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ON-SITE CHILD SAFETY SEAT INVESTIGATION

CASE NUMBER - IN-06-003
LOCATION - INDIANA
VEHICLE - 1994 CHEVROLET CAMARO
CRASH DATE - January 2006

Submitted:

January 16, 2007
Revised: October 18, 2007

Contract Number: DTNH22-01-C-07002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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

1. *Report No.* IN-06-003	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Child Safety Seat Investigation Vehicle - 1994 Chevrolet Camaro Location - Indiana		5. *Report Date:* January 16, 2007 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-01-C-07002	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NPO-122) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: January 2006 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site child safety seat investigation involving a 1994 Chevrolet Camaro equipped with driver and front right passenger air bags; manual, three-point, lap-and-shoulder safety belts and a belt positioning booster seat installed in the back right seat position.			
16. *Abstract* This report covers an on-site child safety seat investigation that involved a 1994 Chevrolet Camaro (case vehicle), which ran-off-road and impacted a mail box post and a culvert. This crash is of special interest because the case vehicle's back right passenger [4-year-old, White (non-Hispanic) male] was seated in a belt positioning booster seat and sustained a fatal injury as a result of the crash. The case vehicle was traveling north on a two-lane county roadway. The case vehicle departed the northbound lane and departed the west side of the roadway and entered a ditch. The front of the case vehicle impacted a mailbox post. The case vehicle's front left then immediately impacted a concrete culvert. The case vehicle rotated counterclockwise and came to rest partially in the ditch with the front of the vehicle against the culvert heading northwest. The case vehicle's back right passenger was restrained in his belt positioning booster seat. The shoulder belt was behind his back and he was restrained only by the lap belt. He sustained a fatal injury when he jackknifed forward as a result of the culvert impact and impacted his head on the center console.			
17. *Key Words* Child Safety Seat Air Bag Non-Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 15	22. *Price* $7,200

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This investigation was brought to NHTSA's attention on January 29, 2006 through a newspaper article. This crash involved a 1994 Chevrolet Camaro (case vehicle) that ran-off-road and impacted a mail box post and a culvert. The crash occurred in January, 2006 at 2:35 p.m., in Indiana and was investigated by the applicable county sheriff department. This crash is of special interest because the case vehicle's back right passenger [4-year-old, White (non-Hispanic) male] was seated in a belt positioning booster seat and sustained a fatal injury as a result of the crash. This contractor inspected the case vehicle and the child safety seat on February 2, 2006, and inspected the scene on February 3, 2006. This contractor was unable to contact the case vehicle's driver for an interview. This report is based on the police crash report, scene, vehicle and child safety seat inspections, discussions with the investigating sheriff's deputies, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling north on a two-lane county roadway. The case vehicle departed the northbound lane and departed the west side of the roadway and entered a ditch. The front of the case vehicle impacted a mailbox post. The front left of the case vehicle then immediately impacted a concrete culvert. The case vehicle rotated counterclockwise and came to rest partially in the ditch with the front of the vehicle against the culvert heading northwest. The evidence indicated the driver attempted to steer right just prior to the impact. It is not known if she also applied the brakes. At the time of the crash the light condition was daylight, the weather was cloudy, and the roadway pavement was dry.

The CDCs for the case vehicle were determined to be: **12-FRLN 1** (**0** degrees) for the impact with the mail box post and **12-FDEW-4** (**0** degrees) for the impact with the culvert. The maximum residual front crush due to the culvert impact was 97 centimeters (38.2 inches) occurring at C_3. The WinSMASH reconstruction program, barrier algorithm, calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs for the culvert impact respectively as: 73.0 km.p.h. (45.4 m.p.h.), -73.0 km.p.h. (-45.4 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.). The case vehicle was towed due to damage.

The case vehicle's back right passenger (4-year-old, male) was seated in a Cosco Voyager high-back belt positioning booster seat. The child seat was manufactured by the Dorel Juvenile Group on September 9, 2004 and was identified by model number 22-210-WAL. The child was restrained in his belt positioning booster seat by only the lap portion of the case vehicle's manual, three-point, lap-and-shoulder safety belt; the shoulder belt was behind his back. When the left side of the case vehicle entered the ditch, the child's upper torso leaned to the left positioning his head in line with the center console. The force of the culvert impact caused the child to jackknife forward and he impacted his head on the back of the center console causing his fatal injury.

The case vehicle's driver (40-year-old, female) was not restrained by her manual, three-point, lap-and-shoulder safety belt system. Her air bag did not deploy as a result of the culvert impact and she heavily loaded the steering assembly. The evidence indicated the likelihood that the front air bag crash sensor was disconnected at the time of the crash. There were indications

the case vehicle had been modified to some extent from factory original parts. The inspection indicated the air bag crash sensor connector had been most likely broken and disconnected during repair/alteration of the vehicle. The driver sustained serious injuries and was hospitalized.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle was traveling was a two-lane, county roadway, traversing in a north and south direction. There was one travel lane in each direction, and the roadway was bordered by narrow grass shoulders with adjacent ditches and a line of trees and bushes on the east side of the roadway. The southbound travel lane was 2.7 meters (8.9 feet) in width. The northbound travel lane was 2.3 meters in width (7.6 feet). The west shoulder was approximately 0.9 meter (3 feet) in width. The east shoulder was 0.6 meter (2 feet) in width. The speed limit was 72.4 km.p.h. (45 mp.h.). There was no regulatory speed limit sign posted near the crash site. At the time of the crash the light condition was daylight, the weather was cloudy, and the roadway pavement was dry, level bituminous with an estimated coefficient of friction of 0.72. The off-road grade along the case vehicle's path to impact was approximately 3% negative. There was no other traffic on the roadway at the time of the crash. The site of the crash was rural. See the Crash Diagram at the end of this report.

Figure 1: Approach of case vehicle northbound in northbound lane, arrow shows impacted culvert

Pre-Crash: The case vehicle was traveling north in the northbound lane (**Figure 1**), and the driver was intending to continue northbound. The case vehicle departed the northbound lane and departed the west side of the roadway and entered a ditch. The driver attempted to steer right just prior to the impact. It is not known if she also applied the brakes. The crash occurred on the west roadside.

Crash: As the case vehicle entered the ditch, the front right bumper impacted a mailbox post breaking off the post. The front of the case vehicle then impacted a concrete culvert (**Figure 2** and **Figure 3** below).

Figure 2: Overview of damage to front of case vehicle from impact with the culvert, each stripe on rods in 5 cm (2 in)

Post-Crash: The case vehicle rotated counterclockwise and came to rest partially in the ditch with the front of the vehicle against the culvert (**Figure 4** below). The case vehicle was heading northwest at final rest.

Figure 3: Overview of impacted culvert and mailbox, arrow shows location of old mailbox post

Figure 4: Police on-scene photo showing rest position of case vehicle, red flags show case vehicle's left side tire mark in grass (arrow)

Figure 5: Front left overview of damage to case vehicle

Figure 6: Left side view of crush to front of case vehicle from culvert impact, measurements were taken to the bumper bar, plastic bumper fascia was separated from the bumper bar

CASE VEHICLE

The 1994 Chevrolet Camaro was a rear wheel drive, two-door, coupe (VIN: 2G1FP22S0R2------) equipped with a 3.4L engine, five-speed manual transmission and four wheel, anti-lock disc brakes. The front seating row was equipped with bucket seats with integral head restraints; manual, three-point, lap-and-shoulder safety belts and driver and front right passenger air bags. The back seat was equipped with bucket seats and manual, three-point, lap-and-shoulder safety belts. The case vehicle's wheelbase was 257 centimeters (101.2 inches). The odometer reading at the time of the vehicle inspection was 316,990 kilometers (196,974 miles).

CASE VEHICLE DAMAGE

Exterior Damage: The case vehicle's impact with the mail box post involved a small area of the right portion of the front bumper. Crush measurements could not be taken for this impact due to overlapping damage from the culvert impact. The damage to the bumper fascia in this area indicated there was most likely no residual crush from the mailbox post impact. The case vehicle's impact with the culvert involved the front of the vehicle (**Figure 5**). The front bumper, left headlamp/turn signal assembly, grille and left fender were directly contacted and crushed rearward. The direct damage began at the front left

bumper corner and extended 127 centimeters (50 inches) across the bumper. The maximum residual crush was measured as 97 centimeters (38.2 inches) occurring at C_3 (**Figure 6** above). The table below shows the case vehicle's front crush profile.

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	127	97	74	89	93	97	74	44	16	-13	0
in		50.0	38.2	29.1	35.0	36.6	38.2	29.1	17.3	6.3	-5.1	0.0

The left side wheelbase was reduced 31 centimeters (12.2 inches) while the right side wheelbase was extended 4 centimeters (1.6 inches). Induced damage involved the left front door, left "A"-pillar, roof and the windshield.

The case vehicle's recommended tire size was P235/55R16; however, the vehicle was equipped with P225/60R16 size tires. The case vehicle'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	0	0	210	31	3	4	Cut in sidewall	Yes	Yes
RF	248	36	210	31	3	4	None	No	No
LR	234	34	210	31	6	8	None	No	No
RR	214	31	210	31	6	8	None	No	No

Inspection of the case vehicle's interior (**Figure 7**) revealed severe deformation of the steering wheel rim (**Figure 8** below) due to driver loading. The steering wheel would not rotate. Examination of the steering column shear capsules showed that the shear plate had completely separated from both shear capsules. The residual shear plate movement was measured as approximately 4 centimeters (1.8 inches). The driver's sunvisor was knocked off and oil transfer and scuff marks were found on the windshield directly in front of and to the right of the driver's seat. In addition, the driver's knee bolster was dented on both sides of the steering column, and

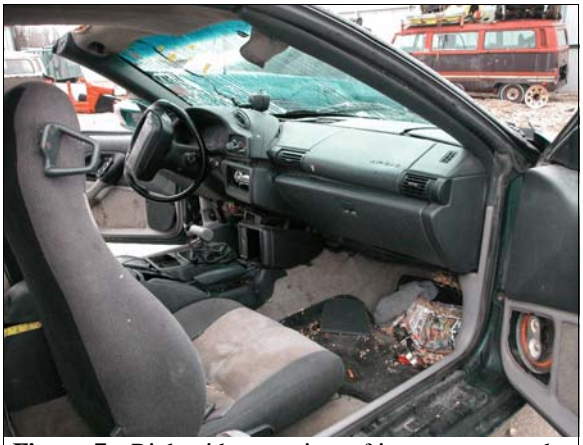


Figure 7: Right side overview of instrument panel, windshield and steering wheel

the rearview mirror was knocked off the windshield. In the back seat, the right corner of the center console appeared to be scuffed, most likely from contact by the back right passenger. Passenger compartment intrusion was present in the driver's occupant space and the front right occupant space. The most severe intrusions were 6 centimeters (2.4 inches) of longitudinal left "A"-pillar intrusion and 4 centimeters (1.6 inches) of left toe pan intrusion.

Figure 8: Right side view of deformation of steering wheel

Damage Classification: Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FRLN 1** (**0** degrees) for the impact with the mail box post and **12-FDEW-4** (**0** degrees) for the impact with the culvert. The WinSMASH reconstruction program, barrier algorithm, was used to reconstruct the case vehicle's Delta V for the culvert impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 73.0 km.p.h. (45.4 m.p.h.), -73.0 km.p.h. (-45.4 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.). The crash fit the reconstruction model and the results appeared reasonable. The case vehicle was towed due to damage.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with a driver and front right passenger air bag. Neither of these air bag deployed in this crash. The damage to the vehicle and the reconstruction results indicated that the crash was severe enough to require air bag deployment. There were indications the case vehicle had been modified to some extent from factory original parts. The vehicle had an after-market transmission and audio system installed, and there had been alterations to the interior. The front seats did not match, the back seat cushions and seat back were not bolted to the vehicle, and it appeared that new carpet had been installed at some point. It is not known if engine repair/replacement had also been performed on the vehicle. It is possible the air bag crash sensor had been compromised during repair/alteration of the vehicle. Examination of the front crash sensor, which was mounted on the center radiator support, revealed that the sensor plug receptacle was broken and the sensor was unplugged. The area where the sensor was located was not directly impacted and there was a minimum of induced damage to the sheet metal components surrounding the crash sensor plug (**Figure 9**). It is possible that the crash sensor was not connected at the time of the crash.

Figure 9: Front crash sensor receptacle was found broken and sensor was unplugged, plug moved to right for photo

The back right passenger was seated in a Cosco Voyager high-back belt positioning booster seat (**Figure 10**). The child seat was manufactured by the Dorel Juvenile Group on September 9, 2004 and was identified by model number 22-210-WAL. It is not known at this time when the child seat was purchased or how often it was used. The child seat consisted of a plastic one-piece shell with a padded cloth cover approximately 8 millimeters thick (0.3 inch). The chid seat was designed to be used with a vehicle's three-point, lap-and-shoulder safety belt system. It was equipped with lap belt guides at the back of the seat cushion and shoulder belt guides on each side of the seat back. The on-scene police photographs show the shoulder belt positioned behind the passenger's back. The police crash report indicated that the back right passenger was found restrained by only the lap belt with the shoulder belt behind him and the safety belt buckled into the buckle for the back left seat position. The buckle for the back right seat position was found by police investigators under the carpet. It appeared that at some point the carpet had been replaced in the vehicle. A slit in the carpet to accommodate the back right safety belt buckle was present; however, the buckle had not been threaded through the slit.

Figure 10: Front view of back right passenger's high back belt positioning booster seat

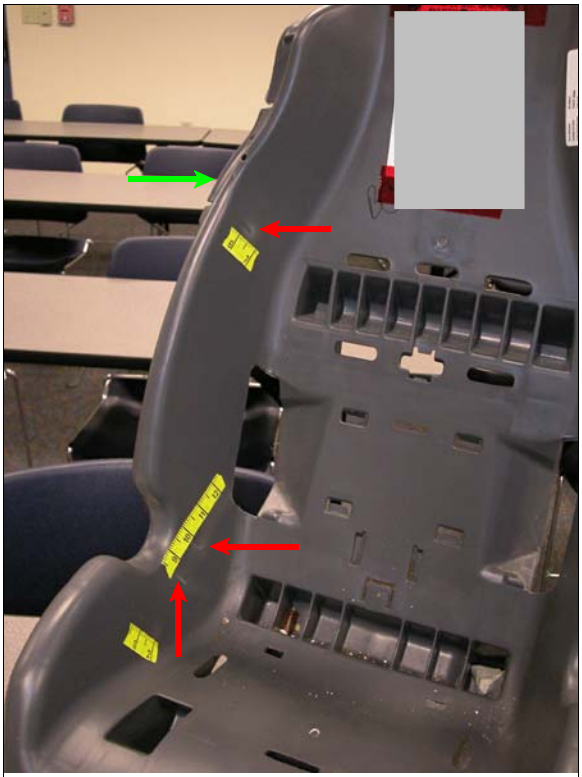


Figure 11: Red arrows show location of stress marks near belt guides, green arrow shows location of lower shoulder belt guide on right side of seat

Inspection of the belt positioning booster seat revealed no apparent damage or fractures to the plastic shell. However, there were stress marks on the inside of the seat just below the right lap belt guide (**Figure 11**) that appeared to be related to loading of the seat on the lap belt during the crash. Another stress mark was observed on the seat back on the inner right side (**Figure 11** below) that appeared to be related to the shoulder belt loading the seat during the crash. The location of this stress mark was consistent with the approximate location of the shoulder belt as observed in the police on-scene photographs. It did not pass through the shoulder belt guide and was behind the child's back. No other damage

was observed to the booster seat. There was a manufacturer's warning label (**Figure 12**) affixed to the right side of the child seat giving the seat's weight, height and age limitations as follows: "use only with children who weigh between 14-36 kilograms (30-80 pounds) and whose height is 74-132 centimeters (29-52 inches), and who are over 1 year of age" The warning label also stated to not use the child seat if the midpoint of the child's head is above the top of the child seat's seat back. In addition, there was an warning with illustration that stated to use the child seat only with a vehicle's lap-and-shoulder safety belt and not to use the seat with a lap belt only.

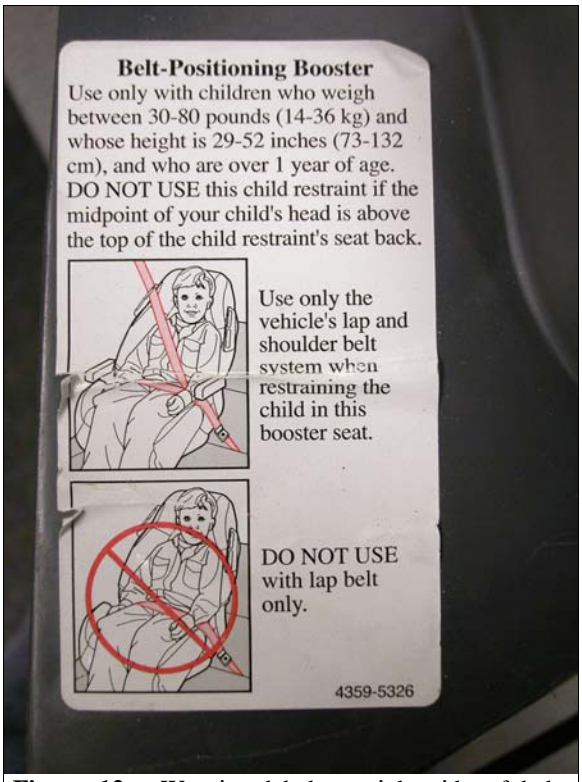


Figure 12: Warning label on right side of belt positioning booster seat

CASE VEHICLE BACK RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's back right passenger [4-year-old, White (non-Hispanic) male, 112 centimeters and 18 kilograms (44 inches, 39 pounds)] was seated in his high-back belt positioning booster seat and was most likely leaned to the left due to the case vehicle entering the ditch and the driver steering right. The passenger was wearing a winter coat.

The back right passenger was restrained in his booster seat by only the case vehicle's lap belt, which was buckled into the buckle for the back left seat position. The shoulder belt was positioned behind the passenger's back.

Figure 13: Police on-scene photo showing position of back right passenger relative to back of center console (arrow), passenger moved back to upright position

Just prior to the crash the case vehicle entered a ditch, and the driver steered to the right just prior to impact. As a result, the back right passenger leaned over to the left to some degree. The back right passenger most likely moved very little due to the case vehicle's initial impact with the mailbox post, which readily broke off at the ground. The case vehicle's impact with the culvert then caused the back right passenger to continue forward along a path opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated. The passenger loaded his lap belt and jackknifed forward, causing a retroperitoneal hematoma and contusions to the small bowel. He then impacted his head on the

back of the center console (**Figure 13** above) causing a fracture and dislocation at the atlanto occipital joint, a laceration of the lower medulla oblongata, subarachnoid hemorrhage and subdural hematoma. This contact also produced a police-reported "C"-shaped abrasion on the left side of his head consistent with contact to the back corner of the center console. The back right passenger remained in his child safety seat as the case vehicle rotated counterclockwise and came to final rest. He was found at final rest leaned over to the left and his head and upper torso were resting on the back left seat cushion.

CASE VEHICLE BACK RIGHT PASSENGER INJURIES

The police crash report indicated the back right passenger sustained fatal injuries. He was dead at the scene. The table below shows the back right passenger'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 and dislocation atlanto-occipital with cervical column displaced posteriorly relative to foramen magnum; spinal cord was not examined	moderate 650216.2,6	Floor, center console	Certain	Autopsy
2	Laceration lower medulla oblongata, 2 cm (0.8 in) inferior to origin	maximum 140212.6,8	Floor, center console	Certain	Autopsy
3	Hemorrhage, subarachnoid, overlying cerebellar hemispheres	serious 140466.3,6	Floor, center console	Certain	Autopsy
4	Hematoma, subdural, thin film, overlying cerebral convexities, bilaterally–left greater than right, and base; very prominent in left middle fossa and anterior brainstem	critical 140654.5,3	Floor, center console	Certain	Autopsy
5 6	Hemorrhage, subarachnoid, mild, over bilateral convexities and base; most prominent in vicinity of basilar cistern	serious 140684.3,1 140684.3,2	Floor, center console	Certain	Autopsy
7	Contusion {ecchymoses} small bowel, anteriorly	moderate 541410.2,8	Lap portion of safety belt system	Probable	Autopsy
8	Contusion {ecchymoses} small bowel mesentery, including root of mesentery	moderate 542010.2,8	Lap portion of safety belt system	Probable	Autopsy
9	Hematoma, retroperitoneal, involving left iliopsoas and inferior perirenal areas	serious 543800.3,8	Lap portion of safety belt system	Possible	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
10	Abrasion left temporal scalp, not further specified	minor 190202.1,2	Floor, center console	Certain	Autopsy
11	Hematoma, subgaleal, with ecchymosis, left frontal–4 x 5 cm (1.6 x 2.0 in), and temporal–4 x 4 cm (1.6 x 1.6 in) scalp	minor 190402.1,2	Floor, center console	Certain	Autopsy
12	Contusion {ecchymoses}, minimal, right and central scalp	minor 190402.1,1	Floor, center console	Certain	Autopsy
13	Abrasion left helix of ear, anterior and inferior	minor 290202.1,2	Floor, center console	Probable	Autopsy
14	Contusion {ecchymosis}, small, left glabella	minor 290402.1,7	Floor, center console	Certain	Autopsy
15	Laceration upper frenulum, not further specified	minor 290602.1,4	Floor, center console	Certain	Autopsy
16	Abrasion mid left lip mucosal surface, upper lip, and anterior chin	minor 290202.1,8	Floor, center console	Certain	Autopsy
17	Contusion {ecchymosis} upper lip and lower vermilion border	minor 290402.1,8	Floor, center console	Certain	Autopsy
18	Abrasions over right jaw	minor 290202.1,1	Seat back, front right passenger's	Probable	Autopsy
19	Abrasion, superficial, left anterior cheek	minor 290202.1,2	Floor, center console	Certain	Autopsy
20	Abrasion, minimal, right neck	minor 390202.1,1	Seat back, front right passenger's	Probable	Autopsy
21	Contusion {ecchymosis} right neck	minor 390402.1,1	Seat back, front right passenger's	Probable	Autopsy
22	Abrasion, minimal, over right abdomen and/or right hip	minor 590202.1,1	Lap portion of safety belt system	Certain	Autopsy
23	Contusion {ecchymoses} on lower anterior abdomen and over bilateral hips	minor 590402.1,8	Lap portion of safety belt system	Certain	Autopsy
24	Contusion {ecchymoses} right anterior shoulder	minor 790402.1,1	Seat back, front right passenger's	Probable	Autopsy
25	Abrasions x 2, superficial, midulnar surface dorsal forearm and dorsal surface left hand overlying metacarpophalangeal joint	minor 790202.1,2	Seat back, driver's	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
26	Abrasion, superficial, distal anterior right leg, vertically oriented	minor 890202.1,1	Seat back, front right passenger's	Probable	Autopsy
27	Contusion {ecchymosis} antero-medial right leg, vertically oriented	minor 890402.1,1	Floor, center console	Certain	Autopsy

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash, the case vehicle's driver [40-year-old, White (non-Hispanic) female, unknown height and weight] was most likely seated in a nominal upright driving posture. She most likely had both hands on the steering wheel, and had steered the case vehicle to the right just prior to the impact and was most likely bracing for impact. At the time of the vehicle inspection, the driver's seat track was located in the rearmost position, and the seat back was upright. The steering column was not adjustable.

Based on this contractor's vehicle inspection, the case vehicle's driver was not restrained by her manual, three-point, lap-and-shoulder, safety belt system. Examination of the safety belt assembly revealed no load marks. In addition, there was severe deformation of the steering wheel, compression of the steering column and separation of the steering column shear capsules indicating the driver was unrestrained at the time of the crash. Lastly, the driver was found in the vehicle unrestrained by investigating sheriff's deputies.

Figure 14: Overview of steering wheel and instrument panel

Just prior to the crash the case vehicle entered a ditch. As a result, the driver most likely leaned over to the left to some degree. Just prior to the impact, the driver steered right, which most likely had little effect on her seated position. The driver most likely moved very little due to the case vehicle's impact with the mailbox post, which readily broke off at the ground. The case vehicle's impact with the culvert then caused the driver to continue forward along a path opposite the case vehicle 0 degree direction of principal force as the case vehicle decelerated. The driver's air bag did not deploy. The driver impacted the steering wheel, severely bending the steering wheel rim (**Figure 14** and **Figure 8** above) and compressing the energy absorbing steering column to a point the shear plate separated from both shear capsules (**Figure 15** below). The driver's contact with the steering wheel caused bilateral lung contusions with pneumothoraces, mediastinal hematoma, thrombus to the left and right

subclavian veins, a grade I posterior spleen laceration, a fractured and displaced left clavicle, and fractured ribs 1 and 2. The driver continued forward and upward, spilled off the right side of the steering wheel and her head impacted her sun visor and loaded the underlying windshield header causing a nonanatomic brain injury, diffuse axonal brain injury, cerebral contusions, subarachnoid hemorrhage, fractured left orbit, fractured left maxillary sinus, and fractured nasal bones. In addition, both of her knees impacted the knee bolster, her left arm impacted the windshield and her right arm impacted the rearview mirror knocking it off the windshield. The driver came to final rest against the instrument panel on the right side of the steering wheel. The driver was removed from the case vehicle by rescue personnel.

Figure 15: Separation of case vehicle's right shear capsule and shear plate due to steering column loading by driver, left seat capsule also separated

CASE VEHICLE DRIVER INJURIES

The case vehicle's driver sustained police reported "A" (incapacitating) injuries and was transported from the scene to a hospital and admitted for treatment of her injuries. She was hospitalized for 9 days, released and then readmitted for an additional 10 days. The table below shows the 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	Nonanatomic brain injury with questionable loss of consciousness at scene[1], GCS=8, and appropriate {purposeful} movements at scene	severe 160820.4,0	Sun visor, driver's	Probable	Hospitalization records
2	Diffuse axonal {white matter shear} injury {hemorrhage consistent with} in ventral pons and left midbrain	critical 140206.5,8	Sun visor, driver's	Probable	Hospitalization records
3	Diffuse axonal {white matter shear} injury[2] , bilaterally, including left frontal lobe	critical 140628.5,3	Sun visor, driver's	Probable	Hospitalization records

[1] The driver was intubated at the scene due to combativeness and confusion.

[2] One CT scan described the lesions as scattered areas of cortical and subcortical hemorrhage consistent with shear injury.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
4	Contusions, cerebral, involving {at least} parenchyma adjacent to left cerebral peduncle, left temporal lobe, over sulci of left frontal convexity, and right frontal lobe {punctate}	serious 140622.3,3	Sun visor, driver's	Probable	Hospitalization records
5	Hemorrhage, subarachnoid, small, over left frontal region	serious 140684.3,2	Sun visor, driver's	Probable	Hospitalization records
6	Contusion bilateral upper lobes of lungs with bilateral pneumothoraces[3], right greater than left, and hypoxia	severe 441410.4,3	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
7	Hematoma, mediastinal, not further specified	moderate 441804.2,4	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
8	Injury thoracic cavity with pneumomediastinum	serious 442204.3,3	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
9	Thrombus[4] left subclavian vein, not further specified	serious 421699.3,2	Steering wheel hub and/or spokes and rim	Probable	Hospitalization records
10	Thrombus left axillary vein, not further specified	moderate 720499.2,2	Steering wheel hub and/or spokes and rim	Probable	Hospitalization records

[3] Because of the persistence of the right pneumothorax a thoracotomy with right pleurodesis was performed. The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:

hypoxia (hi-pok′se-a): reduction of oxygen supply to tissue below physiological levels despite adequate perfusion of the tissue by blood.

pleurodesis (ploo-rod′e-sis): the artificial production of adhesions between the parietal and the visceral pleura for treatment of persistent pneumothorax or severe pleural effusion; formerly done by physically irritating the pleural surface, it is now usually done with a chemical sclerosing agent.

sclerosing (skle-ros′ing): causing or undergoing sclerosis.

***sclerosis (skle-ro′sis)* [Gr. sklerosis hardness]**: an induration or hardening, such as hardening of a part from inflammation, increased formation of connective tissue, or disease of the interstitial substance.

[4] The potential for a deep vein thrombosis lead to the second hospitalization of this driver, almost immediately after she was initially released. The subsequent hospitalization exceeded the initial hospitalization in length of stay. The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:

thrombosis (throm-bo′sis): the formation, development, or presence of a thrombus.

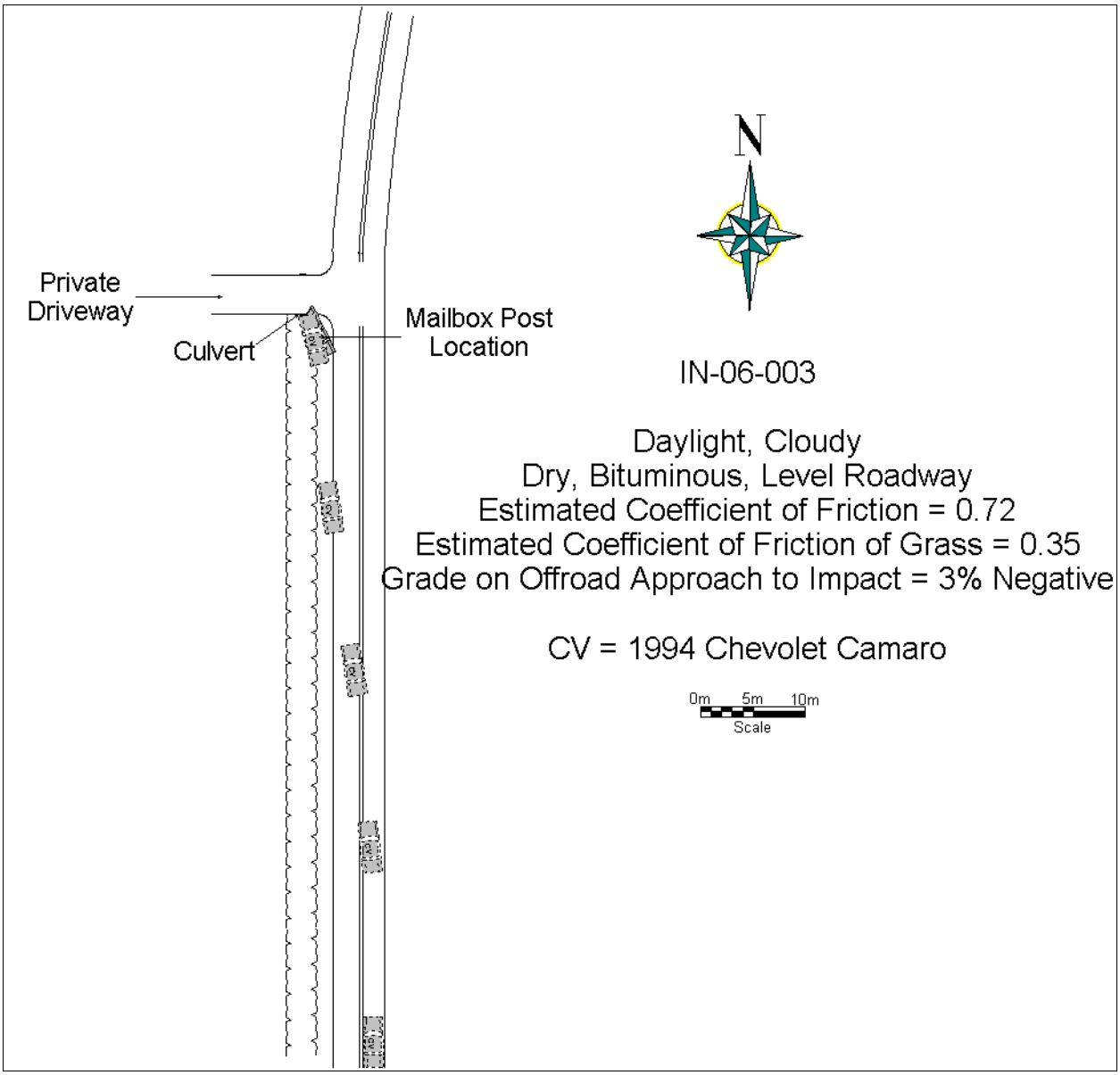
thrombus (throm′bas): an aggregation of blood factors, primarily platelets and fibrin with entrapment of cellular elements, frequently causing vascular obstruction at the point of its formation. Some authorities thus differentiate thrombus formation from simple coagulation or clot formation.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
11	Laceration {tear}, grade I, posterior spleen with extravascation[5] and embolization of the splenic artery	moderate 544222.2,2	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
12	Fracture left orbit, lateral wall and floor without mention of blowout	moderate 251202.2,2	Sun visor, driver's	Probable	Hospitalization records
13	Fractures left maxillary sinus involving anterior, lateral, and medial walls	moderate 250800.2,2	Sun visor, driver's	Probable	Hospitalization records
14	Fractured nasal bones, not further specified	minor 251002.1,4	Sun visor, driver's	Probable	Hospitalization records
15	Fracture, displaced, mid left clavicle requiring open reduction and internal fixation	moderate 752200.2,2	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
16	Fractured ribs: right 1st and 2nd, anteriorly, and left 1st, anteriorly or posteriorly or both	moderate 450220.2,3	Steering wheel hub and/or spokes and rim	Certain	Hospitalization records
17	Fracture {pilon[6]}, comminuted, right tibia extending into the tibial plafond and the medial malleolus, requiring open reduction and internal fixation	moderate 853414.2,1	Floor, including toe pan	Probable	Hospitalization records
18	Lacerations, multiple, scalp, not further specified	minor 190600.1,0	Sun visor, driver's	Probable	Emergency room records
19	Lacerations, multiple, face, not further specified	minor 290600.1,0	Flying glass, right front window	Probable	Emergency room records
20	Laceration, 6 cm (2.4 in), across forehead, not further specified	minor 290602.1,7	Sun visor, driver's	Probable	Hospitalization records
21	Contusion right eye, not further specified	minor 297402.1,1	Front left windshield's glazing	Probable	Hospitalization records

[5] The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
embolization (em"be-li-za′shen): 1. the process or condition of becoming an ***embolus***. 2. therapeutic introduction of a substance into a vessel in order to occlude it; called also *embolotherapy*.
embolus (em′bo-las) pl. ***em′boli***: a mass of clotted blood or other formed elements (bubbles of air, calcium fragments, etc.) brought by the blood from another vessel and forced into a smaller one, thus obstructing the circulation.
extravasation (ek-strav"e-sa′shen): 1. a discharge or escape, as of blood, from a vessel into the tissues. 2. the process of being extravasated. 3. blood or other substance which has been extravasated.

[6] The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
fracture (frak′cher): 1. the breaking of a part, especially a bone. 2. a break or rupture in a bone.
pilon f.: comminuted fracture of the inferior articular surface of the tibia and the malleoli, caused by axial compression of the ankle joint.
plafond (plah-fon′) **[Fr. "ceiling"]**: facies articularis inferior tibiae; so called from its vaulted shape.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
22	Contusion {ecchymosis}, large, left orbital/eye with swelling of globe	minor 297402.1,2	Front left windshield's glazing	Probable	Hospitalization records
23	Contusions {ecchymoses} medial thighs, including distal left and bilateral proximal areas	minor 890402.1,3	Steering wheel hub and/or spokes and rim	Certain	Emergency room records
24	Laceration over right proximal, anterior tibial area	minor 890600.1,1	Knee bolster, driver's, right of steering column	Certain	Emergency room records


Private
Driveway
Culvert
Mailbox Post
Location
N
IN-06-003
Daylight, Cloudy
Dry, Bituminous, Level Roadway
Estimated Coefficient of Friction = 0.72
Estimated Coefficient of Friction of Grass = 0.35
Grade on Offroad Approach to Impact = 3% Negative
CV = 1994 Chevolet Camaro
0m 5m 10m
Scale