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ON-SITE SCHOOL BUS INVESTIGATION

CASE NUMBER - IN-05-015
LOCATION - OKLAHOMA
VEHICLE - 1991 CARPENTER (ON A FORD B700 CHASSIS) SCHOOL BUS
CRASH DATE - March 2005

Submitted:

September 29, 2006
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Contract Number: DTNH22-01-C-07002

Prepared for:

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National Highway Traffic Safety Administration
National Center for Statistics and Analysis
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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

Technical Report Documentation Page

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15. *Supplementary Notes* On-site school bus investigation involving a 1991 Carpenter (on a Ford B700 chassis) school bus not equipped with safety belts.			
16. *Abstract* This report covers an on-site school bus investigation that involved a 1991 Carpenter (on a Ford B700 chassis) school bus (case vehicle) and a 2004 Chevrolet K3500 Silverado 4x4 truck (other vehicle) pulling a loaded stock trailer, which collided right front corner to front left corner in the intersection of a county road and a two-lane state highway. This crash is of special interest because one of the bus passengers [16-year-old, (unknown race and ethnic origin) female] sustained a fatal injury and was reported in the news story as being trapped by the bus door. The focus of this investigation was to determine the kinematics and injury mechanisms of the fatally injured passenger, and to determine if the bi-fold bus door played a roll in her fatal injuries. The case vehicle was traveling east on a two-lane county road and stopped at the stop sign at the four-leg intersection of a two-lane state highway. The Chevrolet was traveling north in the northbound lane of the state highway approaching the intersection. The case vehicle's driver proceeded eastbound across the intersection and the front left corner of the Chevrolet impacted the right front corner of the case vehicle. The case vehicle rotated counterclockwise and the Chevrolet deflected to the right. The left side of the Chevrolet's stock trailer then impacted the right side of the case vehicle. The case vehicle came to final rest on the east side of the roadway heading slightly southwest. The Chevrolet came to rest on the east side of the roadway heading slightly northwest. The fatally injured passenger was seated in the 1st row, left seat center. She was not restrained. There was no safety belt available. She was thrown to the right side of the case vehicle by the impact, impacted her head on a window frame and was subsequently thrown into the door well during the post-impact counterclockwise rotation and came to rest against the bi-fold door. There was no evidence she was physically trapped by the bi-fold door. The evidence indicated the case vehicle's bi-fold door did not play a roll in her fatal injury.			
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This investigation was brought to NHTSA's attention on or before March 31, 2005 by an Oklahoma television station news story. This crash involved a 1991 Carpenter (on a Ford B700 chassis) school bus (case vehicle) and a 2004 Chevrolet K3500 Silverado 4x4 truck (other vehicle) towing a twenty four foot Gooseneck stock trailer loaded with 17 head of Angus calves. The crash occurred in March, 2005 at 4:05 p.m., in Oklahoma and was investigated by the Oklahoma Highway Patrol. This crash is of special interest because one of the bus passengers [16-year-old, (unknown race and ethnic origin) female] sustained a fatal injury and was reported in the news story as being trapped by the bi-fold bus door. The focus of this investigation was to determine the kinematics and injury mechanisms of the fatally injured passenger, and to determine if the bi-fold bus door played a roll in the fatality. In addition, this report addresses the kinematics and restraint usage of the driver and a third passenger who sustained a police reported "B" injury. The other six bus passengers were not injured. This contractor inspected both vehicles on April 25, 2005 and inspected the scene on April 26, 2005. An interview was conducted with two of the bus passengers on July 14, 2005. Rescue personnel were interviewed on August 1, 2005. This contractor also interviewed the case vehicle's driver on September 20 2006. This report is based on the police crash report, police supplemental reconstruction report, scene and vehicle inspections; an interview with the case vehicle's driver, two of the bus passengers and rescue personnel; a post-mortem examination record of the fatally injured passenger; medical records for the second row, right window seat passenger; occupant kinematic principles and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling east on a two-lane county road and stopped at the stop sign at the four-leg intersection of a two-lane state highway. The Chevrolet was traveling north in the northbound lane of the state highway approaching the intersection. Witnesses in the case vehicle stated that the driver looked both ways before pulling into the intersection. The case vehicle's driver made no pre-crash avoidance maneuver. The police crash report concluded that the bus driver did not see the approaching Chevrolet due to a vision obstruction caused by the bus's right "A" pillar and side view mirror. The Chevrolet steered right in an attempt to avoid the crash; however, the front left of the Chevrolet impacted the front of the case vehicle's right fender and front bumper corner. The Chevrolet underrode the case vehicle's right frame member and front right bumper corner. The case vehicle rotated counterclockwise, the Chevrolet deflected to the right and the left side of the Chevrolet's stock trailer impacted the right side of the case vehicle. The case vehicle continued to rotate counterclockwise and came to final rest on the east side of the roadway heading slightly southwest. The Chevrolet deflected to the right and traveled off the east side of the roadway and traveled approximately 156 meters (512 feet) and came to rest on the east side of the roadway heading slightly northwest. The case vehicle and Chevrolet's crash severity was estimated to be high [greater than 40 km.p.h. (25 m.p.h)]. At the time of the crash the light condition was daylight, the atmospheric condition was cloudy and the roadway pavement was dry.

Immediately prior to the crash, the case vehicle's 1st row, left seat center passenger was seated in an unknown position. She was not restrained. There was no safety belt system available. The impact with the Chevrolet caused the passenger to be thrown out of her seat to the

right, across the aisle and over the right cushion barrier. Her head impacted the window frame, glazing and window sill immediately behind the bi-fold door causing blunt head trauma and contusions to her face and head. Her torso also impacted the window frame, glazing and side surface in the 1st row, right seat area. She was subsequently thrown into the door well as the case vehicle rotated counterclockwise, and she came to rest against the bi-fold door.

The front section of the case vehicle's bi-fold door was jammed due to crash damage. The rescue crew cut the door actuating rod and forced the door open in order to remove the passenger from the case vehicle. The passenger was not physically pinned by the bi-fold door and there was no evidence the bi-fold door played a roll in her fatal injury. The passenger was determined to have expired from her injuries prior to efforts to remove her from the vehicle.

The case vehicle's driver was restrained by her two-point lap belt. She sustained a fractured left wrist from impacting the steering wheel rim, a large C-shaped laceration from impacting the door control lever and multiple lacerations and contusions. She was transported from the scene by ambulance and admitted to the hospital for treatment of her injuries.

The case vehicle's second row, right window seat passenger was not restrained. There was no safety belt system available. She sustained a concussion and a displaced right clavicle fracture from impacting the right side window frame as well as multiple lacerations, abrasions and contusions. She was transported by ambulance and admitted to the hospital for treatment of her injuries.

The remaining six passengers in the case vehicle were not injured. They were not transported to a medical facility.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle was traveling was a two-lane, undivided, county roadway traversing in an east and west direction. The case vehicle was stopped at a four-leg intersection. The trafficway on which the Chevrolet was traveling was a two-lane, undivided, state highway, traversing in a north and south direction and approached the four-leg intersection. The case vehicle's approach roadway was gravel with two travel lanes, grass shoulders and was controlled by a stop sign. The total width of the roadway was 6.9 meters (22.6 feet). The Chevrolet's approach roadway was uncontrolled with two bituminous travel lanes and wide grass shoulders. Each travel lane was 3.5 meters in width (11.5 feet). The grade of the roadway on the approach to the intersection was 1% negative.. Roadway pavement markings consisted of solid white edge lines and broken yellow center line. The speed limit for the case vehicle was 72 km.p.h. (45 m.p.h.). The speed limit for the Chevrolet was 105 km.p.h. (65 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was cloudy and the roadway pavement was dry. Traffic density was light and the site of the crash was rural. See the Crash Diagram at the end of this report.

Pre-Crash: The case vehicle was traveling east in the eastbound lane and was stopped at the stop sign (**Figure 1**). The case vehicle's driver was intending to proceed through the intersection and continue eastbound. The Chevrolet was traveling north in the northbound lane (**Figure 2**). The Chevrolet's driver was intending to continue eastbound. Witnesses in the case vehicle stated that the driver looked both ways before pulling into the intersection. The police crash report concluded that the bus driver did not see the approaching Chevrolet due to a vision obstruction caused by the bus's right "A" pillar and side view mirror. Observations made from the driver's seat during the vehicle inspection indicated that the police conclusion is a plausible. The case vehicle's driver made no pre-crash avoidance maneuver. The evidence and the police crash report indicate the Chevrolet steered right in an attempt to avoid the crash. The crash occurred in the four-leg intersection of the two trafficways (**Figure 3**).

Figure 1: Approach of case vehicle eastbound to intersection

Figure 2: Approach of Chevrolet northbound to impact (arrow)

Figure 3: Location of impact from Chevrolet's approach

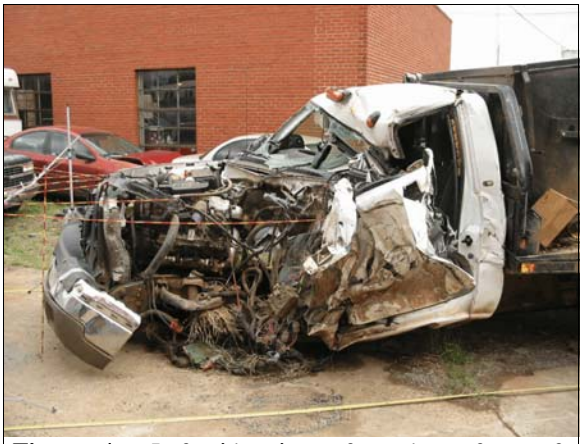


Figure 4: Left side view of crush to front of Chevrolet and collapse of driver's side of cab, each increment on rods is 5 cm (2in)

Crash: The front left of the Chevrolet (**Figure 4**) impacted the front portion of the case vehicle's right fender and front bumper corner (**Figure 5** below). There was a mismatch between the height of the Chevrolet's front bumper and the side and front bumper of the case vehicle. The bumper and left frame member of the Chevrolet sustained only minor engagement as the Chevrolet underrode the case vehicle's right frame member and front right bumper corner. The Chevrolet's

left fender was heavily engaged and crushed rearward. There was also major engagement to the cowl, which collapsed the driver's passenger compartment (**Figure 4** above). The case vehicle rotated counterclockwise and the Chevrolet deflected to the right. The left front door of the Chevrolet (**Figure 6** below) engaged the case vehicle's right front wheel. The left side of the Chevrolet (**Figure 7** below) engaged the case vehicle's cowl and side view mirror (**Figure 8** below). The stock trailer's gooseneck impacted the case vehicle's bi-fold door and roof (**Figure 8** below) and the trailer impacted the right rear side of the case vehicle (**Figures 9** and **10** below).

Figure 5: Damage to right front of case vehicle from due to impact with the Chevrolet

Figure 6: Impression of case vehicle's right front wheel in Chevrolet's driver door

Figure 7: Damage to left side of Chevrolet from engagement with cowl and door of case vehicle, arrows show yellow paint transfer

Figure 8: Overview of damage to cowl, side view mirror, bi-fold door and roof due to impact with Chevrolet and trailer

Figure 9: Damage to left side of stock trailer due to impact with the right side of the case vehicle

Figure 10: Damage to right rear side and roof of case vehicle due to impact with the left rear side of the stock trailer

Post-Crash: As a result of the impact, the case vehicle rotated counterclockwise approximately 240 degrees and came to final rest on the east side of the roadway heading slightly southwest (**Figure 11**). The Chevrolet deflected to the right and traveled off the east side of the roadway and traveled approximately 156 meters (512 feet) and came to rest on the east side of the roadway heading slightly northwest (**Figure 12**).

Figure 11: View to southwest through case vehicle's area of final rest (arrow) back to impact area

Figure 12: View to southwest through Chevrolet's area of final rest (orange flags), arrow shows impact area

CASE VEHICLE

The Carpenter school bus body was mounted on a 1991 Ford B700 rear-wheel drive chassis (VIN: 1FDPJ75P9MV------) equipped with a 6.6 L, V6 turbo diesel engine; power assisted hydraulic brakes and a four speed automatic transmission. There were eleven rows of passenger seats. Each passenger seat accommodated three passengers with the exception of the eleventh row left seat, which accommodated two passengers. The passenger seats were not equipped with safety belt systems. However, the latch plate side of a lap belt was found bolted to the floor in the second row, right seat.

Exterior Damage: The case vehicle's initial impact with the Chevrolet involved the right corner of the front bumper, right fender, and the hood. In addition, the right front wheel, cowl and right side view mirror assembly were directly damaged by contact with the left side of the Chevrolet. The stock trailer's gooseneck impacted and damaged the top of the front section of the bi-fold door and the roof. The front wheel assembly was knocked off the case vehicle by the impact. The direct damage from the initial impact began at the right front bumper corner and extended rearward approximately 151 centimeters (59 inches). The impact shattered the case vehicle's fiberglass fenders and hood, and the engine compartment was shifted to the left. In addition, there was approximately 23 centimeters (9 inches) of leftward shift of both frame rails. The side-slap impact by the Chevrolet's stock trailer directly damaged the side and roof of the case vehicle forward and rearward of the right rear wheel. The direct damage began approximately 167 centimeters (65.7 inches) forward of the right rear axle and extended rearward 304 centimeters (119 inches). Induced damage involved the engine compartment, cowl, windshield, right side and roof of the case vehicle.

Case Vehicle Bi-Fold Door Damage Analysis: The front section of the bi-fold door was directly damaged and the door was twisted (**Figure 13** and **Figure 14**). The undeformed width of each of the two door sections was 33 centimeters. The top of the front door section was crushed to a width of 28 centimeters and both windows were broken out. In addition, the piano hinge on the front door section was jammed by the deformation of the cowl (**Figure 14**), and an approximate 20 centimeter (7.9 inches) section of the door actuating rod had been removed by the rescue crew to facilitate opening the door. Much of the twisting deformation of this section of the door was done as the door was forced open by the rescue crew. The rear section of the door had only minor induced damage and was free to open. It was determined by the evidence in the vehicle and an interview with rescue personnel that there was no involvement of the bi-fold door in the fatal injury to the passenger seated in the 1st row, left seat center position. The evidence in the case vehicle indicated that her fatal injury was not related to interaction with the bi-fold door, but was due to head impact to the lower window frame and window sill immediately rear of the bi-fold door (**Figures 15** and **16** below). The passenger was thrown into the door well during the crash, but she was not physically pinned by the damaged bi-fold door. The passenger was determined to have expired from her injuries prior to efforts to remove her from the vehicle.

Figure 13: Overview of damage to top of front section of the bi-fold door

Figure 14: Overview of damage to front section of bi-fold door and deformation of door piano hinge

Figure 15: Overview of head contact (arrow) from passenger seated in 1st row, left seat center

Figure 16: Close view of head contact to window frame and side surface immediately rear of bi-fold door

Figure 17: Damage to right side from impact by passenger seated in 1st row, left seat center

Vehicle Interior: Inspection of the case vehicle's interior revealed occupant contact evidence on the right side window frame and window sill immediately rear or the bi-fold door. This area was just in front of the cushion barrier located between the right first seat row and the door well. The occupant contact evidence on the window frame and window sill consisted of tissue, blood and a few strands of hair. In addition, there was a large deposit of blood on the steps in the door well. Immediately behind the cushion barrier in the right first seat row was evidence of a hard occupant impact to the window frame and side surface. This impact was of sufficient severity that it bowed the window frame and side surface outward (**Figure 17** and **Figure 18** below). The window glazing was also broken. The source of both of these areas of damage was contact by the fatally injured passenger who was seated in 1st row, left seat center. Evidence of occupant contact was also found in the right second passenger seat area. A 15-year-old female passenger was seated in the window seat in this position. The side window was broken, the window frame was bent outward and the side surface appeared to have been impacted. In addition, the right portion of the seat back in front of this position appeared slightly deformed.

Damage Classification: No damage classification could be assigned to the case vehicle because it is outside the scope of the CDC and TDC damage classification systems. Based on the damage and impact configuration, the case vehicle sustained a direction of principal force of approximately

3 o'clock (100 degrees). The WinSMASH reconstruction program, could not be used to determine the case vehicle's Delta-V because buses are outside the scope of the WinSMASH program. Based on the damage to the case vehicle, the Chevrolet and the post-crash trajectories, the case vehicle's crash severity was estimated to be high [greater than 40 km.p.h. (25 m.p.h)]. The case vehicle was towed due to damage.

Figure 18: Outward buckle of right side of case vehicle (arrow) due to interior impact by passenger seated in the 1st row, left seat center

CASE VEHICLE 1ST ROW, LEFT SEAT CENTER PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's 1st row, left seat center passenger [16-year-old (unknown race and ethnic origin) female; unknown height and weight] was seated in an unknown position. She was not restrained. There was no safety belt system available.

The impact with the Chevrolet caused the passenger to move to the right. She was thrown across the aisle and over the right cushion barrier. Her head impacted the window frame, glazing and window sill immediately behind the bi-fold door (**Figures 15** and **16** above) causing blunt head trauma and contusions to her face and head. Her torso also impacted the window frame, glazing and side surface in the right first row seat area (**Figures 17** above and **Figure 18**). She was subsequently thrown into the stair well as the case vehicle rotated counterclockwise and came to final rest against the bi-fold doors.

The front section of the bi-fold door was jammed due to crash damage. The rescue crew cut the door actuating rod and forced the door open in order to remove the passenger from the case vehicle. There was no evidence the passenger was physically pinned by the bi-fold door and no evidence the bi-fold door played a roll in her fatal injury. The passenger was determined to have expired from her injuries prior to efforts to remove her from the case vehicle.

CASE VEHICLE 1ST ROW, LEFT SEAT CENTER PASSENGER INJURIES

The police crash report indicated the 1st row, left seat center passenger sustained a fatal injury and was transported from the scene to a funeral home. The passenger's injuries and injury mechanisms are shown in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Blunt head trauma, not further specified, and a spinal tap was bloody	unknown 115999.7,0	Right side window frame and sill	Certain	Post-mortem examination
2	Contusion, 6.4 cm (2.5 in), above hairline just right of midline	minor 190402.1,5	Right side window frame and sill	Certain	Post-mortem examination
3 4	Contusion right periorbital, not further specified and left periorbital, not further specified	minor 297402.1,1 297402.1,2	Right side window frame and sill	Certain	Post-mortem examination

CASE VEHICLE 2ND ROW, RIGHT SEAT WINDOW PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's 2nd row, right seat window passenger [15-year-old (unknown race and ethnic origin) female; 160 centimeters and 91 kilograms (63 inches, 200 pounds)] was seated in an unknown position. She was not restrained. There was no safety belt system available.

The impact with the Chevrolet caused the passenger to move to the right and she impacted her head on the right side window frame and glazing causing a concussion and a scalp laceration. She also impacted her right shoulder and forearm on the right side window frame and glazing causing a displaced clavicle fracture and multiple abrasions and an avulsion to her right forearm. In addition, she impacted her chest on the seat back in front of her during the case vehicle's counterclockwise rotation bruising her chest. She also sustained a contusion and abrasion to the left calf, possibly due to contact with the seat cushion during the case vehicle's initial impact with the Chevrolet. She came to rest within her seat position. Interview information indicated that the 2nd row, left seat window passenger was thrown across the aisle and came to rest top of this passenger.

CASE VEHICLE 2ND ROW, RIGHT SEAT WINDOW PASSENGER INJURIES

The police crash report indicated that the 2nd row, right seat window passenger sustained a "B" (non-incapacitating-evident) injury and was transported by ambulance to a medical facility. The passenger's injuries and injury mechanisms are shown in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Unconscious 5-10 minutes at scene with amnesia of event in emergency department	moderate 160202.2,0	Right side window frame	Probable	Emergency room records

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Fracture, displaced, right mid-clavicle	moderate 752200.2,1	Right side window frame	Probable	Hospitalization records
3	Laceration, approximately 5 cm (~2.0 in) right scalp near frontoparietal area with swelling	minor 190602.1,1	Right side window frame	Probable	Hospitalization records
4	Contusions left and right anterior chest wall, primarily on left	minor 490402.1,3	Seat back, right side	Probable	Hospitalization records
5	Abrasions, multiple, right forearm, not further specified	minor 790202.1,1	Noncontact injury: flying glass, right side glazing	Probable	Hospitalization records
6	Avulsion {flap laceration}, 1.5 cm (0.6 in) right anterolateral forearm near right elbow	minor 790802.1,1	Noncontact injury: flying glass, right side glazing	Probable	Hospitalization records
7	Abrasion left calf, not further specified	minor 890202.1,2	Seat cushion, right side passenger's	Possible	Hospitalization records
8	Contusion, extensive, left calf, not further specified	minor 890402.1,2	Seat cushion, right side passenger's	Possible	Hospitalization records

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash, the case vehicle's driver [50-year-old, White (non-Hispanic) female; 168 centimeters and 91 kilograms (66 inches, 200 pounds)] was seated in an upright position with both hands on the steering wheel at the approximate 10 and 2 o'clock positions. She had her right foot on the accelerator and left foot on the floor. Her seat track was adjusted to between its middle and forward-most position. The seat back and steering column were not adjustable.

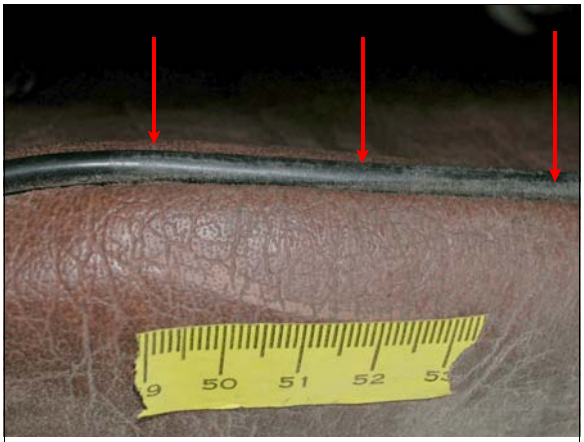


Figure 19: Safety belt abrasion on left side of driver's seat cushion and seat cushion piping (arrows)

The evidence observed at the vehicle inspection indicated the driver was restrained by her manual lap belt. There was an abrasion on the seat cushion and piping on the left side of her seat (**Figure 19**) consistent with loading by the lap belt, and the seat frame and metal safety belt buckle anchor (**Figure 20** below) were bent to the right consistent with loading by a restrained driver during the crash. In addition, there were blood stains on the lap belt consistent with the lap belt being out of its retractor in the crash. The driver also reported belt pattern bruising on her hips and abdomen.

The impact with the Chevrolet caused the driver to move to the right and she loaded her safety belt bruising both thighs and her abdomen. Her left wrist impacted the right portion of the steering wheel rim fracturing her wrist. She was thrown to the right to the extent that her right wrist impacted the floor causing a large bruise to her wrist. During the case vehicle's post-impact counterclockwise rotation she moved back to the left and impacted the left side of her head on the door control lever (**Figure 21**) causing a 15 to 20 centimeter (6 to 8 inch) C-shaped laceration on the left side of her head. She also sustained numerous small lacerations to her forehead from flying glass particles from a broken window in the bi-fold door. The driver remained in her seat as the case vehicle came to final rest. She was removed from the case vehicle by rescue personnel.

Figure 20: Base of case vehicle driver's seat and safety belt anchor shifted to the right

Figure 21: Case vehicle's left instrument panel and steering wheel, arrow shows door control lever

CASE VEHICLE DRIVER INJURIES

The police crash report indicated that the case vehicle's driver sustained an "A" (incapacitating) injury. The driver was transported by ambulance to a medical facility and admitted for treatment of her injuries. The driver indicated that she was off work one year as a result of the crash and received follow-up treatment for neurological problems. The table below shows the case vehicle driver's injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fracture, comminuted, left distal {i.e., close to wrist} ulna	serious 753204.3,2	Steering wheel rim	Possible	Interviewee (same person)
2	Laceration, "C"-shaped, 15.2-20.3 cm (6-8 in) in length, from front to back, along left scalp, not further specified	minor 190602.1,2	Door control lever, mounted near steering wheel	Probable	Interviewee (same person)
3	Lacerations, small, on forehead at hairline	minor 290602.1,7	Noncontact injury: flying glass, right front door glazing	Probably	Interviewee (same person)

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
4	Contusion x 3 {hematomas} on abdomen over stomach near center	minor 590402.1,4	Steering wheel rim	Certain	Interviewee (same person)
5	Contusion {serious bruises} about right wrist, not further specified	minor 790402.1,1	Floor	Possible	Interviewee (same person)
6	Contusions {hematoma} bilateral upper thigh/groin areas	minor 890402.1,3	Lap portion of safety belt system	Certain	Interviewee (same person)

CASE VEHICLE OTHER PASSENGERS

The remaining six passengers in the case vehicle were not injured and were not transported from the scene. Interview information indicated that the 4th passenger row, left seat center passenger was thrown across the aisle and came to rest in the forth passenger row, right seat. The sixth passenger row, left window seat passenger was thrown across the aisle and impacted the passenger in the seventh passenger row, right seat. Figures on pages 15 and 16 show the seating positions, age, sex, police reported injury status and transport status of all the case vehicle occupants.

OTHER VEHICLE

The 2004 Chevrolet K3500 Silverado was a four wheel drive truck (VIN: 1GBJK34114E------) equipped with a 6.6 L, V8 turbo diesel engine; automatic transmission, driver and front right passenger air bags and four wheel anti-lock brakes. The Chevrolet was configured as a flat bed truck with a "Hydra Feeder" mounted on the front of the flat bed, and a trailer hitch designed to accommodate a gooseneck trailer positioned over the rear axle. The Hydra Feeder was approximately three fourths full of corn. The Chevrolet was towing a twenty four foot Gooseneck stock trailer loaded with approximately 17 head of Angus calves.

Exterior Damage: The Chevrolet's initial impact with the case vehicle involved the left portion of the front bumper, and left fender. There was minor engagement of the Chevrolet's bumper and frame because the Chevrolet underrode the right front bumper corner and frame of the case vehicle. The direct damage began at the Chevrolet's front left bumper corner and extended 42 centimeters (16.5 inches) along the bumper. The maximum residual crush occurred above the bumper level and was measured as 151 centimeters (59.4 inches) occurring at C_1. The maximum residual crush at the bumper level also occurred at C_1 and was measured as 23 centimeters (9 inches). The Chevrolet's engagement with the case vehicle also involved the left side of the truck bed and left upright support of the "Hydra Feeder". There was no residual crush to these components. The Gooseneck stock trailer sustained direct damage to its left side due to the side-slap impact with the case vehicle. The direct damage began at the left rear corner of the trailer and extended 293 centimeters (115.4 inches) along the left side of the roof and 166 centimeters

(65.4 inches) along the left side of the trailer. In addition, the coupler shaft was bent rearward approximately 33 centimeters (13 inches). The table below shows the average of the Chevrolet's bumper and above bumper crush.

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	42	151	171	87	30	0	9	13	13	-66	0
in		16.5	59.4	67.3	34.3	11.8	0.0	3.5	5.1	5.1	-26.0	0.0

The Chevrolet's right side wheelbase was extended 7 centimeters (2.8 inches). The left side wheelbase dimension could not be determined because the left front wheel had been torn off the vehicle during the crash. Induced damage involved the front bumper, roof, left fender and truck bed.

The Chevrolet's recommended tire size was LT 245/75R16 or LT215/75R16; however, the vehicle was equipped with LT 215/85R16. The left front tire was not present at the vehicle inspection. The Chevrolet's tire data are shown in the table below.

Tire	*Measured Pressure*		*Recommend Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	Unk	Unk	Unk	Unk	Unk	Unk	Unknown	No	Unk
RF	207	30	Unk	Unk	5	6	None	No	No
LR Outside	Unk	Unk	Unk	Unk	5	6	None (valve stem full of mud)	No	No
LR Inside	359	52	Unk	Unk	4	5	None	No	No
RR Inside	379	55	Unk	Unk	4	5	None	No	No
RR Outside	359	52	Unk	Unk	4	5	None	No	No

Damage Classification: Based on the vehicle inspection the CDC for the Chevrolet was determined to be: **12-FLAW-7** (**0** degrees). No damage classification could be assigned to the stock trailer because it is outside the scope of CDC. The WinSMASH reconstruction program, could not be used to determine the Chevrolet's Delta-V due to the presence of a towed trailing unit

and because an impact with a bus is outside the scope of the WinSMASH program. Based on the damage to the Chevrolet, the bus and the post-crash trajectories, the Chevrolet's crash severity was estimated to be high [greater than 40 km.p.h. (25 m.p.h)]. The Chevrolet was towed due to damage.

Chevrolet's Occupants: According to the police crash report, the Chevrolet's driver [57-year-old, White (non-Hispanic) male] was not restrained by his manual, three-point, lap-and-shoulder safety belt system. He was fatally injured in the crash. The Chevrolet's front right passenger [54-year-old, White (non-Hispanic) female] was not restrained by her manual, three-point, lap-and-shoulder safety belt system. She sustained a police reported "A" (incapacitating) injury and was transported by ambulance to a medical facility.

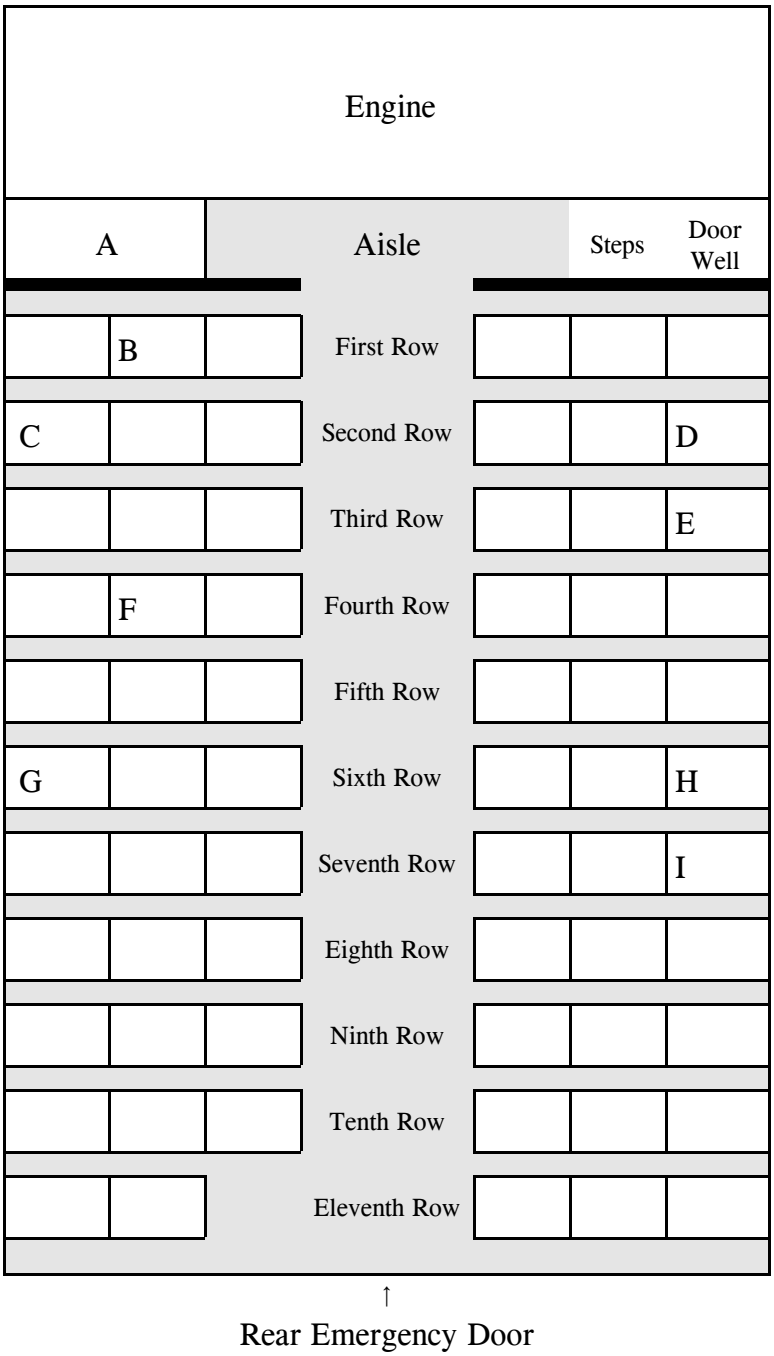
Neither the driver nor front right passenger air bags deployed in this crash. This contractor believes that due to the underride, which resulted in minimal bumper crush and no engagement of the vehicle's frame, the crash pulse was elongated and the electrical system was disrupted cutting power to the air bag system before deployment threshold was reached.

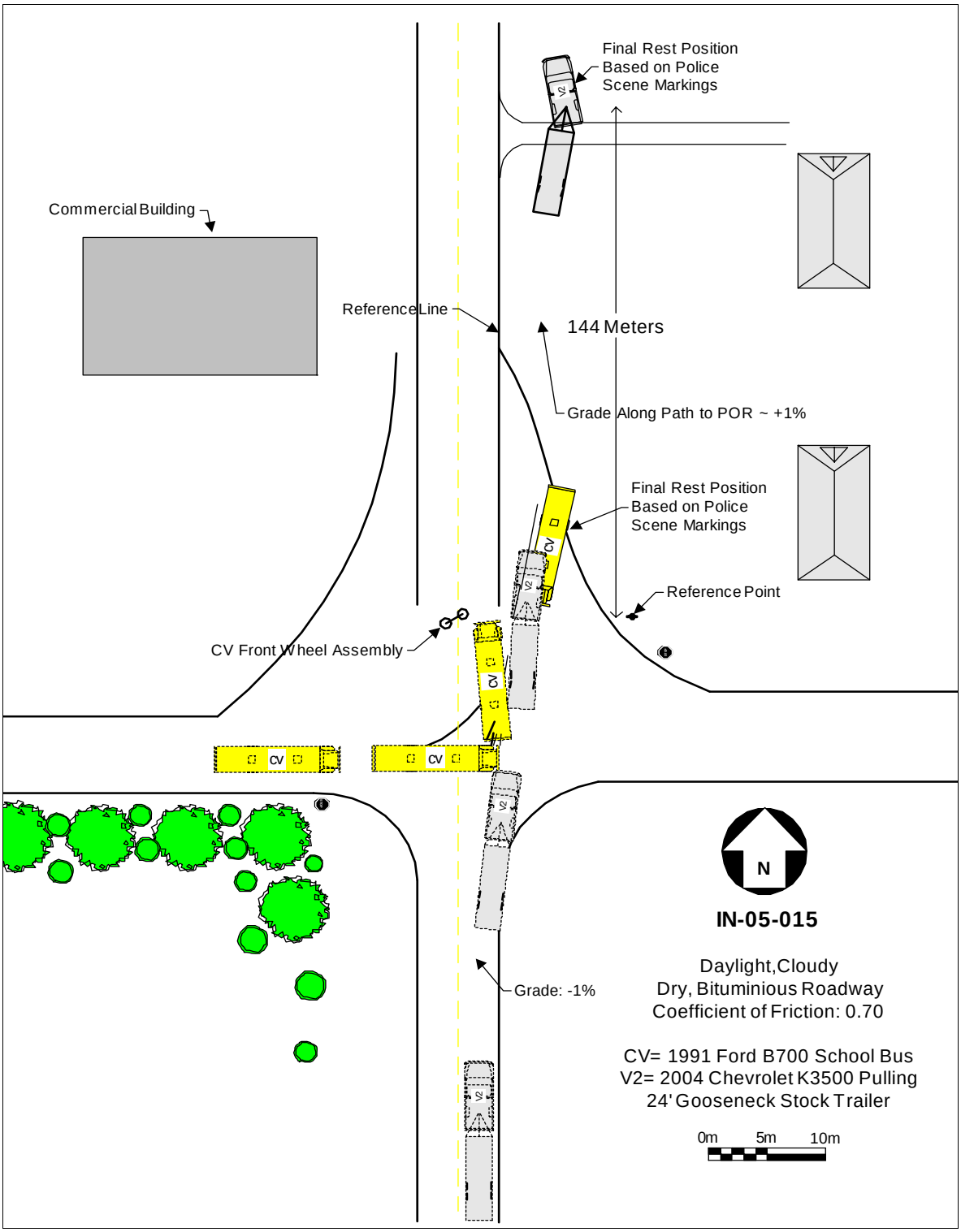
Figure 22: Arrows show Chevrolet's destroyed electrical wiring and electrical components

Occupant Identi-fication	Age	Sex	Police-reported injury descriptor	EMS Transport Status
A	50	Female	A	Transported by ambulance to medical facility
B	16	Female	Fatal	Transported to local funeral home
C	17	Female	No injury	Not transported
D	15	Female	B	Transported by ambulance to medical facility
E	17	Male	No injury	Not transported
F	16	Male	No injury	Not transported
G	14	Male	No injury	Not transported
H	12	Male	No injury	Not transported
I	15	Male	No injury	Not transported

A letter on the diagram corresponds to an occupant on the chart on page 15 above.

Shaded areas represent either an aisle or the area in front of a seat.




Final Rest Position
Based on Police
Scene Markings
Commercial Building
Reference Line
144 Meters
Grade Along Path to POR ~ +1%
Final Rest Position
Based on Police
Scene Markings
Reference Point
CV Front Wheel Assembly
CV
V2
N
IN-05-015
Grade: -1%
Daylight,Cloudy
Dry, Bituminious Roadway
Coefficient of Friction: 0.70
CV= 1991 Ford B700 School Bus
V2= 2004 Chevrolet K3500 Pulling
24' Gooseneck Stock Trailer
0m 5m 10m