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REMOTE CHILD SAFETY SEAT REPORT

CASE NUMBER - IN-02-011

LOCATION - Louisiana

VEHICLE - 1994 Mercury Villager

CRASH DATE - October 2001

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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. <i>Supplementary Notes</i> Remote child safety seat investigation involving a 1994 Mercury Villager minivan with four young child passengers, all in child safety seats, that was hit by a 2002 Freightliner truck-tractor with a semi-trailer					
16. <i>Abstract</i> This report covers a remote child safety seat investigation. The crash involved a 1994 Mercury Villager minivan (case vehicle), a 2002 Freightliner tractor pulling a tank semi-trailer (first other vehicle), a 2001 Isuzu straight truck (second other vehicle) and a 1996 Toyota Camry sedan (third other vehicle). This crash is of special interest because there were four small children in the case vehicle, all in child safety seats. Two of the children (3-year-old female and 3-year-old male) sustained fatal injuries, one (1-year-old male) sustained numerous serious injuries and was hospitalized, and one (1-year-old male) sustained minor soft tissue injuries and was treated and released at a hospital emergency department. The restrained driver (36-year-old female) and the restrained front right passenger (56-year-old female) were also killed. The case vehicle was traveling east in the inside eastbound lane of a two lane roadway that was part of a divided state highway. The Toyota Camry was also traveling east, in the outside eastbound lane of the same roadway, several hundred feet behind the case vehicle. The Isuzu was traveling west in the inside westbound lane and the Freightliner was traveling west in the outside westbound lane. The complex collision sequence began in the westbound lanes. The collision events are too complicated to enumerate in this abstract. In summary, the tractor-trailer's driver lost control and came yawing and sliding across the median in a southwesterly direction and entered the eastbound lanes. The right side of the tractor's engine compartment impacted the left front corner area of the case vehicle (event #6 of 10) in the inside westbound lane, causing catastrophic destruction of the minivan's front seat row and very heavy damage to the entire case vehicle. The tractor-trailer pushed the case vehicle across the outside lane and off the south edge of the road. The case vehicle and the tractor-trailer rig were towed due to disabling damage. The Isuzu and the Camry were driven from the scene. The four fatal victims were all declared dead at the scene.					
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This remote report was brought to the NHTSA's attention in November 2002 by a review of the 2001 Fatality Analysis Reporting System (FARS). The crash occurred in October 2001, at 11:30 a.m., in Louisiana, and was investigated by the applicable municipal police. The crash involved a 1994 Mercury Villager minivan (case vehicle), a 2002 Freightliner tractor pulling a tank semi-trailer (first other vehicle), a 2001 Isuzu straight truck (second other vehicle) and a 1996 Toyota Camry sedan (third other vehicle). This crash is of special interest because there were four small children in the case vehicle, all in child safety seats. Two of the children (3-year-old female and 3-year-old male, both white, unknown if Hispanic) sustained fatal injuries, one (1-year-old male, white, unknown if Hispanic) sustained numerous serious injuries and was hospitalized, and one (1-year-old male, white, unknown if Hispanic) sustained minor soft tissue injuries and was treated and released at a hospital emergency department. The restrained driver (36-year-old female, white, unknown if Hispanic) and the restrained front right passenger (56-year-old female, white, unknown if Hispanic) were also killed. This contractor contacted the investigating police agency and received the basic police crash report on November 4, 2002. At that time, a criminal trial related to this crash was in process and access to the investigative materials was postponed until the criminal trial was concluded. The police photographs were received on June 24, 2003. Civil litigation is continuing at the time of this report's submission and none of the next-of-kin were able to discuss the case. This report is based on the police crash report and police photographs, autopsy reports for the four fatal victims, hospital treatment records for the two non-fatal victims, occupant kinematic principles and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling east in the inside eastbound lane of a two lane roadway that was part of a divided state highway (i.e, there were two lanes in each direction, separated by a curbed, grass median approximately 7 meters [24 feet] wide). The Toyota Camry was also traveling east, in the outside eastbound lane of the same roadway, several hundred feet behind the case vehicle. The Isuzu was traveling west in the inside westbound lane and the Freightliner was traveling west in the outside westbound lane. The complex collision sequence began in the westbound lanes.

The Isuzu straight truck attempted to change lanes to the right and the right rear corner area of the Isuzu impacted the left front corner area of the Freightliner tractor (event #1) (**Figure 1**). The Freightliner's driver braked and steered right in an attempt to avoid further contact with the Isuzu and the right side of the Freightliner tractor impacted a W-beam guardrail (event #2), causing the Freightliner's driver to lose control. The Freightliner was redirected to the left and the driver braked. The tractor-trailer combination began to jackknife and yaw with the right side leading, skidded across the inside westbound lane



Figure 1: Freightliner's and Isuzu's westbound approach toward crash area, black scuff shows the approximate area of the first harmful event (case photo #01)

and entered the grass median (**Figure 2**). The tractor's right front wheel/tire impacted the median curb, breaking the wheel rim and the axle (event #3). The right side of the tractor impacted and folded down a U-channel sign support (event #4), and then impacted and sheared off a breakaway luminaire support (event #5). The tractor-trailer combination continued sliding across the median in a southwesterly direction, with its wheels and the tractor's undercarriage digging deep furrows in the soil, and entered the eastbound lanes (**Figure 3**). The right side of the tractor's engine compartment impacted the left front corner area of the case vehicle (event #6) in the inside westbound lane. The tractor-trailer pushed the case vehicle across the outside lane and off the south edge of the road. The tractor was rotating counterclockwise and the case vehicle separated from the tractor, coming to rest heading east (**Figure 4**). The tractor-trailer continued sliding in a southwesterly direction and the tractor sustained intraunit damage as a result of the jackknife (event #7). The right side of the semi-trailer impacted and sheared off a timber utility pole (event #8), causing the electric power lines to fall to the ground. The tractor-trailer continued a short distance further southeast where it impacted a chain link fence (event #9), penetrating the fence and coming to rest (**Figure 12**). The Camry's driver observed the events ahead and pulled onto the south shoulder in an attempt to avoid the crash. The falling electric power lines fell onto the Camry (event #10), causing minor damage. The case vehicle and the tractor-trailer rig were towed due to disabling damage. The Isuzu and the Camry were driven from the scene.

CASE VEHICLE

The case vehicle was a front wheel drive 1994 Mercury Villager seven-passenger, three-door minivan (VIN: 4M2DV11W8RD-----), equipped with a V6 3.0 liter gasoline engine. Its wheelbase was 285 centimeters [112.2 inches]. According to the published specifications, four-wheel anti-lock brakes were standard for this model and the Villager was equipped with a driver-only air bag. The case vehicle was towed due to disabling damage.

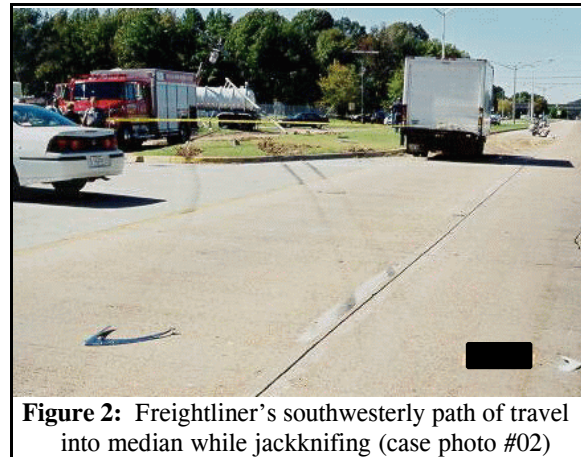


Figure 2: Freightliner's southwesterly path of travel into median while jackknifing (case photo #02)

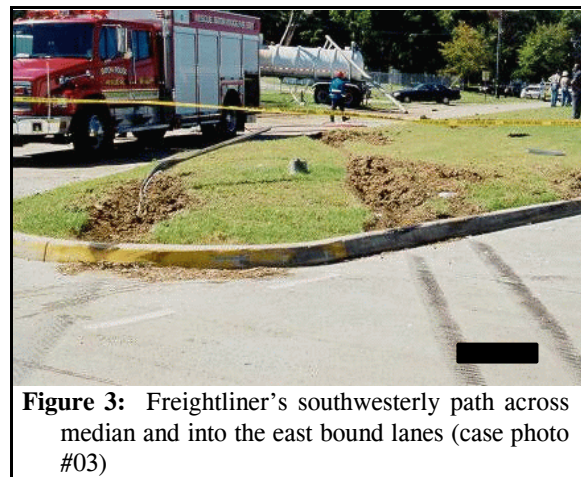


Figure 3: Freightliner's southwesterly path across median and into the east bound lanes (case photo #03)

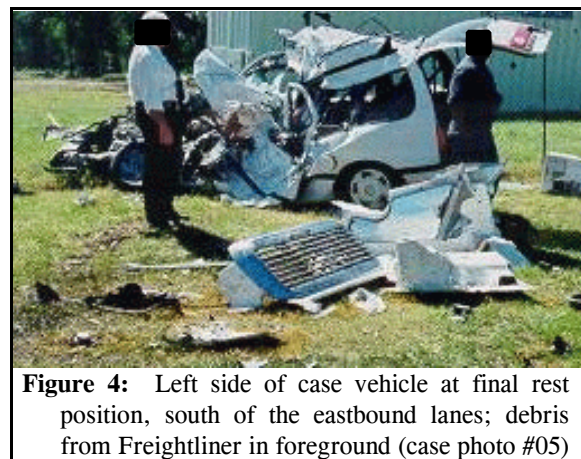


Figure 4: Left side of case vehicle at final rest position, south of the eastbound lanes; debris from Freightliner in foreground (case photo #05)

The front and left side of the case vehicle were massively crushed and catastrophically destroyed (**Figures 4 and 5**). The engine compartment penetrated under the Freightliner tractor's right side. The case vehicle's engine hood was folded and pushed through the windshield opening, both A-pillars were sheared, the windshield header was crushed rearward and the roof was buckled. The driver's door, left B-pillar and left side panels were crushed rearward and inward. All of the glazing except the backlight was shattered. The right side sustained major deformation due to induced damage (**Figure 6**). The CDC for the case vehicle, estimated from photographs, is **11-LYAW-8 (320)**. This catastrophic collision is out of scope for the WinSMASH reconstruction program.

The entire front seat row was catastrophically destroyed, with the front seats pushed rearward and the front seat backs collapsed into the second seat row area. The left side of the second and third seat rows sustained intrusion from the vehicle's left side body panels and the third seat row sustained intrusion from the second row seat back. The right side of the third seat row was the least damaged area of the interior, but it sustained intrusion from the roof buckling.

CHILD SAFETY SEATS

There were four child safety seats in the case vehicle. The second seat row was configured with a two-thirds width bench seat that provided seating at the left and center positions, with the right-most area providing an aisle for access to the third seat row. Two of the child seats were located at the second row left and second row center positions. The third seat row was a full-width bench seat and the two other child seats were located at the third row left and third row right positions. Because there was no adult occupant of the case vehicle who survived the crash, there is no knowledge of the manner in which the seats were installed nor the occupants' posture in their respective seats. This 1994 vehicle did not include LATCH system components and it appears that none of the child safety seats had any LATCH system features.

The second row left position contained a Century Products, Inc., unknown model, convertible child safety seat (CSS) with a tray shield (**Figures 7 and 8**). It was installed in the forward facing configuration and appears to have been secured with the vehicle's safety belt threaded through the CSS frame (**Figure 8**). It is not known if a tether was used with this CSS. The CSS had two sets of slots for the shoulder harness, with the harness straps threaded into the



Figure 5: Front-left view of case vehicle at tow yard (case photo #12)



Figure 6: Induced damage on case vehicle's right side, at tow yard (case photo #14)

upper slots. The child occupant was reported as having been restrained and the harness straps were cut. The second row left seat area sustained heavy intrusion from the other vehicle, the case vehicle's left side components and from the front seat being pushed rearward. The available photos show that the CSS was heavily damaged, with the left side panel pushed leftward, the structural frame distorted and the tray shield broken away (although the tray may have been moved and/or cut to extricate the victim). The child in this seat sustained fatal injuries.

The third row left position contained a Century Products, Inc., "Next Step" model, high-back, forward facing only, belt positioning booster seat (BSS) (Figures 7 and 8). It should be noted that the vehicle's third row left safety belt webbing and latch plate can be seen in the stowed configuration, apparently undamaged (i.e., unused) (Figure 7). It is possible that this BSS might have been located in the third row center position. The police crash report shows the third row left position as the location for this BSS and its occupant. The BSS had two sets of slots for the shoulder harness, with the harness straps threaded into the upper slots. The child occupant was reported as restrained and the harness straps were cut. The BSS did not sustain any obvious damage. The child in this seat sustained fatal injuries.

The second row center position contained a Century Products, Inc., "Smartmove" model, convertible child safety seat (CSS) with a three-point harness (Figure 9). It was positioned in the forward-facing configuration, but there is no knowledge concerning the installation. The CSS had three sets of slots for the shoulder harness, with the harness straps threaded into the center slots and a retainer clip in use. The child occupant was reported as restrained and the harness straps were cut. There are stress marks and a fracture on the forward edge of the left side panel, probably a result of this CSS being impacted by the CSS in the second row left position as the left CSS was pushed rightward. The child in this seat sustained serious injuries and was hospitalized.

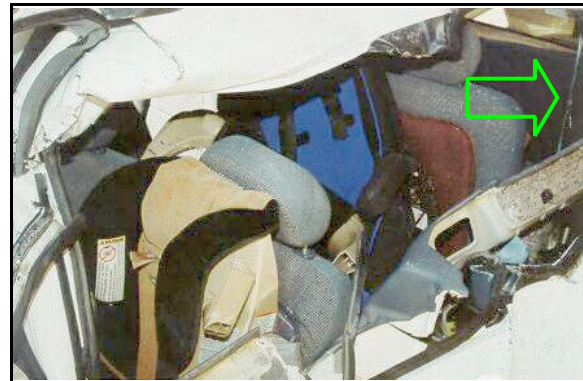


Figure 7: Looking into the case vehicle from the left, second row left CSS and third row left BSS; note, third row left safety belt hanging loose (arrow) (case photo #16)



Figure 8: Looking into the case vehicle from the right, second row left CSS and third row left BSS; note, second row left safety belt threaded through CSS frame and buckled (arrow) (case photo #17)

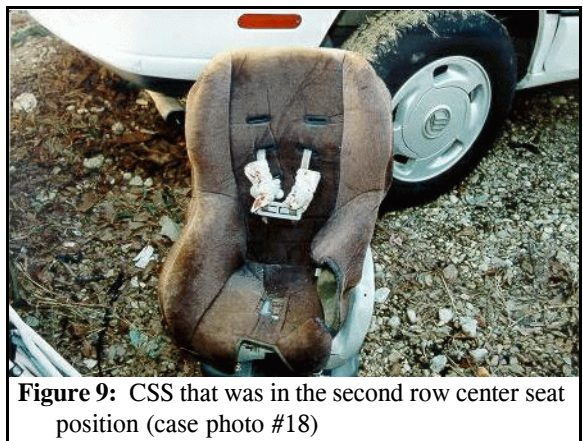


Figure 9: CSS that was in the second row center seat position (case photo #18)

The third row right position contained what appears to be an Evenflow Co., Inc. “Champion” model, convertible child safety seat (CSS) with a three-point harness and a tray shield (**Figure 10**). It was positioned in the forward-facing configuration, but there is no knowledge concerning the installation. The CSS had three sets of slots for the shoulder harness, with the harness straps threaded into the upper slots. The child occupant was reported as restrained, and he sustained minor abrasion injuries consistent with harness use. The upper portion of the CSS seat back appears to be slightly distorted, probably as a result of the CSS impacting the case vehicle’s right side interior surface as the vehicle was redirected by the collision events. This CSS was in the least-damaged portion of the case vehicle (**Figure 6**). The child in this seat sustained minor soft tissue injuries and was treated and released at a hospital emergency department.



Figure 10: Child seat that was in the third row right seat position (case photo #19)

CASE VEHICLE DRIVER KINEMATICS

The case vehicle driver (36-year-old female, white, unknown if Hispanic, 170 centimeters, 70 kilograms [67 inches, 155 pounds]) was restrained by the available, manual, three-point, lap-and-shoulder safety belt system, and the driver-only air bag deployed. Her pre-crash posture and seat adjustments are not known.

When the left-front area of the case vehicle was impacted by the out-of-control tractor trailer rig, the case vehicle’s driver air bag deployed and the driver probably moved forward and leftward in response to the eleven o’clock direction of force. She was immediately overwhelmed by the Freightliner tractor, which overrode the front and left side of the case vehicle, and the deformation and intrusion of her own vehicle. The front seat row was massively destroyed and the autopsy report listed 30 specific injuries, including: subdural and subarachnoid hematomas in the left parietal and occipital regions; bilateral rib fractures; multiple lacerations of the liver and spleen; multiple fractured bones; and multiple contusions, lacerations and abrasions over her head, face, neck, chest and extremities. The driver was declared dead at the scene.

DRIVER’S INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fractures ribs: right 2 nd through 7 th ; left 3 rd through 7 th with bilateral hemothoraces and pneumothorax, not specified as to location	critical 450242.5,3	Steering wheel hub and/or spokes and rim	Possible	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Hematoma, subdural, left parietal and occipital regions	severe 140650.4,2	Side surface of 1 st other vehicle	Possible	Autopsy
3	Hematoma, subarachnoid, left parietal and occipital regions	serious 140684.3,2	Side surface of 1 st other vehicle	Possible	Autopsy
4	Lacerations, multiple, liver, not further specified	moderate 541820.2,1	Steering wheel hub and/or spokes and rim	Possible	Autopsy
5	Lacerations, multiple, spleen, not further specified	moderate 544220.2,2	Left side interior surface, excluding hardware and/or armrest	Possible	Autopsy
6	Hemorrhage, extensive, retro-peritoneum, noted around left kidney, not further specified	serious 543800.3,8	Left side interior surface, excluding hardware and/or armrest	Possible	Autopsy
7	Fracture right clavicle, not further specified	moderate 752200.2,1	Steering wheel hub and/or spokes and rim	Possible	Autopsy
8	Fracture left humerus, mid-shaft	moderate 752600.2,2	Left side interior surface, excluding hardware and/or armrest	Possible	Autopsy
9 10	Fracture, open right radius and right ulna just distal to elbow	serious 752804.3,1 753204.3,1	Steering wheel hub and/or spokes and rim	Possible	Autopsy
11	Fracture, open ¹ , right femur, just proximal to right knee	serious 851814.3,1	Knee bolster, driver's, right of steering column	Possible	Autopsy
12	Fracture, open ² , left femur with protrusion of shaft, location not specified	serious 851814.3,2	Knee bolster, driver's, left of steering column	Possible	Autopsy
13	Laceration, 8.9 cm (3.5 in), scalp, 6.4 cm (2.5 in) from top of head to 2.5 cm (1 in) from top of right ear	minor 190602.1,1	Front left windshield's glazing	Possible	Autopsy
14	Laceration, 2 cm (0.8 in) left eyebrow	minor 290602.1,7	Front left windshield's glazing	Possible	Autopsy

¹ There were two, large lacerations over the right distal thigh ranging in size from 5 to 8 centimeters [2.0 to 3.1 inches].

² There was a 20 centimeter [7.9 inch] laceration over the left femoral shaft.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
15	Abrasion, 2.5 cm (1.0 in) corner of left eye	minor 297202.1,2	Front left windshield's glazing	Possible	Autopsy
16	Laceration, 3 cm (1.2 in) left chin	minor 290602.1,8	Front left windshield's glazing	Possible	Autopsy
17	Abrasion, 4 cm (1.6 in) right neck and upper chest	minor 390202.1,2	Air bag, driver's	Possible	Autopsy
18	Abrasions, multiple, mid-abdomen and left lower quadrant	minor 590202.1,2	Lap portion of safety belt system	Possible	Autopsy
19	Contusions {ecchymoses}, multiple, mid-abdomen and left lower quadrant	minor 590402.1,2	Lap portion of safety belt system	Possible	Autopsy
20	Lacerations, superficial, multiple, mid-abdomen and left lower quadrant	minor 590602.1,2	Left side interior surface, excluding hardware and/or armrest	Possible	Autopsy
21	Abrasion, 7 cm (2.8 in) right shoulder	minor 790202.1,1	Air bag, driver's	Possible	Autopsy
22	Contusions {ecchymoses}, multiple, volar ³ and dorsal ⁴ surfaces right forearm	minor 790402.1,1	Center instrument panel and below	Possible	Autopsy
23	Abrasions dorsal surface right hand	minor 790202.1,1	Center instrument panel and below	Possible	Autopsy
24	Contusions {ecchymoses} dorsal surface right hand	minor 790402.1,1	Center instrument panel and below	Possible	Autopsy
25	Contusions {ecchymoses}, multiple, ranging from 5-20 cm (2.0-7.9 in), over both thighs, not specified as to anterior or posterior	minor 890402.1,3	Unknown contact mechanism	Unknown	Autopsy
26	Contusions {ecchymoses}, multiple, ranging from 5-20 cm (2.0-7.9 in), over both calves	minor 890402.1,3	Seat cushion, driver's	Possible	Autopsy

³ The following term is defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows: **volar (vo'ler)**: pertaining to the palm or sole; plantar; indicating the flexor surface of the forearm, wrist, or hand.

⁴ The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follow: **dorsal (dor'sal)**: 1. pertaining to the back or to any dorsum. 2. denoting a position more toward the back surface than some other object or reference; same as posterior in human anatomy....**dorsum (dor'sem)**: 1. the back. 2. the aspect of an anatomical part or structure corresponding in position to the back; posterior, in the human.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
27	Laceration, 6 cm (2.4 in) over right patella	minor 890602.1,1	Knee bolster, driver's, right of steering column	Possible	Autopsy
28	Laceration, 7 cm (2.8 in) over left patella	minor 890602.1,2	Knee bolster, driver's, left of steering column	Possible	Autopsy
29	Laceration, 10 cm (3.9 in) in left popliteal fossa	minor 890602.1,2	Left side interior surface, excluding hardware and/or armrest	Possible	Autopsy
30	Laceration, 5 cm (2.0 in) right medial calf	minor 890602.1,1	Unknown contact mechanism	Unknown	Autopsy

FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's front right passenger (56-year-old female, white, unknown if Hispanic, 173 centimeters, 70 kilograms [68 inches, 155 pounds]) was restrained by the available, manual, three-point, lap-and-shoulder safety belt system. There was no air bag for the front right passenger. Her pre-crash posture and seat adjustments are not known.

When the left-front area of the case vehicle was impacted by the out-of-control tractor-trailer rig, the front right passenger probably moved forward and leftward in response to the eleven o'clock direction of force. She was immediately overwhelmed by the Freightliner tractor, which overrode the front and left side of the case vehicle, and the intrusion of the case vehicle's deformed components. The front seat row was massively destroyed and the front right passenger sustained more than 30 specific injuries including: subdural and subarachnoid hemorrhages; fracture of the right temporal bone; fracture of the base of the skull; multiple bilateral rib fractures; a large laceration of the heart; multiple lacerations of the spleen; multiple fractured bones; and multiple contusions, lacerations and abrasions over her head, face, neck, chest, abdomen and extremities. The front right passenger was declared dead at the scene.

FRONT RIGHT PASSENGER'S INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Laceration, large, heart, extending through both left and right ventricles	critical 441012.5,4	Center instrument panel and below	Possible	Autopsy
2	Hemorrhage, subdural present over brain, not further specified	severe 140650.4,9	Side surface of 1 st other vehicle	Possible	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
3	Hemorrhage, subarachnoid present over brain, NFS	serious 140684.3,9	Side surface of 1 st other vehicle	Possible	Autopsy
4	Laceration {tear} optic nerve at chiasm ⁵	moderate 130606.2,9	Unknown contact mechanism	Unknown	Autopsy
5	Fracture base of skull through sella turcica, NFS	serious 150200.3,8	Side surface of 1 st other vehicle	Possible	Autopsy
6	Fracture, 3 cm (1.2 in) right temporal bone ⁶ , NFS	moderate 150400.2,1	Side surface of 1 st other vehicle	Possible	Autopsy
7	Fractures, multiple, ribs, both left and right—without specific rib identification and with bilateral hemothoraces	serious 450222.3,3	Center instrument panel and below	Possible	Autopsy
8	Lacerations, multiple, spleen, not further specified	moderate 544220.2,2	Unknown contact mechanism	Unknown	Autopsy
9	Hemorrhage, retroperitoneum, noted around left kidney, NFS	serious 543800.3,8	Unknown contact mechanism	Unknown	Autopsy
10 11	Fracture left radius and left ulna, 4 cm (1.6 in) above left wrist	moderate 752800.2,2 753200.2,2	Unknown contact mechanism	Unknown	Autopsy
12	Fracture left femur, mid-shaft, not further specified	serious 851814.3,2	Center instrument panel and below	Possible	Autopsy
13	Fracture right femur, mid-shaft, not further specified	serious 851814.3,1	Right instrument panel and below	Possible	Autopsy
14	Laceration, 5 cm (2.0 in) on left parietal scalp	minor 190602.1,2	Front right windshield's glazing	Possible	Autopsy
15	Laceration, 2.5 cm (1.0 in) underneath right eye	minor 290602.1,1	Front right windshield's glazing	Possible	Autopsy
16	Laceration {puncture wound} left side of mouth	minor 290602.1,8	Front right windshield's glazing	Possible	Autopsy

⁵ The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follow: *chiasm* (*ki'az-em*): a decussation or X-shaped crossing; see *chiasma*. *optic c.*: *chiasma opticum*. *chiasma* (*ki-az'me*) *pl.* *chias'mata*: a cross, crosspiece; from the shape of the letter Chi. A general term in anatomical nomenclature for a decussation or X-shaped crossing, such as of nerves. *optic chiasma*, *chiasma op'ticum*: *optic chiasm*; the part of the hypothalamus formed by the decussation, or crossing, of the fibers of the optic nerve from the medial half of each retina; called also *optic decussation*. *decussatio* (*de'ke-sa'she-o*): decussation; a general term for the intercrossing of fellow parts or structures in the form of an X. See also *chiasma*. *decussation* (*de'ke-sa'shen*): a crossing over; see *decussatio*.

⁶ This lesion together with the fracture through the sella turcica of the middle cranial fossa may have been a single hinge fracture; however, the autopsy drew no such conclusion.

Front Right Passenger's Injuries (continued)

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Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
17	Abrasion underneath chin, not further specified	minor 290202.1,8	Unknown contact mechanism	Unknown	Autopsy
18	Abrasion, 5 cm (2.0 in) right neck	minor 390202.1,1	Torso portion of safety belt system	Possible	Autopsy
19	Abrasions, multiple, covering chest, not further specified	minor 490202.1,0	Center instrument panel and below	Possible	Autopsy
20	Abrasions, multiple, covering upper abdomen	minor 590202.1,7	Center instrument panel and below	Possible	Autopsy
21	Abrasions, band-like, across lower abdomen	minor 590202.1,8	Lap portion of safety belt system	Possible	Autopsy
22	Contusions {ecchymoses}, band-like, across lower abdomen	minor 590402.1,8	Lap portion of safety belt system	Possible	Autopsy
23	Laceration medial right upper arm just above elbow	minor 790600.1,1	Right side interior surface, excluding hardware	Possible	Autopsy
24	Abrasions, multiple, on volar aspect of right forearm	minor 790202.1,1	Right side interior surface, excluding hardware	Possible	Autopsy
25	Lacerations, multiple superficial, on volar aspect of right forearm	minor 790602.1,1	Right side interior surface, excluding hardware	Possible	Autopsy
26	Abrasion over left lateral biceps muscle	minor 790202.1,2	Front right windshield's glazing	Possible	Autopsy
27	Lacerations, multiple, left upper arm including: 3 cm (1.2 in) over left lateral biceps muscle; 7 cm (2.8 in), deep, above antecubital fossa; and 3 cm (1.2 in), "V"-shaped, in antecubital fossa	minor 790602.1,2	Front right windshield's glazing	Possible	Autopsy
28	Laceration, 6 cm (2.4 in) volar aspect left forearm	minor 790602.1,2	Front right windshield's glazing	Possible	Autopsy
29	Abrasions, multiple, on dorsal surface of left and right hands	minor 790202.1,3	Front right windshield's glazing	Possible	Autopsy
30	Contusions {ecchymoses} on dorsal left hand	minor 790402.1,2	Front right windshield's glazing	Possible	Autopsy
31	Lacerations, superficial, on dorsal surface of left and right hands	minor 790602.1,3	Front right windshield's glazing	Possible	Autopsy
32	Abrasions, multiple, over both thighs, not specified as to anterior or posterior	minor 890202.1,3	Center instrument panel and below	Possible	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
33	Abrasions, multiple over both calves	minor 890202.1,3	Seat cushion, front right passenger's	Possible	Autopsy
34	Contusions {ecchymoses}, multiple, over both thighs, not specified as to anterior or posterior	minor 890402.1,3	Center instrument panel and below	Possible	Autopsy
35	Contusions {ecchymoses}, multiple, over both calves	minor 890402.1,3	Seat cushion, front right passenger's	Possible	Autopsy

SECOND ROW LEFT PASSENGER'S KINEMATICS

The case vehicle's second row left passenger (3-year-old female, white, unknown if Hispanic, 91 centimeters, 11 kilograms [36 inches, 25 pounds]) was seated in a forward facing child safety seat, restrained by the safety seat's three-point harness and tray shield. The safety seat appears to have been secured by the vehicle's safety belt system (**Figures 7 and 8**). There is no knowledge of this child's pre-crash posture.

When the left-front area of the case vehicle was impacted by the out-of-control tractor-trailer rig, the second row left passenger probably moved forward and leftward in response to the eleven o'clock direction of force, loading the harness straps and sustaining abrasions on the left side of her neck. She was probably impacted by the outside surface of the Freightliner tractor's right side as it overwhelmed the case vehicle. This child sustained a crushed skull, including open, comminuted fractures with protrusion of the brain matter. The second row left passenger was declared dead at the scene.

SECOND ROW LEFT PASSENGER'S INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Crushed skull: open, comminuted skull fractures extending from left frontal bone to left occipital bone, including left temporal and parietal bones with protrusion of brain matter through laceration over left parietal bone; in addition, left subarachnoid and subdural hemorrhages of brain	maximum 113000.6,0	Side surface of 1 st other vehicle	Certain	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Contusion {ecchymosis} left eyelid	minor 297402.1,2	Side surface of 1 st other vehicle	Certain	Autopsy
3	Abrasion, patterned, left neck	minor 390202.1,2	Child safety seat harness straps	Probable	Autopsy
4	Abrasion, small, dorsal surface left forearm	minor 790202.1,2	Left side interior surface, excluding hardware	Possible	Autopsy

SECOND ROW CENTER PASSENGER'S KINEMATICS

The case vehicle's second row center passenger (1-year-old male, white, unknown if Hispanic, unknown height, 9 kilograms [20 pounds]) was seated in a forward facing child safety seat, restrained by the child seat's three-point harness (**Figure 9**). There is no knowledge as to whether the child seat was secured by the vehicle's safety belt system, but the police report notes that the child was in the seat and the seat was in the designated location. If the child seat was not secured in some fashion, the violent forces involved in this crash would have caused it to be tossed around the interior or ejected, but it was not.

When the left-front area of the case vehicle was impacted by the out-of-control tractor-trailer rig, the second row center passenger probably moved forward and leftward in response to the eleven o'clock direction of force. The child loaded against the harness straps, sustaining a contusion of the right lung, abrasions and contusions on his left lateral neck and left shoulder, and abrasions across his abdomen. The front right seat back collapsed rearward, striking his legs and causing fractures of his right femur, tibia and fibula and his left tibia and fibula. His face was sprayed with flying glass shards, causing abrasions and lacerations. The front right seat's head restraint struck him in the face, causing multiple contusions over his entire face, including bilateral periorbital contusions ("black eyes"). He also sustained a fracture of the left temporal skull with contusions and swelling of the scalp, possibly as a result of hitting the intruding roof structures as he was jostled by the violent impact forces and post-impact movement to final rest.

SECOND ROW CENTER PASSENGER'S INJURIES

The second row center passenger was transported via ambulance to a hospital. He remained hospitalized for five days and was discharged to the care of relatives.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion, mild, right lower lobe of lung	serious 441402.3,1	Child safety seat harness	Possible	Hospitalization records

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Fracture, minimally depressed, left temporal skull	serious 150404.3,2	Roof	Possible	Hospitalization records
3	Fracture supracondylar right distal femur	serious 851822.3,1	Seat back, front right passenger's	Certain	Hospitalization records
4	Fracture proximal right tibia (i.e., <i>Salter-Harris II</i> ⁷)	moderate 853420.2,1	Seat back, front right passenger's	Certain	Hospitalization records
5	Fracture right distal tibia	moderate 853420.2,1	Seat back, front right passenger's	Certain	Hospitalization records
6	Fracture right distal fibula	moderate 851606.2,1	Seat back, front right passenger's	Certain	Hospitalization records
7	Fracture, comminuted, left distal third tibia	serious 853422.3,2	Seat back, front right passenger's	Certain	Hospitalization records
8	Fracture, nondisplaced, left distal fibula	moderate 851606.2,2	Seat back, front right passenger's	Certain	Hospitalization records
9	Contusions with swelling left temporal scalp area	minor 190402.1,2	Roof	Possible	Hospitalization records
10	Abrasions, multiple, small, to face	minor 290202.1,0	Noncontact injury: flying glass, unknown source	Probable	Hospitalization records
11	Contusions, diffusely, to face	minor 290402.1,0	Head restraint, front right seat	Probable	Hospitalization records
12	Lacerations x 3, small, right face	minor 290602.1,1	Noncontact injury: flying glass, unknown source	Probable	Hospitalization records
13 14	Contusions {ecchymoses} about both eyes	minor 297402.1,1 297402.1,2	Head restraint, front right seat	Probable	Hospitalization records
15	Abrasions left lateral upper neck	minor 390202.1,2	Child safety seat harness	Certain	Hospitalization records
16	Contusions left lateral upper neck	minor 390402.1,2	Child safety seat harness	Certain	Hospitalization records
17	Abrasions upper left shoulder	minor 790202.1,2	Child safety seat harness	Certain	Hospitalization records
18	Contusions upper left shoulder	minor 790402.1,2	Child safety seat harness	Certain	Hospitalization records

⁷ The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follow: *fracture* (*frak'cher*): 1. the breaking of a part, especially a bone. 2. a break or rupture in a bone. *epiphyseal f.*: fracture at the point of union of an epiphysis with the shaft of the bone. *Salter-Harris f.*: an epiphyseal fracture in children that involves the epiphyseal growth plate.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
19	Contusions across umbilical area chest	minor 590402.1,8	Child safety seat harness	Certain	Hospitalization records

THIRD ROW LEFT PASSENGER'S KINEMATICS

The case vehicle's third row left passenger (3-year-old male, white, unknown if Hispanic, 91 centimeters, 16 kilograms [36 inches, 35 pounds]) was seated in a forward facing, high back, belt positioning booster seat (**Figures 7 and 8**). The child was restrained by the booster seat's harness, but there is no knowledge as to whether the booster seat was secured by the vehicle's safety belt system. The police report notes that the child was in the seat and the seat was in the designated location. If the child seat was not secured in some fashion, the violent forces involved in this crash would have caused it to be tossed around the interior or ejected, but it was not. There is no certain knowledge of the child's pre-crash posture.

When the left-front area of the case vehicle was impacted by the out-of-control tractor-trailer rig, the third row left passenger probably moved forward and leftward in response to the eleven o'clock direction of force. He loaded against the booster seat's harness straps, sustaining abrasions and superficial lacerations along the base of the left side of his neck. He was probably impacted by the right outside surface of the Freightliner tractor as it overwhelmed the case vehicle, and he sustained multiple skull fractures on the left side, with extrusion of the brain matter. He also sustained various lacerations and contusions on his face, probably from the intruding tractor, and minor abrasions and lacerations of his left arm, probably from the case vehicle's intruding side surface. The third row left passenger was declared dead at the scene.

THIRD ROW LEFT PASSENGER'S INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Crushed skull: open, comminuted fracture left frontal, parietal, and temporal bones with extrusion of brain matter through left temporal bone; in addition a diastatic fracture along the sagittal suture between the left and right parietal bones and left subarachnoid and subdural hemorrhages	maximum 113000.6,0	Side surface of 1 st other vehicle	Certain	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Lacerations, multiple, over face including: left and right frontal bone—large, 7 cm (2.4 in); bridge of nose; right eyebrow—2 cm (0.8 in); angle left jaw—superficial; and left chin—superficial	minor 290602.1,0	Side surface of 1 st other vehicle	Probable	Autopsy
3	Contusion {ecchymosis} around left eye	minor 297402.1,2	Side surface of 1 st other vehicle	Probable	Autopsy
4	Abrasions left base of neck	minor 390202.1,2	Child safety seat harness	Probable	Autopsy
5	Lacerations, superficial, left base of neck	minor 390602.1,2	Child safety seat harness	Probable	Autopsy
6	Abrasions lateral left upper arm and antecubital fossa	minor 790202.1,2	Left side interior surface, excluding hardware and/or armrest	Probable	Autopsy
7	Lacerations, superficial, lateral left upper arm and antecubital fossa	minor 790602.1,2	Left side interior surface, excluding hardware and/or armrest	Probable	Autopsy

THIRD ROW RIGHT PASSENGER'S KINEMATICS

The case vehicle's third row right passenger (1-year-old male, white, unknown if Hispanic, unknown height, 10 kilograms [22 pounds]) was seated in a forward facing child safety seat (**Figure 10**). He was restrained by the child seat's three-point harness system and tray shield. There is no knowledge as to whether the child seat was secured by the vehicle's belt system, but the police report notes that the child was in the seat and the seat was in the designated location. If the child seat was not secured in some fashion, the violent forces involved in this crash would have caused it to be tossed around the interior or ejected, but it was not. There is no knowledge of the child's pre-crash posture.

When the left-front area of the case vehicle was impacted by the out-of-control tractor-trailer rig, the third row left passenger probably moved forward and leftward in response to the eleven o'clock direction of force. He loaded against the booster seat's harness straps, sustaining abrasions and contusions on the left side of his neck. He also sustained an abrasion on the left aspect of his scalp, with the injury source unknown.

THIRD ROW RIGHT PASSENGER'S INJURIES

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The third row right passenger was transported via ambulance to a hospital emergency department, where he was treated for minor injuries and released.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasion of scalp, not further specified	190202.1,9 minor	Unknown contact mechanism	Unknown	Emergency room records
2	Abrasion of left neck	390202.1,2 minor	Harness of child safety seat	Probable	Emergency room records
3	Contusion of left neck	390402.1,2 minor	Harness of child safety seat	Probable	Emergency room records

FIRST OTHER VEHICLE

The first other vehicle was a 2002 Freightliner CL-120 conventional 6 x 4 truck tractor (VIN: 1FUJA6CG62L-----) pulling a single, two-axle tank semi-trailer (VIN: unknown) (**Figures 11 and 12**). The tank trailer had hazardous materials placarding indicating Class 8 (corrosive), ID Number 1789 (hydrochloric acid solution/hydrogen chloride solution/muriatic acid) liquid cargo. The police crash report indicated there was no cargo spillage. The tractor-trailer rig was towed due to heavy damage on the tractor. The tank semi-trailer did not sustain any apparent structural damage, except on the right side where the semi-trailer impacted the timber utility pole, which caused an area of narrow crush just aft of the center. Because of the many impacts and multiple areas of very heavy damage, the TDCs for the tractor-trailer's nine impacts were not estimated. The Freightliner's engine compartment and front axle area were destroyed, with the front right wheel completely separated and the fenders and hood torn away. There was substantial damage along the lower right side of the cab area, including direct damage to the right side of the saddle fuel tank but apparently without fuel leakage. There was also intra-unit damage on the left side of the area behind the cab as a result of the jackknife rotation by the tractor into the trailer.



Figure 11: Right side of Freightliner tractor at tow yard (case photo #20A)



Figure 12: Freightliner tractor and semi-trailer at final rest (case photo #08)

The Freightliner's driver (47-year-old male, black, unknown if Hispanic, height and weight unknown) sustained police-reported "A" (evident, incapacitating) injuries and was transported to a hospital via ambulance. His restraint use is reported as unknown. His specific injuries and treatment status are not known. There was no other occupant in the Freightliner.

SECOND OTHER VEHICLE

The second other vehicle was a rear wheel drive 2001 Isuzu NPR/W-series tilt cab, two-axle, six-wheel, medium-duty straight truck (VIN: JALB4B14617-----), equipped with a 4-cylinder 4.75 liter turbocharged diesel engine. The VIN indicates that this was an incomplete vehicle. The photos indicate that it was finished as a box van. Its wheelbase is not known, but the specifications indicate between 277 - 447 centimeters [109.0 - 176.0 inches], with a GVWR of 5,443 - 6,577 kilograms [12,000 - 14,500 pounds]. The Isuzu was driven away from the scene (**Figures 13 and 14**). The Isuzu sustained minor deformation at the right rear corner area, mainly to an aftermarket retractable steel elevator platform that protruded beyond the back of the cargo deck and the folding components in their stowed position under the deck, but also including light damage to the box structure above the cargo deck. The photo estimated TDC for the Isuzu's single impact (event #1) is estimated as **04-RBLN-A (120)**.

The Isuzu's driver (60-year-old male, white, unknown if Hispanic, height, and weight unknown) was reported as restrained by the available lap-and-shoulder safety belt system. The Isuzu's front right passenger (36-year-old male, black, unknown if Hispanic, height and weight unknown) was reported as restrained by the available lap-and-shoulder safety belt system. According to the police crash report, neither of these occupants sustained any injury and neither was transported to a medical facility.

THIRD OTHER VEHICLE

The third other vehicle was a front wheel drive 1996 Toyota Camry four-door five-passenger sedan (VIN: 4T1BG12K4TU-----). The Camry was struck by falling electric power lines and was not involved in any impact with another vehicle. The Camry's driver (lone occupant) was not injured and drove away from the scene.

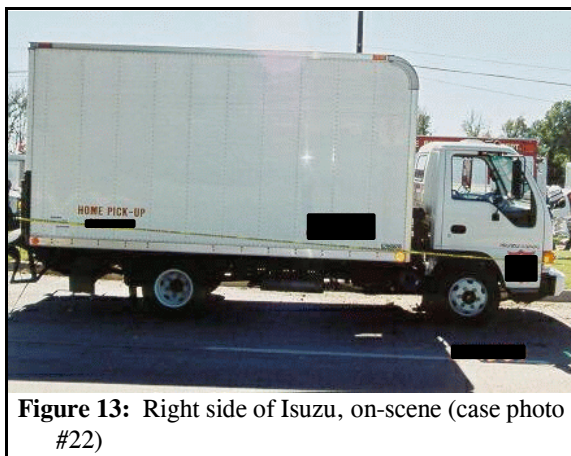


Figure 13: Right side of Isuzu, on-scene (case photo #22)



Figure 14: Isuzu's right rear corner, showing contact damage from impact with Freightliner (case photo #24)

