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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-04-027
LOCATION - Mississippi
VEHICLE - 2004 CHEVROLET AVALANCHE
CRASH DATE - June 2004

Submitted:

March 13, 2006
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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

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

Technical Report Documentation Page

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16. *Abstract*

This report covers an on-site investigation of an air bag deployment crash that involved a 2004 Chevrolet Avalanche (case vehicle) and a1997 Chevrolet K1500 Silverado pickup truck (other vehicle), which were involved in a rear end crash and rollover on a two-lane state highway. This crash is of special interest because the supplemental restraint (air bag) system in the Chevrolet Avalanche 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 [37-year-old, White (non-Hispanic) male] sustained only minor injuries as a result of the crash. The case vehicle was traveling southwest and was towing a boat. The Chevrolet Silverado was in front of the case vehicle also traveling southwest, but at a much slower speed. It was towing a fuel tank. As the case vehicle closed on the Silverado, the case vehicle's driver steered left, and the front right corner of the case vehicle impacted the back left corner of the Silverado's towed trailing unit causing the case vehicle's driver air bag to deploy. The impact caused the case vehicle to rotate clockwise and roll over onto its left side. Following the impact, the towed trailing units separated from both vehicles. The case vehicle rotated clockwise, slid on its left side and departed the west side of the roadway with the undercarriage leading and rolled back up on its wheels to final rest facing southeast. The Silverado came to final rest near the case vehicle partially off the west side of the roadway facing southwest. Both the case vehicle's and Silverado's towed trailing units came to final rest on the west side of the roadway. Just prior to the impact, the case vehicle's driver was seated in a normal driving position. He was not restrained and sustained no injuries from his deployed air bag. As the case vehicle rolled over and slid on its left side, the driver's left forearm contacted the roadway through the open left front window and scrapped on the roadway abrading his forearm. He also impacted the steering wheel with the inside of his right leg causing a large contusion on his leg. He remained in the case vehicle as is slid to final rest. He was able to exit the case vehicle under his own power. He was transported from the scene by ambulance to a local hospital and treated and released.

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BACKGROUND

IN-04-027

This on-site investigation was brought to NHTSA's attention on or before July 12, 2004 by Nationwide Insurance. This crash involved a 2004 Chevrolet Avalanche (case vehicle) and a 1997 Chevrolet K1500 Silverado pickup truck (other vehicle), which were involved in a rear end crash on a two-lane state highway. The case vehicle was towing a boat, and the Chevrolet Silverado was towing a large fuel tank (unknown type of fuel). The crash occurred in June, 2004, at 4:02 p.m., in Mississippi and was investigated by the Mississippi Highway Patrol. This crash is of special interest because the supplemental restraint (air bag) system in the Chevrolet Avalanche 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 [37-year-old, White (non-Hispanic) male] sustained only minor injuries as a result of the crash. This contractor inspected the scene, case vehicle, and downloaded the data from the onboard EDR on August 24, 2004. This contractor interviewed the case vehicle's driver on September 10, 2004, and interviewed the driver of the Chevrolet Silverado on November 9, 2004. This report is based on the police crash report, scene and case vehicle inspections, interviews with the drivers of the case vehicle and the Chevrolet Silverado, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling southwest in the southwest travel lane of a two-lane state highway at approximately 98 km.ph. (61 m.p.h.). The Chevrolet Silverado was in front of the case vehicle in the same lane traveling in the same direction at a police estimated speed of 48 km.p.h. (30 m.p.h.). As the case vehicle closed on the Silverado, the case vehicle's driver steered left, and the front right corner of the case vehicle impacted the back left corner of Silverado's towed trailing unit causing a stage one deployment of the case vehicle's driver air bag. The impact caused the case vehicle to rotate clockwise and roll over onto its left side. Following the impact, the towed trailing units separated from both vehicles. The case vehicle slid on its left side, rotated clockwise approximately 300 degrees, and departed the west side of the roadway with the undercarriage leading and rolled back up on its wheels to final rest facing southeast. The Silverado came to final rest near the case vehicle partially off the west side of the roadway facing southwest. The Silverado's towed trailing unit came to final rest on the west side of the roadway northeast of the case vehicle facing southwest. The case vehicle's towed trailing unit also came to rest on the west side of the roadway southwest of the case vehicle facing southwest. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, level bituminous. Traffic density was light and the site of the crash was rural.

The CDCs for the case vehicle were determined to be: **12-FREE-6** (**0** degrees) for the impact with the back of the Chevrolet Silverado's towed trailing unit, and **00-LDAO-2** for the rollover onto the left side. The WinSMASH reconstruction program could not be used to reconstruct the case vehicle's Delta V for the front impact because the collision conditions are outside the scope of the program due to the presence of towed trailing units on both vehicles. However, the EDR data indicated the case vehicle's maximum recorded longitudinal velocity change for the front impact was -15.4 km.p.h. (-9.6 m.p.h). In addition, this contractor estimates the severity of the case vehicle's rollover to be moderate.

Immediately prior to the crash the case vehicle's driver [37-year-old, White (non-Hispanic) male] was seated in an upright posture with his back against the seat back, his left foot on the floor, and his right foot on the accelerator. The driver's left elbow was on the left door armrest and his left hand was on steering wheel. The driver's right elbow was on the center arm rest and his right hand was on the steering wheel. His seat track was located in it's rear most position, the seat back was upright, and the tilt steering wheel was located in its full down position. The driver was wearing sunglasses at the time of the crash and was not restrained by his integral, three-point, lap-and-shoulder safety belt.

The case vehicle's driver steered left just prior to the impact. As a result of the impact to the back of the Chevrolet Silverado's towed trailing unit, the case vehicle's driver continued forward along a path opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated, and the driver's face and chest most likely contacted his deployed air bag. The case vehicle then rotated clockwise, rolled onto it's left side and rotated clockwise as it slid along the roadway. As a result of the clockwise rotation prior to the rollover, the case vehicle's driver most likely moved forward and to his left. When the case vehicle landed on its left side, the inside of the driver's right thigh contacted the steering wheel bruising his thigh. The left side of his body contacted the left front door, and his left arm contacted the roadway through the open driver's door window abrading his left forearm. The driver stayed in contact with his door and likely moved rearward to some extent as the case vehicle rotated clockwise and slid along the roadway. The driver then moved back to the right as the case vehicle departed the roadway with the undercarriage leading and rolled back up on its wheels to final rest. The extent of the driver's movement to the right as the vehicle came to final rest is not known, but he indicated he was in his seat following the crash. The driver was able to exit the case vehicle under his own power. The injury sources cited above are based on occupant kinematic principles and this contractor's best judgement since there was no direct occupant contact evidence found in the vehicle.

The case vehicle's driver was transported by ambulance to a hospital and was treated and released. The driver reported that he sustained a 10.2 centimeter (4 inches) wide abrasion on the outside of the left forearm due to contact with the roadway, and a large hematoma on the inside of the right thigh due to contact with the steering wheel.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which both vehicles were traveling was a two-lane, undivided, state highway, traversing in a northeasterly and southwesterly direction. There was a gravel shoulder and a shallow ditch adjacent to each travel lane. Each travel lane was 3.4 meters (11.2 feet) wide and each shoulder was approximately 1.5 meters (4.9 feet) wide. Pavement markings consisted of white edge lines and broken yellow center lines. The case vehicle's approach to the crash site was uncontrolled, and the police reported speed limit was 88 km.p.h. (55 m.p.h.). There was no regulatory speed limit sign posted near the crash site. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, level bituminous. Traffic density was light and the site of the crash was rural. See the Crash Diagram at the end of this report.

Pre-Crash: The case vehicle was traveling southwest in the southwest travel lane, and the driver was intending to proceed straight ahead (**Figure 1**). The EDR data indicated the case vehicle was traveling 98 km.p.h. (61 m.p.h.) approximately 1 second prior to the crash. The Chevrolet Silverado was in front of the case vehicle in the same lane traveling in the same direction at a police estimated speed of 48 km.p.h. (30 m.p.h.), and the driver was also intending to proceed straight ahead. Based on the interview with the driver of the Silverado and supporting evidence by the damage offset on the front of the case vehicle, the case vehicle's driver steered left just prior to the crash. The EDR data for the deployment event indicated the case vehicle's driver did not apply the brakes prior to the crash. The crash occurred in the southwest travel lane of the roadway.

Figure 1: Approach of case vehicle and Chevrolet Silverado in the southwest travel lane

Figure 2: Damage to front right corner of case vehicle from impact to back of Silverado's towed trailing unit, each stripe on rods is 5 cm (2 in)

Figure 3: Angled gouge indicated by arrow shows area of impact in southwest travel lane

Figure 4: Pavement grinding on rim of case vehicle's left front wheel

Crash: The front right corner of the case vehicle (**Figure 2**) impacted the back left corner of Chevrolet Silverado's towed trailing unit. The impact caused an angled gouge in the roadway (**Figure 3**) and caused the case vehicle to rotate clockwise and tip up on its left side wheels. The rim of the left front wheel (**Figure 4**) gouged into the pavement (**Figure 5** below) and the case vehicle rolled over onto its left side (**Figures 6 and 7** below). The absence of any direct contact

damage to the right side and top indicates the case vehicle rolled over only one quarter turn onto its left side. Following the impact, the towed trailing units separated from the case vehicle and the Silverado. The location where the separations occurred is not known.

Figure 5: Arrow shows pavement gouge from rim of case vehicle's left front wheel

Figure 6: Rollover damage to case vehicle's left fender and left front door

Figure 7: Rollover damage to case vehicle's left side doors and truck bed

Figure 8: Overview of case vehicle's area of final rest on the west side of the roadway, gouges show location of roadway departure

The impact to the back of the Chevrolet Silverado's towed trailing unit caused the case vehicle driver's air bag to deploy. The EDR data indicated a first stage driver air bag deployment only. The case vehicle's front right air bag did not deploy. The case vehicle's occupant detection system determined that no occupant was seated in the front right seat and suppressed the deployment of the front right air bag.

Post-Crash: Following the rollover, the case vehicle rotated clockwise, slid on its left side on the roadway approximately 40 meters (131 feet) and departed the west side of the roadway. The direction of abrasions in the plastic components on the case vehicle's left side show that the vehicle slid backwards during the rotation. This indicates the case vehicle rotated clockwise about 270 degrees prior to departing the roadway. The case vehicle then traveled approximately 10 meters (33 feet) off the roadway and, based on the police crash diagram and interview data, came to rest on its wheels facing southeast (**Figure 8**). It appears that as the case vehicle departed the roadway

with the undercarriage leading, it rolled back up on its wheels to final rest. The case vehicle's towed trailing unit also came to rest on the west side of the roadway facing southwest approximately 17 meters (56 feet) southwest of the case vehicle. Based on the interview with the case vehicle's driver, the Chevrolet Silverado came to final rest near the case vehicle partially off the west side of the roadway facing southwest. The Silverado's towed trailing unit came to final rest on the west side of the roadway facing southwest approximately 20 meters (66 feet) northeast of the case vehicle.

CASE VEHICLE

The 2004 Chevrolet Avalanche was a four wheel drive, four-door sport utility truck (VIN: 3GNEK12T84G------) equipped with a 5.3L, V-8 engine and a four-speed automatic transmission with overdrive. The case vehicle was also equipped with four wheel, anti-lock brakes, tire pressure monitor, adjustable pedals, dual stage driver and front right passenger air bags; integral driver and front right passenger three point, lap and shoulder safety belt systems, driver and front right passenger safety belt buckle switch sensors, front right passenger occupant detection and automatic air bag suppression system; and back seat, three point, lap and shoulder safety belt systems in all three seat positions and a LATCH system for securing child safety seats. The case vehicle was also equipped with an EDR housed within the vehicle's Sensing and Diagnostic Module (SDM). Front seat back-mounted side impact air bags are an option, but the case vehicle was not so equipped. The case vehicle's wheelbase was 330 centimeters (130 inches), and the odometer reading at inspection is unknown because the case vehicle was equipped with an electronic odometer. The case vehicle's driver estimated that the case vehicle's mileage was approximately 12,874 kilometers (8000 miles) 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 saety 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 pressure sensor and a seat belt tension sensor provide data to the electronic control module. The electronic control module (a) compares the seat pressure and seat belt tension data to threshold values, (b) determines if the front right air bag should be suppressed or enabled, and (c) communicates the decision to the air bag control module. The air bag will be suppressed when the seat pressure is at or below the established threshold, or there is above normal tension on the safety belt (e.g., a secured child seat). The air bag will be enabled if the pressure is above the threshold and the seat belt tension is normal (e.g., a restrained adult occupant) or below (e.g., unrestrained occupant).

CASE VEHICLE DAMAGE

Exterior Damage: The case vehicle's initial contact with the back of the Chevrolet Silverado's towed trailing unit involved the right corner of the front bumper, right headlamp/turn lamp assembly, hood, grille and the right fender (**Figure 9** below). The impact crushed the fender rearward, pulled it outward and broke the right front wheel off its axle. The direct contact extended rearward to the A-pillar. The left portion of the front bumper was pulled forward a significant amount and there was an induced buckle in the center of the bumper. Due to the lack

of direct damage on the left corner of the bumper and the plastic bumper cover, this damage appeared unrelated to the crash and may have occurred due to post-crash handling of the vehicle.

Figure 9: Damage to case vehicle from impact with Chevrolet Silverado's towed training unit; crush measurements taken to bumper backing bar

Figure 10: Crush to front of case vehicle from impact with back of Chevrolet Silverado's towed trailing unit, each stripe on rods is 5.0 centimeters (2.0 inches)

The crash related direct damage began at the front right bumper corner and extended 28 centimeters (11 inches) along the front bumper. Residual maximum crush was measured as 61 centimeters (24 inches) at C_6 (**Figure 10**). The table below shows the case vehicle's 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	1	28	61	139	0	0	19	9	21	61	75	0
in		11.0	24.0	54.7	0.0	0.0	7.5	3.5	8.3	24.0	29.5	0.0

The wheelbase on the case vehicle's left side was extended 4.0 centimeters (1.6 inches) while the right side wheelbase was shortened 12 centimeters (4.7 inches). Direct damage from the rollover involved the entire left side and a small portion of the left roof side rail. There was induced damage to the hood, right front door, left front door and left quarter panel. No other induced damage or remote buckling was noted to the remainder of the case vehicle's exterior.

The recommended tire size was: P265/70R17 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	Flat	Flat	207	30	10	12	None	No	Yes
RF	Flat	Flat	207	30	10	12	Cuts in sidewall and tread face	No	Yes
LR	Flat	Flat	207	30	10	12	None	No	Yes
RR	234	34	207	30	8	10	None	No	No

Vehicle Interior: Inspection of the case vehicle's interior revealed no evidence of occupant contact to any interior surfaces or components. There was no evidence of compression of the energy absorbing steering column or deformation of the steering wheel (**Figure 11**). In addition, there was no indication of damage to the adjustable pedals (**Figure 12**). Several occupant compartment intrusions were observed and documented. The most severe intrusions occurred to the right toe pan, which intruded longitudinally 16 centimeters (6.3 inches) into the front right occupant space and the right front door, which intruded laterally 8.0 centimeters (3.1 inches) into the front right occupant space. Other minor intrusions involved the left front door and the left "A"-pillar cover.

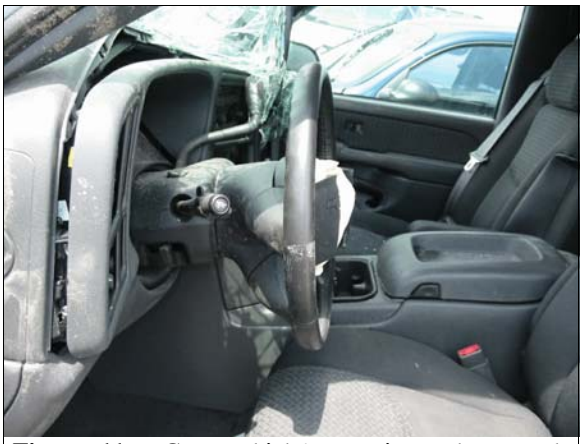


Figure 11: Case vehicle's steering column and steering wheel showing lack of deformation

Figure 12: Case vehicle's adjustable pedals

Damage Classification: Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FREE-6** (**0** degrees) for the impact with the back of the Chevrolet Silverado's towed trailing unit, and **00-LDAO-2** for the rollover onto the left side. The WinSMASH reconstruction program could not be used to reconstruct the case vehicle's Delta V for the front impact because the collision conditions are outside the scope of the program due to the presence of towed trailing units on both vehicles. However, the EDR data indicated that the case vehicle's maximum recorded longitudinal velocity change for the front impact was -15.4 km.p.h. (-9.6 m.p.h) occurring at 230 milliseconds after algorithm enable. In addition, this

contractor estimates the severity of the case vehicle's rollover to be moderate. The case vehicle was towed due to damage. The damage to the case vehicle's towed trailing unit is not known.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle's driver air bag was located in the steering wheel hub. An inspection of the air bag module cover flaps and the air bag fabric revealed that the cover flaps opened at the designated tear points (**Figure 13**). There was no evidence of damage during the deployment to the air bag or the cover flaps. The air bag module cover consisted of symmetrical "I"configuration cover flaps. The two cover flaps were each constructed of pliable vinyl, and each flap was approximately 7 centimeters (2.8 inches) in width at the top and approximately 6.0 centimeters (2.4 inches) in width at the bottom. The vertical tear seam between the two cover flaps was 12 centimeters (4.7 inches) in height. The deployed driver's air bag (**Figure 14**) was round with a diameter of approximately 63 centimeters (24.8 inches) and was designed with two tethers, each approximately 11 centimeters (4.3 inches) in width. The driver's air bag had two vent ports, each approximately 3 centimeters (1.2 inches) in diameter, located at the 10 and 2 o'clock positions (**Figure 15** below). An inspection of the driver's air bag fabric revealed no evidence of occupant contact. The distance between the mid-center of the driver's seat back, as positioned at the time of the inspection (i.e., approximately at the rear track position), and the front surface of the air bag's fabric at full excursion was 34 centimeters (13.4 inches).

Figure 13: Case vehicle's driver air bag cover flaps

Figure 14: case vehicle's driver air bag, each stripe on rods is 5.0 centimeters (2.0 inches)

The front right passenger's air bag was located in the middle of the instrument panel above the glove box door (**Figure 16** below). The front right air bag did not deploy during the crash. The case vehicle's occupant detection and automatic air bag suppression system properly determined that no passenger was in the front right seat and suppressed deployment of the front right air bag.

Figure 15: Case vehicle's driver air bag vent ports and steering wheel

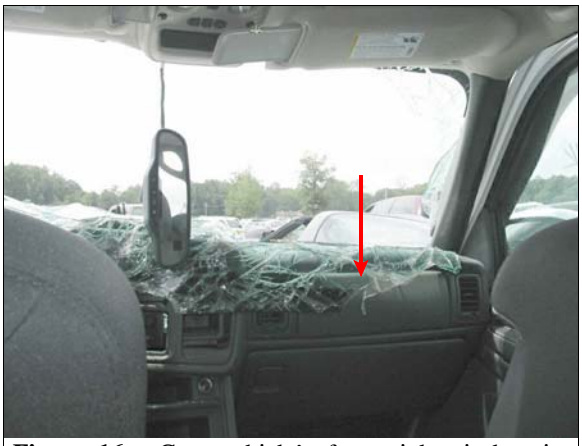


Figure 16: Case vehicle's front right air bag is located in the middle of the instrument panel above the glove box door.

CRASH DATA RECORDING

The download of the case vehicle's EDR was done during the vehicle inspection via direct connection to the SDM. The EDR reports for the downloaded data are presented at the end of this report (**Figures 17-22**). The EDR recorded a first stage deployment event and a non-deployment event. In addition, the data indicated there were multiple events associated with the non-deployment record, and one or more of the events were not recorded. The system status reports for the deployment and non-deployment events show that both events occurred during this crash because they were both recorded on the same ignition cycle. Therefore, the non-deployment event and the non-recorded events associated with it are most likely related to the rollover. The system status reports also show that the SIR warning lamp was recorded as off, and the driver's seat belt switch circuit was recorded as unbuckled. In addition, the maximum SDM recorded longitudinal velocity change was recorded as -15.45 km.p.h. (-9.60 m.p.h.) for the deployment event occurring 230 milliseconds after algorithm enable (AE) and -0.69 km.p.h. (-0.43 m.p.h.) for the non-deployment event occurring 97.5 milliseconds after AE.

The system status report shows that the first stage deployment criteria for the driver's air bag was met 32.5 milliseconds after AE, and the second stage deployment criteria was not met. In addition, the system status report indicates that the deployment of the front right passenger air bag was suppressed. The deployment pre-crash data also indicates the case vehicle's driver did not apply the brakes prior to the crash and was traveling 101 km.p.h. (63 mph) five seconds prior to the crash, and had slowed slightly to 98 km.p.h. (61 mph) one second prior to the crash.

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash the case vehicle's driver [37-year-old, White (non-Hispanic) male; 178 centimeters and 109 kilograms (70 inches, 240 pounds)] was seated in an upright posture with his back against the seat back, his left foot on the floor, and his right foot on the accelerator. The driver's left elbow was on the left door armrest, and his left hand was on steering wheel. The driver's right elbow was on the center arm rest, and his right hand was on the steering

wheel. His seat track was located in its rear most position, the seat back was upright, and the tilt steering wheel was located in its full down position. The driver was wearing sunglasses at the time of the crash.

Based on this contractor's vehicle inspection and supported by the EDR data, the case vehicle's driver was not using his integral, three-point, lap-and-shoulder safety belt system. The inspection of the driver's safety belt assembly showed no evidence of loading.

The case vehicle driver steered left just prior to the impact. As a result of the impact to the back of the Chevrolet Silverado's towed trailing unit, the case vehicle's driver continued forward along a path opposite the case vehicle's 0 degree direction of principal force as the case vehicle decelerated, and the driver's face and chest most likely contacted his deployed air bag. The case vehicle then rotated clockwise, rolled onto its left side and rotated clockwise as it slid along the roadway. As a result of the clockwise rotation prior to the rollover, the case vehicle's driver most likely moved forward and to his left. When the case vehicle landed on its left side, the inside of the driver's right thigh contacted the steering wheel bruising his thigh. The left side of his body contacted the left front door, and his left arm contacted the roadway through the open driver's door window abrading his left forearm. The driver stayed in contact with his door and likely moved rearward to some extent as the case vehicle rotated clockwise and slid along the roadway. The driver then moved back to the right as the case vehicle departed the roadway with the undercarriage leading and rolled back up on its wheels to final rest. The extent of the driver's movement to the right as the vehicle came to final rest is not known, but he indicated he was in his seat following the crash. The driver was able to exit the case vehicle under his own power. The injury sources cited above are based on occupant kinematic principles and this contractor's best judgement since there was no direct occupant contact evidence found in the vehicle.

CASE VEHICLE DRIVER INJURIES

The case vehicle driver's injury code and EMS status were not completed on the police crash report. However, the case vehicle's driver stated he was transported by ambulance to a hospital and was treated and released. The following table shows the driver's self reported 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	Abrasion {road rash}, 10.2 cm (4 in) lateral left forearm, not further specified	minor 790202.1,2	Road surface	Probable	Interviewee (same person)
2	Contusion {hematoma}, large, on anteromedial {inside} of right thigh, not further specified	minor 890402.1,1	Steering wheel rim	Probable	Interviewee (same person)

The 1997 Chevrolet K1500 Silverado was a four wheel drive, two-door, extended cab pickup truck (VIN: 1GCEK19T24E). This vehicle was equipped with a 5.7L, V8 engine and four-wheel anti-lock brakes.

Exterior Damage: There were no photographs of the Silverado or its towed unit. The Silverado was not directly impacted in the crash; therefore, a CDC would not have been applicable. The Silverado was driven from the scene. The status of the Silverado's towed trailing unit is not known.

Silverado's Occupants: According to the police crash report, the Silverado's driver [51-year-old, Black (non-Hispanic) male] was restrained by his manual, three-point, lap-and-shoulder safety belt system. The driver's injury code and EMS status were not completed on the police crash report, but it is likely he was not injured in the crash.

3GNEK12T84Gxxxxxx System Status At Deployment	
SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Deployment	1204
Ignition Cycles At Investigation	1209
Maximum SDM Recorded Velocity Change (MPH)	-9.60
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	230
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	32.5
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Suppressed
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	1
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	-0.31	-0.93	-2.17	-3.72	-4.34	-4.65	-4.96	-4.96	-5.27	-5.58	-5.89	-6.20	N/A	N/A

PRE-CRASH DATA				
Seconds Before AE	**Vehicle Speed (MPH)**	**Engine Speed (RPM)**	**Percent Throttle**	**Brake Switch Circuit Status**
-5	63	1792	17	OFF
-4	63	1792	17	OFF
-3	62	1728	12	OFF
-2	62	1728	17	OFF
-1	61	1728	17	OFF

Figure 17: Case vehicle's System Status at Deployment report

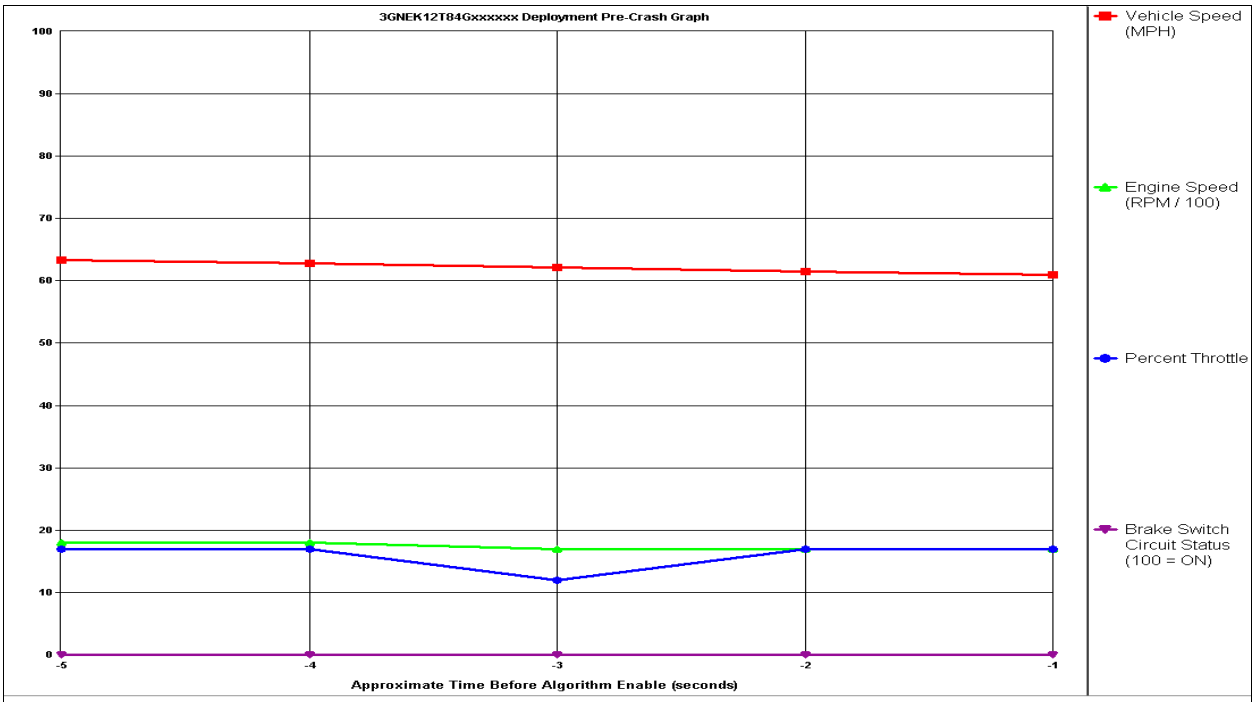


Figure 18: Case vehicle's Deployment Pre-Crash Graph

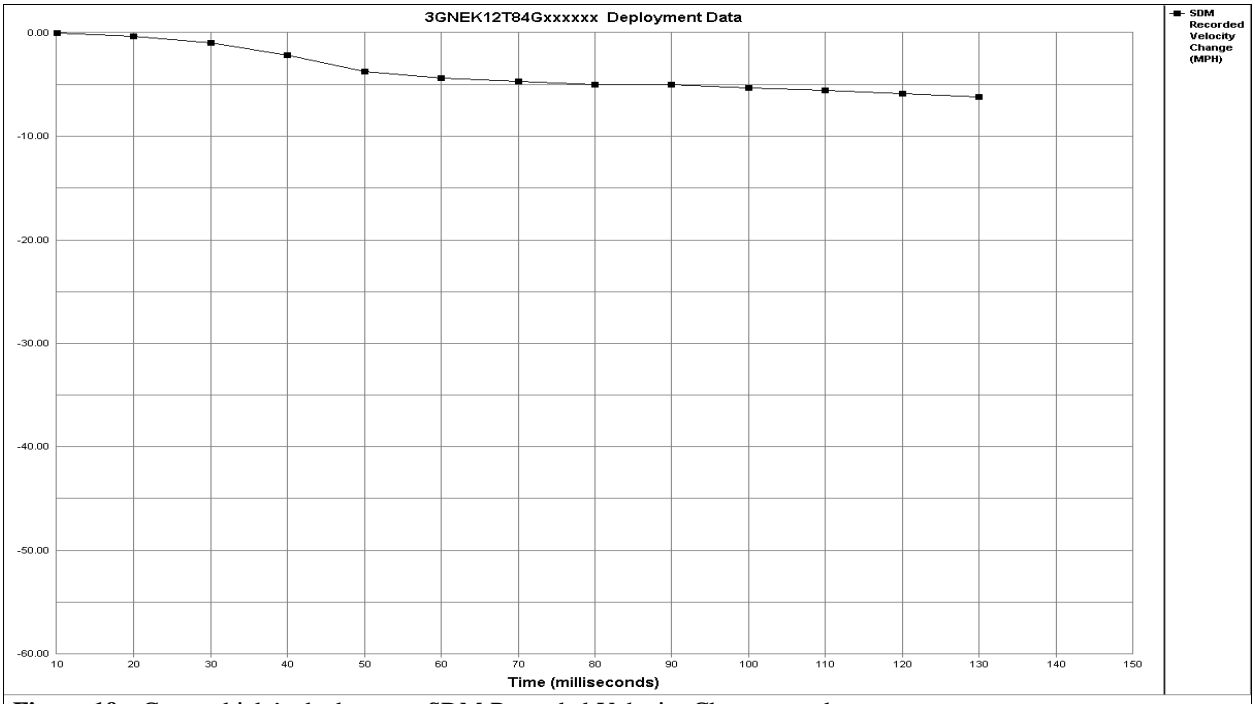


Figure 19: Case vehicle's deployment SDM Recorded Velocity Change graph

3GNEK12T84Gxxxxxx System Status At Non-Deployment	
SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Non-Deployment	1204
Ignition Cycles At Investigation	1209
Maximum SDM Recorded Velocity Change (MPH)	-0.43
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	97.5
Event Recording Complete	Yes
Multiple Events Associated With This Record	Yes
One Or More Associated Events Not Recorded	Yes

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	0.00	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	N/A	N/A	N/A	N/A

PRE-CRASH DATA				
Seconds Before AE	**Vehicle Speed (MPH)**	**Engine Speed (RPM)**	**Percent Throttle**	**Brake Switch Circuit Status**
-5	63	Invalid	17	OFF
-4	62	Invalid	12	OFF
-3	62	1728	17	OFF
-2	61	1856	17	OFF
-1	40	0	0	OFF

Figure 20: Case vehicle's System Status at Non-Deployment report

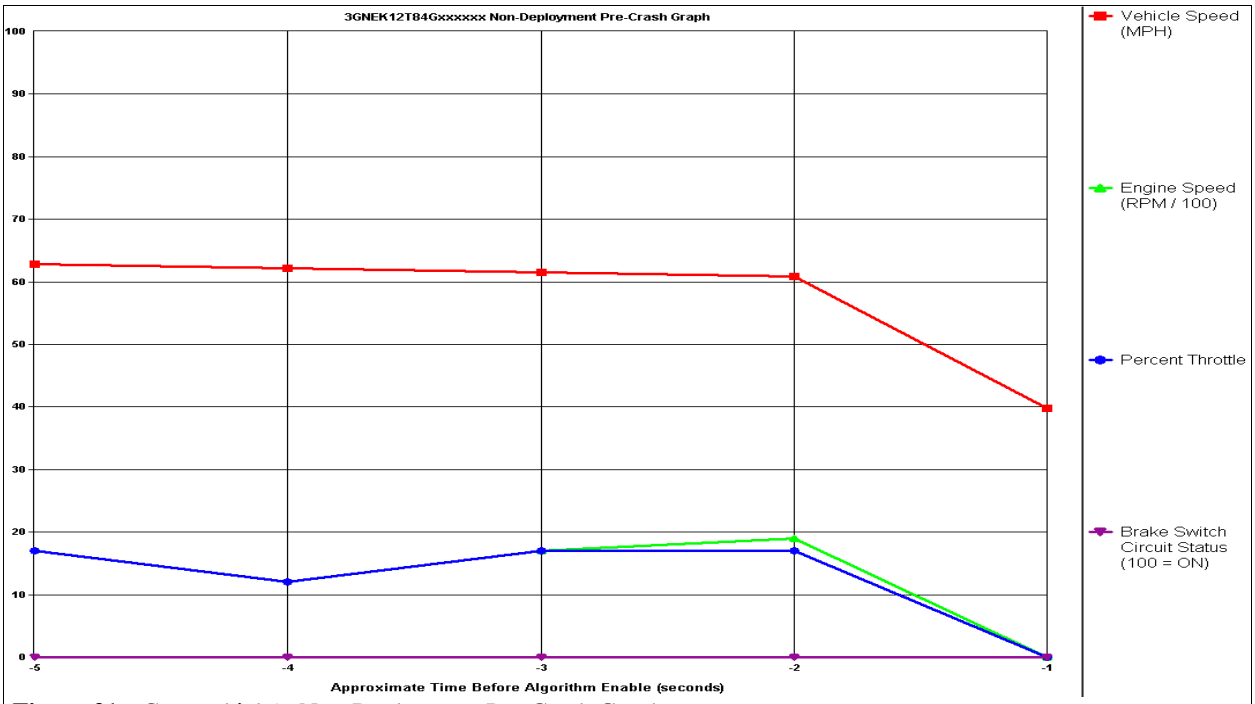


Figure 21: Case vehicle's Non-Deployment Pre-Crash Graph

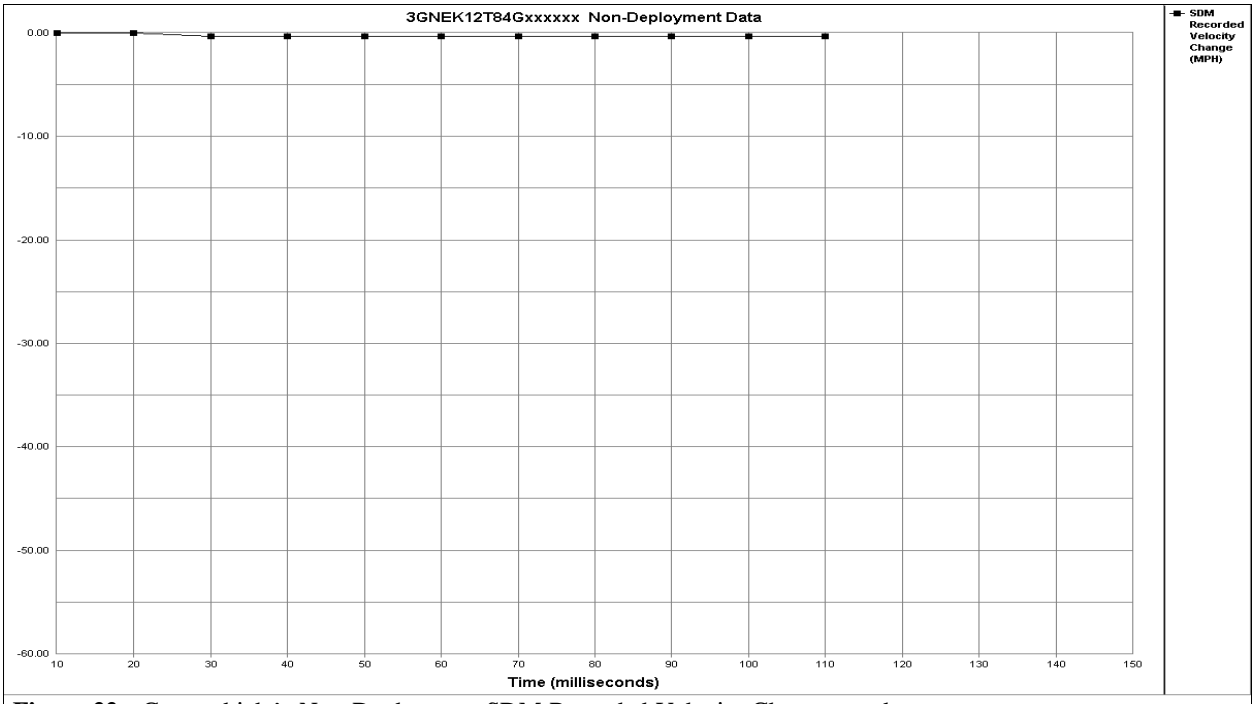
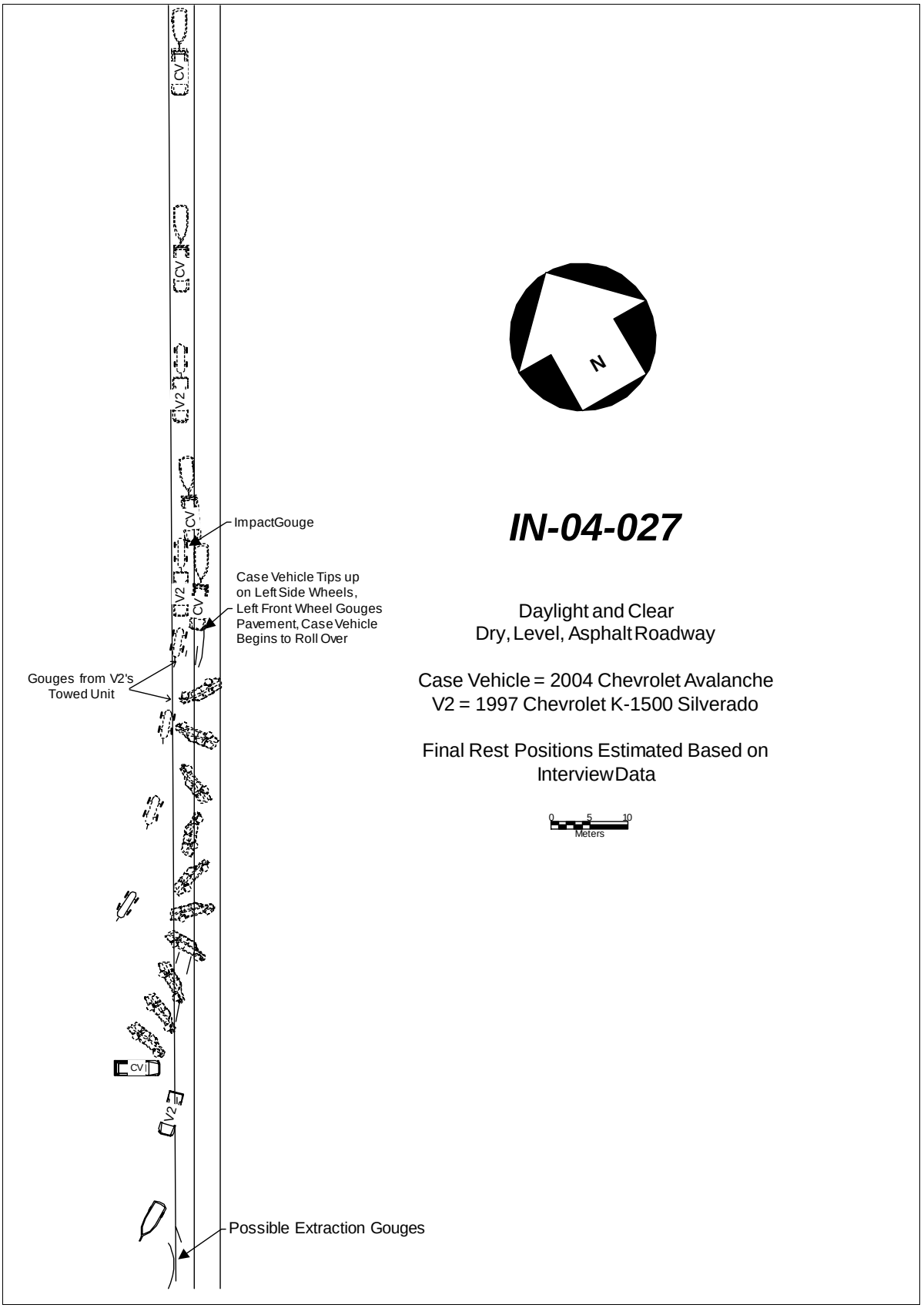


Figure 22: Case vehicle's Non-Deployment SDM Recorded Velocity Change graph


CV
CV
V2
CV
V2
CV
ImpactGouge
Case Vehicle Tips up
on Left Side Wheels,
Left Front Wheel Gouges
Pavement, Case Vehicle
Begins to Roll Over
Gouges from V2's
Towed Unit
CV
V2
Possible Extraction Gouges
N
IN-04-027
Daylight and Clear
Dry, Level, Asphalt Roadway
Case Vehicle = 2004 Chevrolet Avalanche
V2 = 1997 Chevrolet K-1500 Silverado
Final Rest Positions Estimated Based on
Interview Data
0 5 10
Meters