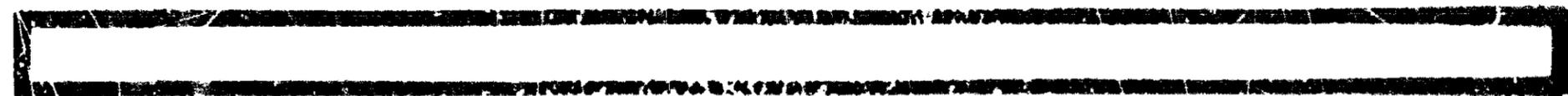
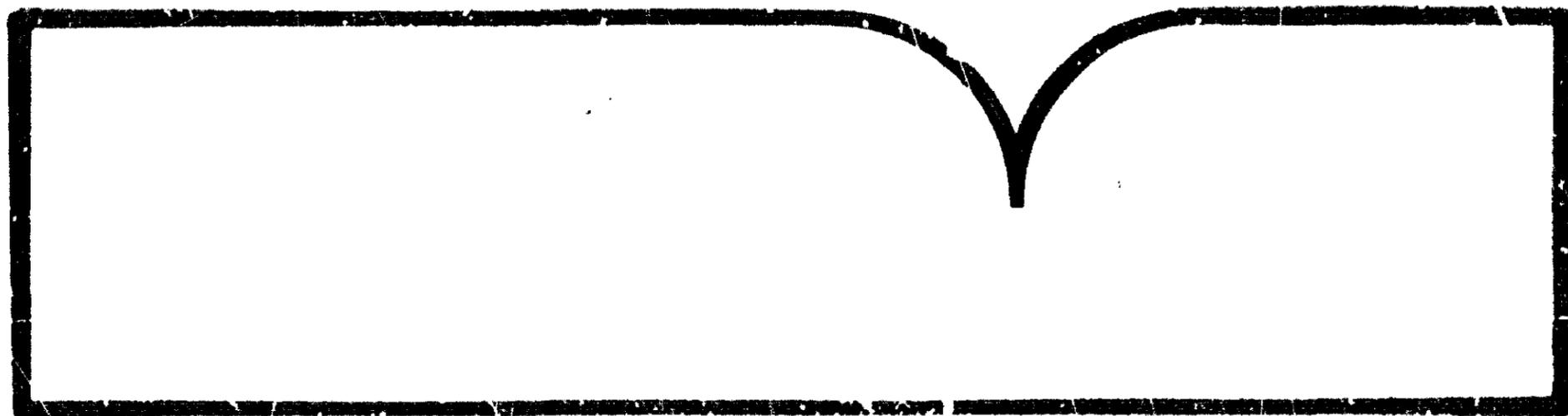


PB82-916201

HIGHWAY ACCIDENT REPORT: COLLISION OF NORTH AMERICAN VAN LINES  
TRACTOR-SEMITRAILER AND FORD VAN IN CONSTRUCTION ZONE, OHIO  
TURNPIKE NEAR CLEVELAND, OHIO, JULY 22, 1981.

National Transportation Safety Board  
Washington, D.C.

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U.S. Department of Commerce  
National Technical Information Service

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16. Abstract  On July 22, 1981, about 5:50 a.m., a 1978 Ford van occupied by seven persons was traveling eastbound on the Ohio Turnpike in a construction zone near Cleveland, Ohio, where traffic was operating in the eastbound lane. Shortly after the van entered the construction zone, it drifted into the opposing traffic lane and collided nearly head-on with a GMC tractor-semitrailer traveling westbound. The van driver and five van passengers were killed and one van passenger was seriously injured. The driver of the tractor-semitrailer received minor injuries.  The National Transportation Safety Board determines that the probable cause of this accident was the failure of the van driver to maintain his vehicle within the proper traffic lane. Contributing to the cause of the accident was the lack of positive separation of opposing traffic in the construction work zone.			
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## CONTENTS

<b>SYNOPSIS</b> . . . . .	1
<b>INVESTIGATION</b> . . . . .	1
The Accident . . . . .	1
Injuries to Persons . . . . .	2
Vehicle Information . . . . .	2
Driver Information . . . . .	6
Highway Information . . . . .	7
Meteorological Information . . . . .	8
Medical and Pathological Information . . . . .	8
Survival Aspects . . . . .	12
Other Information . . . . .	12
<b>ANALYSIS</b> . . . . .	14
The Accident . . . . .	14
Survival Aspects . . . . .	16
The Highway . . . . .	16
<b>CONCLUSIONS</b> . . . . .	19
Findings . . . . .	19
Probable Cause . . . . .	19
<b>RECOMMENDATIONS</b> . . . . .	20
<b>APPENDIX</b>	
Appendix --Investigation . . . . .	21

**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**HIGHWAY ACCIDENT REPORT**

**Adopted: March 24, 1982**

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**COLLISION OF  
NORTH AMERICAN VAN LINES TRACTOR-SEMITRAILER  
AND FORD VAN  
IN CONSTRUCTION ZONE, OHIO TURNPIKE  
NEAR CLEVELAND, OHIO,  
JULY 22, 1981**

**SYNOPSIS**

On July 22, 1981, about 5:50 a.m., a 1978 Ford van occupied by seven persons was traveling eastbound on the Ohio Turnpike in a construction zone near Cleveland, Ohio, where traffic was operating in the eastbound lanes. Shortly after the van entered the construction zone, it drifted into the opposing traffic lane and collided nearly head-on with a GMC tractor-semitrailer traveling westbound. The van driver and five van passengers were killed, and one van passenger was seriously injured. The driver of the tractor-semitrailer received minor injuries.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the van driver to maintain his vehicle within the proper traffic lane. Contributing to the cause of the accident was the lack of positive separation of opposing traffic in the construction work zone.

**INVESTIGATION**

**The Accident**

About 3 a.m., <sup>1/</sup> on July 22, 1981, a driver and six passengers departed Brighton, Michigan, in a Ford van on a family vacation trip to Monden, New Jersey. The van was driven 75 miles south to the Ohio Turnpike (Interstate 80), entered the turnpike at exit 4 about 4:29 a.m., and proceeded east. About 77 miles east of exit 4, and about 8 miles west of the Lorain/Elyria interchange, the van entered a construction work zone, where all westbound traffic had been routed into a single lane on one of the two eastbound lanes. There was not positive separation of the two-way traffic and the eastbound traffic was confined to one lane. The posted speed limit was 50 mph in the construction zone. Traffic was moderately light and moving about 50 to 55 mph. The ambient lighting conditions were bright enough to permit driving without headlights, although the headlights on the van were illuminated, according to witnesses. The van had passed through two similar construction zones before reaching this one. According to witnesses, the van traveled about 0.2 mile into the construction zone, drifted completely over into

1/ All times herein are eastern standard time.

the opposing traffic lane, and forced an oncoming westbound car off the roadway onto the median shoulder. The eastbound van continued approximately another 400 feet in the opposing traffic lane until it collided nearly head-on with a westbound tractor-semitrailer about 5:50 a.m. (See figure 1.) As a result of the accident, the van driver and five van passengers were killed and one passenger was seriously injured.

The driver of the tractor-semitrailer, which had its clearance and side marker lights illuminated, said that he was traveling about 45 mph when suddenly he noticed headlights coming toward the median at an angle. He immediately applied his brakes to avoid impact. He stated that the van driver must have realized at the last moment what was about to occur and attempted to steer his vehicle back into the proper lane of traffic. The van traveled across the front of the tractor, exposing its left side to impact.

A witness who was traveling behind the van said that the van was traveling eastbound with the traffic at a speed of about 55 mph when it swerved completely into the opposing traffic's lane of travel. The van driver did not give a turn signal and there was no vehicle ahead of him to pass, according to the witness.

The surviving passenger of the van, who was seated in the right-front seat, said that no one in the van was sleeping when the accident occurred. Fifteen minutes before the accident, the family was active eating donuts and drinking orange juice. She could not recall anything unusual about the physical condition of the van driver or the accident sequence (seeing any approaching vehicles, etc.) immediately before the collision.

#### Injuries to Persons

<u>Injuries</u>	<u>Driver</u>	<u>Passengers</u>	<u>Total</u>
Fatal	1	5	6
Serious	0	1	1
Minor/None	1	0	1
Total	2	6	8

#### Vehicle Information and Damage

Van.--The 1978 dark blue Ford Club Wagon, VIN/E12BBCA5141, was owned by the driver. It had a seating capacity of eight and a probable loaded weight of 5,300 pounds at the time of the accident. The van was equipped with a six-cylinder engine, automatic transmission, air conditioning, radial tires, and an occupant restraint for each designated seating position.

There was no evidence of preimpact vehicle deficiencies. All systems important to the safe operation of the van were in good to excellent condition (i.e., steering, brakes, tires, and suspension). The left-side components of the van were severely distorted inward and rearward. The left-front door had separated from the vehicle. The left-side "b" pillar and all attaching components were deformed rearward leaving an 8 1/2-foot-long opening in the left side of the vehicle. A 12-inch-deep horizontal indentation, matching the depth of the tractor's bumper, extended across the left-front door. The roof had separated from the left side and was deformed 50 inches inward and 28 inches rearward. The front, right-side, and rear body structures were not significantly damaged. The undercarriage, side rails, crossmembers, and fuel tank also had maintained their basic integrity. However, the filler pipe did separate from the fuel tank during impact; no fire occurred as a result of the fuel spillage. Both rear tires had separated from their rims during impact and both rims were distorted toward the left. (See figures 2 and 3.)



Figure 2.--Side view of van.



Figure 3.--Top view of van showing tractor penetration.

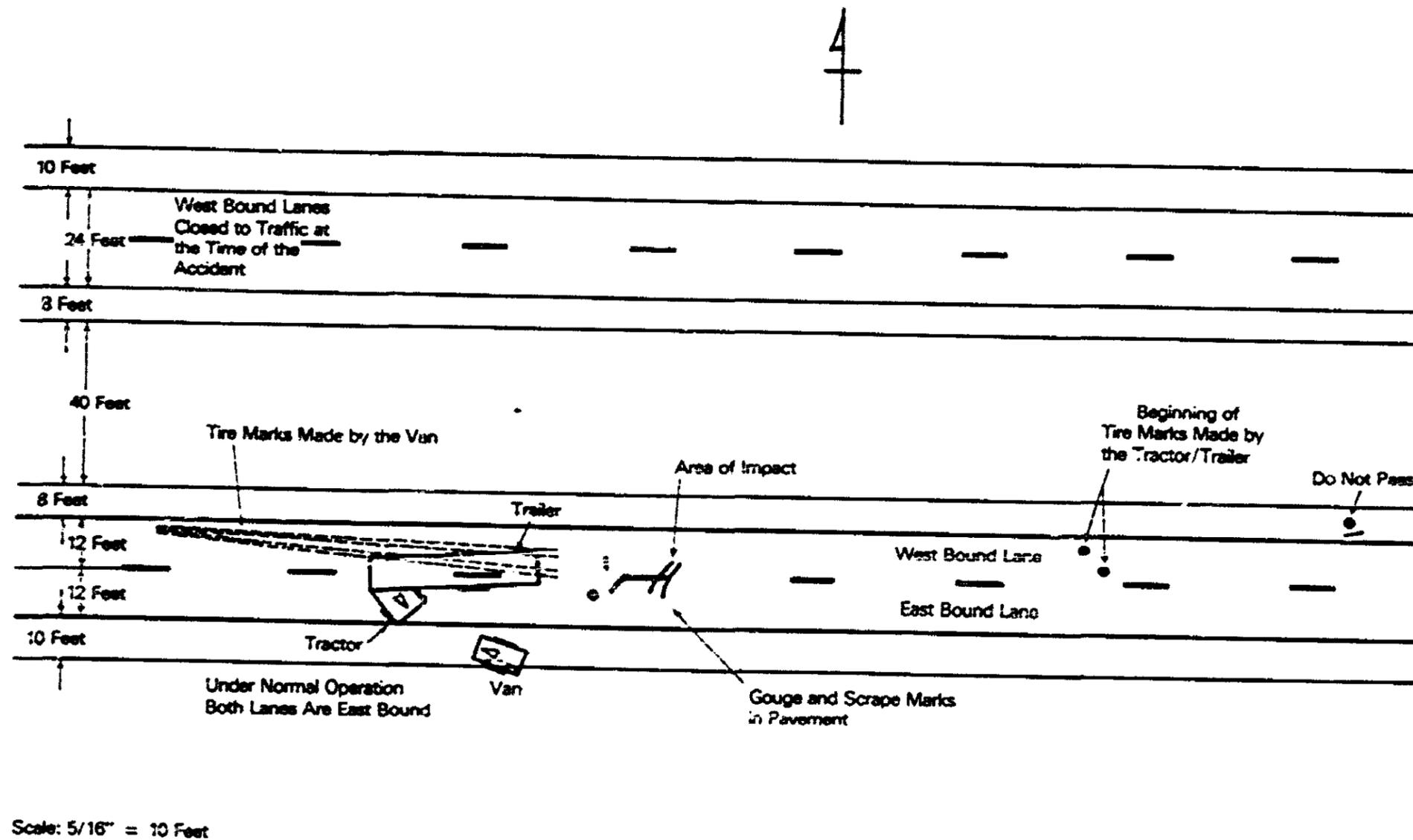


Figure 1.—Plan view of accident site.

The left-side interior instrument panel had separated from the dash during impact; therefore, the preimpact headlight switch position could not be determined. The radio switch was in the "off" position, and the defroster switch was in the "on" position. All of the van windows were closed.

Tractor-semitrailer.--The combination vehicle was composed of a 1978 GMC Astro 95 tractor pulling a 1977 Kentucky Mfg. Co. furniture-van semitrailer. The two-axle tractor was owned and operated by the truckdriver, and the tandem-axle semitrailer was owned by North American Van Lines. The combination vehicle was engaged in interstate commerce and was subject to all Federal Motor Carrier Safety Regulations (FMCSR). The two-axle tractor, VIN-TFC928V594602, was equipped with a Cummins diesel NTC-293 hp engine governed at 1,900 rpm, a nine-speed Fuller Road ranger transmission model RT9509A, 10.00-20 Goodyear tires on all wheels, and conventional air-mechanical brakes with a functional antilock system on all axles. A type-1 occupant restraint was installed on the driver's seat of the tractor cab, but was not being used by the driver at the time of the accident.

The tandem-axle semitrailer, VIN54880, was equipped with 9.00-20 Goodyear tires and conventional air-mechanical brakes on all wheels. The estimated gross combination weight of the tractor-semitrailer at the time of the accident was 36,225 pounds.

The shift-linkage coverplate was removed from the transmission for postaccident inspection. The transmission was in seventh gear, which provided a final gear ratio of 1.35 to 1. The rear-axle ratio for the differential carrier assembly was determined to be 3.70 to 1. The combination vehicle's tires, brakes, and steering components were in good condition, except for the following discrepancies:

- (1) The tractor's left-rear inside tire was bald. Tread depth thickness for all other tires ranged from 10/32 to 13/32 inch. The tractor's left-front tire was flat due to impact damage. Tire pressures for all other inflated tires ranged from 65 to 85 psi.
- (2) The slack adjustments measured for the brakes on the combination vehicle were as follows:

	Left (inches)	Right (inches)	Manufacturer's recommended stroke at which to adjust (inches)	Maximum stroke for brake chamber (inches)
<u>Tractor</u>				
Front	2 1/4	2 1/4	Type 16 - 1 1/4	2 1/4
Rear	1 7/8	1 7/8	Type 30 - 2	2 1/2
<u>Semitrailer</u>				
Front	2	1 1/2	Type 30 - 2	2 1/2
Rear	1 1/2	1 1/2	Type 30 - 2	2 1/2

The front surface of the tractor's cab was damaged during impact. The semitrailer was not significantly damaged, except for minor denting on the left-front corner. (See figure 4.) Dark blue paint transfers were found along the front exterior surfaces below the tractor's windshield. Both sheet metal headlamp panels were bent rearward and also contained dark blue paint transfers. The tractor's cab was displaced rightward and the tractor's frame side rails were buckled to the right about 31 inches. The windshield and

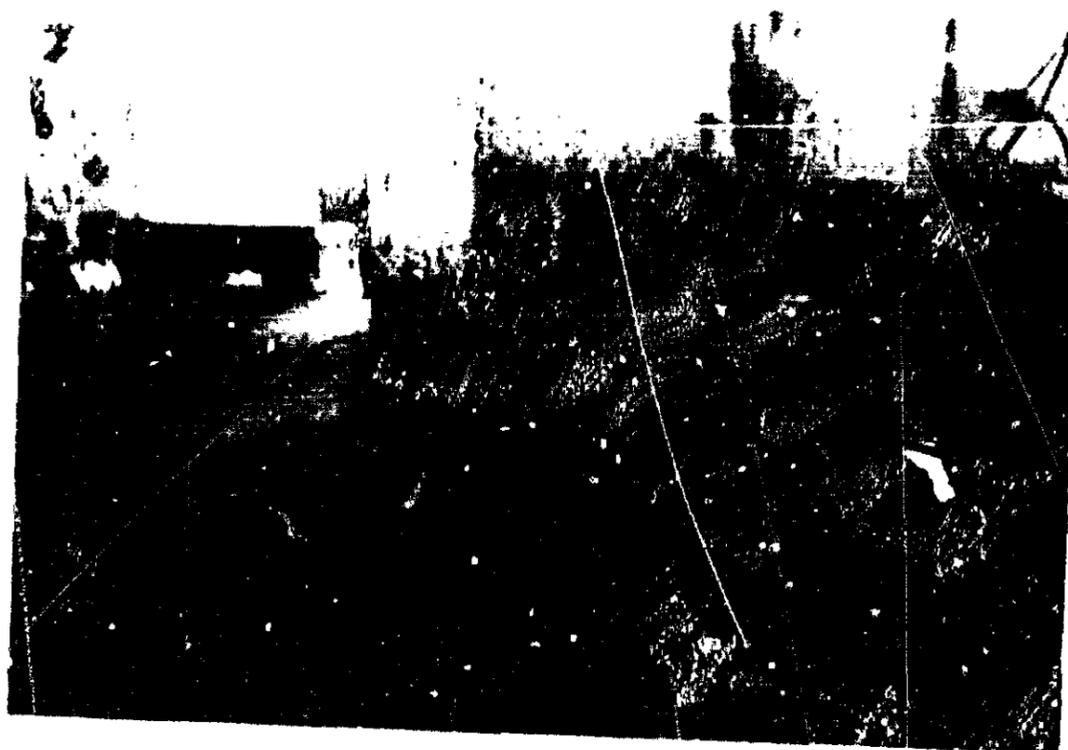


Figure 4.--View of Jackknifed semitrailer.

front headlamp glass were missing. Both ends of the tractor's front bumper were deformed rearward. (See figure 5.)

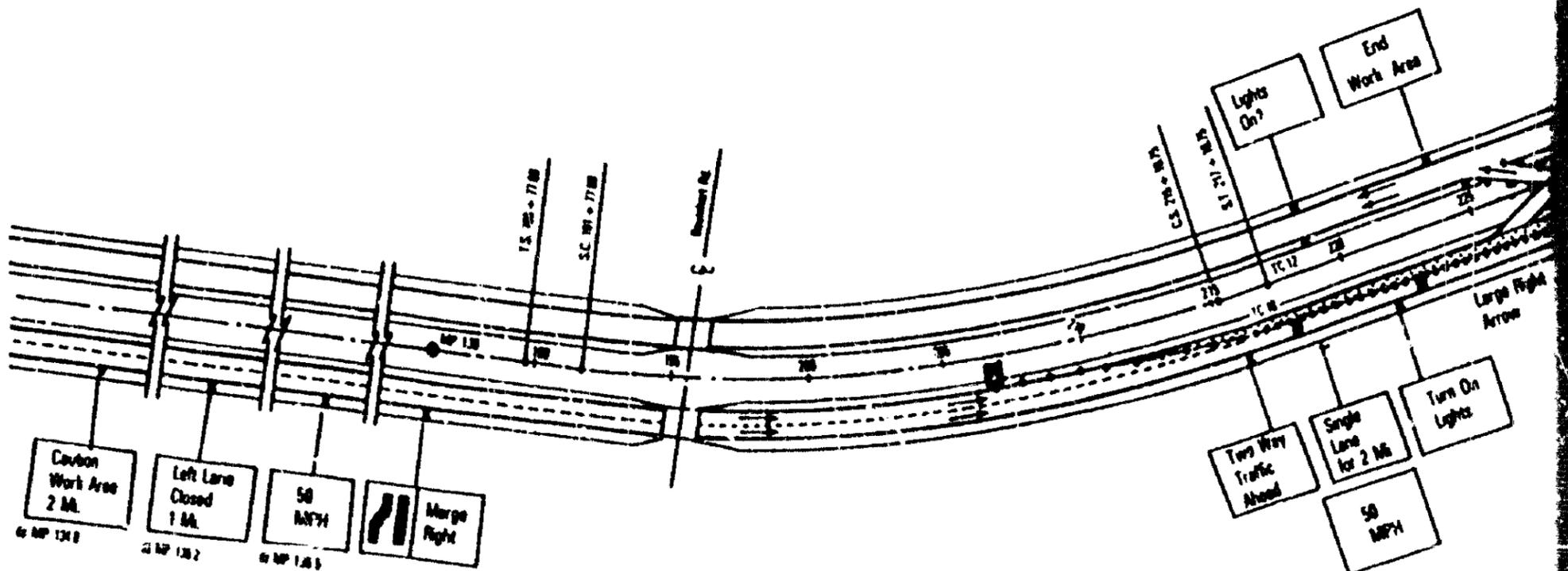
#### Driver Information

The 40-year-old van driver held a valid Michigan operator's license with no restrictions. His Michigan driver records contained no indications of any traffic violation convictions or previous accidents. Interviews with his relatives disclosed that he was in excellent physical condition with no known medical problems. Interviews with his neighbors disclosed that the van driver went to bed around 8 p.m. the night before the accident.

The 37-year-old truckdriver was employed as an owner/operator with North American Van Lines out of Fort Wayne, Indiana. The truckdriver held a valid Massachusetts chauffeur's license with no restrictions. His driving record indicated he had no traffic violations, license suspensions, or revocations. North American Van Lines records disclosed that the truckdriver had been involved in two minor passenger car accidents before being hired. The truckdriver had been employed with North American Van Lines for approximately 4 years and had been driving commercial vehicles regularly for about the same length of time. He held a current medical certificate as required by the FMCSR. His physical examination revealed that he was in good physical condition with no medical problems. His vision was reported to be 20/40 without corrective lenses in both eyes.

The truckdriver had departed Keene, New Hampshire, on July 20, 1981, en route to St. Clair Shores, Michigan. He was hauling 137 cartons of furniture. He entered the Ohio Turnpike on July 21, 1981, about 10:49 p.m. The truckdriver had traveled 137 miles from

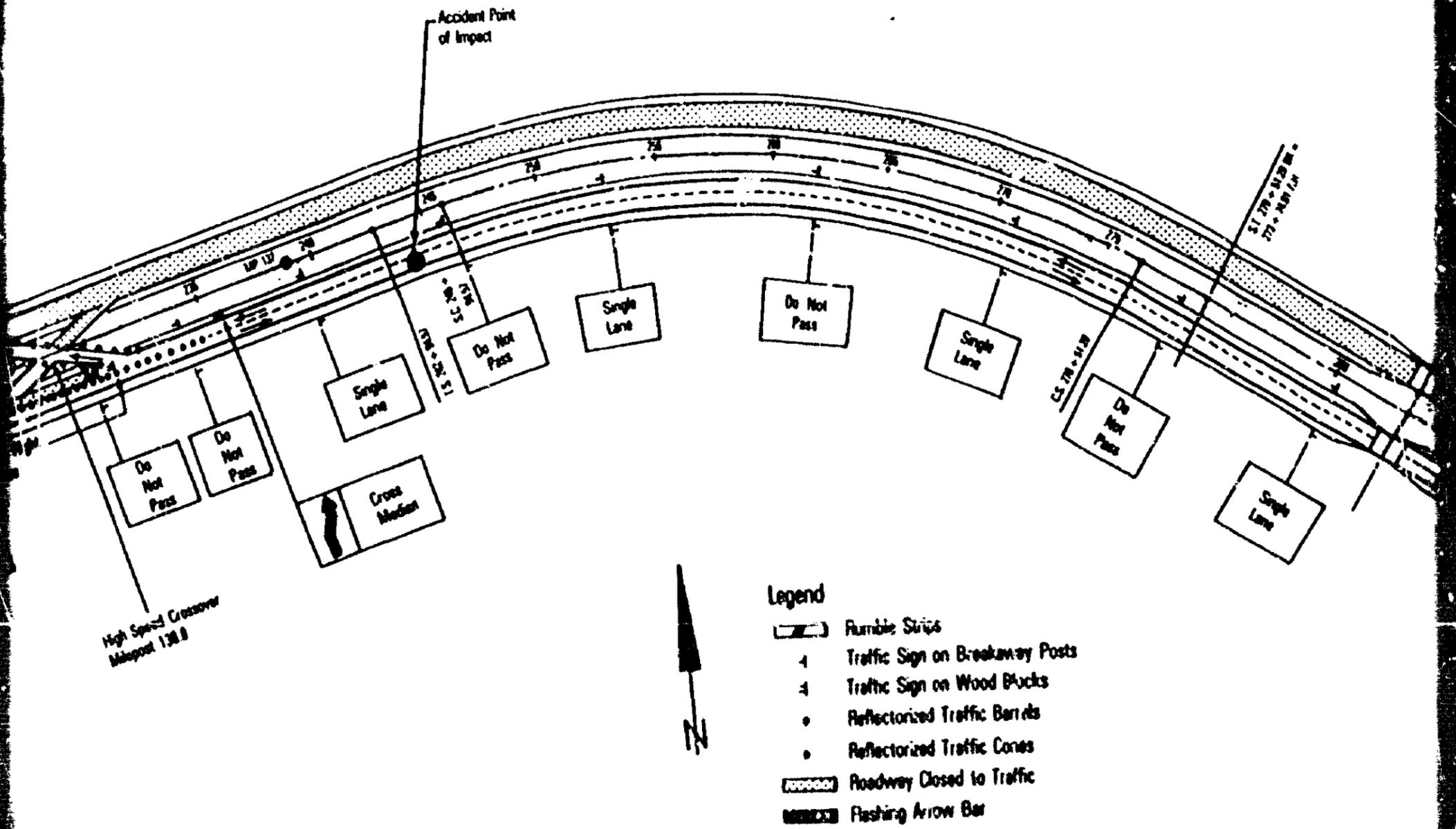
A



7. a

FIGURE 6.—PLAN VIEW OF

1 B



OF CONSTRUCTION ZONE AT THE ACCIDENT SITE.  
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1.c



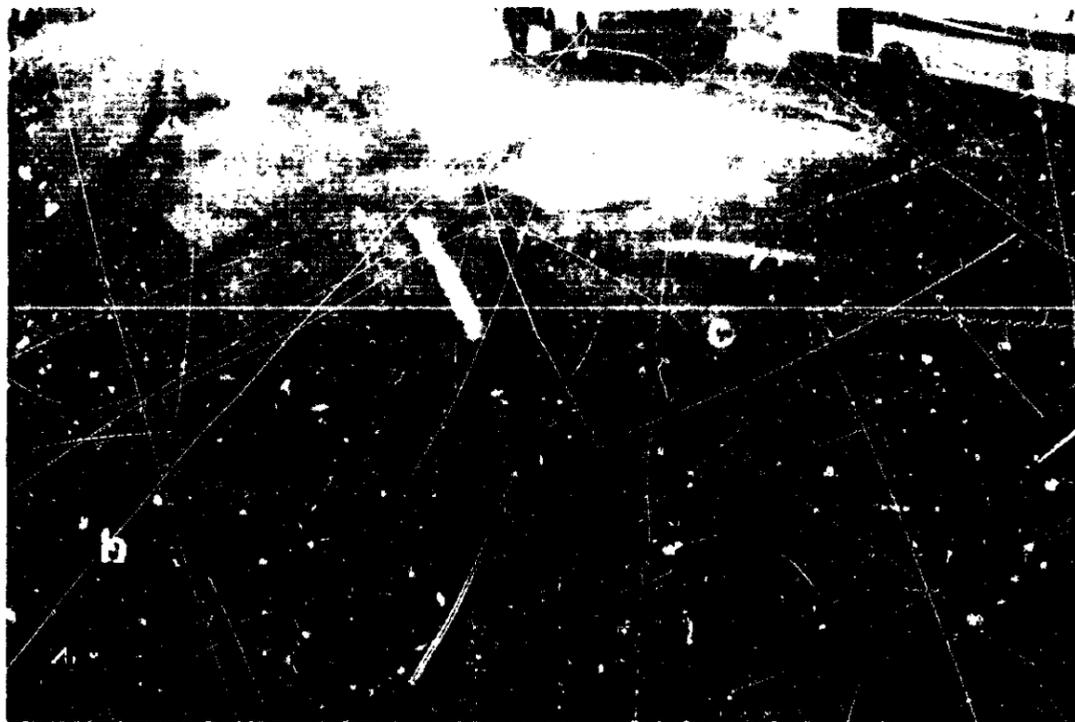


Figure 7.—Eastward view of accident site showing (a) dual-wheel tire marks of combination vehicle, (b) tire marks of van before impact, and (c) tire marks of van after impact.



Figure 8.—Eastward view of accident scene and rest positions of vehicles.

The surviving van passenger suffered a ruptured spleen and a fractured ankle. The unrestrained truckdriver received minor injuries, and was hospitalized and later released.

### Survival Aspects

The van was equipped with two optional front bucket seats and two standard three-passenger bench-type seats in the rear. Each seat was equipped with occupant restraints at each designated seating position. The van driver was the only person wearing a seatbelt at the time of the accident.

The tractor of the combination vehicle struck the left-front corner of the van and penetrated rearward into the left side of the passenger compartment. Three passengers were ejected during the impact sequence and the driver and three other passengers were trapped inside. The surviving van passenger was sitting in the right-front seat slightly out of the area penetrated by the tractor-semitrailer. (See figure 9.)

The OSHP was notified of the accident by citizens band radio immediately after it occurred. The first OSHP unit responded to the accident scene at 5:53 a.m. and called for assistance from appropriate emergency response units.

### Other Information

Because of the continued frequency of severe head-on accidents occurring on normally divided highways which have been reduced to two-lane, two-way operation due to construction and maintenance, the Federal Highway Administration (FHWA) has issued the following regulations covering Federal-aid construction and maintenance projects in the last 3 years:

<u>Item</u>	<u>Title</u>	<u>Date Issued</u>
Final Rule (FHWA Docket No. 76-14)	Traffic Safety in Highway and Street Work Zones	October 12, 1978
Emergency Final Rule (FHWA Docket No. 79-31)	Traffic Safety in Highway and Street Work Zones; Separation of Opposing Traffic	September 17, 1979
Advance Notice of Proposed Rulemaking (ANPRM) (FHWA Docket No. 79-37)	National Standards for Traffic Control Devices; Manual on Uniform Traffic Control Devices	January 3, 1980
Notice of Proposed Rulemaking (NPRM) (FHWA Docket No. 79-31)	Traffic Safety in Highway and Street Work Zones; Separation Of Opposing Traffic and Edge of Pavement Excavation Requirements	October 16, 1980

In summary, these regulatory directives outline strict procedures and guidelines for separating opposing traffic in construction and maintenance work zones.

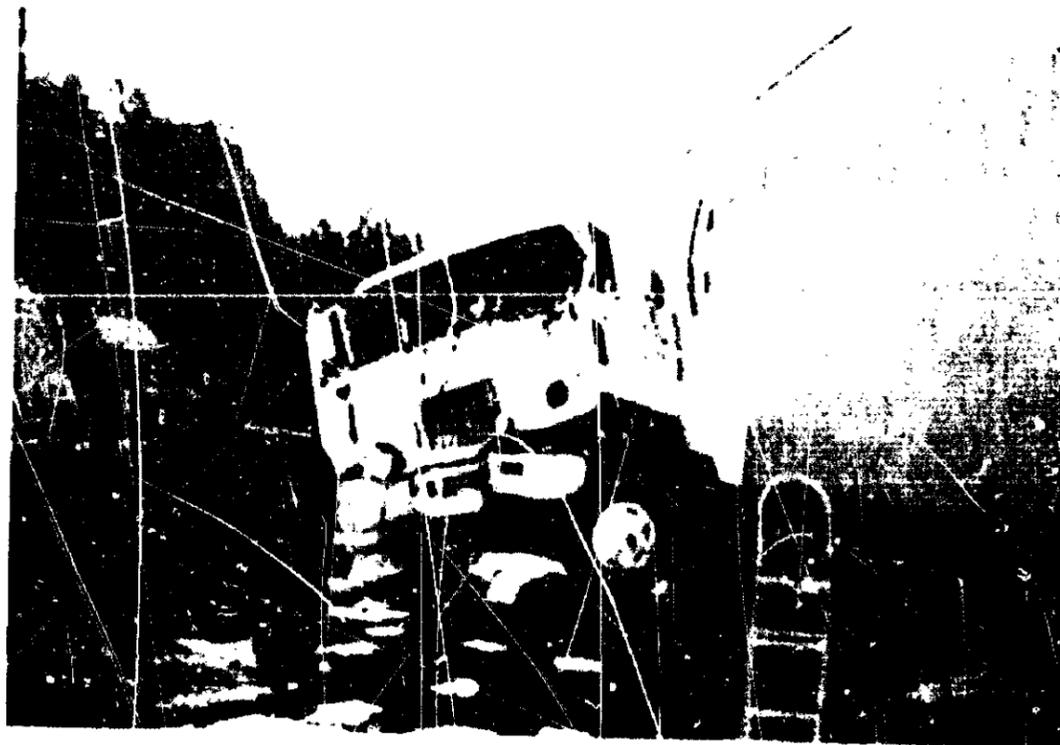


Figure 5.--Jackknifed condition of tractor-semitrailer.

the east entrance of the turnpike to the accident site. He had stopped to rest during the 7 hours between the time he entered the turnpike and the time of the accident. His vehicle was equipped with a sleeping berth.

#### Highway Information

The Ohio Turnpike is a major transportation corridor which extends across Ohio from Pennsylvania to Indiana. The turnpike is a toll road which was constructed and is currently maintained by the Ohio Turnpike Commission without public or Federal funding. The highway was opened in October 1953 and has been incorporated into the National System of Interstate Highways. The turnpike is 241.6 miles long and has 19 interchanges. The section of turnpike where the accident occurred is designated as Interstate 80.

The roadway is a four-lane divided highway with two eastbound lanes and two westbound lanes divided by a 40-foot-wide grass median. The road consists of two 12-foot-wide traffic lanes constructed with reinforced Portland cement concrete that has been resurfaced with an asphaltic concrete. The paved shoulders are 8 feet wide at the median and 10 feet wide on the shoulder. All of the mainline roadway has been resurfaced at least once.

The construction project at the accident site had been contracted to make roadway repairs, to improve the guardrails, and to resurface the existing pavement. The project encompassed an 11.8-mile section of the turnpike from milepost 132.2 to milepost 144.0. The project was divided into seven work zones using seven existing permanent crossovers and requiring the construction of one new crossover. The work zones ranged from 0.56 to 2.40 miles in length. In zone three, where the accident occurred, the westbound traffic

lanes had been closed for resurfacing. All westbound traffic had been diverted into the eastbound lanes just west of the service plaza at milepost 140. The eastbound lanes were temporarily accommodating two-way traffic.

The accident occurred about 0.2 mile past milepost 137 and 120 feet into a 1°30'-spiral horizontal right-hand curve in the eastbound direction. The eastbound travel lane had a grade of +0.147 percent and superelevation varying from 3/16 to 7/16 inch per foot. The pavement markings in this area consisted of a white dashed lane line for the centerline. (See figure 6.)

There were several deep gouge marks present in the pavement surface near the point of impact. Tire marks matching the tire tread width of the van were visible in the westbound lane. They were 84 feet long and extended from the westbound lane slightly into the eastbound lane near impact. There was also a faint set of dual tire marks in the westbound lane. These marks were 120 feet long and extended approximately 45 feet past the point of intersection with the 84-foot-long tire marks. (See figures 7 and 8.)

Safety Board investigators reviewed the Traffic Control Plan (TCP) established by the Ohio Turnpike Commission for the construction project. The traffic control devices in work zone three were in conformance with requirements in the Manual on Uniform Traffic Control Devices (MUTCD), <sup>2/</sup> with the exception of some sign mounting heights and messages. The work zone did not have a temporary double yellow centerline which is recommended in the MUTCD for typical two-way construction work zones. Although the temporary double yellow centerline is recommended, it is not a specified requirement in the MUTCD for construction work zones. The TCP also specified that no two consecutive work zones be closed to traffic at the same time, and that normal operation of the turnpike would be necessary during weekends and high-volume summer months. The TCP did not specify highway lighting in this construction project.

#### Meteorological Information

There was no precipitation or other weather condition which would have influenced the accident. The temperature was 61° F, visibility was 15 miles, sunrise was at 6:12 a.m., and civil twilight <sup>3/</sup> began at 5:40 a.m. The investigating officer of the Ohio State Highway Patrol (OSHP) said that the weather was clear and dry and the ambient light did not require the use of headlights.

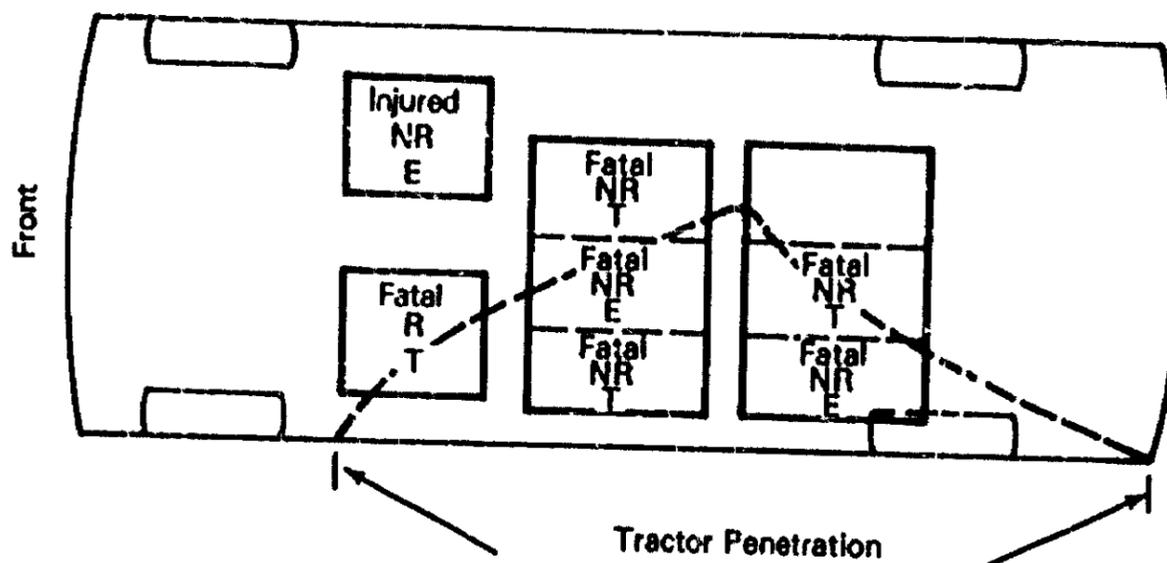
#### Medical and Pathological Information

An autopsy report released by the coroner of Lorain County, Ohio, attributed the cause of death of the van driver to massive head injuries sustained during the crash. There was no evidence of preexisting cardiovascular problems or other medical conditions which would have caused incapacitation. A toxicologic analysis of the driver's blood was negative for alcohol.

The coroner's report indicated the cause of death of the five passengers was either massive head injuries or skull fractures sustained during the crash.

<sup>2/</sup> The MUTCD is published by the Federal Highway Administration, U.S. DOT, 1978 and is the approved national standard for all highways open to public travel in accordance with Title 23, U.S. Code, Sections 109(b) and 402(c) and 23 CFR 1204.4.

<sup>3/</sup> Civil twilight is the interval between sunrise or sunset and the time when the true position of the center of the sun is 6° below the horizon, at which time stars and planets of the first magnitude are just visible and darkness forces the suspension of normal outdoor activities. (Smithsonian Meteorological Tables, Sixth Revised Edition -1951.)



- R — Restrained
- NR — Not Restrained
- T — Trapped
- E — Ejected
- F — Female
- M — Male

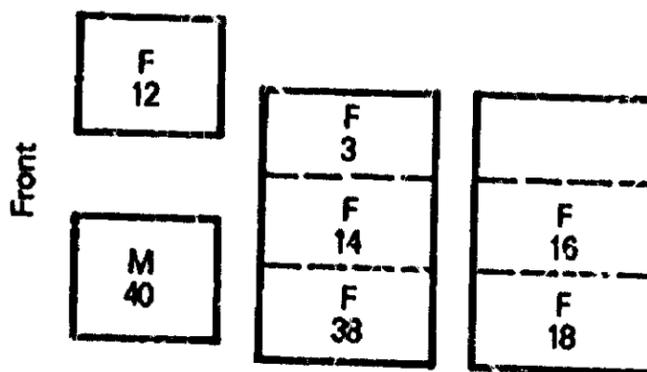


Figure 9.—Van seating diagrams.

FHWA Docket No. 79-31, Notice 2, October 16, 1980 (45 FR 68664) proposed that 23 CFR 630.1010(i) be revised to state:

Where two-way traffic must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated with positive barriers (concrete safety-shape or approved alternate) throughout the length of the two-way operation including transition areas. Where project conditions are such that the added risk of using other types of separation devices is considered minimal, drums, cones, tubular markers, or vertical panels may be used in place of positive barriers. The use of striping and complementary signing alone is prohibited.

The construction work zone where the accident occurred was not subject to Federal regulations and did not have to comply with any of the requirements specified.

### ANALYSIS

#### The Accident

There was no evidence of preimpact mechanical deficiencies on either vehicle which might have contributed to the accident. Although the postcrash inspection revealed that the tractor's front-axle service brakes were out of adjustment, the tractor's drive-axle and semitrailer service brakes were properly adjusted and capable of stopping a vehicle weighing 60,000 pounds (3 axles x 20,000 pounds). Since the combination vehicle only weighed 36,225 pounds, the overall braking capacity of the properly adjusted service brakes was more than sufficient to stop the combination vehicle during normal and emergency driving maneuvers.

Based on the witness statements and physical evidence at the scene, the Safety Board concludes that the van passed through the transition area and traveled about 0.2 mile before moving into the westbound traffic lane of the two-way construction zone. He traveled approximately 400 feet (5 seconds at 55 mph) <sup>4/</sup> within the westbound lane before impact occurred. During this time period the van forced an oncoming westbound car off the roadway, the van continued eastbound in the wrong lane until its driver saw the combination vehicle ahead. After perceiving the danger, the van driver and the truckdriver applied their brakes and attempted to steer to the right to avoid a collision.

Because there was no significant frontal impact damage on the van, initial contact probably occurred between the left-front fender panel of the van and the left-front headlamp panel of the tractor. Upon impact, the van ceased all forward motion and was pushed rearward into the eastbound traffic lane. During this movement, the tractor's front bumper progressed rearward into the left side of the van's passenger compartment extracting the driver's door and pushing the body components 8 1/2 feet rearward and inward. The van finally separated from the tractor and came to rest on the south shoulder of the eastbound lane. The combination vehicle continued west about 45 feet past the initial point of impact before coming to rest. During the collision, the tractor jackknifed to the left. The combination vehicle came to rest headed west in a jackknifed position straddling both lanes of the undivided roadway.

$$4/ \text{ Time} = \frac{\text{distance}}{\text{speed}} = \frac{400 \text{ feet}}{80.6 \text{ feet/second}} = 5 \text{ seconds; where } 55 \text{ mph} = 80.6 \text{ feet/second.}$$

The van and combination vehicle left 84 and 75 feet of skidmarks, respectively, up to the point of impact. Using the conservation of momentum theory, the Safety Board calculated that the van was traveling about 55 mph at the time its driver applied brakes. At impact the van had decelerated to a calculated speed of about 36 mph. Concurrently, the combination vehicle was traveling westbound at a calculated speed of about 44 mph before the truckdriver applied brakes.<sup>5/</sup> At impact, the combination vehicle had decelerated to about 29 mph. The closing speed for the two vehicles was calculated to be about 65 mph (95.3 feet/second) at impact. Assuming the preimpact speeds for the van and combination vehicle were 55 mph (80.7 feet/second) and 44 mph (64.5 feet/second), respectively, the following time/distance calculations were determined:

Preimpact time	Van distance west of impact (feet)		Combination vehicle distance east of impact (feet)		Vehicle separation (feet)
At 1 sec	80.7	+	64.5	=	145.2
At 2 sec	161.4	+	129.0	=	290.4
At 10 sec	807.0	+	645.0	=	1,452.0
At 15 sec	1,210.5	+	967.5	=	2,178.0
At 20 sec	1,614.0	+	1,390.0	=	3,004.0

The terrain was relatively flat in the accident area and the ambient lighting conditions were bright enough to permit driving without headlights. However, as the combination vehicle entered the accident curve, approximately 20 seconds from impact, it is unlikely that the truckdriver could have accurately determined in which traffic lane the van was traveling. The truckdriver probably could not have realized the danger until he was only 15 seconds from impact, when his eyeheight should have provided an unobstructed view of the van. (See figure 10.)

The van driver was neither alert nor driving defensively. He drove his vehicle on the wrong side of the roadway until impact, and forced a passenger car preceding the combination vehicle to drive off the roadway in order to avoid a collision. There is no evidence to suggest that the van driver took any evasive action until he was confronted with the combination vehicle occupying the same lane of travel. After recognizing the danger, the van driver only had about 1.84 seconds<sup>6/</sup> to execute an evasive steering and braking maneuver before impact. This was insufficient time to avoid the collision. The Safety Board concludes that the van driver was operating his vehicle in an inattentive manner and failed to recognize the danger until it was too late.

The Safety Board also concludes that the van driver probably was not incapacitated before impact since he did initiate an evasive maneuver. The autopsy and toxicological test results did not disclose any evidence of medical conditions which might have incapacitated him. He was in good health, and there is also no evidence to suggest that the van driver's actions might have been influenced by personal disorders or suicidal intentions. The driver had rested the night before, had been driving for only about 3 hours up to the time of the accident, and had been eating and drinking juice about 15 minutes before the collision. It is not likely that the van driver was experiencing extreme fatigue.

<sup>5/</sup> Speed determination was calculated based on postimpact transmission position, maximum governed engine rpm, drive-axle tire size, and rear-axle ratio.  
<sup>6/</sup> 1.09 seconds (84 feet ÷ 80.7 feet/second) + 0.75 second (for brake system to activate) = 1.84 seconds.

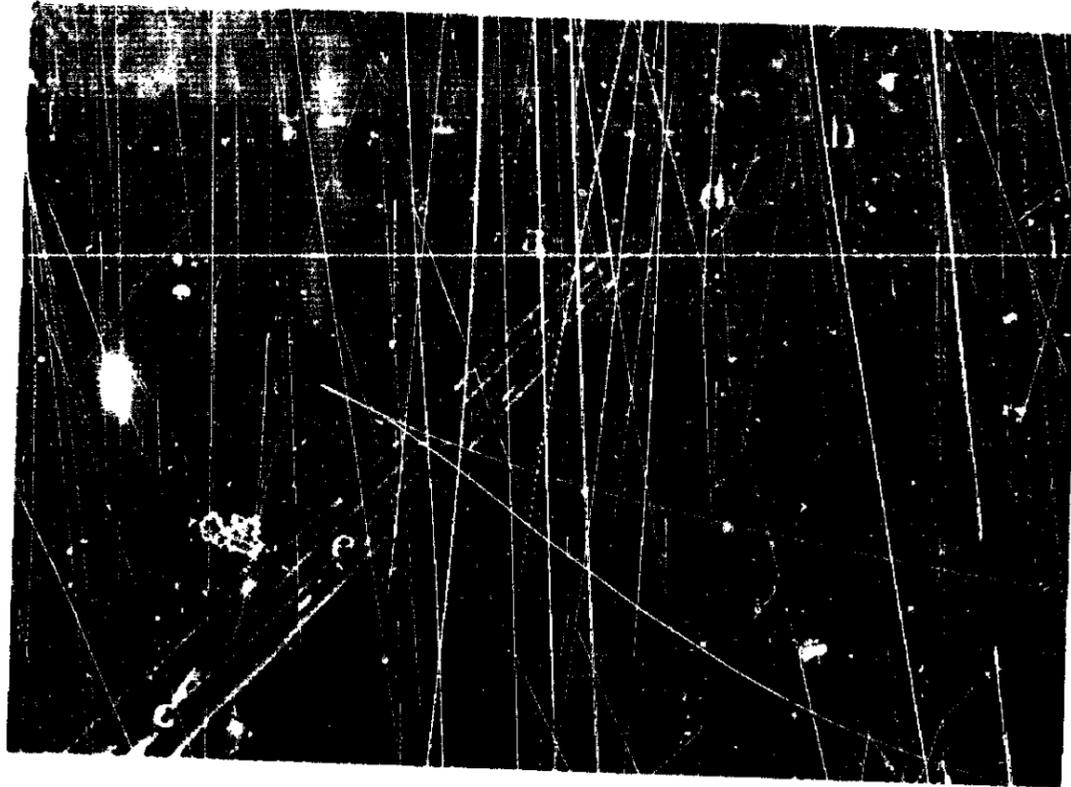


Figure 10.—Aerial view of accident site showing: (a) point of impact, (b) position of tractor-semitrailer 20 seconds (1,390 feet) before impact, (c) position of van 20 seconds (1,614 feet) before impact, (d) position of tractor-semitrailer 15 seconds (967.5 feet) before impact, and (e) position of van 15 seconds (1,210.5 feet) before impact.

#### Survival Aspects

The tractor of the combination vehicle penetrated the passenger compartment of the van during impact. Six of the seven occupants died from severe head injuries resulting from secondary impacts with the deformed sheet metal and interior body components. The surviving passenger was sitting in the right-front seat, an area where minimum deformation occurred. The use of the available occupant restraints probably would not have had any beneficial effect in this accident because of the severe dynamic impact loads and tractor penetration of the passenger compartment. Even though the van driver was restrained with a combination lap and shoulder harness, he did not survive the intrusion of the occupant space by the tractor.

#### The Highway

While there are no applicable national accident statistics available for two-lane undivided construction zones, national statistics do indicate that two-lane roadways experience higher accident rates than divided interstate roadways. Interstate-type highways have about one-half the fatal accident rate and about one-third the injury rate of two-lane, two-way roadways. One reason for safer travel on interstate roadways is the positive separation of two-way traffic by a median and/or barriers.

In the construction work zone where the accident occurred, the westbound lanes had been temporarily closed. All westbound traffic was being diverted and the eastbound lanes were accommodating two-way traffic. When a normally divided highway is reduced

to a two-lane, two-way situation, measures should be taken to maintain the safe driving conditions expected by the public when traveling on a divided interstate roadway.

There was no positive separation of the eastbound lanes in the construction zone to insure that two-way opposing traffic would remain within their proper lane. If positive separation, such as barriers, drums, cones, or vertical panels, were not feasible, then temporary striping should have been used in conjunction with appropriate warning signs and delineation devices to clearly indicate the required vehicle path. The Ohio Turnpike Commission opted to use dashed lane lines and complementary warning signs in the construction zone. The use of dashed lane lines may not have alerted the driver that he was in a temporary two-way opposing traffic situation, especially during early morning hours. The same type of pavement markings were being used as a lane division line on the divided highway prior to the construction zone.

The MUTCD recommends that the double yellow centerline be used in conjunction with other temporary delineation devices, such as raised pavement markers, in construction zones to denote the intended vehicle path. The double yellow centerline denotes the separation of traffic traveling in opposite directions, and the raised pavement marker provides a visual/audible indication to drivers that cross into another traffic lane. Raised pavement markers are normally more visible to drivers than dashed lane lines, especially in inclement weather conditions. The use of dashed lane lines in lieu of the normal double yellow centerline may have confused the van driver and led him to falsely assume that he was still on the divided roadway.

The Ohio Turnpike has been incorporated into the National System of Interstate Highways. Because the turnpike's construction and maintenance is financed solely by private revenue, it is not subject to any local, State, or Federal guidelines and regulations applicable to construction and maintenance projects. The highway industry associations and organizations representing toll roads and turnpikes of this type have not adopted any uniform body of guidelines for highway improvements, although most adhere voluntarily to the applicable standards of the State involved. Transportation organizations should develop and adopt uniform voluntary standards with respect to signing, markings, and separation, such as those in the MUTCD, which will be applicable to all phases of design, construction, and maintenance of highways not funded with public revenue or subject to public regulations.

The Safety Board investigated a similar accident in August 1979 in which a westbound tractor-semitrailer sideswiped an eastbound tractor-semitrailer and then struck an eastbound motor home on Interstate 80 about 30 miles northwest of Laramie, Wyoming. <sup>7/</sup> Interstate 80 was under construction and both eastbound and westbound traffic was traveling on the undivided two-way westbound lanes. Two persons in the westbound truck and six of the seven persons in the motor home were killed.

Just as in the Cleveland accident, there was no positive separation of traffic—only dashed white lane lines—in the construction zone. There was no Federal funding involved in either of these construction projects. The PHWA's September 17, 1979, emergency rule would not have applied to the Wyoming I-80 construction project since 23 CFR 630.1010 applies only to Federal-aid projects and is not retroactive.

<sup>7/</sup> Highway Accident Report—"Multiple-Vehicle Collision in a Construction Zone, U.S. Interstate 80, near Laramie, Wyoming, August 22, 1979" (NTSB-HAR-80-1).

<sup>8/</sup> In lieu of existing channelizing devices (i.e. drums, barrels, barricades, vertical panels, flexible tubes, etc.).

As a result of the Safety Board's investigation of the Wyoming accident, the following recommendations were made to the FHWA concerning construction zones:

Expand the Emergency Final Rule, 23 CFR 630.1010 to apply to all construction and maintenance zones on divided Federal-aid roads. (H-80-9)

Promote the development of a traffic control device [8/] to fill the gap between the shaped concrete barrier and traffic cones to serve as a continuous visual barrier to separate traffic in work zones. (H-80-11)

The FHWA's response to recommendation H-80-9 was, in part:

The FHWA does not agree that it is appropriate to extend the emergency final rule revising 23 CFR, Part 630, Subpart J (PHPM 6-4-2-12). This was a revision to previously adopted regulations concerning traffic safety in highway and street work zones and is intended to apply only to Federal-aid projects.

An alternative approach has already been initiated by FHWA. An Advance Notice of Proposed Rulemaking was published in the Federal Register on January 3, 1980, announcing proposed changes to the Manual on Uniform Traffic Control Devices (MUTCD). One of the proposals (Request VI-14) is to include provisions similar to the emergency rule as part of the MUTCD. This will make the provisions applicable to all roadway work zones, Federal-aid as well as non-Federal-aid. 9/

The Safety Board has been informed by FHWA officials that the proposal to change the MUTCD and incorporate these provisions is being delayed until the final rule on 23 CFR 630.1010 has been issued in order to insure compatible language. The final rulemaking on 23 CFR 630.1010 is pending clearance through the FHWA. The Safety Board strongly supports a change in the MUTCD to incorporate provisions for positive separation of two-way traffic on a normally divided highway. The Safety Board urges the FHWA to expedite the approval of the proposed rulemaking.

The FHWA's response to recommendation H-80-11 was:

It is very difficult to promote a device which has not been clearly identified and possibly not invented. The FHWA continues to identify needs and develop solutions to improve work zone safety. With an active and continuing research and development program in the area of work zone safety, the FHWA has the ability to identify, test, improve, and promote the use of new devices suitable for delineating a work zone. We are unable to respond positively to all the ideas implicit in this recommendation; however, we believe we have programs which will accomplish the same end results. 10/

8/ In lieu of existing channelizing devices (i.e. drums, barrels, barricades, vertical panels, flexible tubes, etc.).

9/ October 8, 1980, letter from Federal Highway Administrator to the National Transportation Safety Board.

10/ Ibid.

The FHWA Office of Research has proposed a project titled "Development of a Low-Cost, Low-Maintenance Channelizing Device." under Project 1Y, Traffic Management in Construction and Work Zones. The Safety Board believes that this accident once again demonstrates the need for a safe, inexpensive, lightweight, strongly anchored, structurally sound, small-based device that would function as a barrier separating traffic flow. The Safety Board believes that in order to accomplish the end result referred to in the above response, the FHWA should expedite the proposed project.

### CONCLUSIONS

#### Findings

1. There is no evidence of preimpact vehicle deficiencies which might have contributed to the accident.
2. The van driver was operating his vehicle in an inattentive manner.
3. There is no evidence to suggest that the van driver was either fatigued or incapacitated before straying into the opposing traffic lane.
4. The van was traveling about 55 mph at the time its driver first saw and reacted to the presence of a combination vehicle in the same lane. The combination vehicle was traveling at approximately 44 mph before the truckdriver saw the van and applied his brakes.
5. The use of the available occupant restraints by the van passengers probably would not have had any beneficial effect in the accident.
6. If a delineation device (i.e. raised pavement markers) had been used in conjunction with a double yellow centerline in the construction work zone, the van driver might have been alerted and stayed within his proper traffic lane.
7. If positive separation devices had been used in the construction work zone, the van driver probably would have stayed within the proper lane of traffic and not struck the combination vehicle.
8. Highway industry associations should adopt uniform voluntary standards, such as those in the MUTCD, with respect to signing, markings, and separation which will be applicable to all phases of the design, construction, and maintenance of highways funded by private revenue.
9. The FHWA should initiate action to promptly adopt the proposed rulemaking which revises the MUTCD and incorporates the provisions outlined in "Emergency Final Rule, 23 CFR 630.1010."
10. The FHWA should expedite the proposed research project entitled "Development of a Low-Cost, Low-Maintenance Channelizing Device."

#### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the van driver to maintain his vehicle within the proper traffic lane. Contributing to the cause of the accident was the lack of positive separation of opposing traffic in the construction work zone.

### RECOMMENDATIONS

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

--to the International Bridge, Tunnel and Turnpike Association and the American Road and Transportation Builders Association:

Develop and adopt voluntary standards similar to those required in the Manual on Uniform Traffic Control Devices by the Federal Highway Administration with respect to signing, markings, and separation which will be applicable to the design, construction, and maintenance of highways funded by private revenue but intended for public use. (Class II, Priority Action) (H-82-6)

--to the Ohio Turnpike Commission:

Develop and implement an operational policy that will insure that when the turnpike carries two-way traffic in a construction zone, positive barriers and/or drums, cones, or vertical panels are used to maintain separation of the two-way traffic. If positive barriers or other traffic lane channelization devices are not practical or feasible, use delineation devices, such as raised pavement markers, in conjunction with temporary solid double yellow centerlines to separate two-way traffic. (Class II, Priority Action) (H-82-7)

--to the Federal Highway Administration:

Promptly adopt the final rule changing the Manual on Uniform Traffic Control Devices to incorporate the provisions of the "Emergency Final Rule, 23 CFR 639.1010." (Class II, Priority Action) (H-82-8)

Expedite the proposed research project titled "Development of a Low-Cost, Low-Maintenance Channelizing Device." (Class II, Priority Action) (H-82-9)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ PATRICIA A. GOLDMAN  
Member

/s/ G. H. PATRICK BURSLEY  
Member

March 24, 1982

**APPENDIX**  
**INVESTIGATION**

**Investigation**

The National Transportation Safety Board was notified of the accident at 8:30 a.m. on July 22, 1981. Investigators were dispatched from Washington, D.C. Headquarters on July 22, 1981. Safety Board investigators were assisted by representatives of the Ohio State Highway Patrol and the Ohio Turnpike Commission.

**Depositions/Hearings**

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