

CRASH DATA RESEARCH CENTER

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**CALSPAN REMOTE CHILD AIR BAG RELATED FATALITY INVESTIGATION
SCI CASE NO: CA08014**

**VEHICLE: 1996 DODGE INTREPID
LOCATION: FLORIDA
CRASH DATE: FEBRUARY, 2007**

Contract No. DTNH22-07-C-00043

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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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 are 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 STANDARD TITLE PAGE

1. Report No. CA08014		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Calspan Remote Child Air Bag Related Fatality Investigation Vehicle: 1996 Dodge Intrepid Location: Florida			5. Report Date: February 2009		
			6. Performing Organization Code		
7. Author(s) Crash Data Research Center			8. Performing Organization Report No.		
9. Performing Organization Name and Address Calspan Corporation Crash Data Research Center P.O. Box 400 Buffalo, New York 14225			10. Work Unit No. C00500.0000.0069		
			11. Contract or Grant No. DTNH22-07-C-00043		
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590			13. Type of Report and Period Covered Technical Report Crash Date: February 2007		
			14. Sponsoring Agency Code		
15. Supplementary Note An investigation of an intersection crash involving a child air bag related fatality in a 1996 Dodge Intrepid.					
16. Abstract This remote investigation focused on the crash dynamics and injury sources resulting in the death of an 8 year old unrestrained male seated in the front right passenger seat of a 1996 Dodge Intrepid. The Dodge was equipped with 1 st -generation driver and front right passenger air bags that deployed as a result of a front-to-side impact crash with a 2004 Chevrolet Malibu Classic. Reportedly, the Chevrolet failed to yield the right of way and pulled forward from a stopped position at a three-leg intersection across the path of the Dodge. The 49 year old driver of the Dodge applied the brakes in an attempt to avoid the collision; however, there was insufficient distance for the Intrepid to stop. The crash occurred with the front plane of the Dodge impacting the left rear quarterpanel of the Chevrolet. The force of the impact caused the frontal air bags in the Dodge to deploy. The unrestrained 8 year old male responded to the Dodge driver's brake application by initiating a forward trajectory across the front right seat. Upon impact, the child was positioned in-close proximity to the deploying front right passenger air bag. The expanding air bag interacted with the child about the chest, head, and neck causing reported trauma. The child was found unresponsive lying on the floor within the front right interior. He was transported to a pediatric trauma center and hospitalized. The child died as a result of the injuries six days post-crash. The driver of the Dodge was not injured in the event. The Intrepid was also occupied by either four or five unrestrained children in the vehicle's second row. Reportedly, these children were not injured in the crash and fled the crash scene on foot.					
17. Key Words Intersection crash Air Bag Deployment Fatality Cervical spine			18. Distribution Statement General Public		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 8	22. Price

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BACKGROUND

This remote investigation focused on the crash dynamics and injury sources resulting in the death of an 8 year old unrestrained male seated in the front right passenger seat of a 1996 Dodge Intrepid, **Figure 1**. The Dodge was equipped with 1st-generation driver and front right passenger air bags that deployed as a result of a front-to-side impact crash with a 2004 Chevrolet Malibu Classic. Reportedly, the Chevrolet failed to yield the right-of-way and pulled forward from a stopped position at a three-leg intersection across the path of the Dodge. The 49 year old female driver of the Dodge applied the brakes in an attempt to avoid the collision; however, there was insufficient distance for the Intrepid to stop. The crash occurred with the front plane of the Dodge impacting the left rear quarterpanel of the Chevrolet. The force of the impact caused the frontal air bags in the Dodge to deploy.



Figure 1: Left front oblique view of the Dodge.

The unrestrained 8 year old male front right passenger responded to the Dodge driver's brake application by initiating a forward trajectory. At impact, the child was positioned in-close proximity to the deploying front right passenger air bag. The expanding air bag interacted with the child about the chest, head, and neck causing the reported trauma. The child was found unresponsive lying on the floor within the front right interior. He was transported to a pediatric trauma center and hospitalized. The child died as a result of the injuries six days post-crash. The driver of the Dodge was not injured in the event. The Intrepid was also occupied by either four or five unrestrained children in the vehicle's second row. Reportedly, these children were not injured in the crash and fled the crash scene on foot.

This crash was identified through a search of the Fatal Analysis Reporting System (FARS) conducted by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) and was identified as a potential air bag related fatality. The Police Accident Report (PAR) of the crash was forwarded to the Calspan Special Crash Investigations (SCI) team for remote follow-up investigation on April 2, 2008. Calspan SCI contacted the investigating police agency and requested copies of the photographs and supplemental information that documented the crash. A copy of the autopsy report documenting the injuries sustained by the youth was also obtained for this investigation.

SUMMARY

VEHICLE DATA

1996 Dodge Intrepid

The 1996 Dodge Intrepid was identified by the Vehicle Identification Number (VIN): 1B3HD46F1TF (production sequence deleted). The vehicle's odometer reading and date of manufacture are unknown. The front wheel drive, four-door sedan was equipped with a 3.5 liter, V6 engine linked to a four-speed automatic transmission. The vehicle was configured for six passengers. The manual restraint system consisted of three-point lap and shoulder belts in the four outboard positions. The first and second row center positions were equipped with lap belts. The Intrepid was also equipped with 1st-generation driver and front right passenger air bags that deployed as a result of the crash.

2004 Chevrolet Malibu Classic

The 2004 Chevrolet Malibu Classic was identified by the Vehicle Identification number (VIN): 1G1ND52F54M (production sequence deleted). The vehicle's odometer reading and date of manufacture are unknown. The power train in this front wheel drive, five passenger, four-door sedan consisted of a 2.2 liter, I4 engine linked to a four-speed automatic transmission. The service brakes were a front disc/rear drum system. The manual restraint system consisted of three-point lap and shoulder belts in the four outboard positions and a second row center lap belt. The Chevrolet was also equipped with redesigned driver and front right passenger air bags. The frontal air bags did not deploy in the lateral impact.

CRASH SITE

This two-vehicle crash occurred during the daylight hours of February 2007. At the time of the crash, the weather was light rain. The asphalt road surface was wet. The crash occurred at the three-leg intersection of a six-lane north/south road and a two-lane east/west road in a commercial setting. The primary road was configured with three travel lanes in the respective travel directions. The two-lane feeder road intersected the primary road from the west. A stop sign controlled the east traffic flow through the intersection. The speed limit in the area of the crash was 72 km/h (45 mph).

Figure 2 is a police image of the crash site looking to the south depicting the intersection and the final rest positions of the vehicles. Due to the wet road surface, no tire marks were observed at the scene by the investigating police officers.



Figure 2: Southward view of the crash site.

CRASH SEQUENCE

Pre-Crash

The 1996 Dodge Intrepid was traveling southbound in the center southbound lane driven by a 49 year old female. The driver was restrained by the vehicle's manual three point lap and shoulder belt. The front right seat in the Dodge was occupied by an unrestrained 8 year old male, the driver's grandson. The second row of the vehicle was occupied by either four or five unrestrained children that fled the scene immediately after the crash. The driver had picked all the children up from an elementary school and was giving them a ride home. The Chevrolet was driven by a 17 year old restrained female and was the vehicle's sole occupant. The Chevrolet was stopped at the intersection facing east, intending to turn left and travel north. The crash occurred when the driver of the Chevrolet accelerated forward across the path of the Dodge. The driver of the Dodge reportedly applied the brakes in an attempt to avoid the crash.

Crash

The center and left aspects of the Dodge's frontal plane struck the left quarterpanel area of the Chevrolet. The direction of the impact force was in the 1 o'clock sector for the Dodge and the 10 o'clock sector for the Chevrolet. The force of the impact caused the frontal air bags in the Dodge to deploy. The impact, located rearward of the Chevrolet's center of gravity, resulted in a counterclockwise (CCW) rotation of the vehicle, and the momentum of the Dodge pushed the Chevrolet laterally to the south. The Dodge remained within the center travel lane and came to rest approximately 15 m (50 ft) from the impact facing south. The Chevrolet came to rest in the center of the road facing south approximately 9 m (30 ft) from the area of the impact. The severity of the impact (delta V) was calculated by the Damage Algorithm of the WINSMASH model using estimated crush measurements. The total delta V of the Dodge was 15 km/h (9.3 mph). The longitudinal and lateral components of the Dodge's delta V were -14 km/h (-8.7 mph) and -5 km/h (-3.1 mph), respectively. The total delta V for the Chevrolet was 16 km/h (9.9 mph). The longitudinal and lateral components were -8 km/h (-5.0 mph) and 14 km/h (8.7 mph), respectively. A schematic of the crash is attached to the end of this narrative report as **Figure 8**.

Post-Crash

The driver of the Chevrolet exited her vehicle and was not injured. She approached the Dodge and noted that the driver had already exited the vehicle. All of the rear seated children exited the second row of the Dodge and fled the scene. The driver of the Dodge walked to the front right of the vehicle and began attending to the front right occupant. Reportedly, the child was on the floor in the front right interior under the deflated air bag. The police and ambulance personnel responded to the scene. The 8 year old child was transported by ground ambulance to a regional pediatric trauma center. He was hospitalized for six days and removed from life support after it was determined that medical intervention had proved unsuccessful.

VEHICLE DAMAGE

1996 Dodge Intrepid Exterior

Figures 3 and 4 are the front and left lateral views of the Dodge. The front plane of the vehicle sustained a combined width of direct and induced damage that extended across the entire 160 cm (63 in) frontal end width. The direct contact damage began approximately 5 cm (2 in) right of the center and extended to 85 cm (33.5 in) to the left corner. The components damaged in the

direct contact included the bumper fascia, reinforcement bar, left head lamp assembly, hood and left fender. The residual damage was limited to the vehicle's structures forward of the radiator support plane. The police photographs were used to estimate the frontal deformation of the vehicle. The estimated residual crush along the bumper reinforcement bar was as follows: C1 = 23 cm (9 in), C2 = 15 cm (6 in), C3 = 10 cm (4 in), C4 = 5 cm (2 in), C5 = 2 cm (1 in), C6 = 0. The maximum crush was located at C1, the left front bumper corner. The left fender buckled rearward and outboard. The windshield was not fractured and there was no damage to the side glazing or backlight. The Collision Deformation Classification (CDC) of the Dodge was determined to be 01-FYEW1.



Figure 3: Front view of the Dodge.



Figure 4: Left lateral view at the front plane of the Dodge.

2004 Chevrolet Malibu Classic Exterior

Figure 5 is a left side view of the damaged Chevrolet. The damage began in the area of the left B-pillar and extended rearward across the left rear door and quarterpanel to the left rear corner. The damage pattern was an estimated 254 cm (100 in) in length. The estimated residual crush profile along the mid door elevation as follows: C1 = 5 cm (2 in), C2 = 10 cm (4 in), C3 = 15 cm (6 in), C4 = 15 cm (6 in), C5 = 10 cm (4 in), C6 = 2 cm (1 in). The left rear tire/wheel was directly involved in the impact. The upper aspect of the tire was deformed inboard indicating bending of the axle. The left rear door was jammed shut by the deformation. There was no damage to the windshield, side glazing or backlight. The CDC of the Chevrolet was determined to be 10-LZEW2.



Figure 5: Left side view of the Chevrolet's impact damage.

1996 Dodge Intrepid Interior

The interior damage to the Dodge was limited to the deployment of the vehicle's frontal air bags. There was no occupant compartment intrusion from the exterior crash force. The available police images did not adequately document the Dodge's interior in order to determine specific points of occupant contact. The driver seat was adjusted to a mid-track position. The front right seat was adjusted to a rear track position. The seat track adjustment was based on a review of the police images, **Figure 6**.



Figure 6: Front right passenger seat of the Dodge.

MANUAL RESTRAIN SYSTEMS

1996 Dodge Intrepid

The manual restraint system in the 1996 Dodge Intrepid consisted of three-point lap and shoulder belts in the four outboard positions. The second row center position was equipped with a lap belt. The driver's belt consisted of a continuous loop webbing, an adjustable D-ring, Emergency Locking Retractor (ELR), and a sliding latch plate. The driver indicated to the investigating police officer that she was restrained at the time of the crash. The front right restraint consisted of continuous loop webbing, adjustable D-ring, ELR retractor and a light-weight locking latch plate. The front right passenger was not restrained at the time of the crash. The lack of restraint use was based on the observed final rest position of the child passenger in the front right foot well of the Dodge. Reportedly, four to five children occupied the second row at the time of the crash. It was probable that none of these individuals was restrained at the time of the crash.

AIR BAG SYSTEMS

1996 Dodge Intrepid

The 1996 Dodge Intrepid was equipped with 1st-generation driver and front right passenger air bags that deployed as a result of the crash. The driver air bag deployed from a module that was located in the center hub of the steering wheel rim. **Figure 7** is a view of the deployed driver air bag. There was no residual driver contact evidence observed in the image. The front right passenger air bag deployed from a top-mount module located in the right aspect of the instrument panel. The module cover flap was rectangular and hinged at its forward aspect. The cover flap did not appear to be damaged (refer to **Figure 7**). The child passenger's contact to the deploying front right air bag membrane was not documented by the police investigators.



Figure 7: Front interior view of the Dodge.

OCCUPANT DEMOGRAPHICS

Age / Sex:	49 year old / Female	8 year old / Male
Height:	Unknown	147 cm (58 in)
Weight:	Unknown	34 kg (76 lb)
Seat Track Position:	Mid to rear track position	Mid to rear track position
Restraint Use:	Three-point lap and shoulder belt	None
Usage Source:	Police report	Witness statements, SCI review
Medical Treatment:	Not injured	Transported by ground ambulance and hospitalized, expired six days post-crash

DRIVER INJURY

The 49 year old female driver was not injured in the crash and did not require medical transport.

DRIVER KINEMATICS

The driver was seated in a mid to rear track position in an unknown posture. She was restrained by the vehicle’s lap and shoulder restraint. The driver reacted to the impending crash by a rapid application of the brakes. Upon impact, the safety belt retractor locked and the frontal air bags deployed. The driver initiated a forward trajectory in response to the 1 o’clock direction of the impact force. The driver loaded the locked belt system and deployed driver air bag with her upper torso and rode down the force of the crash. She rebounded back into the driver seat and came to rest. She was not injured in the event.

FRONT RIGHT PASSENGER INJURY

<i>Injury</i>	<i>Injury Severity (AIS Update 98)</i>	<i>Injury Source</i>
C2-C3 cervical fracture dislocation and subluxation; spinal cord disruption, quadriplegia	Maximum (640236.6,6)	Front right passenger air bag
Cerebral edema, NFS	Serious (140660.3,9)	Front right passenger air bag
Bilateral pneumothorax, NFS	Serious (442202.3,3)	Front right passenger air bag
Liver laceration, NFS	Moderate (541820.2,1)	Right door panel
Right iliac wing fracture, NFS	Moderate (852600.2,1)	Right door panel
Large right cheek abrasion	Minor (290202.1,1)	Front right passenger air bag
Abrasion of undersurface of chin	Minor (290202.1,8)	Front right passenger air bag

Source: Medical Examiner’s Autopsy Report

FRONT RIGHT PASSENGER KINEMATICS

The 8 year old front right child passenger was seated in a mid to rear track position and was unrestrained. The right aspect of the soft tissue facial abrasions indicated the child's head was turned to the left.

Immediately prior to the impact, the driver rapidly applied the brakes in response to the impending crash. The sudden brake application displaced the unrestrained passenger forward into close proximity to the front right passenger air bag. At impact, the frontal air bags deployed. The deploying air bag interacted with the passenger's chest causing the bilateral pneumothorax. The air bag expanded vertically and abraded the child's right cheek and chin. The expansion of the air bag under the child's chin forced his head up and rearward. The hyperextension of the neck resulted in the identified C2/C3 cervical fracture dislocation and subluxation, spinal cord disruption and cerebral edema. The child was accelerated rearward by the expanding air bag and contacted the right door panel with his right flank. This contact was a probable source of the right iliac fracture and liver laceration.

The child then came to rest on the floor within the front right interior. The child was removed from the vehicle and transported to a pediatric trauma center. He was hospitalized for six days and then removed from life-support after it was determined that continued medical intervention to treat the sustained injuries would be unsuccessful.

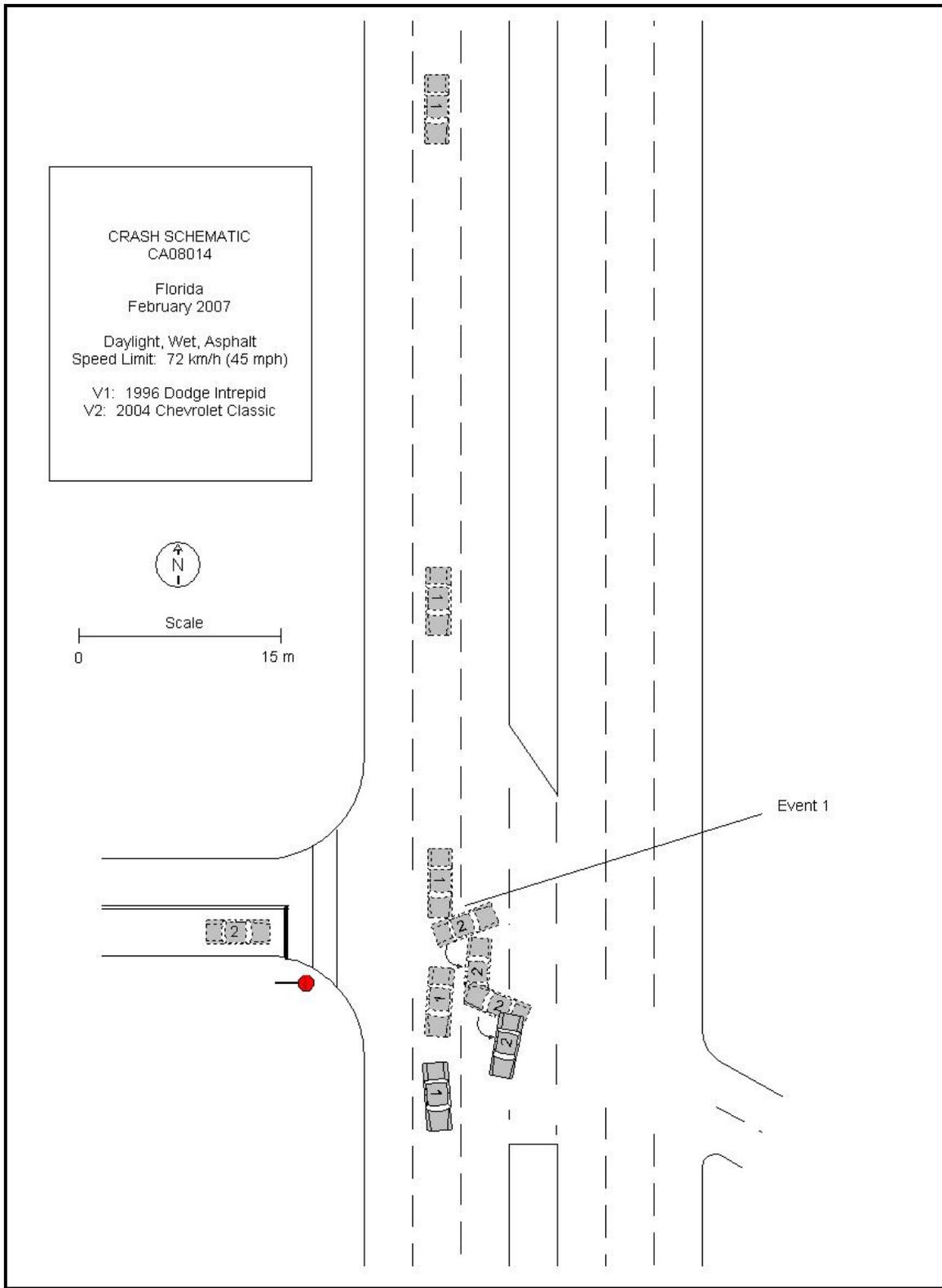


Figure 8: Crash schematic