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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-06-015
LOCATION - TEXAS
VEHICLE - 2006 CHEVROLET COBALT
CRASH DATE - May 2006

Submitted:

December 20, 2006
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Prepared for:

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

Technical Report Documentation Page

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15. *Supplementary Notes* On-site air bag investigation involving a 2006 Chevrolet Cobalt equipped with manual safety belts and dual front advanced air bag system.			
16. *Abstract* This report covers an on-site air bag investigation that involved a 2006 Chevrolet Cobalt (case vehicle) and a 2005 Kia Sedona mini van (other vehicle), which were involved in an intersection collision on a seven-lane, divided city street. This crash is of special interest because the supplemental restraint (air bag) system in the Chevrolet Cobalt is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Standard (FMVSS) No. 208. The case vehicle was also equipped with an Event Data Recorder (EDR) and the front right passenger [20-year-old, White (Hispanic) male] sustained a police reported "C" (possible) injury as a result of the crash. The case vehicle was eastbound in the outside through lane. Eastbound traffic in the center and left through lanes was moving slowly due to heavy traffic and stopped to allow the Kia, which was westbound in the outside left turn lane, to execute the left turn. The case vehicle's driver steered right and braked in an attempt to avoid the Kia as it turned left. The front of the case vehicle then impacted the Kia's right fender, right front wheel and right front bumper corner causing a stage 1 deployment of the case vehicle's driver and front right passenger air bags. The case vehicle rotated clockwise and traveled into the mouth of the south leg of the intersection. The case vehicle's driver then pulled the vehicle off the roadway into a parking lot. The final rest position of the Kia was not indicated on the police crash schematic, but it most likely came to final rest in the mouth of the south leg of the intersection heading southeast. The case vehicle's front right passenger and driver were both restrained by their manual, three-point, lap-and-shoulder safety belts. The driver sustained minor injuries and the front right passenger sustained a cervical neck strain due to the impact.			
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IN-06-015

This on-site investigation was brought to NHTSA's attention on or before June 13, 2006 by NASS CDS/GES sampling activities. This crash involved a 2006 Chevrolet Cobalt (case vehicle) and a 2005 Kia Sedona mini van (other vehicle). The crash occurred in May 2006, at 5:15 p.m., in Texas and was investigated by the applicable city police department. This crash is of special interest because the supplemental restraint (air bag) system in the Chevrolet Cobalt is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Standard (FMVSS) No. 208. The case vehicle was also equipped with an Event Data Recorder (EDR) and the front right passenger [20-year-old, White (Hispanic) male] sustained a police reported "C" (possible) injury as a result of the crash. This contractor inspected the scene on July 18, 2006; inspected the Kia on July 19, 2006; inspected the case vehicle and downloaded the EDR on July 20, 2006 and interviewed the case vehicle's driver on July 25, 2006. This report is based on the police crash report, scene inspection, vehicle inspections, case vehicle's EDR data, driver interview, driver medical records, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was eastbound in the outside through lane of a seven-lane, divided city street. The driver was intending to continue eastbound through the intersection. Eastbound traffic in the center and left through lanes was moving slowly due to heavy traffic and stopped to allow the Kia, which was westbound in the outside left turn lane, to execute her left turn. The case vehicle's driver steered right and braked in an attempt to avoid the Kia as it turned left. The front of the case vehicle then impacted the Kia's right fender, right front wheel and right front bumper corner causing a stage 1 deployment of the case vehicle's driver and front right passenger air bags. In addition, both the driver and front right passenger's safety belt pretensioners actuated. As a result of the impact, the case vehicle rotated clockwise and traveled into the mouth of the south leg of the intersection. The case vehicle's driver stated that she pulled the vehicle off the roadway into a parking lot. The final rest position of the Kia was not indicated on the police crash schematic, but it most likely came to final rest in the mouth of the south leg of the intersection heading southeast.

The CDC for the case vehicle was determined to be **11-FDEW-2** (**340** degrees). The case vehicle sustained 43.0 centimeters (16.9 inches) of maximum residual crush to its front bumper occurring 9 centimeters (3.5 inches) right of C_2. The WinSMASH reconstruction program, missing vehicle algorithm, reconstructed the case vehicle's Total, Longitudinal, and Lateral Delta Vs respectively as: 38 km.p.h. (23.6 m.p.h.), -35.7 km.p.h. (-22.2 m.p.h.), and 13.0 km.p.h. (8.1 m.p.h.). The reconstruction was borderline and the results appeared reasonable. The maximum longitudinal and lateral Delta Vs recorded by the case vehicle's EDR were respectively: -36.00 km.p.h. (-22.37 m.p.h.) and 8.72 km.p.h. (5.42 m.p.h.). The case vehicle was towed due to damage.

The Kia was under repair and only a partial CDC could be assigned. The partial CDC was determined to be: **99-RF99-9** (**70** degrees). The WinSMASH reconstruction program, missing vehicle algorithm reconstructed the Kia's Total, Longitudinal, and Lateral Delta Vs respectively

as: 24.0 km.p.h. (14.9 m.p.h.), -8.2 km.p.h. (-5.1 m.p.h.), and -22.6 km.p.h. (-14.0 m.p.h.). The reconstruction was borderline and the results appeared reasonable. The Kia was towed due to damage.

The case vehicle's front right passenger and driver were both restrained by their manual, three-point, lap-and shoulder safety belts. Their safety belt pretensioner's actuated during the crash. The front right passenger sustained a cervical strain due to impact force. He was transported to a hospital and admitted. The driver sustained a contusion to her right knee from the knee bolster and right wrist due to contact with the air bag. She was transported by private conveyance to a local hospital and treated and released. The driver and front right passenger's use of their safety belts and the deployment of their air bags mitigated their interaction with the case vehicle's front interior components.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle and Kia were traveling was a two-way, seven lane, divided city street, traversing in an east and west direction approaching a four-leg intersection. The west leg of the intersection was curved to the north, had three eastbound through lanes, a left turn lane, three westbound through lanes and was divided by a raised, curbed median. The east leg of the intersection had three westbound through lanes, a left turn lane, three eastbound through lanes and was divided by a raised, curbed median. The average lane width was 3.6 meters (11.8 feet) and the median width at the intersection was 5.4 meters (17.7 feet). The roadways were bordered by mountable curbs. The north and south legs of the intersection were controlled by a stop sign. The east and west legs of the intersection were uncontrolled. Roadway pavement markings consisted of "Bots Dots' lane markers. The speed limit for the case vehicle and the Kia was 64 km.p.h. (40 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, level concrete. Traffic density was heavy, and the site of the crash was urban commercial. See the Crash Diagram at the end of this report.

Pre-Crash: The case vehicle was eastbound in the outside through lane (**Figure 1**). The case vehicle's travel speed based on the driver interview and supported by the EDR data was 64 km.p.h. (40 m.p.h.). The driver was intending to continue eastbound through the intersection. The police crash report indicated that eastbound traffic in the center and left through lanes was moving slowly due to heavy traffic. The Kia was westbound in the outside left turn lane (**Figure 2** below), and the driver was intending to turn left (south) once traffic cleared. The Kia's driver stated that the eastbound traffic stopped to let her turn left. She did not see the approaching case vehicle due to stopped traffic and executed the left

Figure 1: Approach of case vehicle to intersection eastbound in outside through lane, arrow shows area of impact, number shows meters to impact

turn. The case vehicle's driver stated she steered right and braked in an attempt to avoid the crash. The crash occurred in the intersection (**Figure 3**).

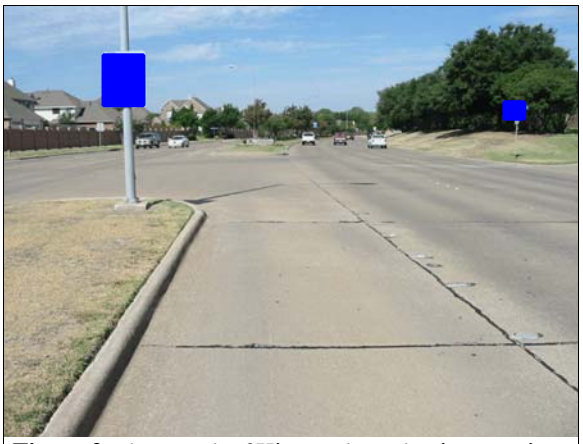


Figure 2: Approach of Kia westbound to intersection in left turn lane

Figure 3: Approach of case vehicle into intersection to area of impact, vehicle on left is following likely approach path of the Kia to impact

Figure 4: Damage to front of case vehicle from impact with Kia

Figure 5: Overview of Kia, under repair, case vehicle impacted right fender, right front wheel and right front bumper corner

Crash: The front of the case vehicle (**Figure 4**) impacted the Kia's right fender, right front wheel and right front bumper corner (**Figure 5**) causing a stage 1 deployment of the case vehicle's driver and front right passenger air bags. In addition, both the case vehicle's driver and front right passenger safety belt pretensioners actuated.

Post-Crash: As a result of the impact, the case vehicle rotated clockwise and traveled into the mouth of the south leg of the intersection. The case vehicle's driver stated that she pulled the vehicle off the roadway into a parking lot, which was located on the southeast corner of the intersection. The final rest position of the Kia was not indicated on the police crash schematic, but it most likely came to final rest in the mouth of the south leg of the intersection heading southeast.

The 2006 Chevrolet Cobalt LS was a front wheel drive, four-door sedan (VIN: 1G1AK55F567-------) equipped with 2.2L, L4 engine and a four-speed automatic transmission. The Chevrolet is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Standard (FMVSS) No. 208. The front seating row was equipped with bucket seats with adjustable head restraints, tilt steering column, dual stage driver and front right passenger air bags; driver and front right passenger manual, three-point, lap-and-shoulder safety belt systems with adjustable upper anchors, usage sensors, pretensioners, and energy management feature. The front right seat was equipped with a passenger detection and automatic air bag suppression system. The back seating row was equipped with a bench seat with folding back, integral head restraints in the outboard seating positions and manual, three-point, lap-and-shoulder belts in all three seating positions. In addition, the case vehicle was equipped with a LATCH system for securing child safety seats. Side curtain air bags and anti-lock brakes were an option, but the case vehicle was not so equipped. The case vehicle's wheelbase was 262 centimeters (103.1 inches). The case vehicle's odometer reading at the time of the vehicle inspection was 4,521 kilometers (2,809 miles).

The various sensors in the case vehicle's advanced occupant restraint system analyze a combination of factors including the predicted crash severity and driver and front right passenger safety belt usage to determine the front air bag inflation level appropriate for the severity of the crash. For the front right seat position, an occupant weight sensor in the seat cushion determines if an occupant is on the seat and enables or suppresses deployment of the air bag based on the amount of weight on the seat.

CASE VEHICLE DAMAGE

Exterior Damage: The case vehicle's impact with the Kia involved the front end. The front bumper, grille, hood and front of the left fender were directly contacted and crushed rearward and slightly to the right (**Figure 6**). The direct damage began at the left corner of the front bumper fascia and extended across the full width of the front bumper. The bumper fascia had sprung back, away from the underlying bumper bar, so crush measurements were taken at the bumper bar. The direct damage began at the front left bumper corner and extended 120 centimeters (47.2 inches) across the bumper. The maximum residual crush was measured as 43.0 centimeters (16.9 inches) occurring 9 centimeters (3.5 inches) right of C_2 (**Figure 7** below). The table below shows the case vehicle's front crush profile.

Figure 6: Overview of damage to front of case vehicle from impact with Kia, vertical scale is in tenths of meter, each stripe on rods in 5 cm (2 in)

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	120	43	95	24	33	36	24	15	8	0	0
in		47.2	16.9	37.4	9.4	13.0	14.2	9.4	5.9	3.2	0.0	0.0

The case vehicle's left side wheelbase was shortened 0.8 centimeters (1.2 inches) and the right side wheelbase was shortened 3.0 centimeters (1.2 inches). Induced damage involved both fenders and the hood.

The case vehicle's recommended tire size was: P195/60R15, and the vehicle was equipped with tires of this size. The case vehicle's tire data are shown in the table below.

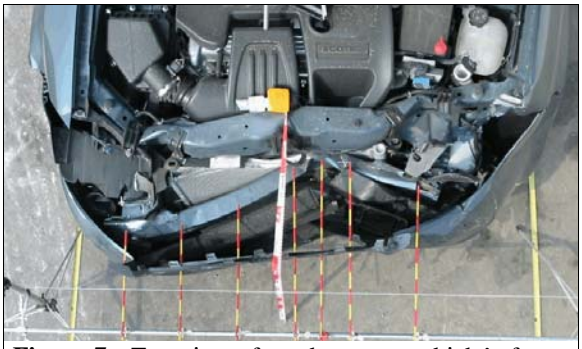


Figure 7: Top view of crush to case vehicle's front bumper bar, each increment on rods is 5 cm (2in)

Tire	*Measured Pressure*		*Recommend Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kpa	psi	kpa	psi	milli-meters	32nd of an inch			
LF	172	25	207	30	6	8	None	No	No
RF	200	29	207	30	6	8	None	No	No
LR	172	25	207	30	8	10	None	No	No
RR	186	27	207	30	8	10	None	No	No

Vehicle Interior: Inspection of the case vehicle's interior revealed no evidence of occupant contact to any of the interior surfaces or components. In addition, there was no passenger compartment intrusion and there was no deformation of the steering wheel rim or compression of the energy absorbing steering column.

Damage Classification: Based on the vehicle inspection, the CDC for the case vehicle was determined to be **11-FDEW-2** (**340** degrees). The WinSMASH reconstruction program, missing vehicle algorithm, was used to reconstruct the case vehicle's Delta Vs. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 38 km.p.h. (23.6 m.p.h.), -35.7 km.p.h. (-22.2 m.p.h.), and 13.0 km.p.h. (8.1 m.p.h.). The reconstruction was borderline and the results appeared reasonable. The maximum longitudinal and lateral Delta Vs recorded by the case vehicle's EDR were respectively: -36.00 km.p.h. (-22.37 m.p.h.) and 8.72 km.p.h. (5.42 m.p.h.). The case vehicle was towed due to damage.

The case vehicle was equipped with dual stage driver and front right passenger air bags. Both the driver and front right passenger air bags deployed as a result of the impact with the Kia. The case vehicle's EDR report indicated that only a first stage deployment of both air bags was commanded by the case vehicle's crash sensing algorithm.

The case vehicle's driver air bag was located in the steering wheel hub. The module cover consisted of symmetrical "I" configuration cover flaps made of thick, pliable vinyl. Each cover flap was 8.5 centimeters (3.3 inches) in width at the top seam, 7 centimeters (2.8 inches) in width at the bottom seam and 11.5 centimeters (4.5 inches) in height along the center seam. There was a semi-circular cut-out in the center of the left cover flap to accommodate the manufacturer's logo on the right cover flap. The distance between the mid-center of the driver's seat back, as positioned at the time of the vehicle inspection (i.e., seat track between middle and full-rear position, seat back slightly reclined) and the front surface of the air bag's fabric at approximate full excursion was 27 centimeters (10.6 inches). An inspection of the air bag module cover flaps and the air bag fabric revealed that the cover flaps opened at the designated tear points (**Figure 8**). There was no evidence of damage during the deployment to the air bag module cover flaps or the air bag fabric. The deployed driver's air bag (**Figure 9**) was round with a diameter of approximately 50 centimeters (19.7 inches). The air bag was designed with two tethers, each approximately 13 centimeters (5.1 inches) in width and had two vent ports (**Figure 10**), each approximately 3 centimeters (1.2 inches) in diameter, located at the 11 and 1 o'clock positions. Inspection of the air bag revealed no evidence of occupant contact. There were a few dark transfers on the air bag that appeared to be grease.

Figure 8: Case vehicle's driver air bag module cover flaps

Figure 9: Case vehicle's driver air bag

Figure 10: Case vehicle driver's air bag vent ports (arrows)

The front right passenger air bag was located in the top of the right instrument panel (**Figure 11**). The module cover consisted of a single, approximately trapezoidal-shaped cover flap. The cover flap was 32 centimeters (12.6 inches) in width. The left side of the flap was 23 centimeters (9 inches) in height and the right side was 16 centimeters (6.3 inches) in height. An inspection of the module cover flap and the air bag fabric revealed that the cover flap opened at the designated tear points (**Figure 11**). There was no evidence of damage during the deployment to the air bag module cover flap or the air bag fabric. The deployed front right passenger's air bag (**Figure 12**) was rectangular in shape with a height of approximately 60 centimeters (23.6 inches) and a width of 43 centimeters (16.9 inches). The air bag was designed with two tethers, each approximately 12 centimeters (4.7 inches) in width and had two vent ports, each approximately 5 centimeters (2 inches) in diameter, located at the 3 and 9 o'clock positions. Inspection of the air bag revealed no evidence of occupant contact.

Figure 11: Case vehicle's front right passenger air bag module cover flap

Figure 12: Overview of case vehicle's front right passenger air bag

CRASH DATA RECORDING

The download of the case vehicle's EDR was done during the vehicle inspection via connection to the diagnostic link connector. The EDR recorded a deployment event. The EDR reports are presented at the end of this report (**Figures 13-18**). The System Status at Deployment report shows the SIR warning lamp was recorded as off, the driver's and front right passenger's seat belt switch circuit were recorded as buckled, the front right passenger air bag was indicated as not suppressed, and a deployment of the driver's and front right passenger's pretensioners was commanded. The interpretation of the Longitudinal Axis Deployment Data graph shows that the first stage deployment command was issued at the approximate 80 millisecond sample point. A second stage deployment was not required and disposal of the second stage was commanded. The maximum recorded longitudinal and lateral Delta Vs were respectively: -36 km.p.h. (-22.37 m.p.h.) and 8.72 km.p.h. (5.42 m.p.h.), and the reported estimated principal direction of force was 345 degrees. Lastly, the data indicated that the deployment event recording was complete.

The pre-crash data indicates the case vehicle was traveling 64 km.p.h. (40 m.p.h) at 15% throttle 5 seconds prior to algorithm enable (AE). Travel speed was then recorded as 63 km.p.h. (39 m.p.h) one second prior to AE.

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's front right passenger [20-year-old, White (non-Hispanic) male; 168 centimeters and 68 kilograms (66 inches, 150 pounds)] was seated in an upright position with his back against the seat back and both feet on the floor. He was holding a drink in his right hand and his left hand was in his lap. The passenger's seat track was adjusted to between it's middle and rear-most position and his seat back was slightly reclined. The passenger was wearing contact lenses at the time of the crash.

Based on the vehicle inspection and supported by EDR data, the front right passenger was restrained by his manual, three-point, lap-and-shoulder safety belt system. The front right pretensioner had actuated in the crash and the safety belt retractor was jammed with a length of belt extended out of the retractor consistent with use during the crash.

Just prior to the impact, the case vehicle's driver steered right and applied the brakes. As a result of the steering and braking maneuver, the front right passenger likely moved slightly left and forward within his seat and his safety belt retractor most likely locked. The case vehicle's impact with the Kia caused the front right passenger's pretensioner to actuate. He continued forward and moved left along a path opposite the case vehicle's 340 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the right and loaded his safety belt. The impact force caused a strain to the passenger's neck. The passenger's face and chest also most likely contacted his deployed air bag. The passenger rebounded back into his seat and remained in his seat following the crash. He was removed from the vehicle the case vehicle following the crash. The passenger's use of his safety belt and the deployment of his air bag mitigated his interaction with the case vehicle's interior front components.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The police crash report indicated that the case vehicle's front right passenger sustained a "C" (possible) injury. He was transported from the scene by ambulance, and according to the driver was hospitalized for three days. The table below shows the front right passenger's injury and injury mechanism. No medical records were obtained for this passenger. The hospital where the passenger was treated could not be determined.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Strain, acute, cervical {neck}, not further specified	minor 640278.1,6	Noncontact injury: impact forces	Probable	Interviewee (driver)

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash, the case vehicle's driver [16-year-old, White (non-Hispanic) female; 173 centimeters and 73 kilograms (68 inches, 160 pounds)] was seated in an upright position with her back against the seat back, her right foot on the brake, left foot on the floor and both hands on the steering wheel. The driver's seat track was adjusted to the middle position and her seat back was slightly reclined. The tilt steering column was located in its center position. She was not wearing glasses of contact lenses at the time of the crash.

Based on the vehicle inspection and supported by EDR data, the driver was restrained by her manual, three-point, lap-and-shoulder safety belt system. A slight abrasion was observed on the shoulder belt and the latch plate belt guide.

Just prior to the impact, the case vehicle's driver steered right and applied the brakes. As a result of the steering and braking maneuver, the driver likely moved left and slightly forward within her seat and her safety belt retractor most likely locked. The case vehicle's impact with the Kia caused the driver's pretensioner to actuate. She continued forward and moved left along a path opposite the case vehicle's 340 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the right and loaded her safety belt. Her face and upper chest most likely contacted her deployed air bag as well as her right wrist, which sustained an approximate 5 centimeter (2 inch) contusion just behind her thumb. The driver also impacted her right knee on the knee bolster causing an approximate 5 centimeter (2 inch) contusion to the knee. The driver rebounded back into her seat and remained in her seat following the crash. The driver stated she pulled the case vehicle into a nearby parking lot and exited the vehicle under her own power. The driver's use of her safety belt and the deployment of her air bag mitigated her interaction with the case vehicle's steering wheel and front interior components and reduced her injury potential.

CASE VEHICLE DRIVER INJURIES

The police crash report indicated the driver sustained no injury. The driver stated she was transported by private conveyance from the scene to a local hospital and was treated and released. She also stated she received no follow-up treatment. The table below shows the case vehicle 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	Contusion, 5.1 cm (2 in) right, wrist with swelling, not further specified	minor 790402.1,1	Air bag, driver's	Probable	Emergency room records
2	Contusion, 5.1 cm (2 in), right knee with swelling, not further specified	minor 890402.1,1	Knee bolster, driver's, right of steering column	Probable	Emergency room records

OTHER VEHICLE

The 2005 Kia Sedona was a front wheel drive minivan (VIN: KNDUP132356------) equipped with a 3.5L, V6 engine; automatic transmission and driver and front right passenger redesigned air bags, which did not deploy as a result of the impact with the case vehicle. The Kia's wheelbase was 291 centimeters (114.6 inches). The Kia's odometer reading is not known because the interior was not inspected.

Exterior Damage: The Kia's impact with the case vehicle involved the right front wheel, right fender and right corner of the front bumper. The fender had been repaired and the front bumper fascia had been removed. The right front wheel was observed to be tilted inward and the rim dented. As a result, no crush measurements could be taken of the damage to the Kia.

The Kia's wheelbase was unaltered from the crash. There was buckling to both fenders. No other obvious induced damage or remote buckling was observed to the remainder of the case vehicle's exterior.

The Kia's recommended tire size was P215/70R15. The Kia's tire data is unknown.

Damage Classification: The Kia was under repair and only a partial CDC could be assigned. The partial CDC was determined to be: **99-RF99-9**. The WinSMASH reconstruction program, missing vehicle algorithm, was used on to reconstruct the Kia's Delta V. The preliminary Total, Longitudinal, and Lateral Delta Vs are, respectively: 24.0 km.p.h. (14.9 m.p.h.), -8.2 km.p.h. (-5.1 m.p.h.), and -22.6 km.p.h. (-14.0 m.p.h.). The reconstruction was borderline and the results appeared reasonable. The Kia was towed due to damage.

Kia's Occupants: According to the police crash report, the Kia's driver [25-year-old, Black (unknown if Hispanic) female] was restrained by her manual, three-point, lap-and-shoulder safety belt system. The police crash report indicated the driver sustained a "C" (possible) injury and refused transport to a treatment facility.

According to the police crash report, the Kia's front right passenger [23-year-old (unknown race and ethnic origin) male] was restrained by his manual, three-point, lap-and-shoulder safety belt system. The police crash report indicated the front right passenger sustained a "C" (possible) injury and was transported by ambulance to a local medical center.

According to the police crash report, the Kia's back right passenger [6-month-old (unknown race and ethnic origin) male] was restrained in a child safety seat. The police crash report indicated the back right passenger sustained a no injury and was transported by ambulance to a local medical center.

CDR File Information

Vehicle Identification Number	1G1AK55F567******
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	IN06015.CDR
Saved on	Thursday, July 20 2006 at 09:31:15 AM
Collected with CDR version	Crash Data Retrieval Tool 2.800
Collecting program verification number	9238B95E
Reported with CDR version	Crash Data Retrieval Tool 2.800
Reporting program verification number	9238B95E
Interface used to collected data	Block number: 00 Interface version: 4A Date: 11-08-05 Checksum: 7500
Event(s) recovered	Deployment

SDM Data Limitations

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It can contain Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.
The second type of SDM recorded crash event is the Deployment Event. It also can contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.
The data in the Non-Deployment Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, then the Deployment Level Event will overwrite the Non-Deployment Event file.

SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. For Deployment Events and Deployment Level Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity Change, that is needed to record a Non-Deployment Event, is 5 MPH.
-Maximum Recorded Vehicle Velocity Change is the maximum recorded velocity change in the vehicle's combined "X" and "Y" axis.
-Calculated Principal Direction of Force (PDOF) is the arctangent of the maximum observed lateral velocity change divided by the maximum observed longitudinal velocity change. PDOF is displayed where zero degrees is located at the front of the vehicle, with 90 degrees is displayed to the right side of the vehicle and so on, clockwise around the vehicle.
-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
-SDM Recorded Vehicle Speed accuracy can be affected if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
-Brake Switch Circuit Status indicates the status of the brake switch circuit.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM receive an invalid message from the module sending the pre-crash data.
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. The Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), will always report a default value of "Buckled".
-The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 5 seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment

Figure 13: Case vehicle's CDR File Information and SDM Data Limitations

Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition counter.
SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.
-The Belt Switch Circuit is wired directly to the SDM.

Figure 14: Case vehicle's SDM Data Limitations continued

System Status At AE

Vehicle Identification Number	**1AK55F*6******
Low Tire Pressure Warning Lamp (If Equipped)	Invalid
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

Transmission Range (If Equipped)	Fourth Gear
Transmission Selector Position (If Equipped)	Fourth Gear
Traction Control System Active (If Equipped)	Invalid
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	89.6
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Unused
Right Rear Door Status (If Equipped)	Unused
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No

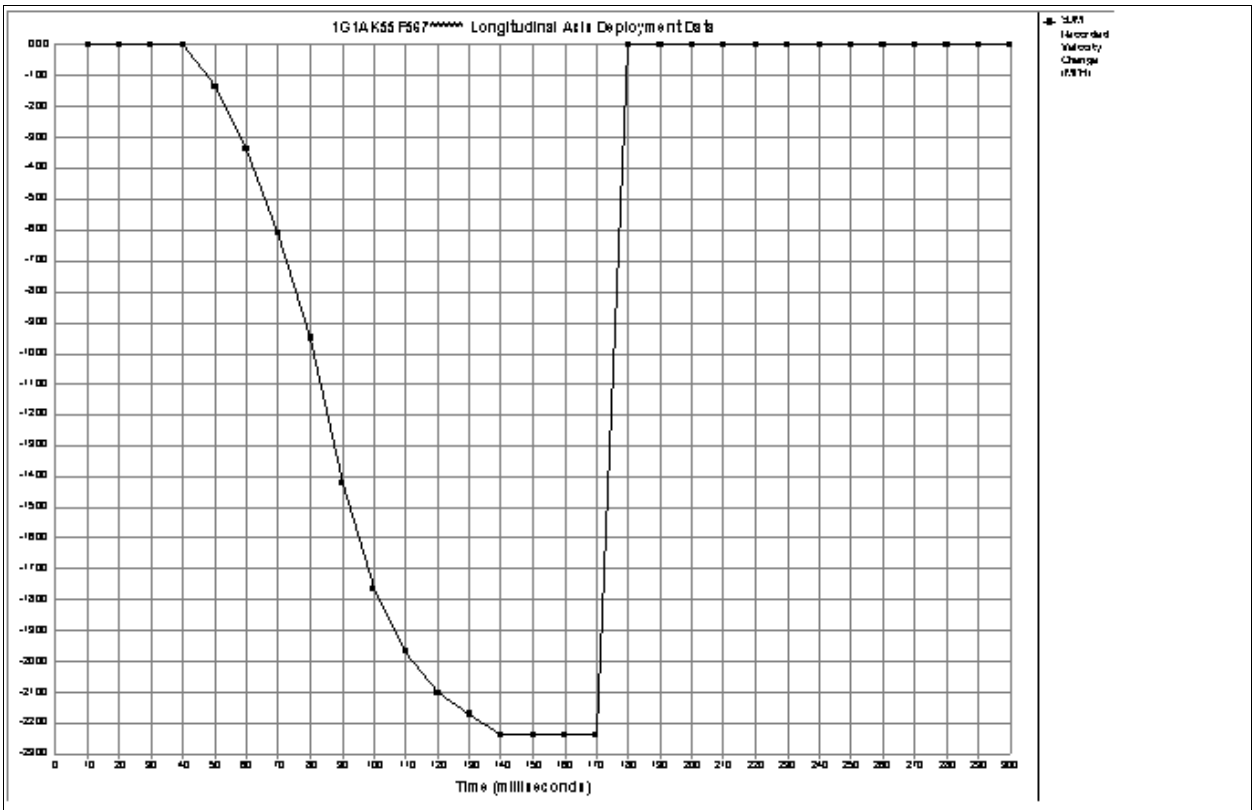
Pre-crash data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	40	40	39	39	39
Engine Speed (RPM)	1408	1344	1408	1344	1216
Percent Throttle	15	15	19	16	15
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	0	0	2	0	0
Antilock Brake System Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Lateral Acceleration (feet/s²)(If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Steering Wheel Angle (degrees) (If Equipped)	0	0	0	0	0
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

Figure 15: Case vehicle's System Status at Algorithm Enable, at 1 second and Deployment Pre-Crash data

System Status At Deployment	
Ignition Cycles At Investigation	1065
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	544840
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	1058
Ignition Cycles At Event	1059
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Not Suppressed
Automatic Passenger SIR Suppression System Validity Status at First Deployment Command	Valid
Automatic Passenger SIR Suppression System Status at First Deployment Command	Air Bag Not Suppressed
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	30
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Disposal
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	30
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Disposal
Time Between Events (sec)	N/A
Driver First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	Yes
Passenger Second Stage Deployment Loop Commanded	Yes
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	Yes
Passenger 2nd Stage Deployment Loop Commanded for Disposal	Yes
Multiple Event Counter	0
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	No
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	345

Figure 16: Case vehicle's System Status at Deployment

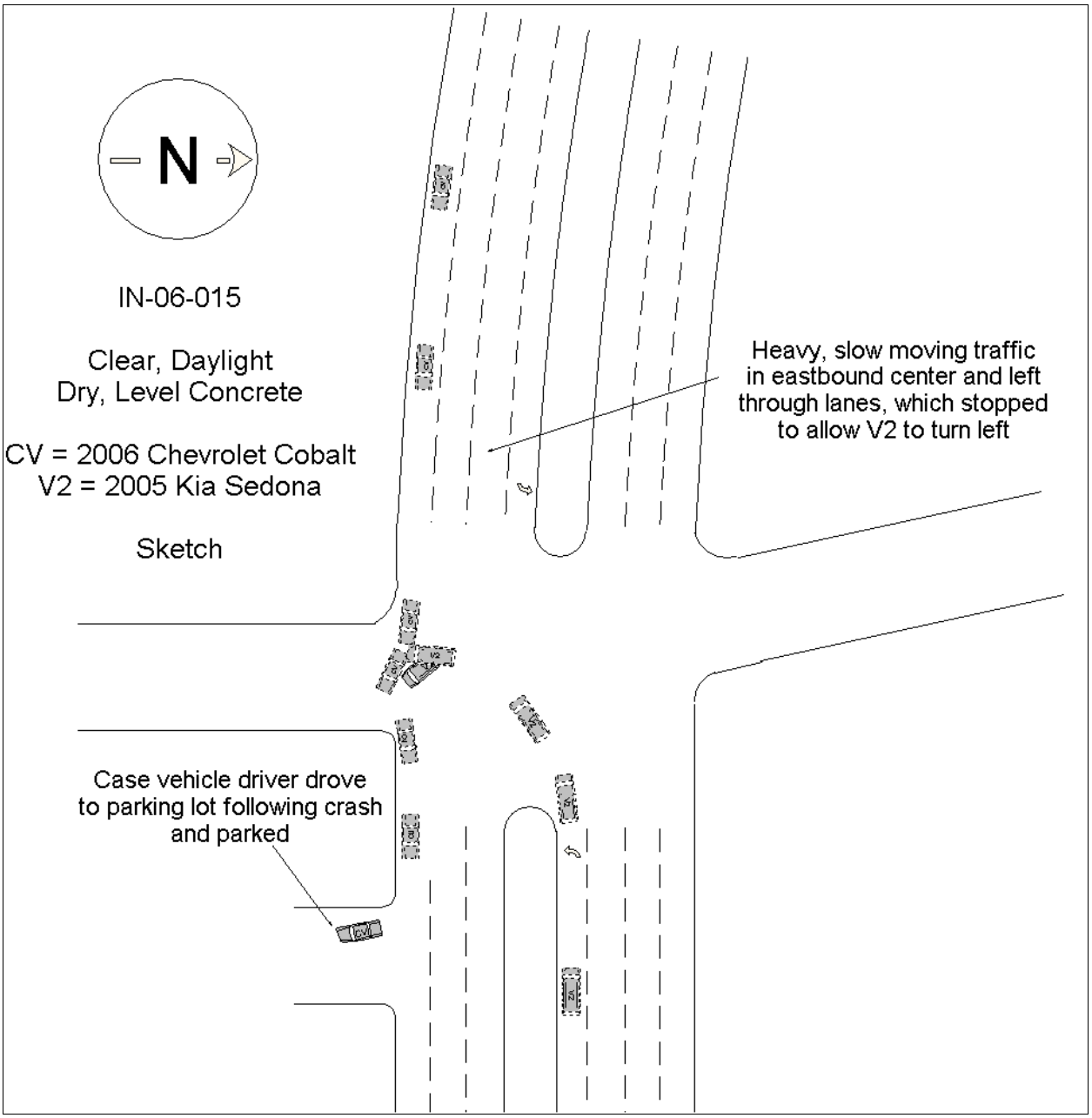


Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	0.00	-1.36	-3.39	-6.10	-9.49	-14.23	-17.62	-19.66	-21.01	-21.69	-22.37	-22.37
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-22.37	-22.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 17: Case vehicle's Longitudinal Axis Deployment Data

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	2.03	3.39	4.74	4.74	5.42	5.42
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	5.42	4.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 18: Case vehicle's Lateral Axis Deployment Data


N
IN-06-015
Clear, Daylight
Dry, Level Concrete
CV = 2006 Chevrolet Cobalt
V2 = 2005 Kia Sedona
Sketch
Heavy, slow moving traffic in eastbound center and left through lanes, which stopped to allow V2 to turn left
Case vehicle driver drove to parking lot following crash and parked
CV
V2