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ON-SITE AIR BAG INVESTIGATION

CASE NUMBER - IN01-004
LOCATION - ARIZONA
VEHICLE - 2000 CHEVROLET CORVETTE
CRASH DATE - February, 2001

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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.

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16. <i>Abstract</i> This report covers an on-site investigation of an air bag deployment crash that involved a 2000 Chevrolet Corvette (case vehicle) and a traffic signal pole. This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver (60-year-old male) sustained no injuries from his deploying driver air bag. In addition, the case vehicle was equipped with an Event Data Recorder (EDR) which was successfully downloaded. The case vehicle was stopped at a four-leg intersection, heading south in the left-hand turn lane of a seven-lane, divided, city trafficway (i.e., both the north and southbound roadways had three through lanes and opposing left-hand turn lanes at the intersection). The case vehicle suddenly accelerated into the intersection while turning left. According to the case vehicle's driver, he was experiencing an on-going medical condition (i.e., diabetes) which caused him to become incapacitated, lose control, and travel off the southeast corner of the intersection where the crash occurred. The front right bumper corner of the case vehicle impacted the metal signal pole, causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. During the impact with the metal signal pole, the pole snagged on the right front wheel assembly and sheared it away from the vehicle's frame. The case vehicle continued forward striking a small tree, a fence, and a fencepost with its front bumper. The case vehicle's driver was seated with his seat track located between its middle and rearmost positions, and the tilt steering wheel was located between its middle and upmost positions. The case vehicle was also equipped with a telescopic steering wheel which was located between its middle and forward-most positions. The driver was not using his available, active, three-point, lap-and-shoulder, safety belt system and sustained, according to his interview and his medical records, only a minor scalp laceration. According to the case vehicle's driver, he credits his air bags as saving his life.					
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This on-site investigation was brought to NHTSA's attention on February 27, 2001 from a newspaper article. This crash involved a 2000 Chevrolet Corvette (case vehicle) and a traffic signal pole. The crash occurred in February, 2000, at 4:16 p.m., in Arizona and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver [60-year-old, White (non-Hispanic) male] sustained no injuries from his deploying driver air bag. In addition, the case vehicle was equipped with an Event Data Recorder (EDR) which was successfully downloaded. This contractor inspected the scene and case vehicle on March 1, 2001. This contractor interviewed the driver of the case vehicle on February 28, 2001. This report is based on the Police Crash Report, interviews with both the case vehicle's driver and the investigating police officer, scene and vehicle inspections, occupant kinematic principles, occupant medical records, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was stopped at a four-leg intersection, heading south in the left-hand turn lane of a seven-lane, divided, city trafficway and was waiting for a traffic signal to change (i.e., both the north and southbound roadways had three through lanes and opposing left-hand turn lanes at the intersection). The case vehicle suddenly accelerated into the intersection while turning left. According to the case vehicle's driver, he was experiencing an on-going medical condition (i.e., diabetes) which caused him to become incapacitated, lose control, and essentially make no avoidance maneuvers prior to the crash. The case vehicle went off the southeast corner of the intersection just prior to the crash. The crash occurred on the trafficway but off the southeast corner of the intersecting roadways.

The front right bumper corner of the case vehicle impacted the metal signal pole, causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle veered off the pole striking a small tree somewhere along the front bumper before continuing a few meters more east-southeastward where it struck a fence and fencepost with its front bumper. The case vehicle's impact with the metal signal pole was to the right (outside) of the right frame rail and raked down the right side, snagging on the right front wheel assembly and shearing it away from the vehicle's frame. The pole contact continued down the right side ending at the front right door hinge.

The 2000 Chevrolet Corvette was a rear wheel drive, two-door convertible (VIN: 1G1YY32G7Y5-----). The case vehicle was equipped with four-wheel, anti-lock brakes and a "Heads Up Instrument Display" system. Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FREW-6 (0)** for the signal pole impact and **12-FDEW-1 (0)** for the fence/fence post impact. No reconstruction program was used on this crash because the primary impact was out-of-scope for the NASS, CDS, WinSMASH protocol and the protocol requires that actual vehicular crush measurements be obtained for the other two impacts. However, this contractor's visually estimated Delta V for the signal pole impact is between 21 km.p.h. (13 m.p.h.) and 27 km.p.h. (17 m.p.h.). The visually estimated crash severity to the case

vehicle from the fence/fence post impact was minor [2-13 km.p.h. (1-8 m.p.h.)]. The case vehicle was towed due to damage.

The case vehicle's initial contact with the traffic signal pole involved the front right corner. Direct damage began 57 centimeters (22.4 inches) to the right of the bumper's center and extended, a measured distance of 23 centimeters (9.1 inches) outward to the bumper's corner. Direct damage extended down the right side to the right front door hinges, a measured 169 centimeters (66.5 inches). The case vehicle's fiberglass body was disintegrated from the front right bumper rearwards to the right "A"-pillar. Because the right front wheel was torn off, it is unknown whether the case vehicle's wheelbase on the right side would have otherwise been shortened. On the other hand, the wheelbase on the left side was not shortened. The case vehicle's front bumper fascia, hood (right side), right headlight and turn signal assemblies, and right fender were directly damaged and crushed rearward. The light assemblies and fender were torn off. The front right door panel was torn away as well. The case vehicle's right front tire was damaged and the rim bent. The case vehicle's second impact involving the small tree also involved the front bumper. Because of the case vehicle's impact with the fence and fence post, the exact location of the tree impact could not be distinguished along the front bumper. Based on the inspection, there were scratches but no measurable deformation to the case vehicle's front bumper fascia from its impact with the fence, fence post, and/or tree.

The data downloaded from the case vehicle's EDR shows the case vehicle's travel speed, engine RPM, percent throttle, and brake switch status for the 5 seconds preceding the Algorithm Enable. Other information downloaded from the EDR included the Delta V, SIR warning lamp status, driver's seat belt buckle status, and the case vehicle's ignition cycle at deployment. Downloaded data of interest indicated the following: the case vehicle's driver accelerated from 0 to 53 km.p.h. (0-33 m.p.h.) during the 5-seconds preceding the crash; the driver's belt status was "**unbuckled**" (which corroborates this investigator's conclusion following the interior inspection); and the Delta V was only 15.3 km.p.h. (9.53 m.p.h.); see **EVENT DATA RECORDER** below. This investigator believes that the recorded Delta V seems low considering the right front wheel assembly was torn away from case vehicle's frame.

The case vehicle's driver air bag was located in the steering wheel hub. An inspection of the air bag module's cover flaps and air bag fabric revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. The driver's air bag was designed with two tethers, each 11 centimeter (4.3 inch) wide, sewn vertically to the interior of the air bag between the 11-7 and 1-5 o'clock positions. The driver's air bag had two vent ports, approximately 1 centimeter (0.4 inches) in diameter, located at the 11:30 and 12:30 clock positions. The deployed driver's air bag was round with a diameter of 63 centimeters (24.8 inches). Inspection of the driver's air bag revealed no readily apparent evidence of occupant contact; however, there were some black scuffs associated with air bag's interaction with the interior surface of the cover flaps.

The front right passenger's air bag was located in the middle of the instrument panel. An inspection of the front right air bag module's cover flap and air bag fabric revealed that the cover flap opened at the designated tear points, and there was no evidence of damage during the

deployment to the air bag or the cover flap. The front right passenger's air bag was designed with one tether, 40 centimeters (15.7 inches) wide and it extended across the entire front surface of the air bag. The front right air bag had no vent ports. The deployed front right air bag was essentially square, with a height of approximately 42 centimeters (16.5 inches) and a width of approximately 40 centimeters (15.7 inches). Inspection of the front right air bag did not reveal any readily apparent contact evidence.

Inspection of the case vehicle's interior revealed a probable knee contact on the knee bolster, just to the right of the steering column and without any obvious deformation, and blood evidence along the left roof side rail. There was no visible sign of intrusion to the case vehicle.

The exact posture of the case vehicle's driver [183 centimeters and 91 kilograms (72 inches, 200 pounds)], immediately prior to the crash, is unknown. A witness to the crash observed the case vehicle's driver pounding on the steering wheel just before the case vehicle accelerated from its stopped position in the left-hand turn lane. The case vehicle's driver was seated and, as a result of the rapid acceleration from its stopped position, the driver was most likely in a reclined posture, with his back against the seat back (i.e., his torso could have been straight up or leaning left or right), his left foot on the floor, his right foot on the accelerator, and both hands on the steering wheel. His seat track was located between its middle and rearmost positions, the seat back was slightly reclined, and the tilt steering wheel was located between its middle and upmost positions. The case vehicle was also equipped with a telescopic steering wheel which was located between its middle and forward-most positions.

The case vehicle's driver was not using his available, active, three-point, lap-and-shoulder, safety belt system. In addition, the inspection of the driver's seat belt webbing, "D"-ring, and latch plate showed no evidence of loading.

The case vehicle's driver, based on his interview, has no recollection of pre-crash events after coming to a stop at the intersection in the left-hand turn lane. However, the case vehicle's EDR showed that the driver applied the brake just prior to impacting the signal pole. While coming to a stop, the driver, who is diabetic and had low blood sugar, reported a sensation of feeling like he was dreaming in slow motion when he was in the left-hand turn lane. According to the driver, he punched down on the accelerator while simultaneously turning the steering wheel to the left, trying to escape from his slow motion dream state. The case vehicle's driver most likely recognized the impending danger and attempted to brake just prior to the crash, albeit in slow motion. Because of the low glucose levels in the driver's blood, his brain did not record (remember) the event. As a result and independent of the nonuse of his available safety belts, his pre-impact body position did not change just prior to impact. The case vehicle's impact with the metal utility pole enabled the driver to continue forward and slightly upward toward the case vehicle's 0 degree Direction of Principal Force as the case vehicle decelerated. The deploying driver's air bag knocked the driver backwards into his seat back. The vehicle's impact with the small tree had little if any affect on the movement of the case vehicle's driver within the vehicle. The vehicle's impact with the fence post and fence resulted in the driver moving forward, again, and leftward as the vehicle came to rest. It was at this point that the top of the driver's head most

likely contacted the left side roof rail. The exact position of the case vehicle's driver at final rest is unknown, but the driver most likely remained in his seat near his original seating position.

The driver was transported by ambulance to the hospital. He sustained minor injuries and was treated for his injuries and for his low blood sugar and released. Based on his medical records and interview, the case vehicle's driver sustained only a minor scalp laceration and some soreness to his rib cage. According to the case vehicle's driver, he credits his air bags as saving his life.

CRASH CIRCUMSTANCES

The case vehicle was stopped (**Figure 1**) at a four-leg intersection, heading south in the left-hand turn lane of a seven-lane, divided, city trafficway and was waiting for a traffic signal to change (i.e., both the north and southbound roadways had three through lanes and opposing left-hand turn lanes at the intersection). The case vehicle suddenly accelerated into the intersection while turning left. According to the case vehicle's driver, he was experiencing an on-going medical condition (i.e., diabetes) which caused him to become incapacitated, lose control, and essentially make no avoidance maneuvers prior to the crash.

The case vehicle went off the southeast corner of the intersection just prior to the crash. The crash occurred on the trafficway but off the southeast corner of the intersecting roadways.

The city roadway was straight and level at the area of impact. The pavement was bituminous, but traveled, and the width of the left-hand turn lane was 3.2 meters (10.5 feet). The shoulders were improved (i.e., concrete). The west side of the southbound road had a narrow shoulder and the east side had a narrow shoulder, prior to the 2.1 meter (7 foot) wide raised, brick median (**Figure 1**). The southbound roadway was bordered by 10.2 centimeter (4 inch) high barrier curbs. Pavement markings for both north and southbound roadways consisted of a single solid white lane line separating the left-hand turn lanes from the through lanes, while the through lanes were divided by dashed white lines. No edge lines were present. The estimated coefficient of friction was 0.75. On-colors, pre-timed, vertically mounted traffic control signals were located on the south leg of the intersection for the southbound traffic. In addition, there were regulatory **NO PARKING ANY TIME** signs (Manual on Uniform Traffic Control Devices, R7-1) on the east and west sides of the roadway. The



Figure 1: Case vehicle's southbound travel path in left-hand turn lane prior to stopping at intersection; Note: struck signal pole (highlighted) at far left of photo (case photo #01)



Figure 2: Case vehicle's east-southeastward travel path into southeast corner of intersection showing impacts with signal pole, small tree (torn away), and fence/fence post; Note: tire marks (highlighted) leading into signal pole (case photo #07)

posted speed limit was 56 km.p.h. (35 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was overcast, and the road pavement was dry. Traffic density was moderate to heavy, and the site of the crash was urban commercial.

The front right bumper corner of the case vehicle impacted the metal signal pole (**Figure 2** above and **Figure 3**), causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle veered off the pole striking a small tree somewhere along the front bumper before continuing a few meters more east-southeastward where it struck a fence and fencepost with its front bumper (**Figure 2** above). The case vehicle's impact with the metal signal pole was to the right (outside) of the right frame rail and raked down the right side, snagging on the right front wheel assembly and shearing it away from the vehicle's frame (**Figure 4**). The pole contact continued down the right side ending at the front right door hinge (**Figure 5**).

CASE VEHICLE

The 2000 Chevrolet Corvette was a rear wheel drive, two-passenger, two-door, two seat, coupe convertible (VIN: 1G1YY32G7Y5-----) equipped with a 5.7L, V-8 engine, power-assisted rack and pinion steering, a four-speed automatic transmission, and traction control. Braking was achieved by a power-assisted, four-wheel, anti-lock system. The case vehicle's wheelbase was 265 centimeters (104.5 inches), and the odometer reading at inspection is unknown because the case vehicle was equipped with an electronic odometer; however, according to the case vehicle's driver, it had less than 16,093 kilometers (10,000 miles).

Inspection of the vehicle's interior revealed six-way, electronic adjustable front bucket seats with integral head restraints; and fixed latch plate, three-point, lap-and-shoulder, safety belt systems at the two front seat positions. The front seat belt systems were equipped with manually operated height adjusters for the "D"-rings. The case vehicle was equipped with a "Heads Up Instrument Display" system (**Figure 6** below), and a power telescoping steering wheel. The vehicle was equipped with knee bolsters for both the driver and front right passenger, neither of



Figure 3: Deformation to case vehicle's front right showing damage extending down right side with right front tire torn off (case photo #33)



Figure 4: Case vehicle's right deformation; Note: right front door panel peeled away and right front tire assembly torn off (case photo #28)

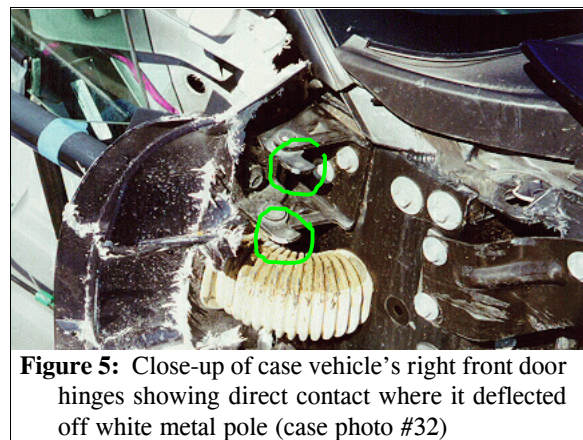


Figure 5: Close-up of case vehicle's right front door hinges showing direct contact where it deflected off white metal pole (case photo #32)

which were deformed. Automatic restraint was provided by a Supplemental Restraint System (SRS) that consisted of a frontal air bag for the driver and front right passenger seating positions. Both frontal air bags deployed as a result of the case vehicle's narrow front right corner impact with the traffic signal pole.

CASE VEHICLE DAMAGE

The case vehicle's initial contact with the traffic signal pole involved the front right corner (Figure 3 above). Direct damage began 57 centimeters (22.4 inches) to the right of the bumper's center and extended, a measured distance of 23 centimeters (9.1 inches) outward to the bumper's corner. Direct damage extended down the right side to the right front door hinges (Figures 4 and 5 above), a measured 169 centimeters (66.5 inches). The case vehicle's fiberglass body was disintegrated from the front right bumper rearwards to the right "A"-pillar. Because the right front wheel was torn off, it is unknown whether the case vehicle's wheelbase on the right side would have otherwise been shortened. On the other hand, the wheelbase on the left side was not shortened. The case vehicle's front bumper fascia, hood (right side), right headlight and turn signal assemblies, and right fender were directly damaged and crushed rearward. The light assemblies and fender were torn off. The right front door panel was torn away as well (Figures 3 and 4 above). The case vehicle's right front tire was damaged and the rim bent (Figure 7). The case vehicle's second impact involving the small tree also involved the front bumper. Because of the case vehicle's impact with the fence and fence post, the exact location of the tree impact could not be distinguished along the front bumper. Based on the inspection, there were scratches but no measurable deformation to the case vehicle's front bumper fascia from its impact with the fence, fence post, and/or tree.

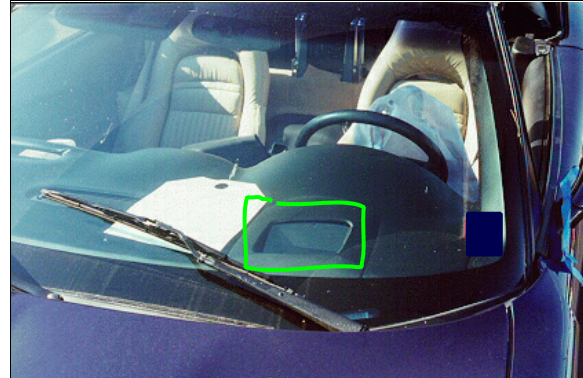


Figure 6: Case vehicle's "Heads Up Instrument Display" projector (highlighted) in dash (case photo #37)

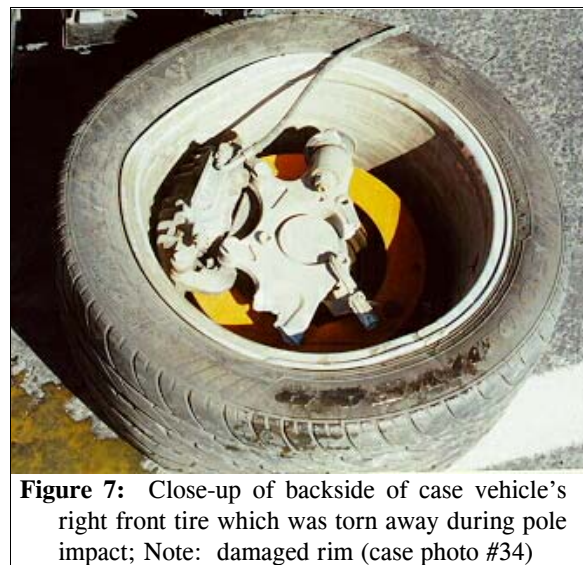


Figure 7: Close-up of backside of case vehicle's right front tire which was torn away during pole impact; Note: damaged rim (case photo #34)

Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FREW-6 (0)** for the signal pole impact and **12-FDEW-1 (0)** for the fence/fence post impact. No reconstruction program was used on this crash because the primary impact was out-of-scope for the NASS, CDS, WinSMASH protocol and the protocol requires that actual vehicular crush measurements be obtained for the other two impacts. However, this contractor's visually estimated Delta V for the signal pole impact is between 21 km.p.h. (13 m.p.h.) and 27 km.p.h. (17 m.p.h.). The visually estimated crash severity to the case vehicle from the fence/fence post

impact was minor [2-13 km.p.h. (1-8 m.p.h.)]. The case vehicle was towed due to damage.

Inspection of the case vehicle's interior revealed a probable knee contact on the knee bolster (Figure 8), just to the right of the steering column and without any obvious deformation, and blood evidence along the left roof side rail. There was no visible sign of intrusion to the case vehicle.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with a Supplemental Restraint System (SRS) that contained frontal air bags at the driver and front right passenger positions. Both air bags deployed as a result of the front right corner impact with the traffic signal pole. The case vehicle's driver air bag was located in the steering wheel hub. The module cover consisted of symmetrical "I"-configuration cover flaps made of thick vinyl with overall dimensions of 7.5 centimeters (3.0 inches) at the left and right horizontal seams and 13.5 centimeters (5.3 inches) vertically. An inspection of the air bag module's cover flaps and air bag fabric revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps (Figure 9). The driver's air bag was designed with two tethers, each 11 centimeter (4.3 inch) wide, sewn vertically to the interior of the air bag between the 11-7 and 1-5 o'clock positions. The driver's air bag had two vent ports, approximately 1 centimeter (0.4 inches) in diameter, located at the 11:30 and 12:30 clock positions. The deployed driver's air bag was round with a diameter of 63 centimeters (24.8 inches). Inspection of the driver's air bag revealed no readily apparent evidence of occupant contact (Figure 10); however, there were some black scuffs associated with air bag's interaction with the interior surface of the cover flaps.



Figure 8: Knee bolster for case vehicle's driver showing probable knee contact on right side of steering column (case photo #40)



Figure 9: Close-up of case vehicle's driver air bag module showing deployed air bag and opened cover flaps (case photo #55)

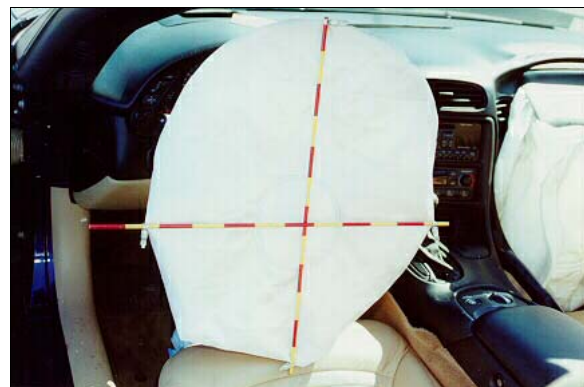


Figure 10: Case vehicle's deployed driver air bag showing no visible evidence of contact; however, black scuffs from cover flaps were present (case photo #56)

The front right passenger's air bag was located in the middle of the instrument panel. There was a single, essentially rectangular, modular cover flap. The cover flap was made of a thick vinyl over a thick cardboard type frame. The flap's dimensions were 26.5 centimeters (10.4 inches) at the lower horizontal seam and 18.5 centimeters (7.3 inches) along both vertical seams. The profile of the case vehicle's instrument panel resulted in a 1.5 centimeter (0.6 inch) setback of the leading edge of the cover flap relative to the protruding right instrument panel. An inspection of the front right air bag module's cover flap and air bag fabric revealed that the cover flap opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flap. The front right passenger's air bag was designed with one tether, 40 centimeters (15.7 inches) wide and it extended across the entire front surface of the air bag. The front right air bag had no vent ports. The deployed front right air bag was essentially square, with a height of approximately 42 centimeters (16.5 inches) and a width of approximately 40 centimeters (15.7 inches). Inspection of the front right air bag did not reveal any readily apparent contact evidence (**Figure 11**).

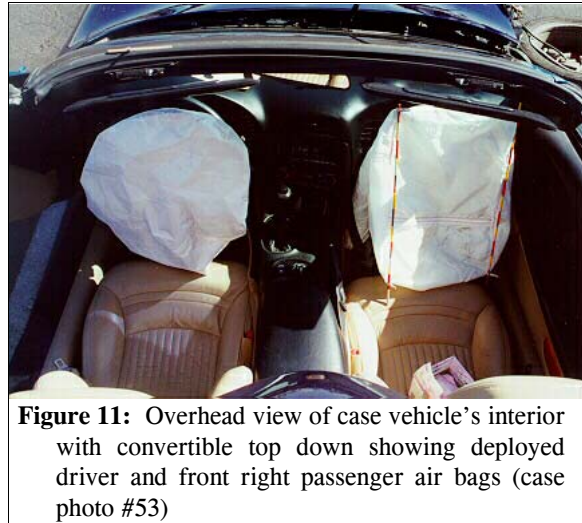


Figure 11: Overhead view of case vehicle's interior with convertible top down showing deployed driver and front right passenger air bags (case photo #53)

EVENT DATA RECORDER

As previously mentioned the case vehicle was equipped with an Event Data Recorder (EDR). The data downloaded from the case vehicle's EDR shows the case vehicle's travel speed, engine RPM, percent throttle, and brake switch status for the 5 seconds preceding the Algorithm Enable. Other information downloaded from the EDR included the Delta V, SIR warning lamp status, driver's seat belt buckle status, and the case vehicle's ignition cycle at deployment. Downloaded data of interest indicated the following: the case vehicle's driver accelerated from 0 to 53 km.p.h. (0-33 m.p.h.) during the 5-seconds preceding the crash; the driver's belt status was "**unbuckled**" (which corroborates this investigator's conclusion following the interior inspection); and the Delta V was only 15.3 km.p.h. (9.53 m.p.h.); see **EVENT DATA RECORDER GRAPHS (Figures 15 through 17)** below. This investigator believes that the recorded Delta V seems low considering the right front wheel assembly was torn away from case vehicle's frame.

CASE VEHICLE DRIVER KINEMATICS

The exact posture of the case vehicle's driver [60-year-old, White (non-Hispanic) male; 183 centimeters and 91 kilograms (72 inches, 200 pounds)], immediately prior to the crash, is unknown. A witness to the crash observed the case vehicle's driver pounding on the steering wheel just before the case vehicle accelerated from its stopped position in the left-hand turn lane. The case vehicle's driver was seated and, as a result of the rapid acceleration from its stopped position, the driver was most likely in a reclined posture, with his back against the seat back (i.e., his torso could have been straight up or leaning left or right), his left foot on the floor, his right foot on the accelerator, and both hands on the steering wheel. His seat track was located between

its middle and rearmost positions, the seat back was slightly reclined, and the tilt steering wheel was located between its middle and upmost positions. The case vehicle was also equipped with a telescopic steering wheel which was located between its middle and forward-most positions.

The case vehicle's driver was not using his available, active, three-point, lap-and-shoulder, safety belt system. In addition, the inspection of the driver's seat belt webbing, "D"-ring, and latch plate showed no evidence of loading (**Figure 12**).



Figure 12: Case vehicle's driver seat belt webbing showing no evidence of usage during the crash (case photo #41)

The case vehicle's driver, based on his interview, has no recollection of pre-crash events after coming to a stop at the intersection in the left-hand turn lane. However, the case vehicle's EDR showed that the driver applied the brake just prior to impacting the signal pole. While coming to a stop, the driver, who is diabetic and had low blood sugar, reported a sensation of feeling like he was dreaming in slow motion when he was in the left-hand turn lane. According to the driver, he punched down on the accelerator while simultaneously turning the steering wheel to the left, trying to escape from his slow motion dream state. The case vehicle's driver most likely recognized the impending danger and attempted to brake just prior to the crash, albeit in slow motion. Because of the low glucose levels in the driver's blood, his brain did not record (remember) the event. As a result and independent of the nonuse of his available safety belts, his pre-impact body position did not change just prior to impact. The case vehicle's impact with the metal utility pole enabled the driver to continue forward and slightly upward toward the case vehicle's 0 degree Direction of Principal Force as the case vehicle decelerated. The deploying driver's air bag knocked the driver backwards into his seat back. The vehicle's impact with the small tree had little if any affect on the movement of the case vehicle's driver within the vehicle. The vehicle's impact with the fence post and fence resulted in the driver moving forward, again, and leftward as the vehicle came to rest. It was at this point that the top of the driver's head most likely contacted the left side roof rail (**Figures 13 and 14**). The exact position



Figure 13: Interior view from right showing contact (i.e., dot) to case vehicle's left side roof rail by top of driver's head (case photo #49)

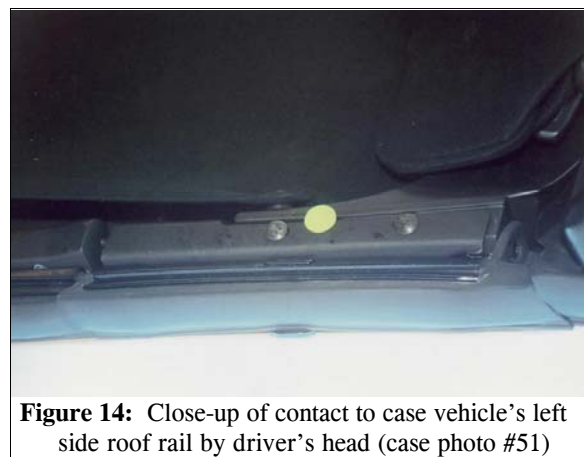


Figure 14: Close-up of contact to case vehicle's left side roof rail by driver's head (case photo #51)

of the case vehicle’s driver at final rest is unknown, but the driver most likely remained in his seat near his original seating position.

CASE VEHICLE DRIVER INJURIES

The driver was transported by ambulance to the hospital. He sustained minor injuries and was treated for his injuries and for his low blood sugar and released. Based on his medical records and interview, the case vehicle’s driver sustained only a minor scalp laceration and some soreness to his rib cage. According to the case vehicle’s driver, he credits his air bags as saving his life.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Laceration, superficial, small, at vertex of scalp	190602.1 minor	Roof side rail, front left	Probable	Emergency room records

EVENT DATA RECORDER GRAPHS

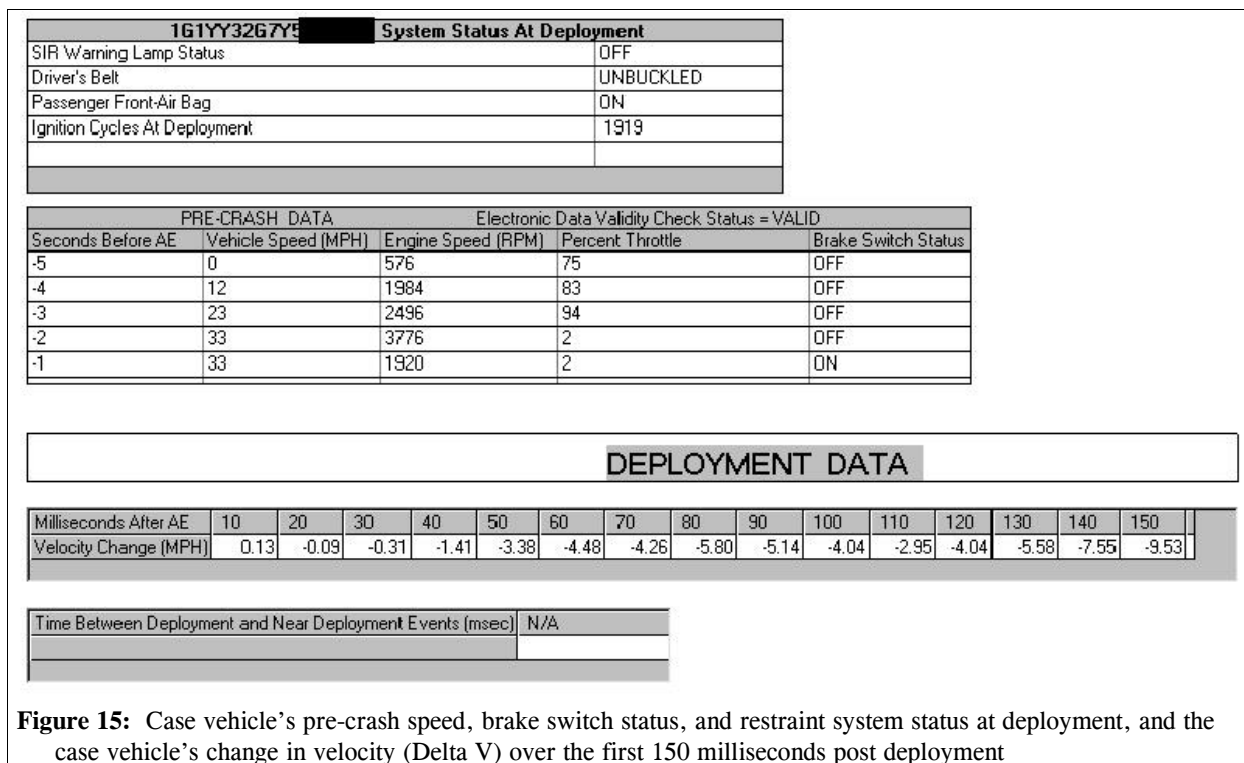


Figure 15: Case vehicle’s pre-crash speed, brake switch status, and restraint system status at deployment, and the case vehicle’s change in velocity (Delta V) over the first 150 milliseconds post deployment

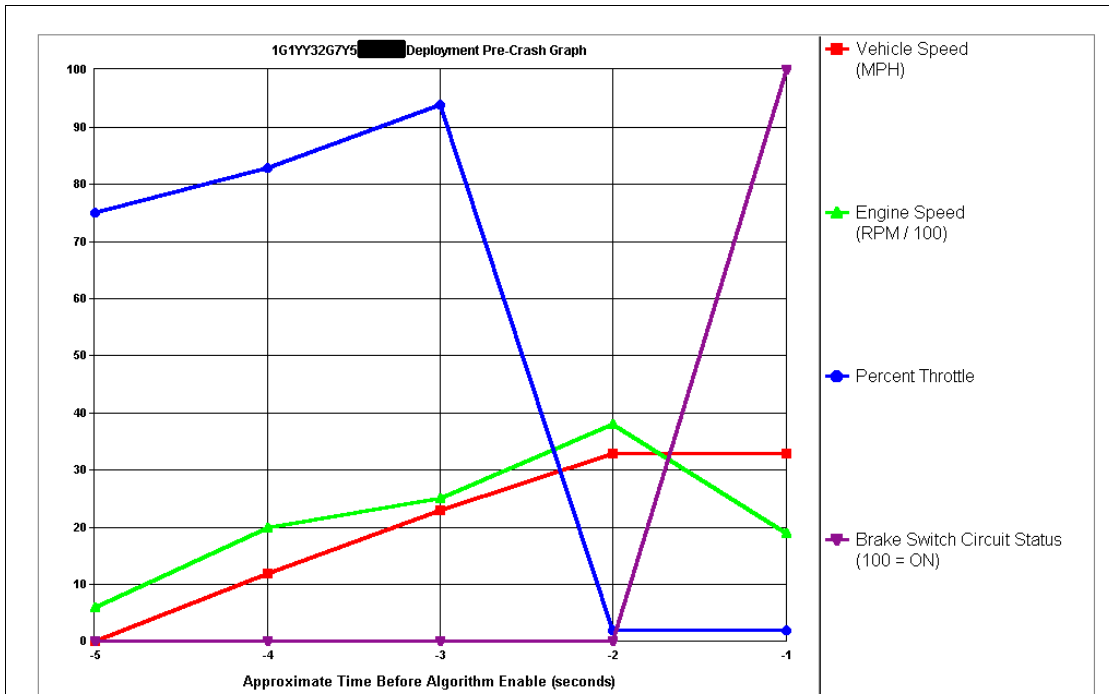


Figure 16: Just prior to the crash the case vehicle had accelerated rapidly to approximately 53 km.p.h. (33 m.p.h.) when the brake was activated one second prior to deployment

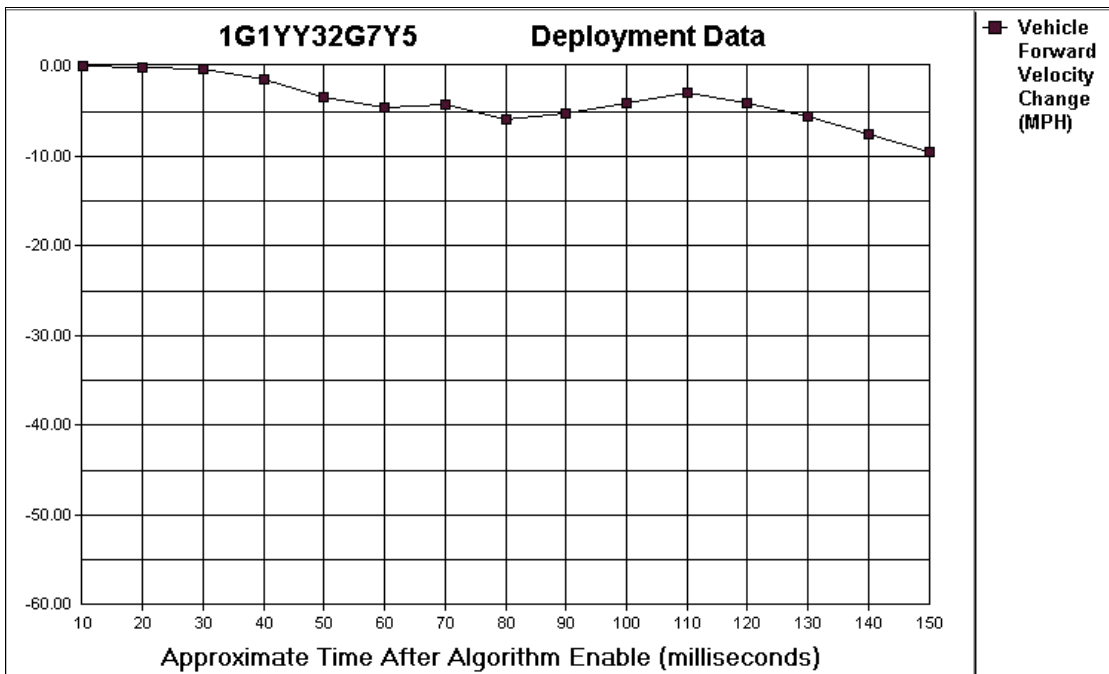


Figure 17: The case vehicle sustained a velocity change of approximately 9.5 km.p.h. (5.9 m.p.h.) during the first 150 milliseconds after deployment

