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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-06-017
LOCATION - TEXAS
VEHICLE - 2006 CHEVROLET COBALT
CRASH DATE - June 2006

Submitted:

February 26, 2007
Revised: March 31, 2008

Contract Number: DTNH22-01-C-07002

Prepared for:

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

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

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

Technical Report Documentation Page

1. *Report No.* IN-06-017	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Certified Advanced 208-Compliant Vehicle Investigation Vehicle - 2006 Chevrolet Cobalt Location - Texas		5. *Report Date:* February 26, 2007 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-01-C-07002	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NPO-122) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: June 2006 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site air bag deployment investigation involving a 2006 Chevrolet Cobalt equipped with manual safety belts and driver and front right passenger advanced air bag system.			
16. *Abstract* This report covers an on-site air bag deployment crash that involved a 2006 Chevrolet Cobalt (case vehicle) and a 2001 Mercury Villager (other vehicle), which were involved in a sideswipe crash on an Interstate highway with subsequent guardrail and sign post impacts to the case vehicle. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection System (AOPS) features, as well as an Event Data Recorder (EDR), and the case vehicle's driver (16-year-old, female) and front right passenger (13-year-old, female) sustained police reported "B" injuries as a result of the crash. The case vehicle was traveling southwest in the outside through lane approaching an exit ramp. The Mercury was traveling southwest in the inside through lane slightly behind the case vehicle. The case vehicle's driver changed lanes to the left in order to enter the exit ramp. The case vehicle's left side was impacted by the front right of the Mercury (event 1). The case vehicle entered the gore and its front right corner impacted the bluff end of a steel guard rail (event 2) causing a first stage deployment of the driver and front right passenger air bags. As the impact progressed, the guardrail snagged the right front wheel, and the case vehicle rapidly rotated clockwise. The front of the case vehicle then impacted the back of the guardrail and guardrail post (event 3). The case vehicle continued to rotate clockwise and the left quarter panel impacted an exit ramp sign post breaking it off its base (event 4). The left front door then impacted one of the guardrail posts (event 5) as the case vehicle continued to rotate to final rest. The case vehicle came to rest approximately parallel to the inside of the guardrail heading northeast. The Mercury continued southwest into the exit ramp, and the driver pulled over and stopped. The case vehicle's driver and front right passenger were restrained by their three-point, lap-and-shoulder safety belts. They sustained minor injuries and were transported to a hospital and treated and released.			
17. *Key Words* Advanced Air Bag Air Bag Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 24	22. *Price*

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS IN-06-017

This on-site investigation was brought to NHTSA's attention on or before July 7, 2006 by NASS CDS/GES sampling activities. This crash involved a 2006 Chevrolet Cobalt (case vehicle) and a 2001 Mercury Villager (other vehicle), which were involved in a sideswipe crash on an Interstate highway with subsequent guardrail and sign post impacts to the case vehicle. The crash occurred in June 2006, at 9:05 a.m., in Texas, and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection System (AOPS) features, as well as an Event Data Recorder (EDR), and the case vehicle's driver [16-year-old, White (non-Hispanic) female], front right passenger [13-year-old, White (non-Hispanic) female] sustained police reported "B" injuries as a result of the crash. In addition, the manufacturer of the case vehicle has certified that it meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This contractor inspected the crash scene and case vehicle on July 12, 2006 and downloaded the data from the onboard EDR. This contractor interviewed the case vehicle driver on July 28, 2006. This report is based on the police crash report, interview with the case vehicle's driver, scene and vehicle inspections, occupant medical records, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling southwest in the outside through lane of a two-lane Interstate highway approaching an exit ramp. The Mercury was traveling southwest in the inside through lane slightly behind the case vehicle. The case vehicle's driver changed lanes to the left in order to enter the exit ramp. The case vehicle's left side was impacted by the front right of the Mercury (event 1). The case vehicle entered the gore and its front right corner impacted the bluff end of a steel guard rail (event 2) causing a first stage deployment of the driver and front right passenger air bags. As the impact progressed, the guardrail snagged the right front wheel, and the case vehicle rapidly rotated clockwise. The front of the case vehicle then impacted the back of the guardrail and guardrail post (event 3). The case vehicle continued to rotate clockwise and the left quarter panel impacted an exit ramp sign post breaking it off its base (event 4). The left front door then impacted one of the guardrail posts (event 5) as the case vehicle continued to rotate to final rest. The case vehicle came to final rest approximately parallel to the inside of the guardrail heading northeast. Following the impact with the case vehicle, the Mercury continued southwest into the exit ramp. The driver pulled over and stopped on the north side of the exit ramp heading south. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry.

The CDC for the case vehicle's sideswipe impact with the Mercury (event 1) was determined to be: **06-LZES-1** (**190** degrees). The CDC for the impact with the bluff end of the guardrail (event 2) was determined to be: **12-FREE-3** (**0** degrees). The CDC for the subsequent impact with the back of the guardrail (event 3) during the case vehicle's post-impact clockwise rotation was determined to be: **12-FYEW-1** (**0** degrees). The CDC for the left quarter panel impact with the exit ramp sign post (event 4) was determined to be: **09-LBAN-3** (**270** degrees), and the CDC for the guardrail post impact to the left front door (event 5) was determined to be: **09-LPEN-1** (**270** degrees). The WinSMASH reconstruction program, could not be used to reconstruct the

Delta Vs of any of the impacts to the case vehicle because the impacts were out-of-scope for the program due to sideswiping damage, yielding object impacts (guardrail and exit sign post) and overlapping damage. The crash severity for the case vehicle's most severe impact (i.e., event 2) was estimated to be low [14-23 km.p.h. (9-14 m.p.h.)]. The case vehicle's EDR recorded a maximum longitudinal Delta V of -10.91 km.p.h. (-6.78 m.p.h.) for the deployment event. The case vehicle was towed due to damage.

The case vehicle's driver and front right passenger were both restrained by their three-point, lap-and-shoulder safety belts. Their safety belt pretensioners actuated in the crash. They both received minor injuries and were transported to a hospital and treated and released. The driver and front right passenger's use of their safety belts and the deployment of their advanced air bags mitigated their interaction with the interior vehicle components and reduced their injury potential.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which both vehicles were traveling was a two-lane, divided, Interstate highway, traversing in a northeast-southwest direction, curved to the south and approached an exit ramp. The crash location was within a large interchange area. Each travel lane was approximately 3.7 meters (12 feet) in width and bordered by paved shoulders. Each shoulder was bordered by a blocked-out, W-beam, steel guardrail. Roadway pavement markings consisted of solid white outside edge line, broken white lane line and solid yellow median line. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, travel polished bituminous with an unknown positive grade and an estimated coefficient of friction of 0.65. The speed limit was 88 km.p.h. (55 m.p.h.). There was no regulatory speed limit sign near the crash site. Traffic density was heavy, and the site of the crash was commercial. See the Crash Diagram at end of this report.

Pre-Crash: The case vehicle had been traveling southwest in the outside through lane (**Figure 1**). According to the driver, she missed her exit and was intending to take the next exit in order to return to the correct freeway. The case vehicle was fast approaching the exit the driver intended to enter, which was located on the left side of the roadway . The Mercury was traveling west in the inside through lane slightly behind the case vehicle. Its driver was intending to continue southwest through the left curve. The case vehicle's driver accelerated and moved from right to left, attempting to stay in front of and go around the Mercury in order to enter the exit ramp. The crash occurred in the inside southwestbound lane of the roadway near the mouth of the exit ramp.

Figure 1: Approach of case vehicle in outside lane and Mercury in inside lane southwestbound, arrow shows location of exit ramp case vehicle driver was intending to enter

Crash: As the case vehicle changed lanes to the left in front of the Mercury, the case vehicle's left side (**Figure 2**) was impacted by the front right of the Mercury (event 1). The case vehicle entered the gore (**Figure 3**) and its front right corner (**Figures 4** and **5**) impacted the bluff end of a steel guard rail (event 2, **Figure 6** below) causing a first stage deployment of the driver and front right passenger air bags. As the impact progressed, the guardrail snagged the right front wheel (**Figure 7** below) and the case vehicle rapidly rotated clockwise. The front of the case vehicle (**Figures 4** and **5**) then impacted the back of the guardrail and guardrail post (event 3). The case vehicle continued to rotate clockwise and the left quarter panel (**Figure 2**) impacted an exit ramp sign post breaking it off its base (event 4). The left front door (**Figure 8** below) then impacted one of the guardrail posts as the case vehicle continued to rotate.

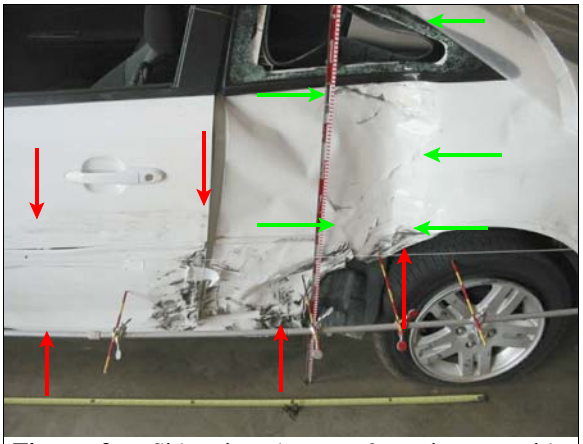


Figure 2: Sideswipe damage from impact with Mercury (red arrows) and damage from exit ramp sign post impact (green arrows)

Figure 3: Approach of case vehicle southwest bound into gore, arrow shows impacted guardrail (repaired)

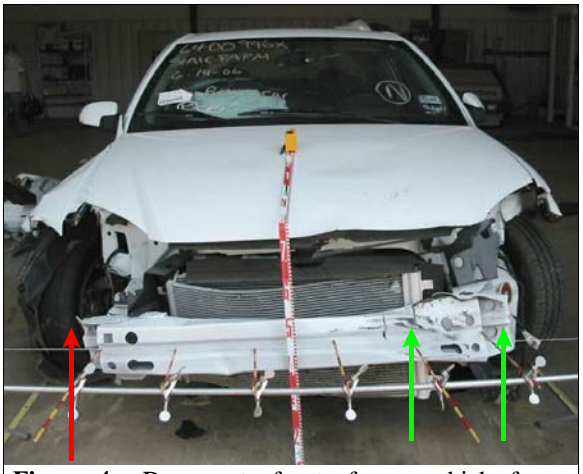


Figure 4: Damage to front of case vehicle from impact with guardrail, red arrow shows damage from end of guardrail, green arrows show damage from secondary guardrail impact

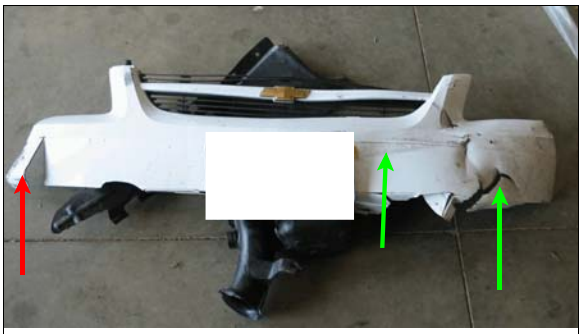


Figure 5: Damage to case vehicle's front bumper fascia, red arrow shows damage from end of guardrail, green arrows shows damage from secondary guardrail impact

Post-Crash: As a result of the impact with the end of the guardrail, the case vehicle rotated clockwise approximately 180 degrees and came to rest approximately parallel to the inside of the guardrail heading northeast (**Figure 9** below). Following the impact with the case vehicle, the Mercury continued southwest into the exit ramp and the driver pulled over on the north side of the exit ramp heading south.

Figure 6: Overview of impacted guardrail (repaired), arrows show locations of exit ramp sign post bases

Figure 7: Displacement of right front wheel from snagging guardrail

Figure 8: Guard rail post direct damage (arrows) to case vehicle's left front door and sideswipe damage from impact with Mercury

Figure 9: View north back to area of case vehicle's final rest (arrow) and approach of case vehicle and Mercury

CASE VEHICLE

The 2006 Chevrolet Cobalt was a front wheel drive, two-door coupe (VIN: 1G1AL15F367------). The manufacturer of this vehicle has certified that it meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This vehicle was equipped with a 2.2L, L4 engine; four-speed automatic transmission and four wheel, anti-lock disc brakes. 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 pretensioners and energy management feature, and a front right passenger detection and automatic air bag suppression system. The back seating row was equipped with a bench seat with folding back, non-adjustable head restraints in the outboard seating positions and manual, three-point, lap-and-shoulder safety belts in all three seating positions. In addition, the case vehicle was equipped with an EDR and a LATCH system for securing child safety seats. The case vehicle's specification wheelbase was 262 centimeters (103.1 inches). The case vehicle's odometer reading at the time of the vehicle

inspection was unknown because the case vehicle was equipped with an electronic odometer. The case vehicle's driver estimated there were approximately 3000 miles on the case vehicle at the time of the crash.

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 Mercury (event 1) involved the left quarter panel, left rear wheel and left front door. This was a sideswiping impact and the sheet metal in front of the left rear wheel house was crushed inward and displaced forward indicating a rear to front force direction. The sideswipe scraping continued forward onto the left front door. The direct damage began 31 centimeters (12.2 inches) rear of the left rear axle and extended forward 211 centimeters (83.1 inches). There was also an overlapping narrow vertical damage pattern just in front of the left rear wheel due to the impact with the exit ramp sign post (event 4) that extended to the "C"-pillar. In addition, there was an overlapping narrow vertical damage pattern near the middle of the left front door due to the impact with the guardrail post (event 5). The crush resulting from each of these impacts could not be effectively separated; therefore, a single set of crush measurements were taken to capture the totality of the damage to the left side. The crush measurements were taken at the mid-door level. The maximum residual crush was measured as 13 centimeters (5.1 inches) occurring at C_3. The table below shows the crush measurements for the totality of the left side impacts.

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	1,4 and 5	211	13	221	0	4	13	0	0	0	-56	-56
in		83.1	5.1	87.0	0.0	1.6	5.1	0.0	0.0	0.0	-22.0	-22.0

The damage from the impact with the bluff end of the guardrail (event 2) involved the front right corner of the bumper fascia. The guardrail passed by the right corner of the bumper bar, and the right unibody frame member and engaged the right front wheel and crushed it rearward approximately 20 centimeters (7.9 inches). There was no crush to the front bumper bar as a result of this impact.

The front impact with the back of the guardrail (event 3) involved approximately 80% of the front bumper, with the majority of the direct damage occurring at the left portion of the front bumper. Crush measurements were taken at the front bumper bar. The maximum residual crush

was determined to be 11 centimeters (4.3 inches) occurring at C_1 (the front left corner of the bumper bar). The table below shows the case vehicle's front bumper bar crush for the impact to the back of the guardrail.

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	3	50	11	104	11	9	4	5	4	4	-52	0
in		19.7	4.3	40.9	4.3	3.5	1.6	2.0	1.6	1.6	-20.5	0.0

The case vehicle's left side wheelbase was shortened 2.0 centimeters (0.8 inches). The right side wheelbase was shortened 20.0 centimeters (7.9 inches). The totality of the induced damage involved both fenders, the left quarter panel, left "C"-pillar and the left roof side rail. In addition, the left front window, left rear window and backlight were broken out.

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

Tire	*Measured Pressure*		*Recommend Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kpa	psi	kpa	psi	milli-meters	32nd of an inch			
LF	255	37	207	30	6	8	None	No	No
RF	0	0	207	30	6	8	Cut in sidewall	No	Yes
LR	0	0	207	30	8	10	None	No	Yes
RR	0	0	207	30	7	9	None	No	Yes

Vehicle Interior: Inspection of the case vehicle's interior (**Figure 10** and **Figures 11-13** below) revealed no evidence of occupant contact to any of the interior surfaces or components. Passenger compartment intrusion occurred to the back left seat position (**Figure 12** below) due to the left quarter panel impact with the exit ramp sign post. The side panel rear of the "B"-pillar intruded laterally 6 centimeters, (2.4 inches) the "C"-pillar intruded 3 centimeters (1.2 inches) laterally and the seat back intruded 7 centimeters (2.8 inches) laterally. Finally, there was no evidence of

Figure 10: Case vehicle's left front door, steering wheel and instrument panel

compression of the energy absorbing steering column, and no deformation of the steering wheel rim was observed.

Damage Classification: Based on the vehicle inspection, the CDC for the case vehicle's sideswipe impact with the Mercury (event 1) was determined to be: **06-LZES-1** (**190** degrees). The CDC for the impact with the bluff end of the guardrail (event 2) was determined to be: **12-FREE-3** (**0** degrees). The CDC for the subsequent impact with the back of the guardrail (event 3) during the case vehicle's post-impact clockwise rotation was determined to be: **12-FYEW-1** (**0** degrees). The CDC for the left quarter panel impact with the exit ramp sign post (event 4) was determined to be: **09-LBAN-3** (**270** degrees), and the CDC for the guardrail post impact to the left front door (event 5) was determined to be: **09-LPEN-1** (**270** degrees). The WinSMASH reconstruction program, could not be used to reconstruct the Delta Vs of any of the impacts to the case vehicle because the impacts were out-of-scope for the program due to sideswiping damage, yielding object impacts (guardrail and exit sign post) and overlapping damage. The crash severity for the case vehicle's most severe impact (i.e., event 2) was estimated to be low [14-23 km.p.h. (9-14 m.p.h.)]. The case vehicle's EDR recorded a maximum longitudinal Delta V of -10.91 km.p.h. (-6.78 m.p.h.) for the deployment event (i.e., event 2). The WinSMASH reconstruction program, barrier algorithm, was used to calculate a Barrier Equivalent Speed (EBS) for the front impact to the back of the guardrail (i.e., event 3). The calculated EBS was 15.6 km.p.h. (9.7 m.p.h.). The case vehicle was towed due to damage.

Figure 11: Case vehicle's steering wheel, windshield and instrument panel

Figure 12: Overview of case vehicle's back left seat position, arrows show instrusion

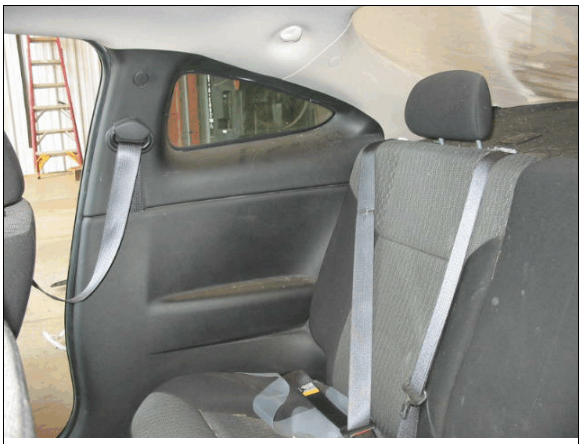


Figure 13: Overview of case vehicle's back right seat position

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with dual stage driver and front right passenger air bags. The first stage of each of these air bags deployed as a result of the impact with the bluff end of the guardrail (i.e., event 2). The second stage of each air bag was "disposed" during the deployment.

The case vehicle's driver air bag was located in the steering wheel hub. The air bag module cover consisted of symmetrical "I"-configuration cover flaps (**Figure 14**). There was a semi-circular contour in the center of the right cover flap to accommodate the manufacturer's logo. A corresponding semi-circular cut-out was present on the left cover flap. The cover flaps were constructed of vinyl and were approximately 3 millimeters (0.1 inch) thick. Each module flap was approximately 8.5 centimeters (3.3 inches) in width at the top, 7 centimeters (2.8 inches) in width at the bottom and 11.5 centimeters (4.5 inches) in height at the vertical tear seam. 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. There was no evidence of damage during the deployment to the cover flaps or the air bag fabric. The deployed driver's air bag (**Figure 15**) was round with a diameter of approximately 58 centimeters (22.8 inches). The air bag was designed with two tethers, each approximately 11 centimeters (4.3 inches) in width and had two vent ports (**Figure 16**), each approximately 3 centimeters (1.2 inches) in diameter, located at the 11 and 1 o'clock positions. No evidence of occupant contact was found on the driver's air bag. There were several small spots, which appeared to be grease, on the front of the air bag in the right lower quadrant and a larger area on the back of the air bag in the upper left quadrant.

Figure 14: Case vehicle driver's air bag module cover flaps

Figure 15: Case vehicle's driver air bag

Figure 16: Arrows show case vehicle driver's air bag vent ports

The front right passenger air bag was located in the top of the instrument panel (**Figure 17** below). The air bag module cover consisted of a single approximate trapezoidal-shaped cover flap constructed of slightly pliable vinyl. Its left side was approximately 22.5 centimeters (8.9 inches) in height, the right side was approximately 16.5 centimeters (6.5 inches) in height and the flap was approximately 37 centimeters (14.6 inches) in length. An inspection of the cover flap and the air bag fabric revealed that the cover flap opened at the designated tear points (**Figure 17** below).

There was no evidence of damage during the deployment to the air bag cover flap or the air bag fabric. The deployed front right passenger's air bag (**Figure 18**) was rectangular in shape and was approximately 63 centimeters (24.8 inches) in height and approximately 44 centimeters (17.3 inches) in width. 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 2:30 and 9:30 o'clock positions. There was no evidence of occupant contact to the air bag. The module cover flap contacted and cracked the windshield during the deployment.

Figure 17: Case vehicle's front right passenger air bag module cover flap

Figure 18: 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 direct connection to the Sensing and Diagnostic Module (SDM). The EDR recorded a deployment event and a non-deployment event. The EDR reports for both events are presented at the end of this report (**Figures 20-28**). The System Status at Deployment report shows the SIR warning lamp was recorded as off, the driver and front right passenger's safety belt switch circuit were recorded as buckled, a deployment command was issued for the driver and front right passenger's safety belt pretensioner, and the front right passenger's air bag was indicated as not suppressed. Analysis of the deployment data (**Figure 24** at the end of this report) based on the SDM data limitations indicated that algorithm enable (AE) occurred at the 10 millisecond sample point, and the deployment was commanded at the approximate 80 millisecond sample point. The system status report showed that the first stage deployment criteria for the driver and front right passenger air bags was met at 42 milliseconds after AE. A second stage deployment was not commanded and "disposal" of the second stage occurred. The deployment data also shows that the longitudinal Delta V reached -10.91 km.p.h. (-6.78 m.p.h.) at the 120 millisecond sample point. The deployment record indicated that the event recording was complete.

Immediately prior to the crash the case vehicle's driver [16-year-old, White (non-Hispanic) female; 160 centimeters and 64 kilograms (62 inches, 141 pounds)] was seated in an upright position with her right foot on the accelerator, left foot on the floor and both hands on the steering wheel. Her seat track was adjusted to between its middle and forward-most position and her seat back was slightly reclined. The tilt steering column was adjusted to its full down position. The driver was not wearing glasses or contact lenses at the time of the crash.

Based on the vehicle inspection and supported by the EDR data, the case vehicle's driver was restrained by her manual, three-point, lap-and-shoulder safety belt system. The case vehicle was equipped with a pretensioner, which activated in the crash. The safety belt retractor was jammed with a length of belt extended out of the retractor consistent with usage in the crash. In addition, the driver reported that she sustained a safety belt abrasion to the left side of her neck.

The case vehicle's impact with the Mercury caused the driver to move rearward and left along a path opposite the case vehicle's 190 degree direction of principal force as the case vehicle was accelerated forward and to the right and she loaded her seat back. The front impact with the bluff end of the guardrail caused a first stage deployment of her air bag and deployment of her safety belt pretensioner. She continued forward opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated and loaded her safety belt causing an abrasion on the left side of her neck. Her face, upper chest and right forearm contacted her deployed air bag causing an abrasion and contusion to her right forearm and a contusion to her left cheek. She continued to load her safety belt as the front of the case vehicle impacted the back of the guardrail and guardrail post as the case vehicle rotated clockwise. The left quarter panel impact with the exit ramp sign post caused the driver to move left along a path opposite the case vehicle's 270 degree direction of principal force and the left side of her body most likely impacted the left front door. The subsequent left front door impact with the guardrail post just prior to the case vehicle coming to rest caused the driver to again move left and the left side of her body most likely contacted her door again. The driver remained restrained in her seat, and she reported that she was removed from the vehicle by medical personnel. The driver's use of her safety belt system and the deployment of her advanced air bag mitigated her interaction with the interior vehicle components and reduced her injury potential.

CASE VEHICLE DRIVER INJURIES

The police crash report indicated the case vehicle's driver sustained a "B" (non-incapacitating-evident) injury and was transported by ambulance to a local hospital. The driver was treated in the emergency room and released. 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 {bruise}, 5.1 cm (2 in) in diameter, left check	minor 290402.1,2	Air bag, driver's	Probable	Interviewee (same person)

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2	Abrasion left neck, not further specified	minor 390202.1,2	Torso portion of safety belt system	Probable	Interviewee (same person)
3	Abrasion {friction burn} antero-medial right forearm	minor 790202.1,1	Air bag, driver's	Probable	Emergency room records
4	Contusion right forearm, not further specified	minor 790402.1,1	Air bag, driver's	Probable	Emergency room records

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's front right passenger [13-year-old, White (non-Hispanic) female; 154 centimeters and 52 kilograms (60 inches, 115 pounds)] was seated in an upright position with both feet on the floor. She was reading a magazine at the time. Her seat track was adjusted to between its middle and forward-most position and her seat back was slightly reclined. The front right passenger was not wearing glasses or contact lenses at the time of the crash.

Based on the vehicle inspection, and supported by the EDR data, the case vehicle's front right passenger was restrained by her manual, three-point, lap-and-shoulder safety belt system. The case vehicle was equipped with a pretensioner, which activated in the crash. The safety belt retractor was jammed with a length of belt extended out of the retractor consistent with usage in the crash. In addition, the driver reported that the front right passenger sustained a safety belt abrasion to the right side of her neck.

The case vehicle's impact with the Mercury caused the front right passenger to move rearward and left along a path opposite the case vehicle's 190 degree direction of principal force as the case vehicle was accelerated forward and to the right and she loaded her seat back. The front impact with the bluff end of the guardrail caused a first stage deployment of her air bag and deployment of her safety belt pretensioner. She continued forward along a path opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated and loaded her safety belt causing an abrasion on the right side of her neck. Her face and chest contacted her deployed air bag causing a closed head injury. In addition, her left knee impacted the glove box door causing a contusion to the knee. As the guardrail impact progressed and the case vehicle continued to rotate clockwise, she continued to load her safety belt as the front of the case vehicle impacted the back of the guardrail and guardrail post. The left quarter panel impact with the exit ramp sign post caused the front right passenger to continue left along a path opposite the case vehicle's 270 degree direction of principal force as the case vehicle decelerated and her left flank likely contacted the arm rest and her left lower leg and thigh likely contacted the center console. The subsequent left front door impact with the guardrail post just prior to the case vehicle coming to rest caused her to again move left. The front right passenger remained restrained in her seat following the crash. The driver reported that the passenger was removed from the vehicle by

medical personnel. The front right passenger's use of her safety belt system and the deployment of her advanced air bag mitigated her interaction with the interior vehicle components and reduced her injury potential.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The police crash report indicated the case vehicle's front right passenger sustained a "B" (non-incapacitating-evident) injury and was transported by ambulance to a local hospital. She was treated in the emergency room and released. The table below shows the front right passenger's injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Closed head injury with possible loss of consciousness, awake, GCS=15	unknown 115099.7,0	Air bag, front right passenger's	Probable	Emergency room records
2	Abrasions right side of neck, not further specified	minor 390202.1,1	Torso portion of safety belt system	Probable	Interviewee (driver)
3	Contusion left knee with swelling, not further specified	minor 890402.1,2	Glove compartment door	Probable	Emergency room records

CASE VEHICLE BACK LEFT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's back left passenger [17-year-old, White (non-Hispanic) female; 168 centimeters and 59 kilograms (66 inches, 130 pounds)] was asleep and leaning to the left against the side panel. She had both feet on the floor and her hands in her lap. Her seat track and seat back were not adjustable.

Based on the vehicle inspection and the interview data, the case vehicle's back left passenger was restrained by her manual, three-point, lap-and-shoulder safety belt system.

The case vehicle's impact with the Mercury caused the back left passenger to move rearward and left along a path opposite the case vehicle's 190 degree direction of principal force as the case vehicle was accelerated forward and to the right. She loaded her seat back and the left side of her body most likely impacted the side panel and her head most likely impacted the "C"-pillar. The front impact with the bluff end of the guardrail caused her to continue forward opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated and she loaded her safety belt. As the guardrail impact progressed and the case vehicle continued to rotate clockwise, she continued to load her safety belt as the front of the case vehicle impacted the back of the guardrail and guardrail post. The left quarter panel impact with the exit ramp sign post occurred adjacent to her seat position (**Figure 19**) causing her to continue left along a path opposite the case vehicle's 270 degree direction of principal force as the case vehicle decelerated. The impact broke

the back left glazing and tempered glass fragments impacted the left side of her face causing several small lacerations. In addition, the left side of her head impacted the left "C"-pillar causing a closed head injury without loss of consciousness, and the left side of her body impacted the side panel. The subsequent left front door impact with the guardrail post, just prior to the case vehicle coming to rest, caused her to again move left and the left side of her body most likely contacted the side panel and her head most likely contacted the "C"-pillar again. The back left passenger remained restrained in her seat following the crash. The driver reported that the passenger was removed from the vehicle by medical personnel.

Figure 19: Exit ramp sign post impact adjacent to back left seat position (arrows)

CASE VEHICLE BACK LEFT PASSENGER INJURIES

The police crash report indicated the case vehicle's back left passenger sustained a "B" (non-incapacitating-evident) injury and was transported by ambulance to a local hospital. She was treated in the emergency room and released. The table below shows the back left passenger's injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Closed head injury without loss of consciousness, GCS=15, head pain	unknown 115099.7,0	Left "C"-pillar	Probable	Emergency room records
2	Lacerations {cuts}, small, left side of face	minor 290602.1,2	Noncontact injury: flying glass, left rear glazing	Probable	Interviewee (driver)

CASE VEHICLE BACK RIGHT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's back right passenger [16-year-old, White (non-Hispanic) female; 165 centimeters and 68 kilograms (65 inches, 150 pounds)] was seated in an upright position using her cell phone. She had her left foot on the floor and her right leg on the seat tucked under her left leg. Her seat track and seat back were not adjustable.

Based on the vehicle inspection and the interview data, the case vehicle's back right passenger was restrained by her manual, three-point, lap-and-shoulder safety belt system.

The case vehicle's impact with the Mercury caused the back right passenger to move rearward and left along a path opposite the case vehicle's 190 degree direction of principal force as the case vehicle was accelerated forward and to the right and she loaded her seat back. The front impact with the bluff end of the guardrail caused her to continue forward along a path opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated and she loaded her safety belt and her left shin impacted the back of the front right seat causing a contusion to her shin. As the guardrail impact progressed and the case vehicle continued to rotate clockwise, she continued to load her safety belt as the front of the case vehicle impacted the back of the guardrail and guardrail posts. The left quarter panel impact with the exit ramp sign post caused her to continue left along a path opposite the case vehicle's 270 degree direction of principal force as the case vehicle decelerated and she impacted the back left passenger causing spraining her left shoulder. The impact broke out the backlite and some of the flying tempered glass fragments impacted and abraded her left shoulder near her neck. The subsequent left front door impact with the guardrail post as the case vehicle came to rest caused her to again move left. The back left passenger remained restrained in her seat following the crash. The driver reported that the passenger was removed from the vehicle by medical personnel.

CASE VEHICLE BACK RIGHT PASSENGER INJURIES

The police crash report indicated the case vehicle's back right passenger sustained a "B" (non-incapacitating-evident) injury. The police crash report had no information on her transport status. However, the case vehicle's driver stated that the passenger was transported to a local hospital, treated in the emergency room and released.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Sprain left shoulder[1], not further specified	minor 751020.1,2	Other occupant: back left passenger	Possible	Emergency room records
2	Abrasion left shoulder, not further specified	minor 790202.1,2	Noncontact injury: flying glass, backlite	Possible	Emergency room records
3	Contusion {bruise} left mid-tibia (i.e., shin)	minor 890402.1,2	Seat back, front right passenger's	Probable	Emergency room records

OTHER VEHICLE

The 2001 Mercury Villager, was a front wheel drive mini-van (VIN: 4M2ZV12T21D------) equipped with a 3.3L, V6 engine and redesigned air bags.

[1] According to the interview with the case vehicle's driver, this occupant had a pre-existing dislocation of her left shoulder. However, she was medically diagnosed with a left shoulder strain without any mention of any prior damage to her shoulder.

Exterior Damage: The Mercury was not inspected. With no available vehicle photographs, a CDC could not be estimated. The Mercury was towed due to damage.

Mercury's Occupants: According to the police crash report, the Mercury's driver [60-year-old, White (unknown ethnic origin) female] was restrained by her manual, three-point, lap-and-shoulder, safety belt system. The police crash report indicated the driver sustained no injury in the crash and was not transported to a treatment facility.

CDR File Information

Vehicle Identification Number	1G1AL15F367******
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	IN06017.CDR
Saved on	Wednesday, July 19 2006 at 11:24:18 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 Non-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 20: Case vehicle 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 21: Case vehicle's SDM Data Limitations continued

System Status At AE

Vehicle Identification Number	**1AL15F*6*******
Low Tire Pressure Warning Lamp (If Equipped)	OFF
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)	No
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	78.8
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

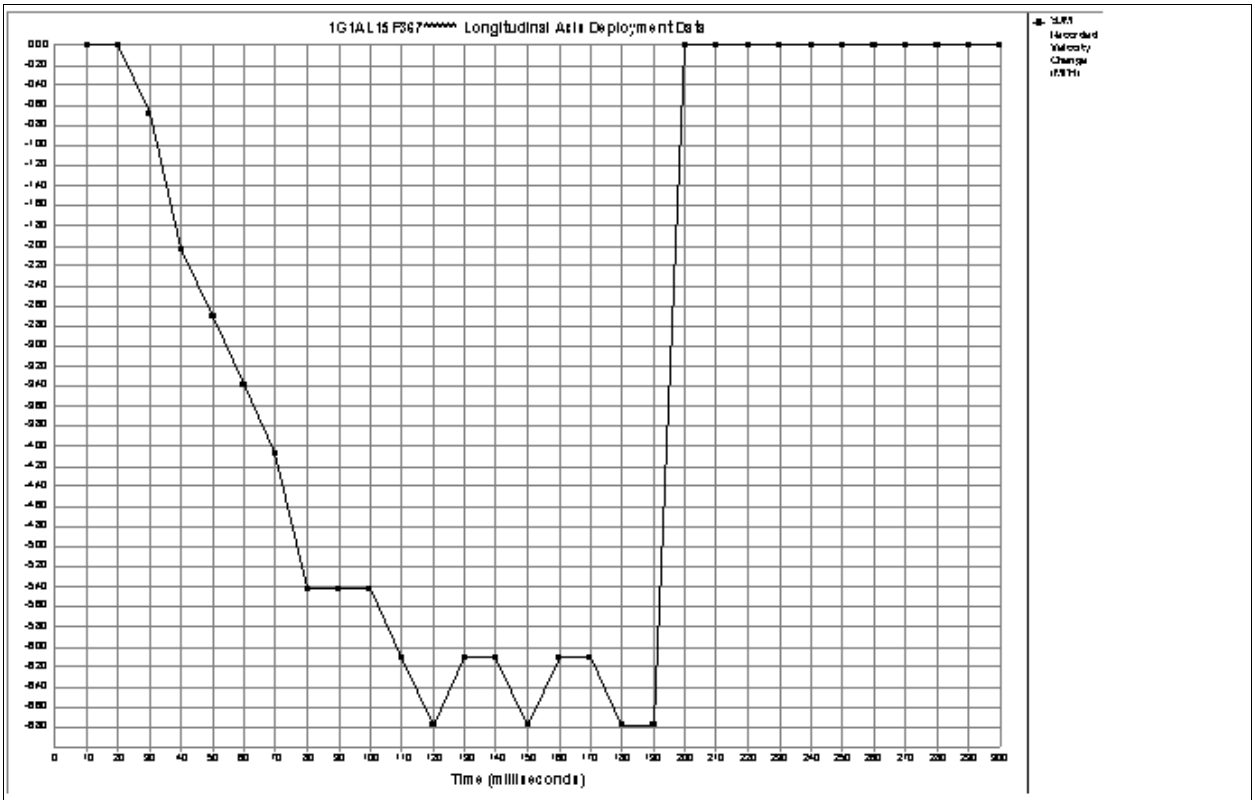
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	43	42	41	47	45
Engine Speed (RPM)	1472	1408	1472	1600	1536
Percent Throttle	15	15	16	16	16
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	0	0	0	0	0
Antilock Brake System Active (If Equipped)	No	No	Yes	Yes	No
Lateral Acceleration (feet/s^2)(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 22: Case vehicle's System Status at AE, at one second and the Pre-crash data

System Status At Deployment

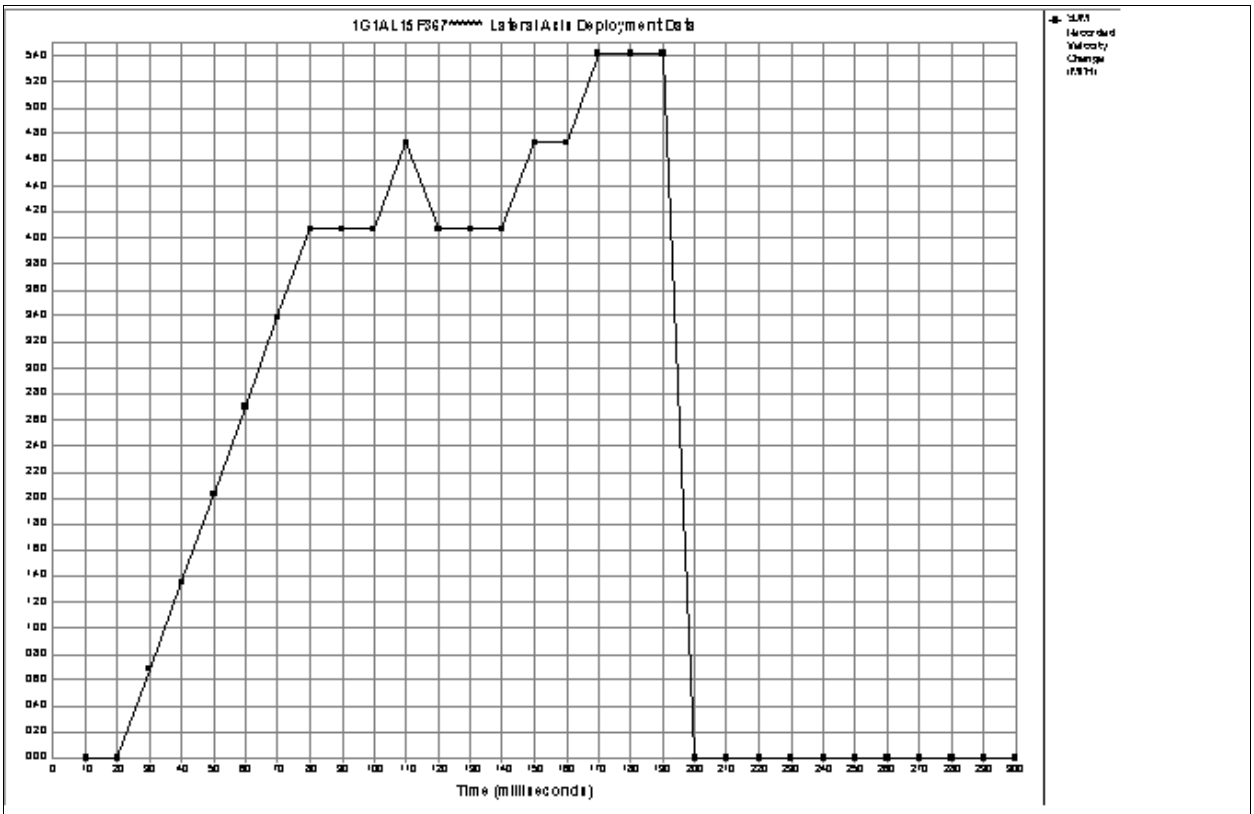
Ignition Cycles At Investigation	718
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	531100
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	708
Ignition Cycles At Event	713
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
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)	42
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)	42
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
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	No
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	320

Figure 23: Case vehicle's System Status at Deployment report



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	-0.68	-2.03	-2.71	-3.39	-4.07	-5.42	-5.42	-5.42	-6.10	-6.78	-6.10	-6.10	-6.78
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-6.10	-6.10	-6.78	-6.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 24: Case vehicle's Longitudinal Axis Deployment Data

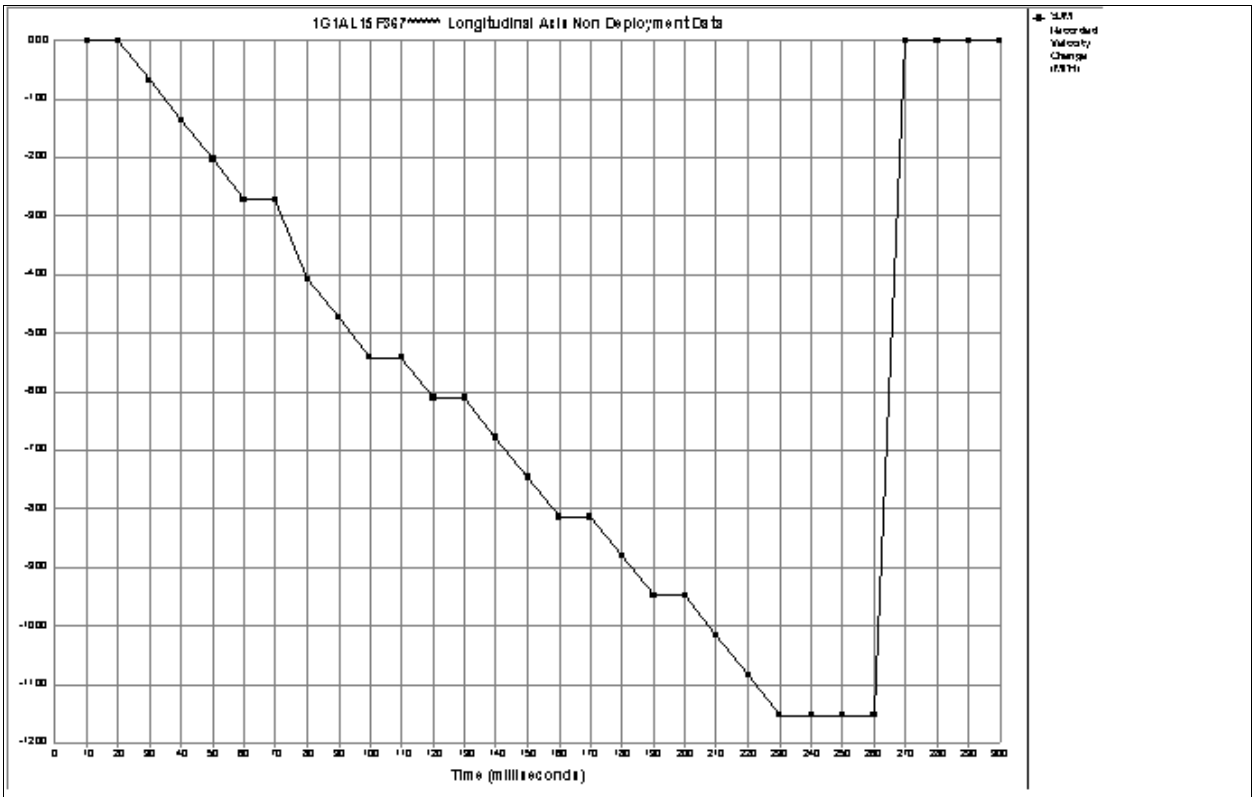


Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.68	1.36	2.03	2.71	3.39	4.07	4.07	4.07	4.74	4.07	4.07	4.07	4.74
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	4.74	5.42	5.42	5.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 25: Case vehicle's Lateral Axis Deployment Data

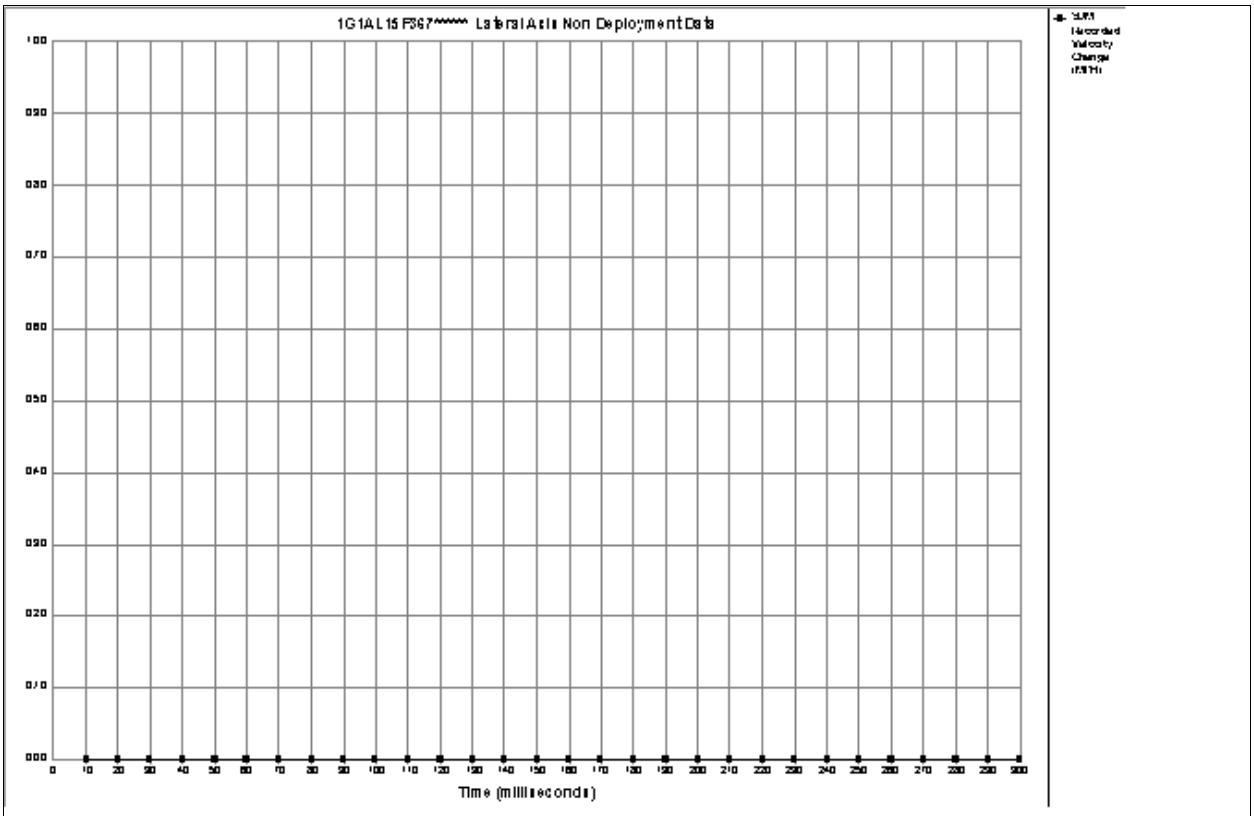
System Status At Non-Deployment	
Ignition Cycles At Investigation	718
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	531100
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	708
Ignition Cycles At Event	713
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's 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
Maximum SDM Recorded Velocity Change (MPH)	11.52
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	230
Driver First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
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	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
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
Multiple Event Counter	1
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)	Yes
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	Yes
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	0

Figure 26: Case vehicle's System Status at Non-Deployment report



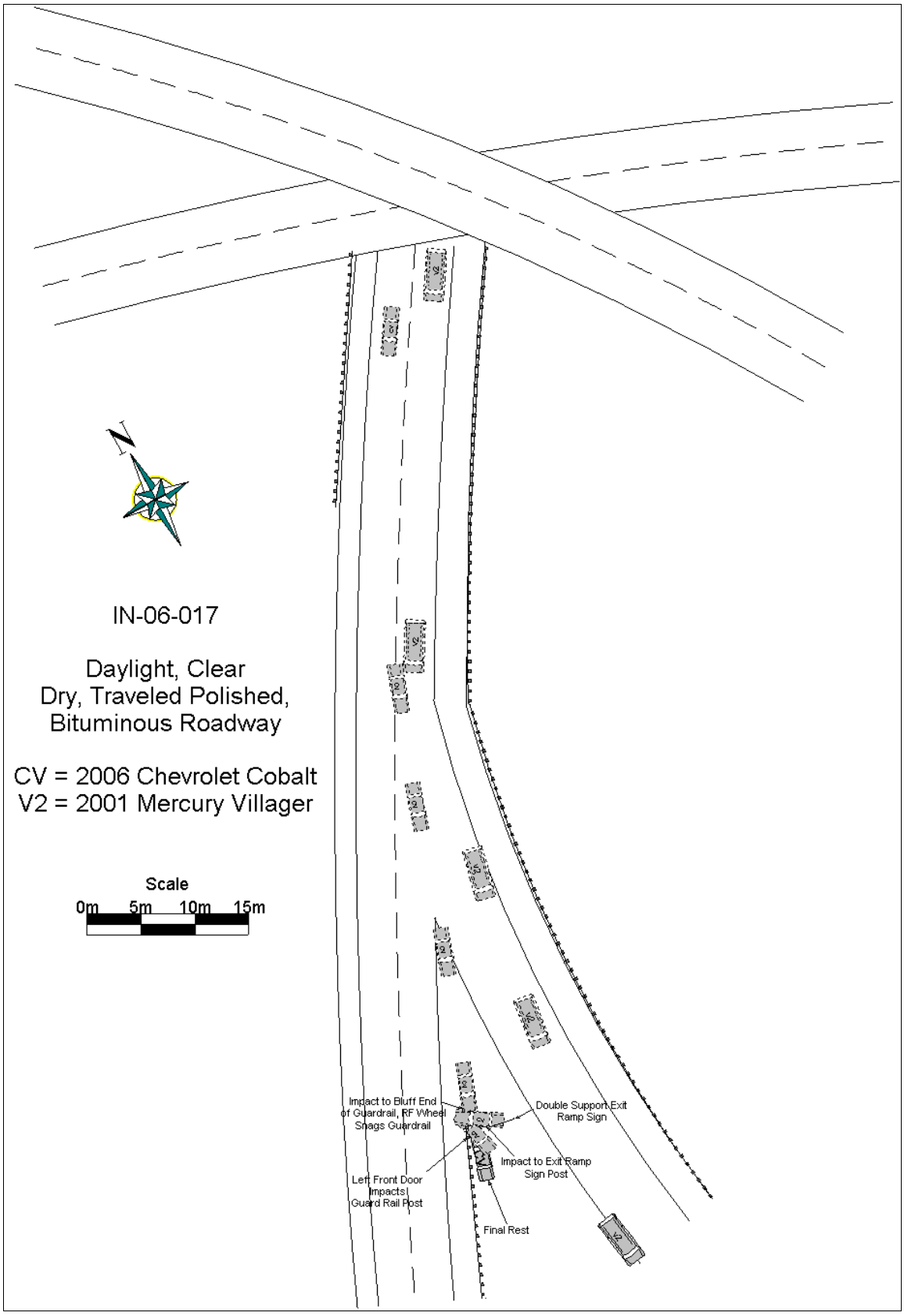
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	-0.68	-1.36	-2.03	-2.71	-2.71	-4.07	-4.74	-5.42	-5.42	-6.10	-6.10	-6.78	-7.46
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-8.13	-8.13	-8.81	-9.49	-9.49	-10.17	-10.85	-11.52	-11.52	-11.52	-11.52	0.00	0.00	0.00	0.00

Figure 27: Case vehicle's Longitudinal Axis Non-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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	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	0.00	0.00

Figure 28: Case vehicle's Lateral Axis Non-Deployment Data


IN-06-017
Daylight, Clear
Dry, Traveled Polished,
Bituminous Roadway
CV = 2006 Chevrolet Cobalt
V2 = 2001 Mercury Villager
Scale
0m 5m 10m 15m
Impact to Bluff End of Guardrail, RF Wheel Snags Guardrail
Double Support Exit Ramp Sign
Impact to Exit Ramp Sign Post
Left Front Door Impacts Guard Rail Post
Final Rest