	1.6	1.4	1.3
TRANSMISSION RATIO	1.170				D/L RPM =	1794		RPM DROP =	280
MPH	32.1	34.6	37.1	39.6	42.0	44.5	47.0	49.5	51.9
GRADE	1.4	1.4	1.4	1.3	1.3	1.1	1.0	0.9	0.7
TRANSMISSION RATIO	1.000				D/L RPM =	2100		RPM DROP =	305
MPH	37.6	40.5	43.4	46.3	49.2	52.1	55.0	57.9	60.8
GRADE	0.8	0.9	0.8	0.8	0.7	0.6	0.4	0.3	0.2
TRANSMISSION RATIO	0.870				D/L RPM =	2413		RPM DROP =	273
MPH	43.2	46.6	49.9	53.2	56.5	59.9	63.2	66.5	69.8
GRADE	0.4	0.4	0.4	0.3	0.2	0.1	-0.1	-0.2	-0.4

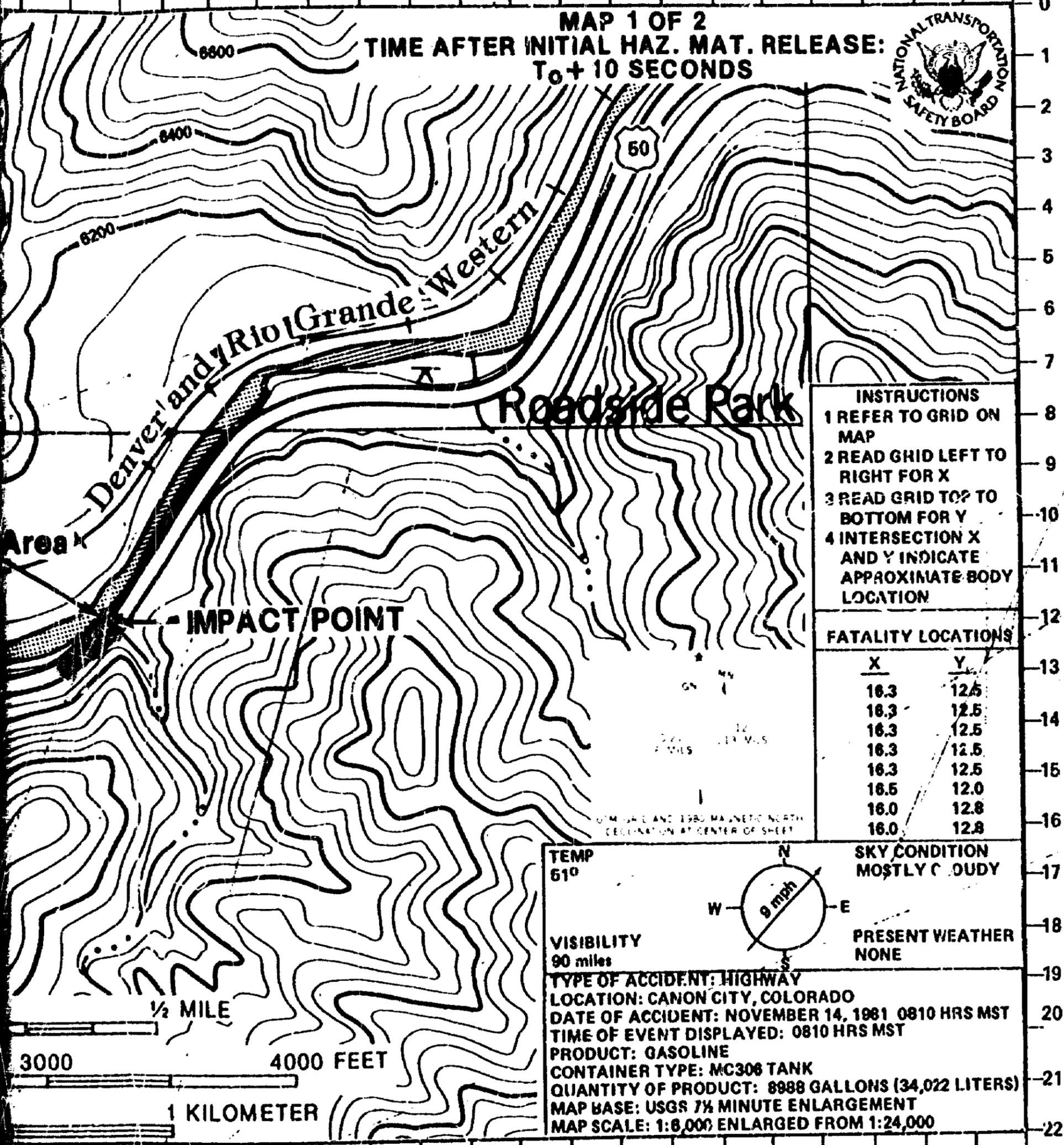


**APPENDIX D HAZARDOUS MATERIAL**

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

MAP 1 OF 2

TIME AFTER INITIAL HAZ. MAT. RELEASE:  
T<sub>0</sub> + 10 SECONDS



**INSTRUCTIONS**

- 1 REFER TO GRID ON MAP
- 2 READ GRID LEFT TO RIGHT FOR X
- 3 READ GRID TOP TO BOTTOM FOR Y
- 4 INTERSECTION X AND Y INDICATE APPROXIMATE BODY LOCATION

**FATALITY LOCATIONS**

X	Y
16.3	12.5
16.3	12.5
16.3	12.5
16.3	12.5
16.3	12.5
16.5	12.0
16.0	12.8
16.0	12.8

TEMP 61°

SKY CONDITION MOSTLY CLOUDY

VISIBILITY 90 miles

PRESENT WEATHER NONE

9 mph

TYPE OF ACCIDENT: HIGHWAY

LOCATION: CANON CITY, COLORADO

DATE OF ACCIDENT: NOVEMBER 14, 1981 0810 HRS MST

TIME OF EVENT DISPLAYED: 0810 HRS MST

PRODUCT: GASOLINE

CONTAINER TYPE: MC308 TANK

QUANTITY OF PRODUCT: 8988 GALLONS (34,022 LITERS)

MAP BASE: USGS 7 1/2 MINUTE ENLARGEMENT

MAP SCALE: 1:8,000 ENLARGED FROM 1:24,000

1/2 MILE

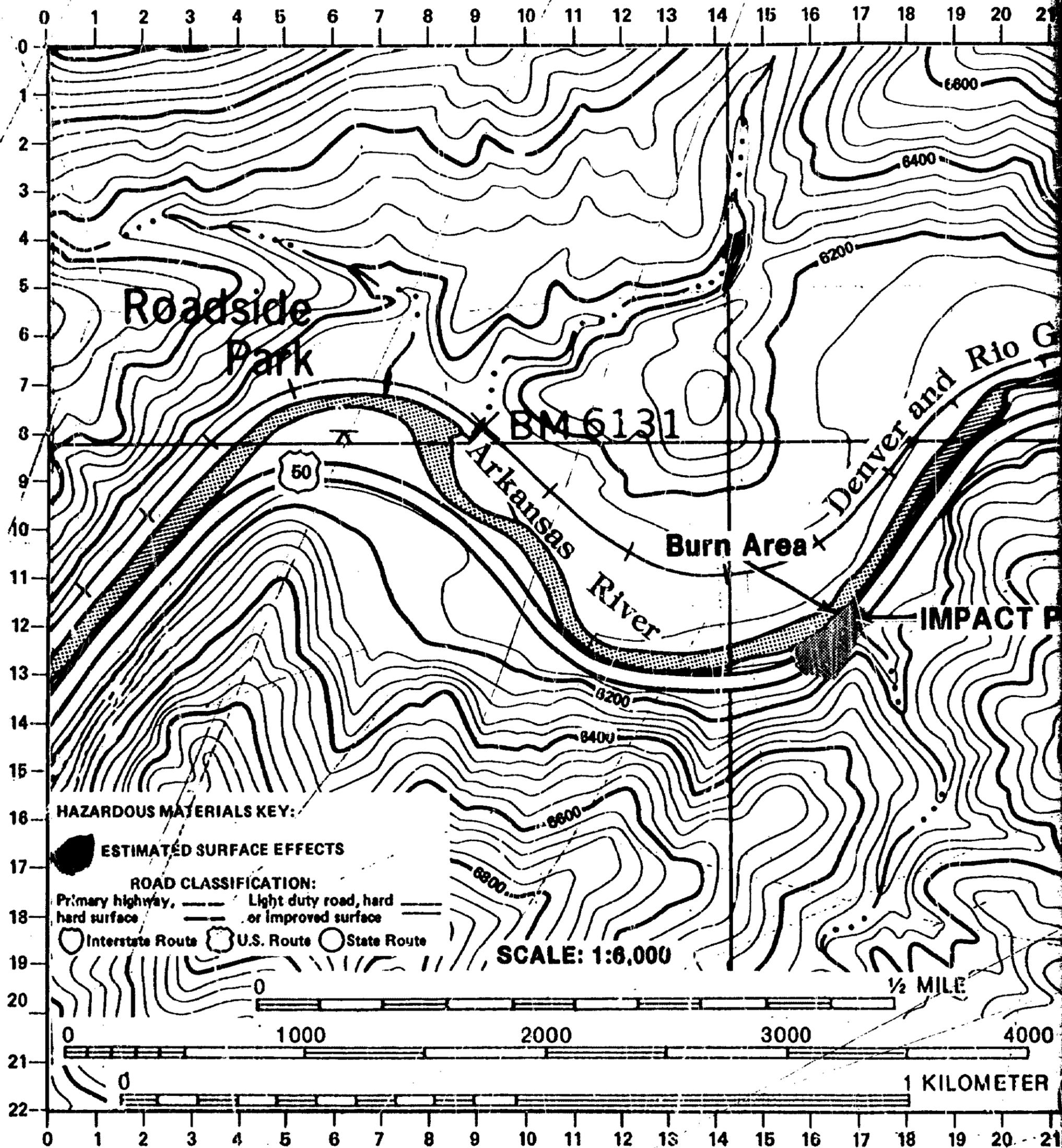
3000 4000 FEET

1 KILOMETER

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

# HAZARDOUS MATERIAL SPILL MAP

B

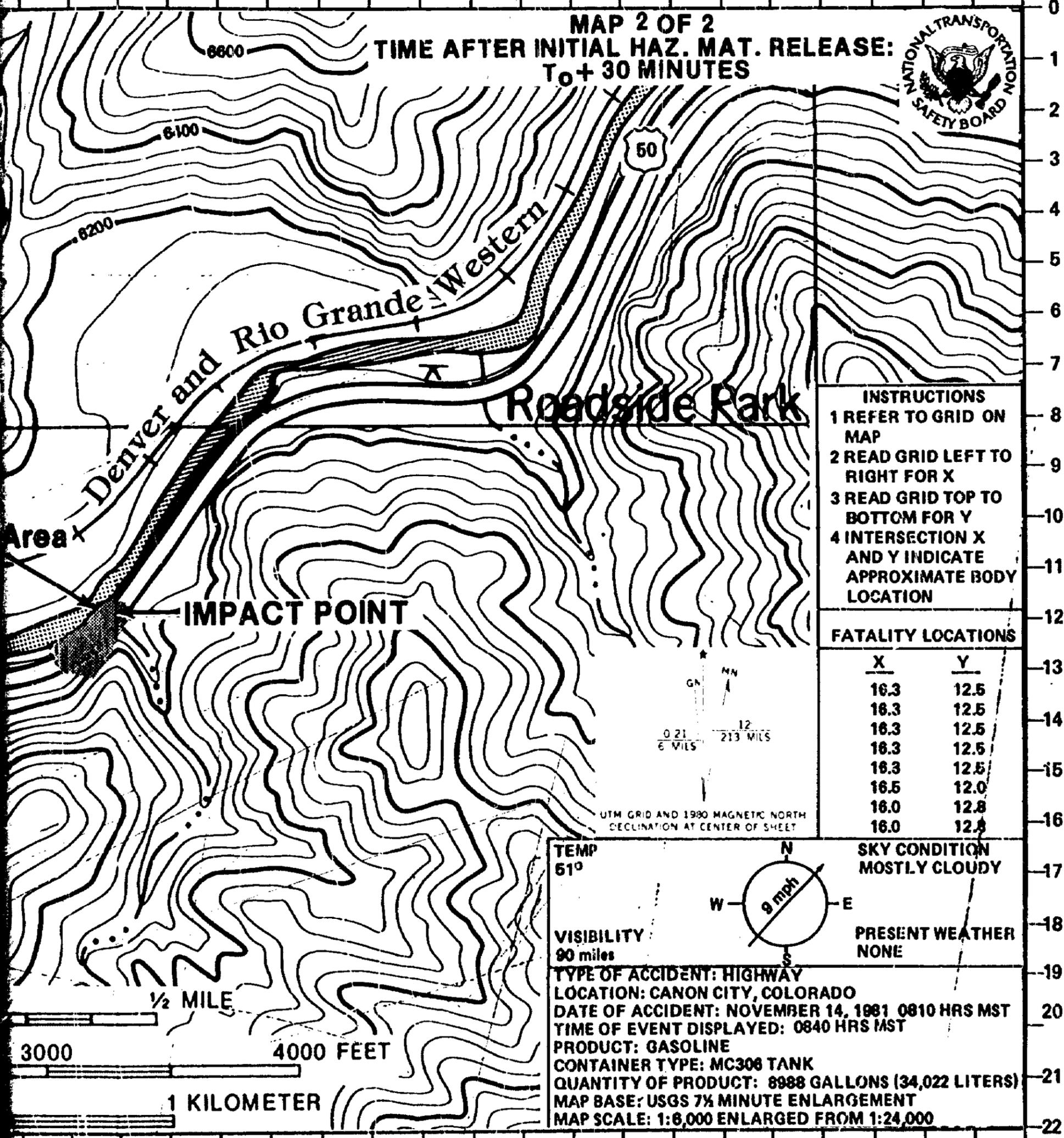


**APPENDIX D HAZARDOUS MATERI**

A

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

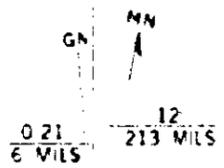
**MAP 2 OF 2**  
**TIME AFTER INITIAL HAZ. MAT. RELEASE:**  
**T<sub>0</sub> + 30 MINUTES**



**INSTRUCTIONS**  
1 REFER TO GRID ON MAP  
2 READ GRID LEFT TO RIGHT FOR X  
3 READ GRID TOP TO BOTTOM FOR Y  
4 INTERSECTION X AND Y INDICATE APPROXIMATE BODY LOCATION

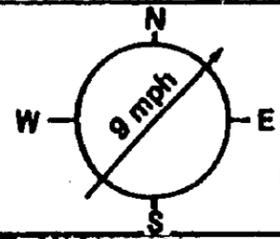
**FATALITY LOCATIONS**

X	Y
16.3	12.5
16.3	12.5
16.3	12.5
16.3	12.5
16.3	12.5
16.5	12.0
16.0	12.8
16.0	12.8



UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

TEMP  
51°

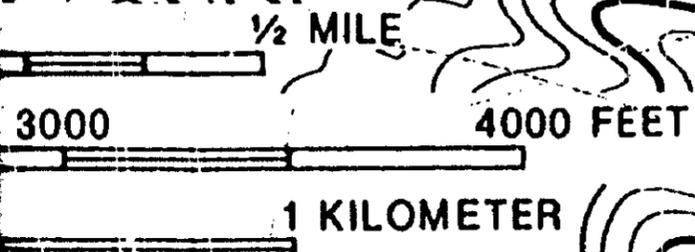


SKY CONDITION  
MOSTLY CLOUDY

VISIBILITY  
80 miles

PRESENT WEATHER  
NONE

TYPE OF ACCIDENT: HIGHWAY  
LOCATION: CANON CITY, COLORADO  
DATE OF ACCIDENT: NOVEMBER 14, 1981 0810 HRS MST  
TIME OF EVENT DISPLAYED: 0840 HRS MST  
PRODUCT: GASOLINE  
CONTAINER TYPE: MC306 TANK  
QUANTITY OF PRODUCT: 8988 GALLONS (34,022 LITERS)  
MAP BASE: USGS 7 1/2 MINUTE ENLARGEMENT  
MAP SCALE: 1:8,000 ENLARGED FROM 1:24,000



15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

**HAZARDOUS MATERIAL SPILL MAP**

B