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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-05-008
LOCATION - OHIO
VEHICLE - 2005 CADILLAC ESCALADE
CRASH DATE - January 2005

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

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

Technical Report Documentation Page

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15. *Supplementary Notes* On-site air bag investigation involving a 2005 Cadillac Escalade with manual safety belts, certified advanced 208-compliant front air bag system and front seat back-mounted side impact air bags.			
16. *Abstract* This report covers an on-site investigation of a side impact air bag deployment crash that involved a 2005 Cadillac Escalade (case vehicle) and a 2004 Jeep Liberty (other vehicle), which collided in the intersection of two county roadways. This crash is of special interest because the supplemental restraint (air bag) system in the Cadillac Escalade is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Standard (FMVSS) No. 208. The case vehicle was also equipped with an Event Data Recorder (EDR) and the driver [40-year-old, White (no-Hispanic) female], front right passenger [13-year-old, White (non-Hispanic) female] and the back right passenger [11-year-old, White (non-Hispanic) male] sustained no injuries as a result of the crash. The case vehicle was southbound on a snow covered, two lane county roadway approaching a four leg intersection. The driver was applying the brakes intending to stop at the intersection, but the case vehicle was sliding on the snow covered roadway. The Jeep was traveling west in the westbound lane approaching the intersection. The case vehicle's driver continued to brake in an attempt to avoid the crash as the case vehicle slid into the intersection. The front of the Jeep impacted the case vehicle's left front and rear doors causing the case vehicle driver's seat back-mounted side impact air bag to deploy. None of the case vehicle's other air bags deployed. As a result of the impact, the case vehicle rotated counterclockwise and came to rest on the southwest corner of the intersection facing northeast. The impact with the case vehicle caused the Jeep to rotate counterclockwise. The police crash schematic showed the Jeep at final rest in a parking lot on the northwest corner of the intersection facing northwest. This final rest location is not consistent with the crash forces acting on the vehicle. It appears the Jeep's driver most likely drove the vehicle to this position following the impact. The case vehicle driver was not restrained and was not injured. The front right passenger and second seat row, right passenger were both restrained by their three-point, lap and shoulder safety belts. Neither passenger was injured in the crash.			
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IN-05-008

This investigation was brought to NHTSA's attention on or about February 10, 2005 by Nationwide Insurance Company. This crash involved a 2005 Cadillac Escalade (case vehicle) and a 2004 Jeep Liberty (other vehicle). The crash occurred in January 2005, at 11:55 a.m., in Ohio and was investigated by the Ohio State Highway Patrol. This crash is of special interest because the supplemental restraint (air bag) system in the Cadillac Escalade is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Standard (FMVSS) No. 208. The case vehicle was also equipped with an Event Data Recorder (EDR) and the driver [40-year-old, White (no-Hispanic) female], front right passenger [13-year-old, White (non-Hispanic) female] and the back right passenger [11-year-old, White (non-Hispanic) male] sustained no injuries as a result of the crash. This contractor inspected the case vehicle and harvested the EDR for subsequent download, inspected the Jeep Liberty, and inspected the scene on February 23, 2005. The case vehicle's driver was interviewed on March 21, 2005. This summary is based on the police crash report, scene and vehicle inspections, an interview with the case vehicle's driver, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was southbound on a snow covered, two lane county roadway approaching a four leg intersection. The driver was applying the brakes intending to stop at the intersection, but the case vehicle was sliding on the snow covered roadway. The Jeep was traveling west in the westbound lane approaching the intersection. The Jeep's driver was intending to continue straight through the intersection and continue west. The case vehicle's driver continued to brake in an attempt to avoid the crash as the case vehicle slid into the intersection. The front of the Jeep impacted the case vehicle's left front and rear doors causing the case vehicle driver's seat back-mounted side impact air bag to deploy. None of the case vehicle's other air bags deployed. As a result of the impact, the case vehicle rotated counterclockwise and came to rest on the southwest corner of the intersection facing northeast. The impact with the case vehicle caused the Jeep to rotate counterclockwise. The police crash schematic showed the Jeep at final rest in a parking lot on the northwest corner of the intersection facing northwest. This final rest location is not consistent with the crash forces acting on the vehicle. It appears the Jeep's driver most likely drove the vehicle to this position following the impact.

Based on the vehicle inspection, the CDC for the case vehicle was determined to be **10-LPEW-2** (**290** degrees). The WinSMASH reconstruction program, damage only algorithm, calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs respectively as: 11.0 km.p.h. (6.8 m.p.h.), -3.8 km.p.h. (-2.4 m.p.h.), and 10.3 km.p.h. (-6.4 m.p.h.). The case vehicle's EDR recorded a non-deployment event and recorded a longitudinal Delta V of -2.19 km.p.h. (-1.36 m.p.h.) occurring 27.5 milliseconds after algorithm enable. The case vehicle was towed due to damage.

Based on the vehicle inspection, the CDC for the Jeep was determined to be **01-FDEW-1** (**20** degrees). The WinSMASH reconstruction program, damage only algorithm calculated the Jeep's Total, Longitudinal, and Lateral Delta Vs respectively as: 24.0 km.p.h. (14.9 m.p.h.), -22.6 km.p.h. (-14.0 m.p.h.), and -8.2 km.p.h. (-5.1 m.p.h.). The Jeep was towed due to damage.

Immediately prior to the crash the case vehicle's driver (40-year-old, female) was seated in an upright position with both hands on the steering wheel, her back against the seat back, her left foot on the floor and her right foot on the brake pedal. The driver's seat track was adjusted to the middle position and her seat back was slightly reclined. The tilt steering wheel was most likely located between its center and full down position. The position of the power adjustable pedals is not known. The driver was wearing a heavy winter coat at the time of the crash, was not wearing glasses and was not restrained by her integral, three-point, lap-and-shoulder, safety belt system.

The Jeep's impact with the case vehicle caused the driver to move left and slightly forward along a path opposite the case vehicle's 290 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the right. The driver's left arm and side contacted her deployed seat back-mounted side impact air bag, her left leg most likely contacted the driver's door and her right knee possibly contacted and scuffed the right knee bolster. The driver remained in her seat and moved back to the right as the case vehicle rotated counterclockwise to final rest. The driver's door was jammed closed by the crash. She exited the case vehicle under her own power through the right front door. The case vehicle driver was not injured.

Immediately prior to the crash the case vehicle's front right passenger (13-year-old, female) was seated upright with both feet on the floor and her back against the seat back. The position of her hands is not known. Her seat track was adjusted to the middle position, and the seat back was slightly reclined. The passenger was wearing a heavy winter coat at the time of the crash, and she was restrained by her integral, three-point, lap-and-shoulder safety belt system.

The Jeep's impact with the case vehicle caused the front right passenger to move left and slightly forward along a path opposite the case vehicle's 290 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the right. The passenger's left hip most likely contacted the center console and her safety belt buckle. Her lower legs possibly contacted the glove box door. The passenger remained in her seat and moved back to her right as the case vehicle rotated counterclockwise to final rest. The passenger was able to exit the case vehicle under her own power through the right front door. The front right passenger was not injured.

Immediately prior to the crash the case vehicle's second seat row, right passenger (11-year-old, male) was seated upright with both feet on the floor and his back against the seat back. The position of his hands is not known. His seat track was not adjustable, and the seat back was slightly reclined. The passenger was wearing a heavy winter coat at the time of the crash and was restrained by his manual, three-point, lap-and-shoulder safety belt system.

The Jeep's impact with the case vehicle caused the second seat row, right passenger to move left and slightly forward along a path opposite the case vehicle's 290 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly. The passenger remained in his seat and moved back to his right as the case vehicle rotated counterclockwise to final rest. The passenger was able to exit the case vehicle under his own power through the right rear door. He was not injured in the crash.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle was traveling was a straight, two-lane, undivided county roadway traversing in a north and south direction, and the case vehicle was approaching a four-leg intersection. The case vehicle's approach was controlled by a stop sign posted on each side of the roadway at the intersection. The northbound lane was 3.8 meters (12.5 feet) in width. The southbound lane was 3.5 meters (11.5 feet) in width. There was a 0.7 meter (2.3 feet) wide bituminous shoulder on the west side of the roadway and a 1 meter (3.3 feet) wide bituminous shoulder on the east side of the roadway. The trafficway on which the Jeep was traveling was a straight two-lane, undivided, county roadway traversing in an east and west direction. The Jeep's approach to the intersection was uncontrolled. The westbound lane was 3.6 meters (11.8 feet) in width. The eastbound lane was 4.8 meters (15.7 feet) in width. The south side of the roadway was bordered by a barrier curb. The north side of the roadway was bordered by a 1.2 meter (3.9 feet) wide bituminous shoulder. The speed limit for both vehicles was 72 km.p.h. (45 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was snow, and the roadway pavement was level, snow covered bituminous with an estimated coefficient of friction of 0.25. Traffic density was light, and the site of the crash was rural residential. See the Crash Diagram at the end of this report.

Pre-Crash: The case vehicle was southbound in the southbound lane (**Figure 1**) approaching the intersection. The driver was applying the brakes intending to stop at the intersection, but the case vehicle was sliding on the snow covered roadway. The Jeep was traveling west in the westbound lane (**Figure 2** below) approaching the intersection. The Jeep's driver was intending to continue straight through the intersection and continue west. The case vehicle's driver continued to brake in an attempt to avoid the crash as the case vehicle slid into the intersection. The crash occurred within the intersection.

Figure 1: Approach of case vehicle southbound to area of impact, indicated by arrow, number shows meters to impact area

Crash: The front of the Jeep (**Figure 3** below) impacted the case vehicle's left front and rear doors (**Figure 4** below) causing the case vehicle driver's seat back-mounted, side impact air bag to deploy. None of the case vehicle's other air bags deployed in this crash.

Figure 2: Approach of Jeep westbound to area of impact, indicated by arrow

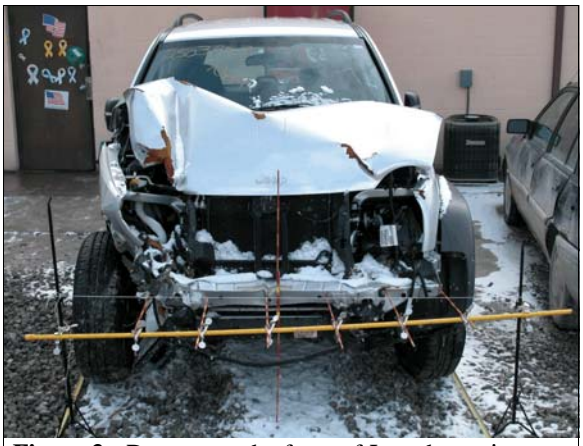


Figure 3: Damage to the front of Jeep due to impact with the left side of the case vehicle

Figure 4: Damage to case vehicle's left side, each black mark on tape is 0.31 meter (1 foot), each increment on rod is 5 cm (2 in)

Figure 5: View northeast through case vehicle's area of final rest (arrow) back to area of impact in intersection

Post-Crash: As a result of the impact, the case vehicle rotated counterclockwise about 150 degrees while traveling southwest across the intersection into the west leg of the intersection. The case vehicle continued southwest and came to rest partially off the south side of the roadway (**Figure 5**) facing northeast. The impact with the case vehicle caused the Jeep to rotate counterclockwise. The police crash schematic shows the Jeep at final rest in a parking lot on the northwest corner of the intersection facing northwest (**Figure 6**). This final rest location is not consistent with the crash forces acting on the vehicle. The case vehicle's driver stated the Jeep was in this location immediately after the crash. The Jeep's driver most likely drove the vehicle to this position following the impact.

Figure 6: View southeast through area of Jeep's final rest (arrow) back to the intersection, double head arrow shows area of rest of case vehicle

The 2005 Cadillac Escalade was an all-wheel drive, four-door sport utility vehicle (VIN: 1GYEK63N95R------) equipped with a 6.0L, V8 engine; automatic transmission; four wheel, anti-lock brakes; traction control, stability control and power adjustable pedals. The front seating row was equipped with dual stage driver and front right passenger air bags, bucket seats with adjustable head restraints, integral, three-point, lap-and-shoulder safety belt systems with buckle sensors, seat back-mounted side-impact air bags and a front right passenger detection and automatic air bag suppression system. The second seating row was equipped with bucket seats with adjustable head restraints and manual three-point, lap-and-shoulder safety belt systems. The third seating row was equipped with a split bench with folding backs, adjustable head restraints and integral, three-point, lap-and-shoulder safety belt systems in the outboard seat positions and a two-point lap belt in the middle seat position. In addition, the case vehicle was equipped with a LATCH system for securing child safety seats and an EDR housed within the air bag system's Sensing and Diagnostic Module (SDM)

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 Jeep involved the left front and rear doors and the left sill. The doors and sill were directly damaged and crushed inward. The direct damage began 25 centimeters (9.8 inches) forward of the left rear axle and extended 148 centimeters (58.3 inches) forward along the left side of the vehicle. Crush measurements (**Figure 7**) were taken at the lower door level, and maximum crush was measured as 26.0 centimeters (10.2 inches). Maximum crush was located 45 centimeters (17.7) forward of C_3. The table below shows the case vehicle's crush profile.

Figure 7: Top view of crush to left side of case vehicle

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	148	26	278	0	4	22	17	10	0	-43	-48
in		58.3	10.2	109.4	0.0	1.6	8.7	6.7	3.9	0.0	-16.9	-18.9

The impact did not alter the case vehicle's right or left side wheelbase. Induced damage involved the left front and rear doors, and the left quarter panel. In addition, the right rear door frame was slightly deformed by the impact. The door would open and close with some binding in the frame.

The recommended tire size was: P265/70R17 and the 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	248	36	207	30	9	11	None	No	No
RF	248	36	207	30	9	11	None	No	No
LR	269	39	207	30	9	11	None	No	No
RR	241	35	207	30	9	11	None	No	No

Vehicle Interior: Inspection of the case vehicle's interior (**Figures 8** and **9**) revealed three small possible occupant contact scuffs on the driver's right knee bolster. Two small possible occupant contact scuffs were observed on the glove box door, and one small scuff was observed on the right rear door armrest. In addition, there was a scuff on the left front window (**Figure 10** below) that appeared to be due to contact by the deploying seat back-mounted side impact air bag.

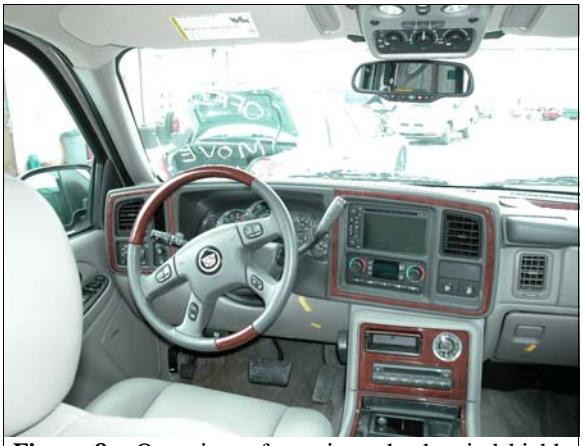


Figure 8: Overview of steering wheel, windshield and instrument panel, yellow tape shows possible occupant contact scuffs on driver's knee bolster

Figure 9: Overview of windshield, instrument panel and right front door

The case vehicle sustained six intrusions (**Figure 11** below) due to the impact with the Jeep. There were three intrusions into the driver's occupant space as follows: the left front sill intruded laterally 15 centimeters (5.9 inches); the left front door intruded laterally 4 centimeters (1.6 inches); and the upper left B-pillar intruded laterally 1 centimeter (0.4 inches). There were also

three intrusions into the second seat row, left occupant's space as follows: the left sill intruded laterally 15 centimeters (5.9 inches); the left rear door intruded laterally 9 centimeters (3.5 inches); and the left B-pillar intruded laterally 9 centimeters (3.5 inches). There was no compression of the energy absorbing steering column, and no deformation of the steering wheel rim was observed (**Figure 12**).

Figure 10: Scuff on driver's door window

Figure 11: Overview of left side intrusion

Damage Classification: Based on the vehicle inspection, the CDC for the case vehicle was determined to be **10-LPEW-2** (**290** degrees). The WinSMASH reconstruction program, damage only algorithm, was used to reconstruct the case vehicle's Delta V. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 11.0 km.p.h. (6.8 m.p.h.), -3.8 km.p.h. (-2.4 m.p.h.), and 10.3 km.p.h. (-6.4 m.p.h.). In addition, the case vehicle's EDR recorded a non-deployment event and recorded a longitudinal Delta V of -2.19 km.p.h. (-1.36 m.p.h.) occurring 27.5 milliseconds after algorithm enable. The case vehicle was towed due to damage.

Figure 12: Case vehicle's steering wheel and steering column showing lack of deformation

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with a certified advanced 208-compliant front air bag system and front seat back-mounted side impact air bags. The driver's seat back-mounted side impact air bag deployed as a result of the side impact. The driver and front right passenger air bags did not deploy in this crash. The EDR data and the WinSMASH reconstruction indicated that the case vehicle's forward deceleration during the crash was not sufficient to require deployment of the front air bags.

Figure 13: Overview of driver's seat and seat back-mounted side impact air bag

The driver's seat back-mounted side impact air bag was located in the outboard side of the driver's seat back. An inspection of the single air bag module cover flap and the air bag fabric revealed that the cover flap opened at the designated tear points. The air bag module cover flap was rectangular in shape and was 6 centimeters (2.4 inches) in width and 16 centimeters (6.3 inches) in length. There was no evidence of damage during the deployment to the air bag module cover flap or the air bag fabric. However, there were a few dark colored areas on the air bag that appeared to be related to the deployment. In addition, it appeared that the air bag had contacted and scuffed the left front window during the deployment (**Figure 10** above). No occupant contact evidence was observed on the air bag. The deployed seat back-mounted side impact air bag (**Figure 13**) was rectangular in shape with a length of approximately 34 centimeters (13.4 inches) and a height of 24 centimeters (9.4 inches). The air bag was designed without tethers or vent ports.

CRASH DATA RECORDING

Due to the damaged sheet metal folds in the floor pan under the driver's seat from the side impact, it was necessary to remove the SDM from the case vehicle to accomplish the download. The EDR recorded a non-deployment event. The EDR reports are presented at the end of this report (**Figures 19 - 21**). The system status report indicated the SIR warning lamp was off, and the driver's seat belt switch circuit was recorded as unbuckled. The maximum SDM recorded longitudinal velocity change was recorded as -2.19 km.p.h. (-1.36 m.p.h.) occurring 27.5 milliseconds (0.0275 seconds) after algorithm enable. In addition, the system status report shows that event recording was complete, and there were no multiple events associated with the record. The pre-crash data indicated the brake switch circuit was on five seconds prior to algorithm enable, off for the next three one second sample periods and then on again at one second prior to algorithm enable.

Figure 14: Overview of driver's seat with safety belt buckled

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash the case vehicle's driver [40-year-old, White (non-Hispanic) female; 168 centimeters and 56 kilograms (66 inches and 123 pounds)] was seated in an upright position with both hands on the steering wheel, her back against the seat back, her left foot on the floor and her right foot on the brake pedal. The driver's seat track was adjusted

to the middle position and her seat back was slightly reclined (**Figure 14** above). The driver did not know the position of her tilt steering wheel. However, based on the vehicle inspection, the tilt steering wheel was most likely located between its center and full down position. In addition, the position of the power adjustable pedals is not known. The driver was not aware the case vehicle had adjustable pedals. The driver was wearing a heavy winter coat at the time of the crash. Lastly, the driver was not wearing glasses at the time of the crash.

The case vehicle driver was not restrained by her integral, three-point, lap-and-shoulder, safety belt system. Inspection of the safety belt assembly revealed some use scratches on the latch plate indicating some prior usage; otherwise, the safety belt system was unremarkable.

Based on the case vehicle driver's interview and supported by the EDR data, the driver was applying the brakes just prior to the crash. The braking most likely did not cause the driver's seated position to change just prior to the impact. The case vehicle's impact with the Jeep caused the driver to move left and slightly forward along a path opposite the case vehicle's 290 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the right. The driver's left arm and side contacted her deployed seat back-mounted, side impact air bag, her left leg contacted the driver's door and her right knee possibly contacted and scuffed the right knee bolster. The driver remained in her seat and moved back to the right as the case vehicle rotated counterclockwise to final rest. The driver's door was jammed closed by the crash. She exited the case vehicle under her own power through the right front door.

CASE VEHICLE DRIVER INJURIES

The case vehicle's driver did not sustain any injury as a result of the crash and was not transported from the crash scene. The driver was not employed at the time of the crash.

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; 160 centimeters and 36 kilograms (63 inches and 80 pounds)] was seated upright with both feet on the floor and her back against the seat back. The position of her hands is not known. Her seat track was adjusted to the middle position and the seat back was slightly reclined (**Figure 15**). The passenger was wearing a heavy winter coat at the time of the crash.

Figure 15: Overview of front right seat with safety belt buckled

Based on the case vehicle driver's interview, the front right passenger was restrained by her

integral, three-point, lap-and-shoulder safety belt system. Inspection of the safety belt assembly revealed some use scratches on the latch plate indicating some prior usage; otherwise, the safety belt system was unremarkable.

The driver's braking just prior to the impact most likely did not cause the passenger's seated position to change just prior to the impact. The Jeep's impact with the case vehicle caused the front right passenger to move left and slightly forward along a path opposite the case vehicle's 290 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the right. The passenger's left hip most likely contacted the center console and her safety belt buckle. Several scuffs were observed on the glove box door during the vehicle inspection indicating possible contact by the passenger's lower legs. The passenger remained in her seat and moved back to her right as the case vehicle rotated counterclockwise to final rest. The passenger was able to exit the case vehicle under her own power through the right front door.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger did not sustain any injury as a result of the crash and was not transported from the crash scene. The passenger was a student and missed no school days as a result of the crash.

CASE VEHICLE SECOND SEAT ROW, RIGHT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's second seat row, right passenger [11-year-old, White (non-Hispanic) male; 142 centimeters and 32 kilograms (56 inches and 70 pounds)] was seated upright with both feet on the floor and his back against the seat back. The position of his hands is not known. His seat track was not adjustable, and the seat back was slightly reclined (**Figure 16**). The passenger was wearing a heavy winter coat at the time of the crash.

Figure 16: Overview of case vehicle's second row, right seat with safety belt buckled

Based on the case vehicle driver's interview, the second seat row, right passenger was restrained by his manual, three-point, lap-and-shoulder safety belt system. Inspection of the safety belt assembly was unremarkable.

The driver's braking most likely did not cause the passenger's seated position to change just prior to the crash. The Jeep's impact with the case vehicle caused the second seat row, right passenger to move left and slightly forward along a path opposite the case vehicle's 290 degree

direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly. The passenger remained in his seat and moved back to his right as the case vehicle rotated counterclockwise to final rest. A scuff was observed on the right rear door arm rest during the vehicle inspection; however, it was most likely not an occupant contact mark. The passenger was able to exit the case vehicle under his own power through the right rear door.

CASE VEHICLE SECOND SEAT ROW, RIGHT PASSENGER INJURIES

The second seat row, right passenger did not sustain any injury as a result of the crash and was not transported from the crash scene. The passenger was a student and missed no school days as a result of the crash.

OTHER VEHICLE

The 2004 Jeep Liberty Sport was a four door, four-wheel drive sport utility vehicle (VIN: 1J4GL48K24W------) 3.7L, V6 engine and three speed automatic transmission. The Jeep was equipped with driver and front right passenger dual stage air bags. The driver's air bag deployed as a result of the impact with the case vehicle

Exterior Damage: The Jeep's impact with the case vehicle involved the entire front end of the Jeep (**Figure 17**). The Jeep's front bumper cover was not present at the inspection. The direct damage began at the front right corner and extended 118 centimeters (46.5 inches) across the front end. Based on the damage to both vehicles, the direct damage most likely involved the full width of the Jeep's front bumper. Crush measurements were taken at the bumper level (**Figure 18** below), and maximum crush was measured as 17.0 centimeters (6.7 inches) occurring at C_5. The table below shows the Jeep's crush profile.

Figure 17: Right front view of damage to front of Jeep due to impact with the case vehicle

Figure 18: Top view of crush to front of Jeep

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	118	17	118	8	5	11	16	17	11	0	0
in		46.5	6.7	46.5	3.2	2.0	4.3	6.3	6.7	4.3	0.0	0.0

The Jeep's right side wheelbase was reduced 2 centimeters (0.8 inch) while the left side wheelbase was unchanged. Induced damage involved both front fenders and the hood.

The recommended tire size was: P215/75R16, and the 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	193	28	228	33	8	10	None	No	No
RF	186	27	228	33	7	9	None	No	No
LR	165	24	228	33	8	10	None	No	No
RR	165	24	228	33	7	9	None	No	No

Damage Classification: Based on the vehicle inspection, the CDC for the Jeep was determined to be **01-FDEW-1** (**20** degrees). The WinSMASH reconstruction program, damage only algorithm, was used to reconstruct the Jeep's Delta Vs. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 24.0 km.p.h. (14.9 m.p.h.), -22.6 km.p.h. (-14.0 m.p.h.), and -8.2 km.p.h. (-5.1 m.p.h.). The Jeep was towed due to damage.

Jeep's Occupants: According to the police crash report, the Jeep's driver [21-year-old (unknown race and ethnic origin) female] was restrained by her manual, three-point, lap-and-shoulder safety belt system. The police crash report indicated the driver sustained a "B" (non-incapacitating-evident) injury and was transported by ambulance to a treatment facility.

1GYEK63N95Rxxxxxx System Status At Non-Deployment	
SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Non-Deployment	599
Ignition Cycles At Investigation	621
Maximum SDM Recorded Velocity Change (MPH)	-2.19
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	27.5
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	-0.62	-1.86	-1.24	-1.24	-1.55	-1.86	-1.86	-1.86	-1.86	-1.86	-1.86	-1.55	-1.55	-1.55

PRE-CRASH DATA				
Seconds Before AE	**Vehicle Speed (MPH)**	**Engine Speed (RPM)**	**Percent Throttle**	**Brake Switch Circuit Status**
-5	11	576	0	ON
-4	7	640	0	OFF
-3	6	1216	21	OFF
-2	9	1664	0	OFF
-1	9	896	0	ON

Figure 19: Case vehicle's System Status at Non-Deployment report

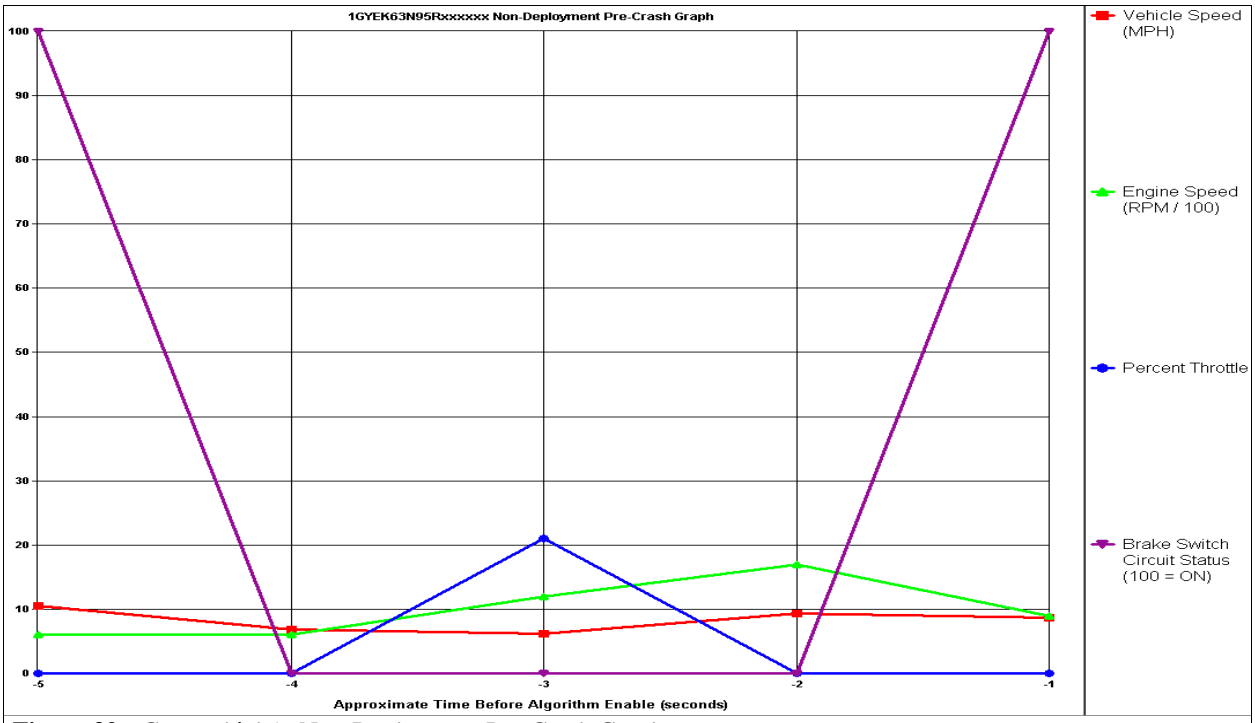


Figure 20: Case vehicle's Non-Deployment Pre-Crash Graph

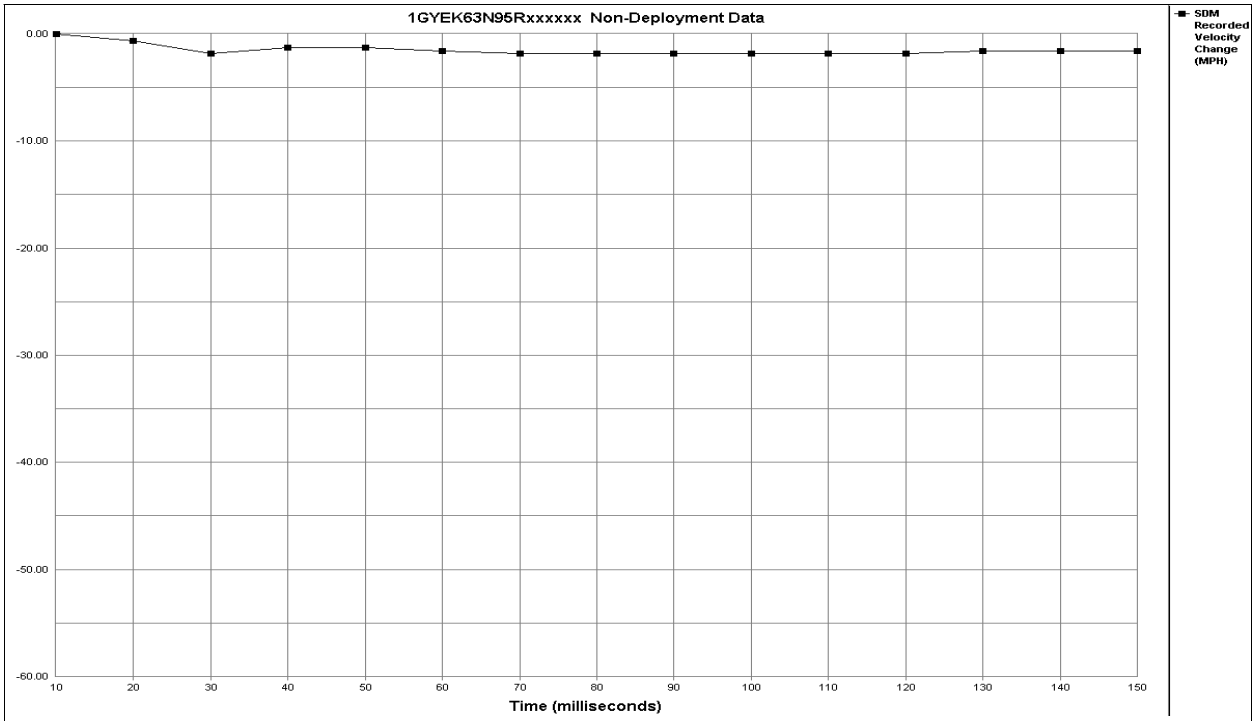
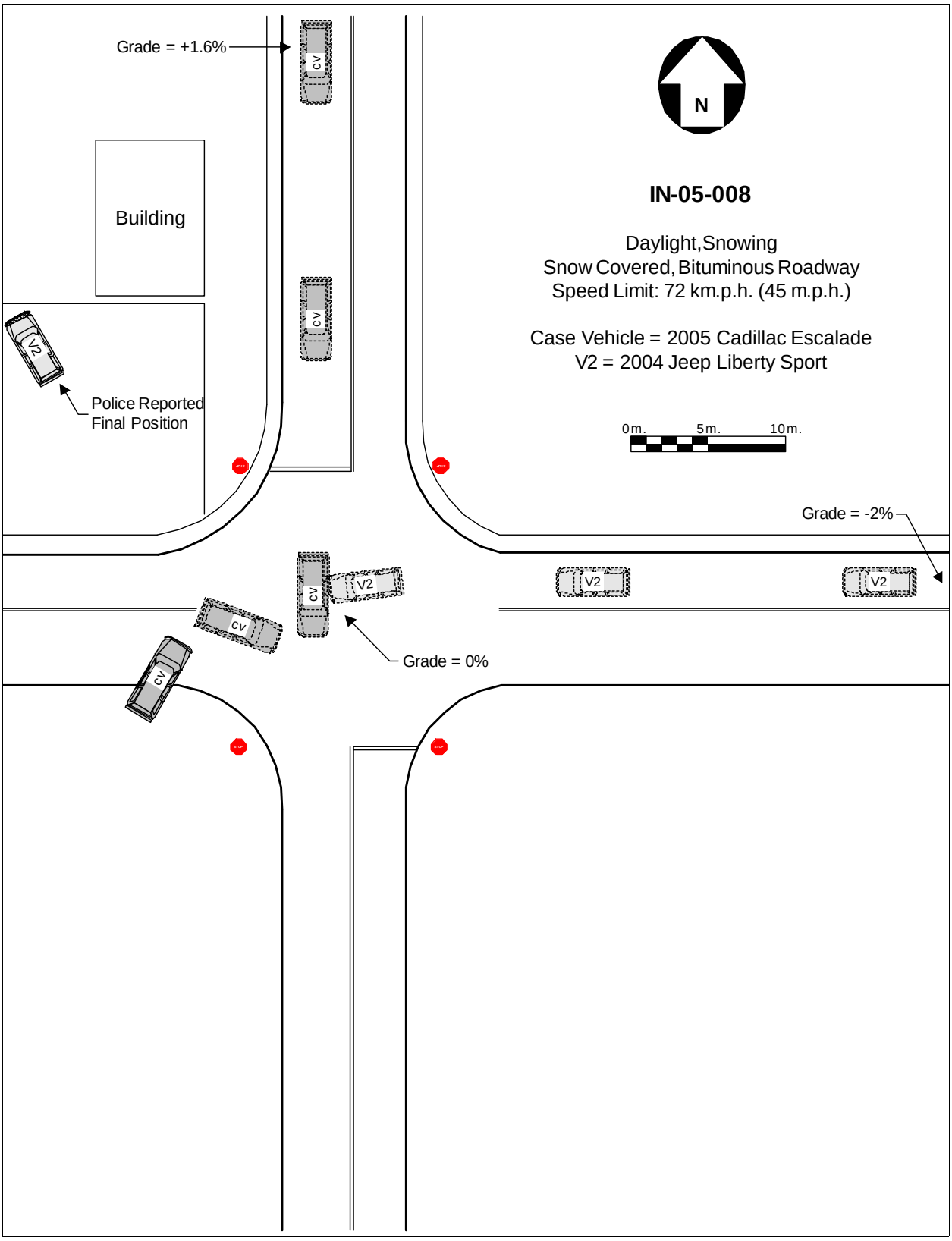


Figure 21: Case vehicle's non-deployment SDM Recorded Velocity Change graph


Grade = +1.6%
CV
CV
Building
V2
Police Reported
Final Position
N
IN-05-008
Daylight,Snowing
Snow Covered, Bituminous Roadway
Speed Limit: 72 km.p.h. (45 m.p.h.)
Case Vehicle = 2005 Cadillac Escalade
V2 = 2004 Jeep Liberty Sport
0m. 5m. 10m.
Grade = -2%
V2
V2
CV
V2
CV
CV
Grade = 0%