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## REMOTE CHILD AIR BAG FATALITY INVESTIGATION

CASE NUMBER - IN08004  
LOCATION - Texas  
VEHICLE - 2001 KIA SPECTRA GS  
CRASH DATE - January 2008

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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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16. Abstract This report covers a remote child air bag fatality investigation involving a 2001 Kia Spectra GS and a 1999 Dodge Ram 2500. This crash is of special interest because the Kia's front right passenger (6-year-old female) sustained fatal injuries as a result of her interaction with the deploying front right passenger air bag. The Kia was traveling east on a local road in a suburban/commercial area. The Dodge had been traveling west on the same roadway and turned left across the Kia's travel path. The Kia's driver braked hard, depositing lock-up braking skid marks, but could not avoid the collision. The Kia's front impacted the Dodge's right side, causing the Kia's driver and front right passenger air bags to deploy. The Kia was deflected, rotated approximately 20 degrees clockwise and came to rest in the roadway close to the point of impact. The Dodge's driver pulled into a commercial parking area and brought the Dodge to a controlled stop. The Kia was towed from the scene due to disabling engine damage and the Dodge was driven away. The Kia's front right passenger was transported from the scene to a local hospital and then air-lifted to a trauma center, where she was pronounced dead 17 days post-crash. The Kia's driver and back left passenger were not injured, and the back right passenger sustained minor injuries. The Dodge's driver was not injured.					
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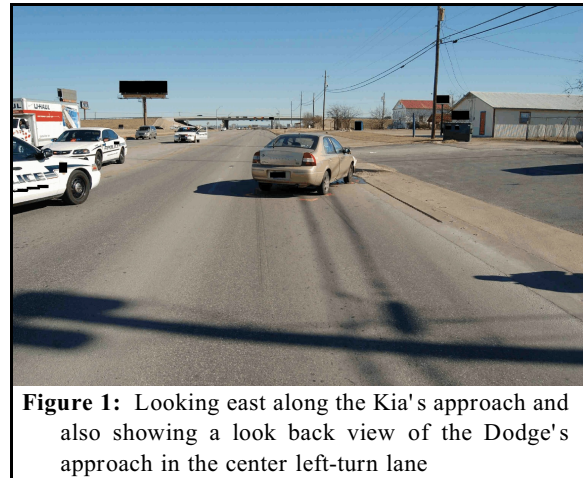
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This crash was brought to the National Highway Traffic Safety Administration's attention on February 11, 2008 by a news service article. This crash involved a 2001 Kia Spectra hatchback (case vehicle) and a 1999 Dodge Ram pickup. The crash occurred in January 2008 at 1325 hours, in Texas, and was investigated by the applicable municipal police. This crash is of special interest because the Kia's front right passenger (6-year-old female) sustained fatal injuries as a result of her interaction with the front right passenger's air bag. The case vehicle was not available to be inspected and the driver declined to be interviewed on the advice of her attorney. An on-scene witness was able to provide limited information. This report is based on the police crash report with on-scene photographs, medical treatment data for the injured parties, an interview with a witness, and this contractor's evaluation of the available evidence.

### CRASH CIRCUMSTANCES

**Crash Environment:** Both vehicles were traveling on a five-lane local roadway (two lanes in each direction with a continuous center left-turn lane), traversing in an east-west direction. It was daylight and there were no adverse atmospheric conditions. The roadway was straight and level, the speed limit was 72 km/h (45 mph) and the asphalt surface was dry and free of defects (**Figure 1**). Traffic density was moderate. The site of the crash was primarily suburban-commercial, with driveways for businesses along the south side of the roadway and undeveloped open land along the north side of the roadway.



**Figure 1:** Looking east along the Kia's approach and also showing a look back view of the Dodge's approach in the center left-turn lane

**Pre-Crash:** The Kia was traveling eastward in the outside eastbound lane, intending to continue straight ahead. The Dodge was stopped, heading westward in the center left-turn lane, intending to turn left to enter a commercial driveway. A witness described that traffic in the inside eastbound lane ahead of the crash site was stopped for a traffic signal, with approaching vehicles slowing in preparation for stopping. Traffic in the outside eastbound lane was also stopped for the signal, but there were fewer vehicles in the outside lane and the stopped traffic was further ahead. Traffic in the outside lane was moving forward in the area where inside lane traffic was stopped. A vehicle in the inside lane stopped, leaving space ahead to permit the Dodge to turn left. The Dodge began the intended left turn across the Kia's path. The Kia's driver braked, depositing lock-up braking skid marks, but could not avoid the impact.

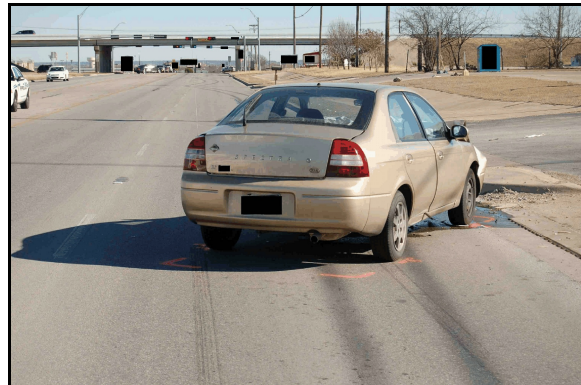
**Crash:** The Kia's front right-center area impacted the Dodge's right rear wheel/tire and the body panel forward of the wheel well, causing the Kia's driver and front right passenger air bags to deploy.

**Post-Crash:** The Kia rotated approximately 20 degrees clockwise and came to rest close to the point of impact (**Figure 2**). The Dodge's driver continued forward into a commercial parking area and brought the Dodge to a controlled stop.

The case vehicle was a 2001 Kia Spectra GS front wheel drive, five-door, five-passenger hatchback (VIN: KNAFB161815-----), equipped with a 1.8 liter four cylinder gasoline engine and an automatic transmission with a console-mounted selector lever. Four-wheel anti-lock brakes were an option for this model, but this vehicle was not so equipped. The case vehicle was equipped with driver and front right passenger redesigned air bags and manual lap-and-shoulder safety belts. Its specification wheelbase is 256 centimeters (100.8 inches). The Kia was towed due to disabling damage.

**Exterior Damage:** The Kia sustained direct contact damage on its front, beginning slightly to the right of center and extending to the right corner, with induced damage encompassing the entire front end (**Figures 3 and 4**). The flexible plastic bumper cover/cowl is distorted and displaced such that the steel bumper and other stiff frontal structures are not visible in the available photographs. The right half of the Kia's front bumper area engaged the Dodge's right rear wheel and tire, crushing the frontal structures rearward against the radiator, causing leakage of the coolant and leaving black rubber scuffs on the bumper cover near the right headlamp. The right half of the engine hood and the leading edge of the right fender engaged the Dodge's body panel forward of the right rear wheel well, causing the hood to be bent downward along its front edge and folded upward at the middle. The right headlamp lens was shattered and the right fender was distorted and displaced rearward. None of the wheels/tires were deflated or restricted. The windshield had stress cracks and there was no other glazing damage. There is an area of abrading and light denting on the rocker panel beneath the right rear door, but this appears to be prior damage. The front right wheel cover is missing and is not visible in any of the photographs.

**Damage Classification:** Based on the available photographs, the Kia's Collision Deformation Classification (CDC) code was estimated to be: **11-FZEW-01** (340 degrees). The WinSMASH



**Figure 2:** Kia at final rest; note, lock-up braking skid marks (see also Fig. 1) and clockwise deflection



**Figure 3:** Kia's frontal damage



**Figure 4:** Kia's right side at final rest

reconstruction program, missing vehicle algorithm based on the photo-estimated crush profile for the Dodge, was used. The total, longitudinal and lateral delta-Vs are, respectively: 15 km/h (9.3 mph), -14 km/h (-8.7 mph) and 5 km/h (3.1 mph). This is a borderline reconstruction because the crush profile was estimated from the police on-scene photos, but the results appear reasonable.

**Vehicle Interior:** The available photographs provide limited views of the driver's and front right passenger's seating area (**Figures 5 and 6**). The two front bucket seats were both adjusted with the seat track at or close to full forward and both seat backs slightly reclined. There is no visible evidence of intrusion or occupant contact in these limited views.

**Manual Restraints:** The Kia was manufactured with manual lap-and-shoulder safety belt systems at the four outboard seating positions and a lap-only safety belt at the back seat center position. There is no evidence to suggest that the safety belt system had been altered. The driver's safety belt system consisted of continuous loop belt webbing, an Emergency Locking Retractor, a sliding latch plate and an adjustable upper anchor in an unknown position. The front right passenger's position was equipped with a switchable Emergency Locking Retractor/Automatic Locking Retractor (ELR/ALR) in an unknown setting and with the adjustable upper anchor in an unknown position. The back seat safety belts were similar to the front right passenger's, but with a fixed upper anchors. None of the safety belt systems were equipped with pretensioners.

The Kia's driver was police-reported as restrained by the lap-and-shoulder safety belt. There is no evidence to confirm or refute this assertion, except to note that the driver was not injured. This contractor concludes that the driver was restrained by the manual safety belt.



Figure 5: Kia's driver seat area



Figure 6: Kia's front right passenger seat area

The front right passenger was police-reported as restrained by the lap-and-shoulder safety belt. The witness explained that, immediately following the crash, several bystanders attempted to get the front right passenger out of the Kia but she was restrained by the safety belt and they could not disengage the safety belt latch. One of the bystanders cut the safety belt webbing with a knife in order to remove the passenger. The front right latch plate can be seen still inserted into the buckle (**Figures 5 and 6**), with the belt webbing laying slack across the seat. This contractor concludes that the front right passenger was restrained by the manual safety belt.

The two back seat passengers were both police-reported as restrained by their respective lap-and-shoulder safety belts. The back left passenger was not injured and this contractor concludes

that she was using the safety belt system. The back right passenger sustained injuries that would be highly unlikely if he had been using the safety belt and this contractor concludes that the back right passenger was not using the safety belt system.

**Automatic Restraints:** The Kia was equipped with redesigned air bags for the driver and front right passenger seat positions and both air bags deployed (**Figures 5 and 6**). The driver's air bag was mounted in the steering wheel hub and the front right passenger's air bag was mounted in the top of the instrument panel. The available photographs do not show any obvious signs of occupant contact or damage to the air bags.

#### **DRIVER KINEMATICS**

The Kia's driver (33-year-old female, height and weight unknown) was restrained by her manual lap-and-shoulder safety belt system and the steering wheel air bag deployed. The available photographs (**Figure 5**) show that her seat back was slightly reclined and her seat track was adjusted at or near the full forward position. Her posture is not known but she was probably in a normal, forward facing driving posture, with at least one hand on the steering wheel and her feet operating the foot controls.

The driver observed the Dodge turning across the Kia's path of travel and braked hard, depositing lock-up braking skid marks (**Figures 1 and 2**). The driver moved forward in response to the braking deceleration and the safety belt retractor probably locked. The Kia's front impacted the Dodge's right side, causing the Kia's driver and front right passenger air bags to deploy. The driver probably contacted the deployed front right air bag with her face and chest. Following the initial impact, the Kia was deflected and rotated approximately 20 degrees clockwise. The driver probably moved to the left in response to this rotational motion. The Kia came to rest a short distance from the point of impact. The driver's position at final rest is not known.

The driver was police-reported as not injured. She was not transported via ambulance from the scene. The witness indicated that the driver did not seem to have any injuries. It is not known if she sustained any specific injuries or if she sought any medical treatment.

#### **FRONT RIGHT PASSENGER KINEMATICS**

The Kia's front right passenger (6-year-old female, 23 kilograms [51 pounds], height unknown) was restrained by the manual lap-and-shoulder safety belt system and the front right passenger air bag deployed. The available photographs (**Figure 6**) show that her seat back was slightly reclined and the seat track was adjusted at or near the full forward position. Her pre-crash seated posture and safety belt position are otherwise not known.

When the Kia's driver braked, the front right passenger moved forward in response to the braking deceleration and the safety belt retractor probably locked. The Kia's front impacted the Dodge's right side, causing the Kia's driver and front right passenger air bags to deploy. The front right passenger's face and chest interacted with the deploying front right air bag, causing: diffuse cerebral edema; subarachnoid hemorrhage in the occipital lobes; intraventricular hemorrhage in the fourth ventricle; compression of the brain stem; and contusions of the lungs



bilaterally. Her interaction with the deploying air bag also caused: atlanto-occipital dissociation with anterior subluxation of the occipital condyles; epidural hematoma at the craniocervical junction with compression of the spinal cord; and laceration of the dura exposing the cord at the C1-C2 junction. Following the initial impact, the Kia was deflected and rotated approximately 20 degrees clockwise. The front right passenger probably moved to the left in response to this rotational motion. The Kia came to rest a short distance from the point of impact. The front right passenger's position at final rest is not known.

#### FRONT RIGHT PASSENGER INJURIES

The front right passenger was transported to a local hospital via ground ambulance and later air-lifted to a trauma center. She was pronounced dead 17 days after the crash, at 1500 hours.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
	Nonanatomic brain injury with length of unconsciousness greater than 24 hours <sup>1</sup>	Not coded	Air bag, front right passenger's	Certain	Hospitalization records
1	Cerebral edema with diffuse effacement of basilar cisterns	severe 140664.4,9	Air bag, front right passenger's	Certain	Hospitalization records
2	Hemorrhage, intraventricular, in 4 <sup>th</sup> ventricle	severe 140678.4,9	Air bag, front right passenger's	Certain	Hospitalization records
3	Hemorrhage, subarachnoid, small, occipital lobes	serious 140684.3,1 140684.3,2	Air bag, front right passenger's	Certain	Hospitalization records
4	Brain stem compression {herniation syndrome} with disruption of tentorial membrane and subarachnoid hemorrhage surrounding midbrain	critical 140202.5,8	Air bag, front right passenger's	Certain	Hospitalization records

<sup>1</sup> The patient sustained traumatic cardiopulmonary arrest and was unconscious on arrival of the emergency medical technicians and at the initial hospital facility. She was unresponsive with pupils fixed, non-reactive, and dilated. Glasgow Coma Scale was 3. Pulseless electrical activity (PEA) was noted at scene.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
5	Contusion {compression} cervical spinal cord with epidural hematoma at craniocervical junction, a traumatic dural laceration at C <sub>1</sub> -C <sub>2</sub> exposing spinal cord, and severe cord edema at level of dens with dens pressing on spinal cord causing right and left indentation, and including, an atlanto-occipital dissociation/dislocation--measuring 19.9 mm basion to dens interval, with anterior subluxation of occipital condyles	maximum 640234.6,6	Air bag, front right passenger's {indirect injury}	Certain	Hospitalization records
6	Contusions lungs bilaterally with minimal left pneumothorax	serious 441410.4,3	Air bag, front right passenger's	Certain	Hospitalization records
7	Laceration, 2 cm (0.8 in) right anterior thigh, not further specified	minor 890602.1,1	Unknown contact source	Unknown	Emergency room records

### BACK LEFT PASSENGER KINEMATICS

The Kia's back left passenger (10-year-old female, height and weight unknown) was restrained by her manual lap-and-shoulder safety belt system. Her seat back and seat track were not adjustable. Her pre-crash seated posture is otherwise not known.

When the Kia's driver braked, the back left passenger moved forward in response to the braking deceleration and the safety belt retractor probably locked. The Kia's front impacted the Dodge's right side and the back left passenger was held in place by her safety belt. Following the initial impact, the Kia was deflected and rotated approximately 20 degrees clockwise. The back left passenger probably moved to the left in response to this rotational motion. The Kia came to rest a short distance from the point of impact. The back left passenger's position at final rest is not known.

The back left passenger was police-reported as not injured. She was not transported via ambulance from the scene. It is not known if she sustained any specific injuries or if she sought any medical treatment.

The Kia's back right passenger (11-year-old male, 43 kilograms [95 pounds], height unknown) was not restrained by the available manual lap-and-shoulder safety belt system. His seat back and seat track were not adjustable. His pre-crash seated posture is not known.

When the Kia's driver braked, the back right passenger moved forward in response to the braking deceleration. When the Kia's front impacted the Dodge's right side, he moved further forward and his face and chest impacted the back of the front right bucket seat, resulting in a contusion and an abrasion on the right side of his face and a contusion on his chest. Following the initial impact, the Kia was deflected and rotated approximately 20 degrees clockwise. The back right passenger probably moved to the left in response to this rotational motion. The Kia came to rest a short distance from the point of impact. The back right passenger's position at final rest is not known.

**BACK RIGHT PASSENGER INJURIES**

The back right passenger was transported via ground ambulance to a local hospital, where he was treated and released.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Abrasion right face near right eye, not further specified	minor 290202.1,1	Seat back, front right passenger's	Probable	Emergency room records
2	Contusion {bruise, bump} right face near right eye on temple	minor 290402.1,1	Seat back, front right passenger's	Probable	Emergency room records
3	Contusion with soreness left chest wall, not further specified	minor 490402.1,2	Seat back, front right passenger's	Probable	Emergency room records

**OTHER VEHICLE: 1999 DODGE RAM 2500**

The other vehicle was a 1999 Dodge Ram 2500 4x4 Quad Cab pickup truck (VIN: 1B7KF23W4XJ-----) equipped with an 8.0 liter V-10 gasoline engine. The Dodge was equipped with a steering wheel-mounted air bag that did not deploy and three-point lap-and-shoulder safety belts. Its specification wheelbase is 352 centimeters (138.7 inches). The Dodge was driven away from the scene.



**Figure 7:** Dodge's right side

**Exterior Damage:** The Dodge sustained direct contact on the right rear wheel and tire and on the body panel immediately forward of the right rear wheel well (**Figures 7 and 8**). Scuff marks can be seen on the tire, but there is no visible damage to the wheel or suspension. The Dodge also sustained minor direct contact denting and scraping on the body panel immediately forward of the right rear wheel well.

The following table details the Dodge's crush profile, which was generated by making scale measurements on the police photographs.

Units	Event	Direct Damage		Field L	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	Direct	Field L
		Width CDC	Max Crush								± D	± D
cm	1	135	24	170	0	0	24	16	8	0	-148	-129
in		53.2	9.4	66.9	0.0	0.0	9.4	6.3	3.2	0.0	-58.3	-50.8

**Damage Classification:** Based on the available photographs, the Dodge's CDC was estimated to be **02-RBLW-2 (60 degrees)**. The WinSMASH reconstruction program, missing vehicle algorithm based on the photo-estimated crush profile for the Dodge, was used. The total, longitudinal and lateral delta-Vs are, respectively: 7.0 km/h (4.3 mph), -3.5 km/h (-2.2 mph) and -6.1 km/h (-3.8 mph). This is a borderline reconstruction because the crush profile was estimated from police on-scene photographs, but the results appear reasonable.



**Figure 8:** Close up, Dodge's right side damage

**Other Vehicle's Driver:** The Dodge's driver (82-year-old male) was police-reported as having been restrained by the available, manual, lap-and-shoulder safety belt system. The driver's air bag did not deploy. He was police-reported as not injured and was not transported via ambulance. There was no other occupant in the Dodge.

