INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
501 S. Madison Street–Suite 105
Bloomington, Indiana 47403-2452
(812) 855-3908 Fax: (812) 855-3537

ON-SITE ROLLOVER INVESTIGATION

CASE NUMBER - IN09019
LOCATION - TEXAS
VEHICLE - 2006 CADILLAC SRX
CRASH DATE - April 2009

Submitted:

November 30, 2009

Contract Number: DTNH22-07-C-00044

Prepared for:

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

DISCLAIMERS

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

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

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

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

Technical Report Documentation Page

1. *Report No.* IN09019	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Rollover Investigation Vehicle - 2006 Cadillac SRX Location - TEXAS		5. *Report Date:* November 30, 2009 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 501 South Madison Street, Suite 105 Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-07-C-00044	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NVS-411) 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: April 2009 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site rollover investigation involving a 2006 Cadillac SRX.			
16. *Abstract* This on-site investigation focused on the rollover of a 2006 Cadillac SRX. The unrestrained 61-year-old male driver was traveling east in the inside lane of a divided interstate highway. According to the police crash report, the driver dropped his cellular telephone and looked down to pick it up. As a result, the driver lost directional control of the vehicle and it traveled across the eastbound lanes and departed the road where it rolled over in a primarily left side leading configuration. During the rollover, the vehicle's rollover/side impact inflatable curtain (IC) air bags deployed. Based on the damage on the Cadillac, it was estimated that the vehicle rolled over at least 5 quarter turns. The driver sustained minor injury and was not transported to a hospital.			
17. *Key Words* Rollover Inflatable Curtain Air Bag 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* 17	22. *Price*

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

TABLE OF CONTENTS IN09019

This on-site investigation focused on the rollover of a 2006 Cadillac SRX (**Figure 1**). This crash was brought to our attention by the National Highway Traffic Safety Administration (NHTSA) on June 3, 2009 through the sampling activities of the National Automotive Sampling System-General Estimates System (NASS-GES). This investigation was assigned on June 19, 2009. The crash occurred in April, 2009 at 1836 hours, in Texas and was investigated by the sheriff's department. The Cadillac and the crash scene were inspected on June 23-24, 2009. The driver refused to be interviewed. This report is based on the police crash report, vehicle and crash scene inspections, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2006 Cadillac SRX

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Cadillac was traveling was an 8-lane, divided interstate highway that traversed in an east-west direction. The trafficway had four travel lanes in each direction and was separated by a concrete traffic barrier. The barrier was movable to allow for a reversible High Occupancy Vehicle (HOV) lane. The eastbound travel lanes were approximately 3.7 m (12 ft) in width and were bordered by a bituminous shoulder and an embankment. The shoulder was 6.2 m (20 ft) in width. The Cadillac's roadway curved slightly left prior at the area of departure. Due to traffic conditions, the measurements necessary to determine the radius of curvature could not be taken. The roadway was level at the area of departure and the grade along the vehicle's path of travel down the embankment was negative 17%. The posted speed limit was 96 km/h (60 mph). At the time of the crash, the light condition was daylight, the atmospheric condition was clear, and the roadway was dry bituminous. The traffic density was unknown and the site of the crash was suburban commercial. The Crash Diagram can be seen on page 8 of this report.

Pre-Crash: The Cadillac's unrestrained 61-year-old male driver was traveling east in the inside lane. According to the police crash report, the driver dropped his cellular telephone and reached down to pick it up. As a result, the driver lost directional control of the vehicle and it traveled across all the eastbound lanes of traffic toward the outside shoulder. The vehicle was equipped with Electronic Stability Control (ESC), but the driver did not regain directional control and the vehicle departed the south side of the roadway in a clockwise yaw (**Figure 2**).

Figure 2: View back to the approach of the Cadillac from the area the vehicle departed the shoulder

Crash: The clockwise yaw increased as the vehicle traversed the shoulder. The vehicle probably became airborne as it departed the shoulder and rolled over in a primarily left side leading configuration. The vehicle's rollover/side impact inflatable curtain (IC) air bags deployed during the crash sequence. The vehicle came to final rest on its left side headed northwest at the bottom of the embankment.

Post-Crash: The police were notified of the crash at 1835 hours and arrived on scene at 1840 hours. The driver sustained minor injury and was not transported by ambulance to a medical facility. The vehicle was towed from the crash scene due to damage.

Figure 3: Yaw marks from the Cadillac on the shoulder and path of travel off the roadside; arrow on left shows left rear yaw mark; arrow on right shows left front yaw mark

Figure 4: Damage on the grille, hood, and fender of the Cadillac

Figure 5: Damage from post impact on Cadillac's right rear door

ROLLOVER DISCUSSION

The Cadillac's rollover mitigation features consisted of ESC and rollover sensing. The vehicle has not been tested by the NHTSA for rollover stability[1].

The tire mark evidence on the bituminous shoulder (**Figure 3**) indicated that the Cadillac was in a clockwise yaw as it departed the south shoulder. It probably became airborne as it traveled off the edge of the embankment and began to rollover (event 1). The damage pattern indicated that the vehicle touched down on the front plane and hood (**Figure 4**) as it rolled over in a primarily left side leading configuration. The damage on the vehicle did not support an end-over-end type of rollover since the back plane was not damaged. During the rollover the right side plane (**Figure 5**) impacted a wood post (event 2, **Figure 6**) of a single cable guardrail located adjacent to a service roadway at the bottom of the embankment. Based on the damage on the Cadillac, it was estimated that the vehicle rolled over at least 5 quarter turns. However, there was insufficient information and physical evidence to determine the specific rollover dynamics, specific

[1] www.safercar.gov, 11/17/09

number of quarter turns, and distance traveled during the rollover. The police crash report contained no measurements. The police crash sketch showed the vehicle at final rest on its left side heading northwest.

Figure 6: Damaged wood post

Figure 7: Damage on the front plane, hood, and left side of the Cadillac

Figure 8: Left side damage from the rollover on the left side plane of the Cadillac

CASE VEHICLE

Case Vehicle: The 2006 Cadillac SRX was a rear wheel drive, 4-door, sport utility vehicle (VIN: 1GYEE63A6601------) that was equipped with a 4.8-liter, V8 engine, an automatic transmission, 4-wheel anti-lock disc brakes with electronic brake force distribution, traction control, ESC, rollover sensing, a tire pressure monitoring system, adjustable pedals, and an Event Data Recorder (EDR). The front row was equipped with bucket seats, adjustable head restraints, lap-and-shoulder safety belts, redesigned driver and front passenger frontal air bags, seat-mounted side impact air bags, and rollover/side impact IC air bags that provided protection for the front and second rows. The second row was equipped with a split bench seat (70/30) with folding backs, adjustable head restraints at the outboard seat positions, lap-and-shoulder safety belts, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The third row was equipped with a bench seat with folding back. The mileage could not be determined since the vehicle was equipped with an electronic odometer and was without power. The specified wheelbase was 295 cm (116 in).

CASE VEHICLE DAMAGE

Exterior Damage: The damage from the rollover involved the front plane, top of the hood, and the left side plane of the vehicle (**Figures 7** and **8**). The direct damage was distributed across the entire frontal plane and hood. There was no evidence of direct damage on the roof or back plane of the vehicle. On the front bumper and grille, the direct damage began at the front left bumper corner and extended 139 cm (54.7 in). The front bumper sustained 11 cm (4.3 in) of crush at the left bumper corner. The direct damage on the left side plane (**Figure 8**) began 249 cm (98 in) rear of the left front axle and extended 141 cm (55.5 in) rearward to the back bumper corner.

Diagonal scratches that began 292 cm (115 in) rear of the left front axle extended from the roof side rail to the tail light. The direct damage on the right side plane due to the impact with the wood post began 187 cm (74 in) rear of the right front axle and extended 13 cm (5.1 in) rearward on the rear door. The maximum residual crush was 9 cm (3.5 in) occurring at C_5. The table below shows the right side crush profile.

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	2	13	9	116	0	0	3	7	9	0	-86	-53
in		5.1	3.5	45.7	0.0	0.0	1.2	2.8	3.5	0.0	-33.9	-20.9

Damage Classification: The Collision Deformation Classifications were **00-TFDO-6** for the rollover, and **00-RPEN-1** for the impact with the cable guardrail post. The WinSMASH program could not be used on this crash because rollovers and non-horizontal impacts are out of scope for the program. The severity of the rollover damage was moderate based on the extent of the damage on the front plane and hood. Based on the extent of the crush on the right side plane, the severity of the damage due to the impact with the cable guardrail post was minor.

The vehicle manufacturer's recommended tire size was P235/60R18. The Cadillac was equipped with tires sized P255/45R20. The vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	262	38	207	30	6	8	None	No	No
LR	241	35	221	32	4	5	None	No	No
RR	262	38	221	32	4	5	None	No	No
RF	Flat	Flat	207	30	5	6	None	No	Yes

Vehicle Interior: The inspection of the Cadillac's interior (**Figures 9** and **10**) revealed no discernable evidence of occupant contact. There was no deformation of the steering wheel and no compression of the energy absorbing steering column.

All of the vehicle's doors remained closed and operational. The pre-crash status of the right rear window glazing and roof glazing was partially open and fully open, respectively. The pre-crash status of the remaining window glazing was either fixed or closed. The windshield was in

place and cracked from impact forces. No other glazing was damaged due to impact forces. The vehicle's passenger compartment did not sustain any intrusion due to the rollover or right side impact.

Figure 9: The Cadillac's steering wheel, instrument panel, and windshield

Figure 10: Cadillac driver's seating area

EVENT DATA RECORDER

The Cadillac's EDR was imaged using version 3.2 of the Bosch Crash Data Retrieval software through direct connection to the vehicle's air bag control module. The EDR file was subsequently read and printed using version 3.3 of the software. The EDR recorded a deployment and a non-deployment event. Six associated events were detected but not recorded. The data indicated that the SIR warning lamp was off and the driver's seat belt switch circuit was recorded as unbuckled. The rollover sensor was recorded as detecting a rollover event. The time from Algorithm Enable (AE) to the deployment command criteria being met for the IC air bags was 318.75 msec. The data also indicated that the driver's safety belt pretensioner actuated. The maximum recorded longitudinal velocity change was -5.12 km/h (-3.18 mph) occurring 50 msec after the deployment criteria was met. The maximum lateral velocity change was recorded as -66.61 km/h (-41.39 mph) occurring 40 msec after the deployment criteria was met.

The pre-crash data was recorded as associated with the deployment event. The EDR recorded the vehicle's speed as 151 km/h (94 mph) at 5 seconds prior to AE increasing to 156 km/h (97 mph) at 1 second prior to AE. The throttle was recorded as 27% and the brake switch circuit was recorded as off from 5 seconds to 1 second prior to AE. The EDR repot is attached at end of this report[2].

AUTOMATIC RESTRAINT SYSTEM

The Cadillac was equipped with a redesigned frontal air bag system. The driver's air bag was located within the steering wheel hub and the front passenger air bag was located within the middle of the instrument panel. The frontal air bags did not deploy in this crash.

[2] Pages 10-12 of the EDR report have been deleted for confidentiality purposes.

The Cadillac was also equipped with rollover/side impact IC air bags and front seat-mounted side impact air bags. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the vehicle's side impact sensors were located within the lower B-pillars. The IC air bags deployed in this crash. The seat-mounted side impact air bags did not deploy.

Figure 11: The front left portion of the Cadillac's deployed left IC air bag

Figure12: Front tether/air tube of the Cadillac's left IC air bag

The deployed left IC air bag (**Figure 11**) was located along the left roof side rail inside the headliner and extended from the A-pillar to the C-pillar. It was designed with inflation chambers adjacent to the driver and second row left seat positions. There was also an inflatable tube at the bottom of the air bag that was 15 cm (5.9 in) in height. The ends of the tube were attached to the A and C-pillars. A cloth tether (**Figure 12**) that was 17 cm (6.7 in) in length was attached to the tube and the A-pillar. There was also a triangular shaped fabric 17 cm (6.7 in) in width and 13 cm (5.1 in) in height that attached the front of the IC air bag to the A-pillar. The deployed IC air bag was 140 cm (55.1 in) in width and 37 cm (14.6 inches) in height. There was no gap between the air bag and the A-pillar or C-pillar. The IC air bag extended 8 cm (3.1 in) below the beltline. There were no discernable evidence of occupant contact on the air bag and it did not sustain any damage. The right IC air bag was of the same dimensions and features and had no discernable evidence of occupant contact and was undamaged.

MANUAL RESTRAINT SYSTEM

The Cadillac was equipped with integral lap-and-shoulder safety belts for the driver and front passenger seating positions. The driver's safety belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), and a sliding latch plate. The front passenger safety belt was equipped with an ELR and locking latch plate. The driver and front passenger safety belts were equipped with buckle-mounted pretensioners. The second and third row lap-and-shoulder safety belts consisted of continuous loop belt webbing, sliding latch plates, switchable ELR/ALRs (Automatic Locking Retractor), and fixed upper anchors.

Inspection of the driver's seat belt assembly revealed historical scratches on the latch plate. No scuffing or stretching on the webbing and no evidence of loading was present. The EDR recorded the driver's and front passenger's pretensioners as actuated, and the driver's safety belt

as unbuckled. Both front safety belt buckle stalks measured 13 cm (5.1 cm) and did not appear to be shortened. This evidence indicated that the driver was not restrained at the time of the crash. The remaining seat positions were unoccupied.

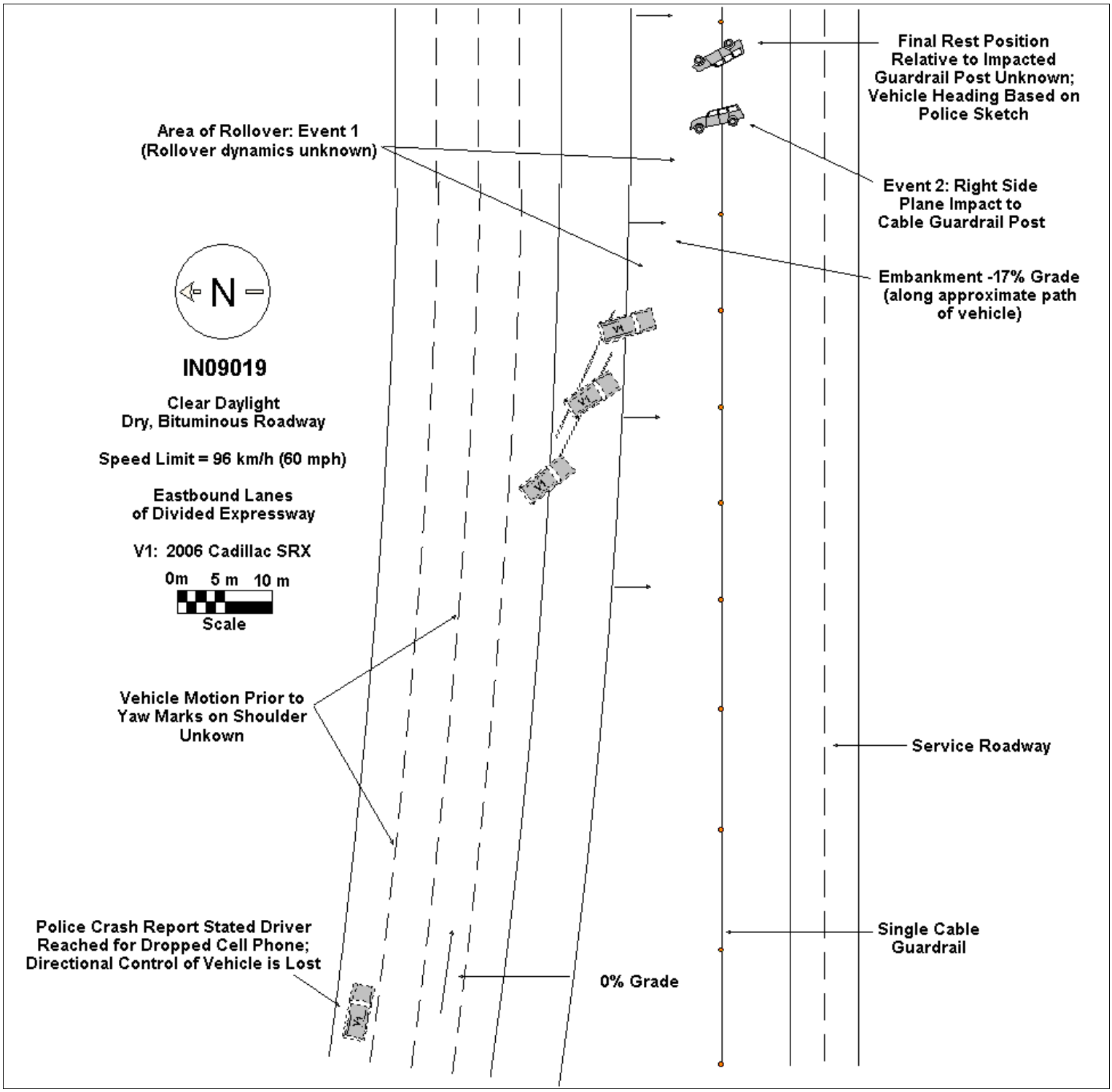
CASE VEHICLE DRIVER KINEMATICS

The Cadillac's driver (61-year-old, male; unknown height and weight) was seated in an unknown posture. At the time of the inspection, the seat track was adjusted between the forward and middle positions and the seat back was upright. The tilt steering column was located in the center position.

Occupant kinematic principles suggest that the driver was displaced to the left and toward the roof as the vehicle departed the right side of the road in a clockwise yaw and began to rollover. He remained within the vehicle during the rollover. There was no discernable evidence of occupant contact on any of the interior surfaces or components.

CASE VEHICLE DRIVER INJURIES

The driver sustained a police reported C (possible) injury. He was not transported by ambulance to a medical facility.


Final Rest Position Relative to Impacted Guardrail Post Unknown; Vehicle Heading Based on Police Sketch
Area of Rollover: Event 1 (Rollover dynamics unknown)
Event 2: Right Side Plane Impact to Cable Guardrail Post
N
Embankment -17% Grade (along approximate path of vehicle)
IN09019
Clear Daylight
Dry, Bituminous Roadway
Speed Limit = 96 km/h (60 mph)
Eastbound Lanes of Divided Expressway
V1: 2006 Cadillac SRX
0m 5 m 10 m
Scale
Vehicle Motion Prior to Yaw Marks on Shoulder Unkown
Service Roadway
Police Crash Report Stated Driver Reached for Dropped Cell Phone; Directional Control of Vehicle is Lost
Single Cable Guardrail
0% Grade

CDR File Information

User Entered VIN	1GYEE63A660******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN09019EDR.CDR
Saved on	Thursday, June 25 2009 at 04:55:38 PM
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.3
EDR Device Type	airbag control module
Event(s) recovered	Deployment Non-Deployment

IMPORTANT NOTICE: Robert Bosch LLC recommends that the latest production release of Crash Data Retrieval software be utilized when viewing, printing or exporting any retrieved data from within the CDR program. This ensures that the retrieved data has been translated using the most recent information including but not limited to that which was provided by the manufacturers of the vehicles supported in this product.

Data Limitations

Recorded Crash Events:

There are two types of recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event records data but does not deploy the air bag(s). The minimum SDM Recorded Vehicle Velocity Change, that is needed to record a Non-Deployment Event, is five MPH. A Non-Deployment Event may 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 velocity change. This event will be cleared by the SDM, after approximately 250 ignition cycles. This event can be overwritten by a second Deployment Event, referred to as Deployment Event #2, if the Non-Deployment Event is not locked. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds of a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared by the SDM.
The second type of SDM recorded crash event is the Deployment Event. It also may contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events. If a second Deployment Event occurs any time after the Deployment Event, the Deployment Event #2 will overwrite any non-locked Non-Deployment Event. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

Data:

-SDM Recorded Vehicle Velocity Change reflects the change in velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle 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. For Deployment Events, the SDM will record 230 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-The CDR tool displays time from Algorithm Enable (AE) to time of deployment command in a deployment event and AE to time of maximum SDM recorded vehicle velocity change in a non-deployment event. Time from AE begins when the first air bag system enable threshold is met and ends when deployment command criteria is met or at maximum SDM recorded vehicle velocity change. Air bag systems such as frontal, side, or rollover, may be a source of an enable. The time represented in a CDR report can be that of the enable of one air bag system to the deployment time of another air bag system.
-Maximum Recorded Vehicle Velocity Change is the maximum square root value of the sum of the squares for the vehicle's combined "X" and "Y" axis change in velocity.
-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 by various factors, including but not limited to the following:
  -significant changes in the tire's rolling radius
  -final drive axle ratio changes
  -wheel lockup and wheel slip
-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.
-Pre-Crash data is recorded asynchronously.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
  -the SDM receives a message from the module sending the pre-crash data
  -no data is received from the module with an "invalid" flag sending the pre-crash data
  -no module present to send the pre-crash data
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit.

-The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment 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.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

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.

Multiple Event Data

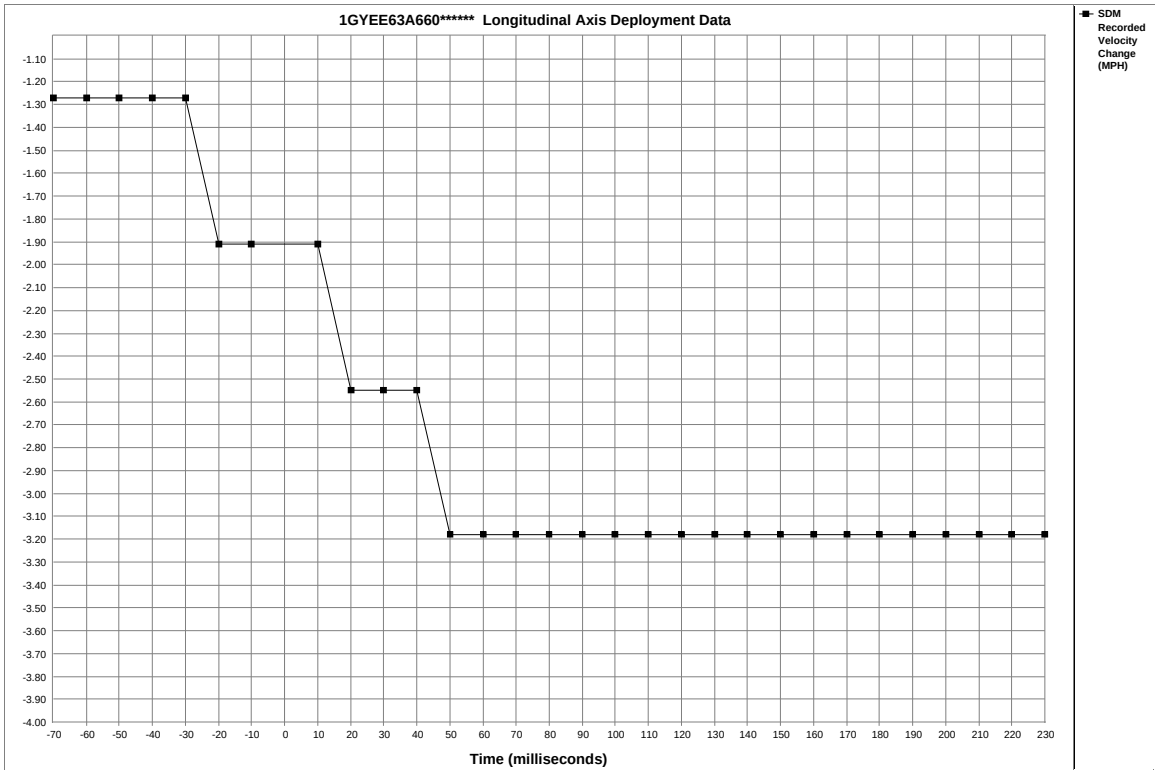
Associated Events Not Recorded	6
An Event(s) Preceded the Recorded Event(s)	Yes
An Event(s) was in Between the Recorded Event(s)	Yes
An Event(s) Followed the Recorded Event(s)	Yes
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	Yes

Pre-Crash Data

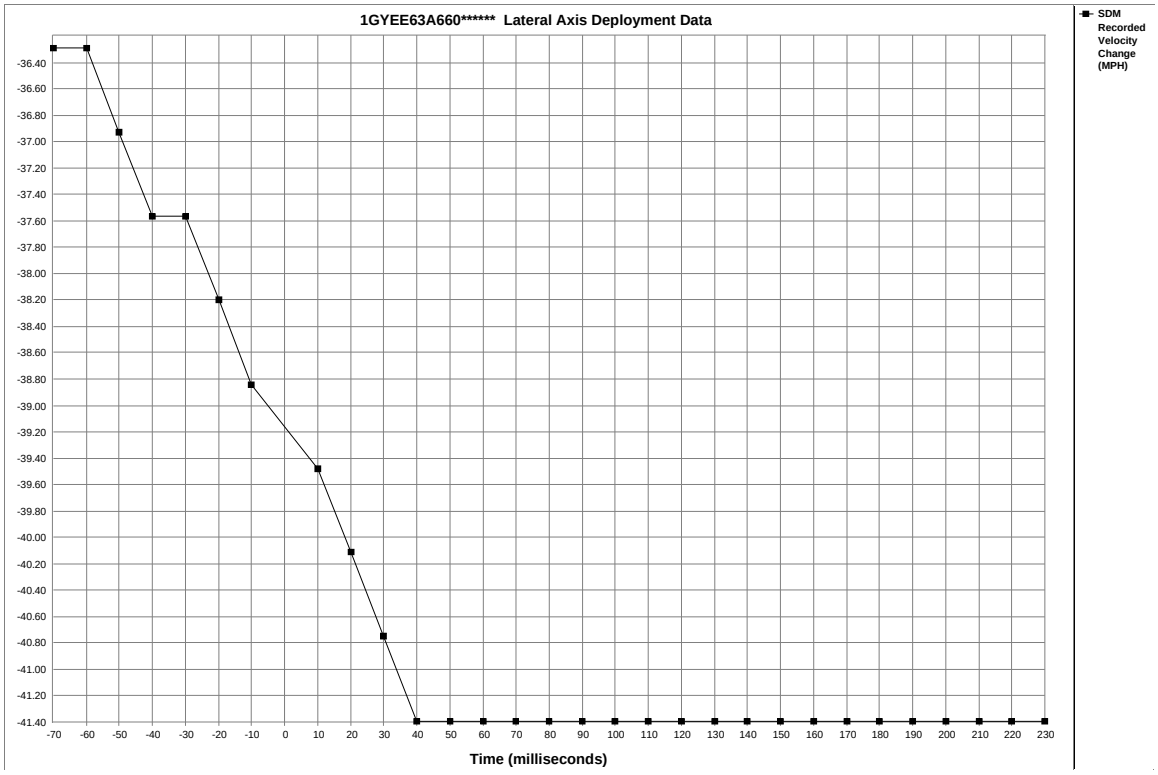
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	94	96	96	96	97
Engine Speed (RPM)	3840	3840	3840	3840	3904
Percent Throttle	27	27	27	27	27
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF

System Status At Deployment

SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655350
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	4239
Ignition Cycles At Investigation	4243
Ignition Cycles At Event	4239
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	UNBUCKLED
Rollover Sensor Status	Rollover Event
Number of Consecutive Error Free Messages Received From Rollover Sensor	Last 128 Consecutive Message Were Error Free
SDM Synchronization Counter	6826
Side Air Bag(s) Were First Commanded to Deploy Due to Side Impact Event	No
Side Air Bag(s) Were First Commanded to Deploy Due to Rollover Event	No
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	318.75
Passenger Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	318.75
Driver 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver Roof Rail/Head Curtain Loop Commanded (If Equipped)	Yes
Supplemental Deployment Loop #1 Commanded (If Equipped)	No
Passenger 1st Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger Roof Rail/Head Curtain Loop Commanded (If Equipped)	Yes
Supplemental Deployment Loop #2 Commanded (If Equipped)	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #3 Commanded (If Equipped)	No
Second Row Right Side Deployment Loop Commanded (If Equipped)	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Supplemental Deployment Loop #4 Commanded (If Equipped)	No
Second Row Center Pretensioner Deployment Loop Commanded	No
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
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Event Recording Complete	Yes



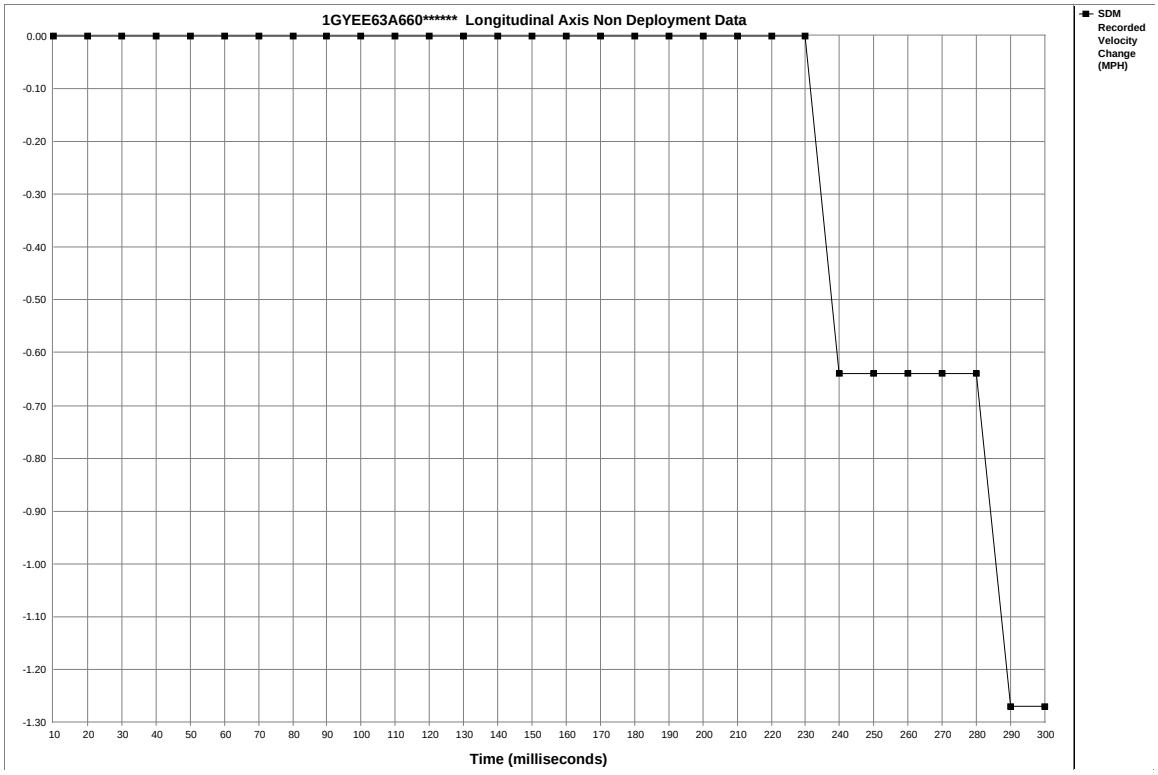
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	10	20	30	40	50	60	70	80
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-1.27	-1.27	-1.27	-1.27	-1.27	-1.91	-1.91	-1.91	-2.55	-2.55	-2.55	-3.18	-3.18	-3.18	-3.18
Time (milliseconds)	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18	-3.18



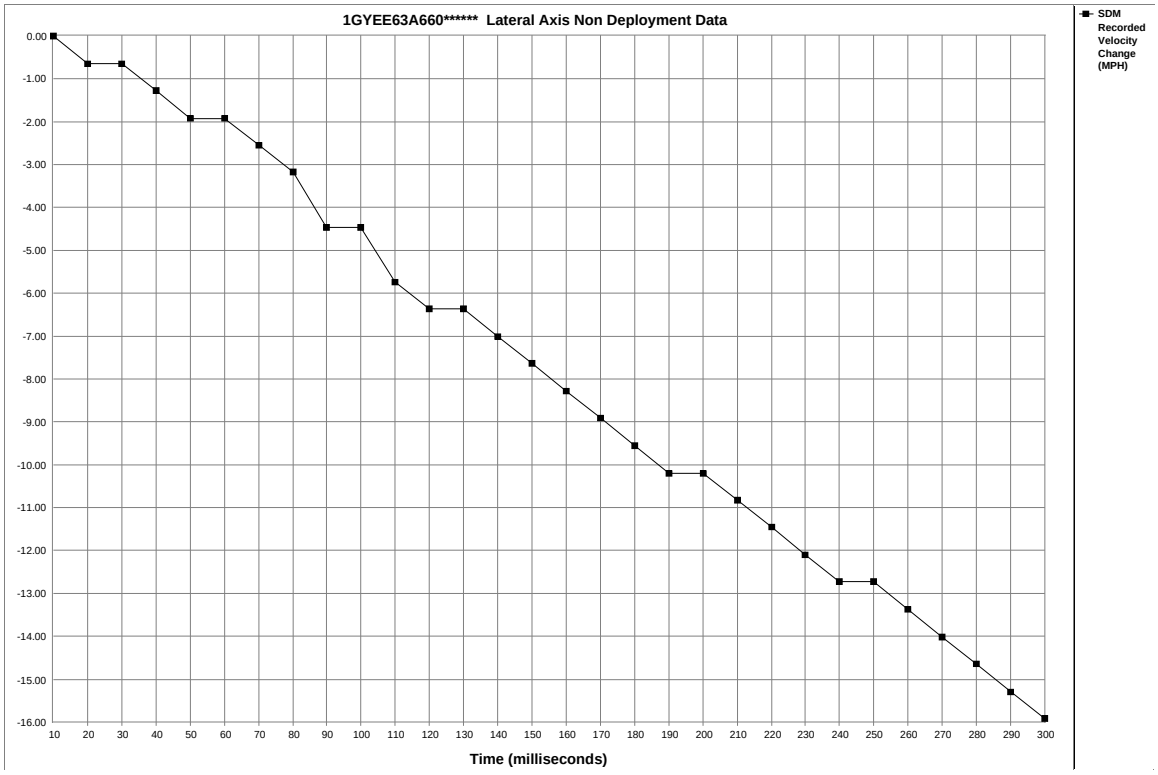
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	10	20	30	40	50	60	70	80
SDM Lateral Axis Recorded Velocity Change (MPH)	-36.29	-36.29	-36.93	-37.57	-37.57	-38.20	-38.84	-39.48	-40.11	-40.75	-41.39	-41.39	-41.39	-41.39	-41.39
Time (milliseconds)	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
SDM Lateral Axis Recorded Velocity Change (MPH)	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39	-41.39

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655350
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	4239
Ignition Cycles At Investigation	4243
Ignition Cycles At Event	4239
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	UNBUCKLED
Rollover Sensor Status	Data Invalid
Number of Consecutive Error Free Messages Received From Rollover Sensor	Last 128 Consecutive Message Were Error Free
SDM Synchronization Counter	6826
Side Air Bag(s) Were First Commanded to Deploy Due to Side Impact Event	No
Side Air Bag(s) Were First Commanded to Deploy Due to Rollover Event	No
Driver 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
Driver Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #1 Commanded (If Equipped)	No
Passenger 1st Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Passenger Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #2 Commanded (If Equipped)	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #3 Commanded (If Equipped)	No
Second Row Right Side Deployment Loop Commanded (If Equipped)	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Supplemental Deployment Loop #4 Commanded (If Equipped)	No
Second Row Center Pretensioner Deployment Loop Commanded	No
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
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Maximum SDM Recorded Velocity Change (MPH)	15.97
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	290
Crash Record Locked	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Vehicle Event Data (Pre-Crash) Associated With This Event	No
Event Recording Complete	Yes



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Longitudinal 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
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.64	-0.64	-0.64	-0.64	-0.64	-1.27	-1.27



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	-0.64	-0.64	-1.27	-1.91	-1.91	-2.55	-3.18	-4.46	-4.46	-5.73	-6.37	-6.37	-7.00	-7.64
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Lateral Axis Recorded Velocity Change (MPH)	-8.28	-8.91	-9.55	-10.19	-10.19	-10.82	-11.46	-12.10	-12.73	-12.73	-13.37	-14.01	-14.64	-15.28	-15.92