

Remote Passenger Air Bag Serious Injury Investigation
Dynamic Science, Inc. (DSI), Case Number DS09004
2001 Honda Accord
Washington
March 2006

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.

1. Report No. DS09004	2. Government Accession No.		3. Recipient Catalog No.	
4. Title and Subtitle Remote Passenger Air Bag Serious Injury Investigation			5. Report Date July 22, 2010	
			6. Performing Organization Report No.	
7. Author(s) Dynamic Science, Inc.			8. Performing Organization Report No.	
9. Performing Organization name and Address Dynamic Science, Inc. 299 West Cerritos Avenue Anaheim, CA 92805			10. Work Unit No. (TRAIS)	
			11. Contract or Grant no. DTNH22-07-00045	
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation (NVS-411) National Highway Traffic Safety Administration 1200 New Jersey Ave, SE Washington, DC 20590			13. Type of report and period Covered [Report Month, Year]	
			14. Sponsoring Agency Code	
15. Supplemental Notes				
16. Abstract This remote investigation focused on the air bag related injuries sustained by a child seated in a rear-facing Graco SnugRide infant safety seat (ISS). The subject vehicle was a 2001 Honda Accord being driven by a restrained 21-year-old female and occupied by a 4-month-old female, a 2-year-old female, and a 3-year-old female. The 4-month-old female occupant was seated in the ISS which had been installed in the front right seat. The Honda was initially being driven southbound in the inboard lane of a four-lane, undivided roadway. There were two other vehicles involved in the crash. The first other vehicle was a 2001 Chrysler Town and Country and the second was a 2002 Ford Taurus. The two other vehicles were stopped in heavy traffic ahead of the Honda in the outboard traffic lane. The Honda changed lanes from the inboard lane to the outboard lane. The driver of the Honda was unable to stop in time and the front of the Honda impacted the rear of the Chrysler. The Chrysler was then pushed it into the rear of the Ford. The 4-month-old child sustained severe intracranial hypertension, severely displaced comminuted skull fractures, and subdural hemorrhages. The child was hospitalized 10 months before succumbing to her injuries. The cause of death was reported as severe respiratory failure/arrest due directly to the severe closed head injury she sustained in the collision.				
17. Key Words Air bag, deployment, serious injury, front right occupant			18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price	

Dynamic Science, Inc.
Crash Investigation
Case Number: DS09004

TABLE OF CONTENTS

Background	1
Summary	1
Crash Site	1
Pre-Crash	2
Crash	2
Post-Crash	2
Vehicle Data - 2001 Honda Accord	3
Vehicle Damage	3
Exterior Damage	3
Interior Damage	4
Manual Restraints	4
Supplemental Restraint Systems	4
Child Restraint Systems	5
Vehicle Data - 2001 Chrysler Town and Country	6
Vehicle Data - 2002 Ford Taurus LX	6
Occupant Demographics	7
Occupant Injuries	8
Occupant Kinematics	8
Attachment 1. Scene Diagram	10

BACKGROUND

This remote investigation focused on the air bag related injuries sustained by a child seated in a rear-facing Graco SnugRide infant safety seat (ISS). The subject vehicle was a 2001 Honda Accord (**Figure 1**) being driven by a restrained 21-year-old female and occupied by a 4-month-old female, a 2-year-old female, and a 3-year-old female. The 4-month-old female occupant was seated in the ISS which had been installed in the front right seat position. The Honda was initially being driven southbound in the inboard lane of a four-lane, undivided roadway. There were two other vehicles involved in the crash. The first other vehicle was a 2001 Chrysler Town and Country and the second was a 2002 Ford Taurus. The two other vehicles were stopped in heavy traffic ahead of the Honda in the outboard traffic lane. The Honda changed lanes from the inboard lane to the outboard lane. The Honda was unable to stop in time and the front of the Honda impacted the rear of the Chrysler. The Chrysler was then pushed it into the rear of the Ford.



Figure 1. Subject vehicle, 2001 Honda Accord (police photo)

The 4-month-old child sustained serious head injuries and was hospitalized 10 months before succumbing to her injuries¹. The cause of death was reported as severe respiratory failure/arrest due directly to the severe closed head injury she sustained in the collision.

This Passenger Air Bag Serious Injury Investigation was identified in an internet news article. The article cited the air bag as the source of the injuries to a 4-month-old child who was seated in a rear-facing ISS. The article was forwarded to the National Highway Traffic Safety Administration (NHTSA) Special Crash Investigations (SCI) office on February 4, 2009. DSI was assigned the case on February 5, 2009. The police report and the accompanying on-scene images were requested February 5, 2009. According to the lead investigator, the police report was available, but photos from the case file were in “do not release” status at that time due to an upcoming arraignment. DSI received the police report on February 5, 2009 and the photos on June 27, 2009. The following information was obtained from the police report, police photos, and the medical records for the 4-month-old child.

SUMMARY

Crash Site

The three-vehicle crash occurred in the southbound outboard lane approaching a three-leg intersection (**Figure 2**). A second intersection was located south of the three-leg intersection and was controlled by a three-phase traffic signal that was red at the time of the crash. The north/south

¹According to the NASS Coding Manual, this was not considered a fatality because the death occurred more than 30 days after the crash.

roadway was comprised of two southbound travel lanes and two northbound travel lanes. The north and south travel lanes were separated by double yellow painted lines. The concrete roadway was straight, level, dry and free of any defects at the time of the crash. The posted speed limit was 48 km/h (30 mph).

Pre-Crash

This crash occurred in March 2006 at 1110 hours. The Honda was initially being driven southbound in the inboard travel lane by a restrained 21-year-old female. The front right seat was occupied by a 4-month-old female who was seated in a Graco SnugRide rear-facing ISS. The second row left seat was occupied by a 2-year-old female who was seated in a Dorel High Back Booster² forward-facing child restraint system (CRS). The second row middle seat was occupied by a 3-year-old female who was restrained by the vehicle's lap and shoulder belt.



Figure 2. Overview of crash scene, southbound view (police photo)

The Chrysler van was being driven southbound by a 29-year-old male and was stopped in heavy traffic in the outboard travel lane. The Ford was being driven by a 23-year-old female and was stopped ahead of the Chrysler.

Prior to impact, the Honda changed lanes into the outboard lane from the inboard lane to avoid stopped traffic in the outboard lane.

Crash

The driver of the Honda braked but was unable to stop in time and the front of the Honda impacted and underrode the rear of the Chrysler (Event 1). The frontal air bags in the Honda deployed during this impact. The CDC-only algorithm of the WinSMASH program computed a Total Delta-V of 27.0 km/h (16.7 mph); the longitudinal and lateral components were -27.0 km/h (-16.7 mph) and 0 km/h, respectively. The results appear high, based on the estimated crush. The rear-end impact pushed the Chrysler forward and the front of the Chrysler impacted the rear of the Ford (Event 2). All three vehicles came to rest on the roadway.

Post-Crash

The driver of the Honda exited the vehicle without assistance. She opened the front right door of the Honda and removed the ISS from the vehicle. The driver of the Ford exited her vehicle without assistance. She went to the Honda and assisted the driver in rendering medical assistance to the

²Identification based on police photo.

child in the ISS. At some point, the driver removed the child from the ISS. EMS personnel arrived on scene shortly after the crash and transported the 4-month-old female by ground ambulance to a local trauma center. The ISS was left at the scene.

Upon arrival, the child exhibited decorticate posturing³ and her pupils were fixed and non-reactive. The child was reported as being unresponsive with a Glasgow Coma Score of 3, indicating a severe brain injury. She did not exhibit any evidence of musculoskeletal, thoracic, or abdominal trauma. She sustained skull and brain injuries and was hospitalized in a pediatric intensive care unit for one month. She was then transferred to a care facility for nine months before succumbing to her injuries.

The second row left child occupant sustained a left clavicle contusion and was transported to a local hospital where she was treated and released. The second row middle child occupant sustained an abrasion to the iliac crest (unknown aspect) and was transported to a local hospital where she was treated and released.

The driver of the Chrysler exited his vehicle under his own power. The police did not report any injuries.

The Honda and Chrysler were towed from the scene due to damage. The Ford was driven from the scene by the driver.

Vehicle Data - 2001 Honda Accord

The 2001 Honda Accord four-door sedan was identified by the Vehicle Identification Number (VIN): 1HGCG16581Axxxxxx. The Honda was equipped with a 6-cylinder, 3.0-liter engine, automatic transmission, 4-wheel disc brakes with an anti-lock brake system, and front wheel drive. The vehicle manufacturer's recommended tire size was P195/65R15 and the recommended cold tire pressure was 207 kPa (30 psi). This was a remote case and the tire pressure was not measured or reported by the police.

The Honda's interior was configured with seating for five occupants. The front row seating consisted of outboard bucket seats with adjustable head restraints. The second row seating consisted of a bench seat with folding backs.

Vehicle Damage

Exterior Damage

The Honda sustained moderate front end damage during the impact with the Chrysler (**Figure 3**). The direct damage extended across the entire front bumper. There was underride-type damage to the



Figure 3. Frontal damage (police photo)

³Abnormal posturing that involves rigidity, flexion of the arms, clenched fists, and extended legs.

hood and upper radiator support. The hood was buckled rearward and the leading edge was abraded from contact with the Chrysler. Both headlight assemblies were displaced and the top of the bumper fascia was abraded. The maximum averaged crush was estimated to be 20-25 cm (7.8-9.8 in). The Collision Deformation Classification (CDC) for the frontal impact was 12FDEW1.

Interior Damage

Based on the on-scene police photographs, there was no evidence of damage to the vehicle interior. The doors remained closed and operational, and there was no glazing damage.

Manual Restraints

The Honda's front row seating was equipped with 3-point manual lap and shoulder belts with sliding latch plates and adjustable D-ring assemblies. The D-ring on the right was adjusted to the full-up position; the adjustment on the left was not known. The driver's safety belt had an Emergency Locking Retractor (ELR). The remaining safety belts had switchable ELR/Automatic Locking Retractors (ALR). The front right seat belt was used to secure a rear-facing ISS (**Figure 4**). The retractor mode was not known for this seat belt. The second row left belt was used to secure a forward-facing combination Child Restraint System (CRS) and, according to the police report, the retractor was in the ELR mode. The front seat belts were equipped with retractor pretensioners; it is not known if they actuated during the crash.



Figure 4. Front row right seat position (police photo)



Figure 5. Front right passenger air bag (police photo)

Supplemental Restraint Systems

The Supplemental Restraint System (SRS) included an air bag control module, dual-stage driver and passenger frontal air bag, seat-mounted side air bags, and seat belt pretensioners for the front row. The frontal air bags deployed at impact with the Chrysler. The driver's air bag deployed from the steering wheel hub and the front right passenger air bag deployed from the top of the right instrument panel. The passenger air bag face exhibited an area of faint striations that may have been deposited from the ISS during the deployment (**Figure 5**).

Child Restraint Systems

Front Row Right

A Graco SnugRide rear-facing ISS was positioned in the front row right of the Honda (**Figure 6**). The model number and date of manufacture were unknown. The ISS was designed with a carrying handle, a 5-point harness, and a stay-in-vehicle base. The ISS can be used with or without the base. Labeling on the ISS indicated that the manufacturer recommended that the seat be used for children with a weight between 2.3-10 kg (5-22 lbs) and whose height is 73 cm (29 in) or less. The 4-month-old child was within both the height and weight guidelines. Photos show that the ISS harness was routed through the lower slots. It could not be determined if the ISS had sustained any damage from the air bag deployment.



Figure 6. Graco rear-facing ISS (police photo)

Shortly after the crash, the driver of the Honda removed the ISS from the vehicle. Later, the ISS was placed back in the vehicle by the police and witnesses to show how the seat had been installed. The shoulder portion of the belt was placed behind the seat. The police made the following observations:

- The stay-in-vehicle base was not used with the ISS. It was located in the second row right seat and was not anchored to the vehicle.
- The ISS had been placed in the vehicle by the driver.
- The cover on the ISS was homemade.
- The carrying handle was in the upright position.
- There were folders and notebooks under the ISS.
- The harness appeared to be very loose for a child that was 4 months old.
- The lap belt portion was used to anchor the ISS and had been routed through the left and right belt hooks.

Second Row Left

A Dorel High Back Booster forward facing CRS was positioned in second row left seat position in the Honda (**Figure 7**). It was not known if the 2-year-old child in this seat position met the CRS age, height, weight recommendations. The police made the following observations:



Figure 7. CRS, Dorel High Back Booster (police photo)

- The CRS harness straps were twisted to a point where they were only 1.3 cm (0.5 in) wide.
- The CRS was anchored to the vehicle using the 3-point lap and shoulder belt.
- The retractor was in the ELR mode.
- The CRS moved freely 3.0-5.0 cm (1.2-2.0 in) in the forward direction.

Vehicle Data - 2001 Chrysler Town and Country

The 2001 Chrysler Town and Country LX 4-door van was identified by the VIN: 2C4GP44311Rxxxxxx. The Chrysler 4-door van was equipped with a 3.3-liter, 6-cylinder engine, and a 4-speed automatic transmission. The Chrysler was being driven by a 29-year-old male and was stopped in traffic before the crash. The vehicle sustained rear end damage from the impact with the Honda and front end damage from the subsequent impact with the Ford. The CDCs for the frontal and rear impacts were 12FDEW1 and 06BDEW1, respectively (**Figures 8-9**). The Chrysler was towed from the scene.



Figure 8. Rear end damage to Town and Country (police photo)



Figure 9. Front end damage to Town and Country (police photo)

Vehicle Data - 2002 Ford Taurus LX

The 2002 Ford Taurus was identified by the VIN: 1FAFP52262Gxxxxxx. The Ford 4-door sedan was equipped with a 3.0-liter, 6-cylinder engine, front wheel drive, and a 4-speed automatic transmission. The Ford was being driven by a 23-year-old female and was stopped in traffic before the crash. The vehicle sustained rear damage from the impact with the Chrysler and was assigned a CDC of 06BDLW1 (**Figure 10**). The Ford was driven from the crash site by the driver.



Figure 10. Rear end damage to Ford (police photo)

OCCUPANT DEMOGRAPHICS

	Driver	Front Row Right (02)
Age/Sex:	21/Female	4-month/Female
Seated Position:	Front row left	Front row right
Seat Type:	Bucket	Bucket
Seat Track Position:	Unknown	Unknown
Height:	Unknown	56 cm (22 in)
Weight:	Unknown	6 kg (13 lbs)
Alcohol/Drug Involvement:	None	N/A
Body Posture:	Unknown	Seated in ISS
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt	Lap and shoulder belt with ISS
Air bag:	Steering wheel mounted frontal air bag deployed. Seat-mounted side air bag did not deploy.	Top instrument panel mounted frontal air bag deployed. Seat-mounted side air bag did not deploy.
	Second Row Left (03)	Second Row Middle (04)
Age/Sex:	2/Female	3/Female
Seated Position:	Second row left	Second row middle
Seat Type:	Bench with folding back	Bench with folding back
Seat Track Position:	N/A	N/A
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and should belt in combination with CRS	Lap and shoulder belt

Occupant Injuries

Driver: No reported injuries.

Front row right occupant (02): Injuries obtained from discharge summary, history and physical reports, and emergency room records.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Displaced comminuted skull fractures with a large amount of subdural hemorrhage bleeding into the subgaleal space	150404.3,9 140684.3,9	ISS and passenger air bag	Certain
Loss of consciousness with inappropriate movements (decerebrate, decorticate, flaccid, no response to pain) no matter the length of consciousness.	160824.5,0	ISS and passenger air bag	Certain
Collapsed left lung and right main stem	442299.7,3	ISS and passenger air bag	Certain

Second row left occupant (03): Injury obtained from emergency room records and radiology report.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Contusion, left clavicle	790402.1,2	CRS harness	Certain

Second row middle occupant (04): Injury obtained from emergency room records.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Illiatic abrasion, unknown aspect	890202.1,9	Seat belt webbing	Certain

Occupant Kinematics

Driver Kinematics

The 21-year-old female driver was seated in an unknown posture. The seat back was slightly reclined in the on-scene photographs. The police report indicated that the driver was restrained by the available manual 3-point lap and shoulder belt. Based on the underride configuration damage pattern of the Honda, the driver was braking prior to impact. At impact, the frontal air bag system deployed and she initiated a forward trajectory. She probably loaded the manual restraint and

contacted the deployed air bag. She did not report any injuries and was able to exit the vehicle under her own power.

Front Row Right Occupant Kinematics

The 4-month-old child female passenger was restrained in a rear-facing Graco SnugRide ISS that was installed in the front right passenger's seat without the required detachable base. It was not known how the child was restrained within the ISS or how tightly the ISS was installed in the vehicle. Folders and papers were placed on the fabric bucket seat beneath the ISS. Prior to impact, the driver of the Honda began braking. The child passenger was displaced to some degree in a forward direction. At impact, the front right passenger's air bag deployed. The ISS pivoted rearward as the air bag expanded against the plastic shell. The ISS shell was deflected against the rear aspect of the child's head as a result of the air bag expansion. The child sustained displaced comminuted skull fractures with a large amount of subdural hemorrhage bleeding into the subgaleal space. CT scans indicated infarction of the bilateral hemispheres, covering approximately 75% of her brain. There was a skull deformity with a residual cephalohematoma⁴ on the right parietal area. The child was removed from the ISS and the vehicle by the driver of the Honda and was transported from the scene by ground ambulance. She was hospitalized for a total of 10 months before succumbing to her injuries. According to the doctor who pronounced the death, she died due to a severe respiratory failure/arrest due directly to the severe closed head injury she sustained in the collision.

Second Row Left Occupant Kinematics

The 2-year-old female passenger was restrained in a forward-facing CRS that was installed in the second row right passenger's seat. The CRS was anchored to the vehicle using the manual lap and shoulder belt. The belt was routed through the forward facing belt path and the retractor was in the ELR mode. Prior to impact, the driver of the Honda began braking and the child passenger and the CRS were displaced to some degree in a forward direction. At impact, she loaded the CRS harness and sustained a left clavicle contusion. It was not known who removed the child from the vehicle. She was transported from the scene to a local hospital where she was treated and released.

Second Row Middle Occupant Kinematics

The 3-year-old female passenger was seated in an unknown posture in the second row middle passenger's seat. The police reported that she was wearing the manual lap and shoulder belt. It was not known if the child was properly restrained. As the driver began braking, she was displaced forward. At impact, she loaded the lap and shoulder belt. She sustained an iliac crest abrasion due to contact with the lap belt was transported to a local hospital where she was treated and released. It was not known who removed the child from the vehicle or if she exited the vehicle on her own.

⁴Collection of blood under the scalp.

Attachment 1. Scene Diagram

