On-Site Certified Advanced 208-Compliant Air Bag Investigation
Dynamic Science, Inc. (DSI), Case Number DS10017
2011 Toyota Camry
California
July 2010

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

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

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
DS10017		

4. Title and Subtitle	5. Report Date
On-Site Certified Advanced 208-Compliant Air Bag Investigation	March 11, 2011
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 299 West Cerritos Avenue Anaheim, CA 92805	11. Contract or Grant no. DTNH22-07-00045

12. Sponsoring Agency Name and Address	13. Type of report and period Covered [Report Month, Year]
U.S. Dept. of Transportation (NVS-411) National Highway Traffic Safety Administration 1200 New Jersey Ave, SE Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

The focus of this Certified Advanced-208 Compliant investigation was the deployed air bags in a 2011 Toyota Camry. This three-vehicle crash occurred in July 2010 in the state of California within an offset four-leg intersection. The subject vehicle was being driven by a restrained 61-year-old male; the front right occupant was a 56-year-old female. Two other vehicles were involved in the crash: a 2002 Saturn SL1 being driven by a 44-year-old male and a 1999 Dodge Durango being driven by a 60-year-old male. The Toyota was traveling eastbound and the Saturn was traveling westbound. The Dodge was stopped in the northbound travel lane. The Toyota and Saturn entered the intersection at the same time. The Saturn began a left turn to travel south. The front end of the Toyota impacted the right rear side of the Saturn. The frontal air bags in both vehicles deployed at impact. There was a secondary, side-slap type impact between the two vehicles. The Saturn was redirected into a clockwise rotation, rotated approximately 90 degrees as it traveled south backwards, and the right rear of the vehicle impacted the left front of the stopped Dodge. The driver of the Toyota sustained unspecified injuries to his left leg, shoulders, chest, and back. The front right occupant sustained unspecified injuries to her right elbow, chest, back, and legs. She was transported to a local hospital, admitted, and remained in the hospital for an unknown number of days. The Toyota was towed from the scene due to damage and was later declared a total loss by the insurance company. The Saturn was towed from the scene due to damage and the Dodge was driven from the scene.

17. Key Words	18. Distribution Statement
Certified Advanced-208 Compliant (CAC), air bag, deployed, minor injuries.	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Dynamic Science, Inc.
Crash Investigation
Case Number: DS10017

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BACKGROUND

The focus of this Certified Advanced-208 Compliant (CAC) investigation was the deployed air bags in a 2011 Toyota Camry (**Figure 1**). A CAC vehicle is certified by the manufacturer to be compliant with the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This three-vehicle crash occurred in July 2010 in the state of California within an offset four-leg intersection. The subject vehicle was being driven by a restrained 61-year-old male; the front right occupant was a 56-year-old female. Two other vehicles were involved in the crash: a 2002 Saturn SL1 being driven by a 44-year-old male and a 1999 Dodge Durango being driven by a 60-year-old male.

Figure 1. Subject vehicle, 2011 Toyota Camry

The Toyota was traveling eastbound and the Saturn was traveling westbound. The Dodge was stopped in the northbound travel lane. The Toyota and Saturn entered the intersection at the same time. The Saturn began a left turn to travel south. The front end of the Toyota impacted the right rear side of the Saturn. The frontal air bags in both vehicles deployed at impact. There was a secondary, side-slap type impact between the two vehicles. The Saturn was redirected into a clockwise rotation, rotated approximately 90 degrees as it traveled south backwards, and the right rear of the vehicle impacted the left front of the stopped Dodge.

The driver of the Toyota sustained unspecified injuries to his left leg, shoulders, chest, and back. The front right occupant sustained unspecified injuries to her right elbow, chest, back, and legs. She was transported to a local hospital, admitted, and remained in the hospital for an unknown number of days.

The Toyota was towed from the scene due to damage and was later declared a total loss by the insurance company. The Saturn was towed from the scene due to damage and the Dodge was driven from the scene.

This CAC investigation was identified during the testing of a new software version of the Toyota Read Out Tool (ROT). A late model Toyota was located for the test, permission to image the Event Data Recorder (EDR) was obtained, and the data was imaged using version 1.3.1.2 of the ROT software and reported using version 1.4.1.1. A summary of the imaged data is incorporated in this report. On July 26, 2010 DSI obtained the police report and was instructed by NHTSA to locate the second vehicle in the crash and image the EDR in that vehicle if possible. On August 20, 2010, DSI obtained permission to inspect the second vehicle in the crash and the case was assigned on that day. The EDR was imaged during the vehicle inspection using the Bosch Crash Data Retrieval Tool version 3.3. A sanitized version of the Bosch report using version 4.0 of the software with the hexadecimal data removed is attached to this report.

SUMMARY

Crash Site

This three-vehicle crash occurred within an offset four-leg intersection. The intersection was configured with an east/west roadway intersecting a northbound roadway. Approximately 25.9 m (85.0 ft) west of the northbound roadway was a second intersection that was configured with the east/west roadway intersecting a southbound roadway. At the time of the crash there were no adverse weather conditions and the roadway surfaces were dry.

West of the southbound intersecting roadway, the west leg of the intersection was comprised of three eastbound travel lanes, a left turn lane, and three westbound travel lanes (**Figure 2**). The east leg of the eastern intersection was comprised of three westbound travel lanes, a left turn lane, and three eastbound travel lanes (**Figure 3**). The east/west roadway was of concrete composition and was level. The posted speed limit was 64 km/h (40 mph). The northbound intersecting roadway was comprised of a northbound travel lane and a southbound travel lane. The roadway was of asphalt composition and was level. The posted speed limit was 40 km/h (25 mph). The intersection was controlled by 3-phase traffic signals.

Figure 2. Eastbound approach for Toyota

Figure 3. Westbound approach for Saturn

Pre-Crash

The Toyota was traveling eastbound at an EDR-reported speed of 68.0 km/h (42.3 mph) five seconds prior to impact. At two seconds prior to impact the brake switch circuit status was “on” and the speed decreased to 54.0 km/h (33.6 mph). The Saturn was initially traveling westbound at an EDR-reported speed of 3.2 km/h (2.0 mph) five seconds before Algorithm Enable (AE). As the Saturn turned left to go south, the vehicle began accelerating and reached a speed of 25.7 km/h (16.0 mph) one second before AE. At two seconds before impact, the brake switch circuit state was “on”. The driver of the Saturn was likely driving using both feet, with the left on the brake and the right pressing down on the accelerator.

Crash

As the Saturn crossed the path of the Toyota, the front end of the Toyota impacted the right side of the Saturn (Event 1). The Standard algorithm of the WinsSMASH program computed a Total

Delta-V of 19.0 km/h (12.0 mph), based on the Toyota's frontal crush profile. The longitudinal and lateral components were -18.0 km/h (-11.0 mph) and 6.0 km/h (4.0 mph), respectively. The EDR reported a maximum longitudinal Delta-V of -20.9 km/h (-13.1 mph) at 200 milliseconds (ms) after Algorithm Enable (AE). The impact resulted in sufficient longitudinal deceleration of the Toyota to command the deployment of the driver air bag, the driver's knee air bag, the front right passenger air bag, and to actuate both front safety belt pretensioners. For the Saturn, the WinSMASH program computed a Total Delta-V of 29.0 km/h (18.0 mph). The longitudinal and lateral components were -14.0 km/h (-9.0 mph) and -25.0 km/h (-16.0 mph), respectively. The EDR reported a maximum SDM Recorded Velocity Change of -8.9 km/h (-5.52 mph)[1] at 97.5 ms after AE. The impact resulted in sufficient longitudinal deceleration of the Saturn to command the deployment of the frontal air bags.

The Saturn was redirected into a clockwise rotation and there was a sideslap-type impact between the right rear of the Toyota and the right front of the Saturn (Event 2). The CDC-only algorithm of the WinSMASH program computed a Total Delta-V of 6.0 km/h (3.7 mph), based on Toyota's right side profile. The longitudinal and lateral components were -1.0 km/h (-0.6 mph) and -5.9 km/h (-3.7 mph), respectively. The EDR for the Toyota reported a maximum lateral Delta-V of -6.5 km/h (-4.1 mph) at 72 ms after AE.

The Saturn rotated approximately 90 degrees as it traveled south backwards, and the right rear of the vehicle impacted the left front of the stopped Dodge (Event 3). The Dodge was displaced slightly clockwise.

Post-Crash

The Toyota came to rest in the intersection facing generally east. The Saturn came to rest in the south leg of the intersection facing north. The Dodge came to rest in the south leg of the intersection also facing north.

The driver of the Toyota sustained minor injuries and was able to exit the vehicle under his own power. The front right occupant sustained minor injuries. She exited the vehicle with some assistance and was transported to a local hospital where she was hospitalized for an unknown number of days.

The Toyota was towed from the scene due to damage and was later declared a total loss by the insurance company. The Saturn was towed from the scene due to damage and was waiting to be sold at the time of the vehicle inspection. The Dodge was driven from the scene.

Vehicle Data - 2011 Toyota Camry

The 2010 Toyota Camry 4-door 5-passenger sedan was identified by the Vehicle Identification Number (VIN): 4T1BF3EK8BUxxxxxx. The vehicle's date of manufacture was May 2010 and the insurance facility reported mileage was 4,928 km (3,062 miles).

[1]According to the data limitations section of the report, the recorded vehicle change is the change in longitudinal velocity.

The vehicle was equipped with a 2.5-liter, 4-cylinder engine, automatic transmission, front wheel drive, and power steering with tilt and telescoping column functionality.

The vehicle manufacturer's recommended tire size was P215/55R17 and the cold tire pressure was 221 kPa (32 psi). The vehicle was equipped with Toyo Proxes J33 P215/55R17 tires, and were all manufactured in 2010. The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	241 kPa (35 psi)	7 mm (9/32 in)	No	None
LR	241 kPa (35 psi)	8 mm (10/32 in)	No	None
RR	234 kPa (34 psi)	8 mm (10/32 in	No	Sidewall scuffs
RF	234 kPa (34 psi)	7 mm (9/32 in)	No	Gouge in sidewall

The Toyota's interior was equipped with seating for five occupants. The front row seating consisted of outboard bucket seats with adjustable head restraints and the second row seating consisted of a bench seat with adjustable head restraints at all three seating positions.

Figure 4. Frontal damage, 2010 Toyota Camry

Vehicle Damage

Exterior Damage

The Toyota sustained moderate front end damage from the initial impact (Event 1) and minor right side damage from the secondary side-slap (Event 2).

The frontal damage began at the left front bumper corner and extended 178.0 cm (70.0 in) to the right across the entire front bumper width (**Figure 4**). The height of the direct damage measured 89.0 cm (35.0 in) from the ground. The bumper fascia had been dislodged and had also been compressed with the bumper backing bar and then had restituted (**Figure 5**). The width of the backing bar measured 118.0 cm (46.4 in) and was used as the Field L when measuring the crush profile.

Figure 5. Side view of bumper fascia and backing bar

Six crush measurements were measured along the backing bar as follows: C_1 = 11.0 cm (4.3 in), C_2 = 18.0 cm (7.0 in), C_3 = 28.0 cm (11.0 in), C_4 = 22.0 cm (8.7 in), C_5 = 18.0 cm (7.0 in), C_6 = 16.0 cm (6.3 in). Maximum crush was located at C_3. The Collision Deformation Classification (CDC) for Event 1 was 11FDEW2.

The right side damage began 25.0 cm (9.8 in) forward of the rear axle and extended 98.0 cm (38.6 in) forward (**Figure 6**). Six crush measurements were documented along the lower door as follows: C_1 = 0 cm, C_2 = 2.0 cm (0.8 in), C_3 = 2.0 cm (0.8 in), C_4 = 2.0 cm (0.8 in), C_5 = 2.0 cm (0.8 in), C_6 =0 cm. The Collision Deformation Classification (CDC) for Event 2 was 03RPLW1.

Figure 6. Right side damage

Interior Damage

The Toyota sustained minor interior damage resulting from intrusion, occupant loading, and occupant contacts. There was minor intrusion along the lower left instrument panel. The driver air bag, lower instrument panel, steering column, steering wheel, and passenger air bag exhibited occupant loading evidence. Both front row safety belt restraints revealed occupant load marks.

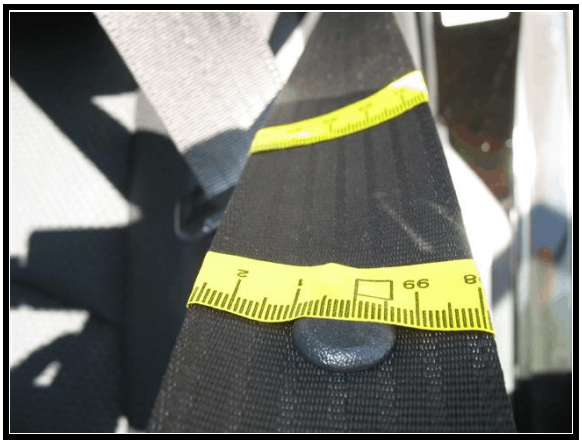


Figure 7. Driver's safety belt webbing showing scuffs near stop button

Manual Restraints

The vehicle's front row seating was equipped with 3-point manual lap and shoulder safety belts with sliding latch plates, adjustable D-rings, and retractor pretensioners. The driver's safety belt was equipped with an Emergency Locking Retractor (ELR) and the front right passenger's safety belt had a switchable ELR/Automatic Locking Retractor (ALR).

The driver's safety belt adjustable D-ring anchorage was in the full-up position and the latch plate was scratched indicating historical usage. The safety belt retractor pretensioner actuated during the crash and was spooled out at the time of the SCI vehicle inspection. The safety belt webbing and latch plate revealed evidence of occupant loading. The webbing exhibited scuff marks measuring 4.0 x 4.0 cm (1.6 x 1.6 in) that

Figure 8. Front right occupant's safety belt showing load mark near the latch plate

began at the stop button (**Figure 7**). The EDR reported that the belt switch status for the driver was belted. Based on the vehicle inspection it was determined that the front left safety belt was used to restrain the driver during the crash.

The front row passenger's safety belt adjustable D-ring was in the full-down position and the latch plate was scratched indicating historical usage. The safety belt webbing and latch plate revealed evidence of occupant loading. The webbing exhibited scuffs measuring 1.0 x 1.0 cm (0.4 x 0.4 in) along the edge 31.0 cm (12.2 in) above the stop button (**Figure 8**). The EDR reported that the belt switch status for the passenger was belted. Based on the vehicle inspection it was determined that the front right safety belt was used to restrain the front right occupant during the crash.

Supplemental Restraint Systems

The vehicle's Supplemental Restraint System (SRS) included an air bag control module, driver and passenger frontal air bags, a driver's knee air bag, side impact inflatable curtain (IC) air bags, front seat-mounted side impact air bags, and safety belt retractor pretensioners for both front seats. Based on the vehicle mileage and age it is believed that the vehicle has not been involved in any prior crashes and the air bags were original to the vehicle. Based on the vehicle's EDR and the frontal damage, it was determined that the frontal air bags and the driver's knee air bag deployed during the initial impact to the right rear side of the Saturn.

Figure 9. Driver's air bag

The driver's air bag module was located in the steering wheel hub (**Figure 9**), and the air bag deployed through Y-configured module cover flaps. The flaps opened at their tear points and were not damaged. The air bag was circular in shape and measured 58.0 cm (22.8 in) in diameter in its deflated state. The air bag had two internal tethers that terminated at the bag's front center. There were two vent ports that measured 3.0 cm (1.2 in) in diameter that were located at the 11 and 1 o'clock positions on the air bag's back panel.

Figure 10. Driver's knee air bag

The air bag exhibited loading evidence in the form of dark scuff marks that were probably deposited from the module cover flap as the air bag deployed. A scuff mark that measured 1.0 x 2.0 (0.4 x 0.8 in) was located in the upper left quadrant 24.0 cm (9.4 in) from the center of the air bag. A group of black scuff marks that measured 6.0 x 4.0 cm (2.4 x 1.6 in) were located in the upper right quadrant 12.0 cm (4.7 in) from the center of the air bag. A 1.0 cm (0.4 in) scuff mark was located in the upper right quadrant 18.0 cm (7.0 in) from the center of the air bag.

The driver's knee air bag was located in the lower instrument panel and deployed through a single rectangular module cover flap (**Figure 10**). The air bag was generally rectangular in shape and measured 30.0 cm (11.8 in) in height and 60.0 cm (23.6 in) in width. There was a 20.0 x 20.0 cm (7.8 x 7.8 in) sail on the front side and there were no tethers or vent ports. The air bag was not damaged and there was no evidence of occupant loading.

Figure 11. Front right passenger air bag

The front passenger air bag was located in the top of the instrument panel and deployed through a single rectangular module cover flap (**Figure 11**). The air bag was rectangular in shape and measured 35.0 cm (13.8 in) in width and 65.0 cm (25.6 in) in height. The bag had a maximum excursion of 50.0 cm (19.6 in). It was configured with 6.0 cm (2.4 in) vent ports at the 2 and 10 o'clock positions and was not tethered.

The air bag exhibited loading evidence in the form of make-up transfer. The 2.0 x 4.0 cm (0.8 x 1.6 in) transfer was located in the lower right quadrant 17.0 cm (6.7 in) right of the center line.

Event Data Recorder (EDR) - Toyota

Data in the vehicle's EDR was imaged using the Toyota ROT software version 1.3.1.2 and reported using version 1.4.1.1. For this crash, the EDR recognized two events.

Latest Pre-Crash Page 0	
Occupant Data	
Belt Switch Status Driver	Belted
Belt Switch Status Passenger	Belted
Occupant Detection	AM50[2]
Seat Position	RM[3]
Shift Position	Others
PAB Manual Cut Off (N/A)	(N/A)
R/O CSA-Manual Cut Off (N/A)	(N/A)

[2] Assumed to indicate American Male 50% percentile, weight classification

[3] Assumed to indicate Rearward

Writing Flag for Pre-Crash/Occupant	Finished Writing

Pre-Crash Data						
Time (sec)	-5	-4	-3	-2	-1	0
Speed (mph)	42.3	42.3	43.5	44.7	33.6	33.6
Brake	OFF	OFF	OFF	OFF	ON	ON
Accelerator	OFF	OFF	MIDDLE	MIDDLE	OFF	OFF
Engine (rpm)	1200	1600	2000	2000	1200	1200

Frontal Crash Page 0	
Max delta-Vx	13.1 (mph)[4]
TGR Counter	1 (times)
Previous Event	No Event
Linked Pre-Crash Date Page No.	Page 0
Time from Pre-Crash to TGR	0 milliseconds (ms)
Frontal AB Deployment Time	32 ms
Pretensioner Deployment Time	32 ms
Deployment Stage Driver	Low
Deployment Stage Passenger	ExLow
Writing Flag for Frontal Crash	Finished Writing

Frontal Crash Page 1	
Deployment Stage Driver	Not Fired
Deployment Stage Passenger	Not Fired
Writing Flag for Frontal Crash	Finished Writing

[4] Maximum Post-crash Delta-V occurred at 200 ms

Side Crash Page 0	
Post-Crash Data (Vel Chg) B-Pillar	0.6 (mph) at 72 ms[5]
Post-Crash Data (Vel Chg) C-Pillar	1.3 (mph) at 72 ms
Post-Crash Data (Vel Chg) Floor	-4.1 (mph) at 72 ms
Time from TGR to Initial G	0 (ms)
TGR Counter	2 (times)
Previous Event	Frontal
Linked Pre-Crash Date Page No.	Page 0
Time from Pre-Crash to TGR	20 (ms)
Deployment Time (B-Pilllar)	Not Fired
Deployment Time (C-Pilllar)	Not Fired
Deployment Side	Driver's side
Writing Flag for Side Crash	Finished Writing

Vehicle Data - 2002 Saturn SL2

The 2002 Saturn SL2 4-door, 4-passenger sedan was identified by the VIN: 1G8ZH52892Zxxxxxx. The vehicle was equipped with a 1.9-liter, 4-cylinder engine, automatic transmission, and front wheel drive. The vehicle manufacturer's recommended tire size was P185/65R14 and the recommended cold tire pressure was 207 kPa (30 psi) for the front and 179 kPa (26 psi) for the rear. The vehicle was equipped with American Sunny Power Touring P175/65R14 tires on the front, a VeeRubber CityStar 65 P185/65R14 on the left rear, and a Michelin Symetry P175/65R14 tire on the right rear. The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	193 kPa (28 psi)	6 mm (8/32 in)	No	None
LR	207 kPa (30 psi)	5 mm (6/32 in)	No	None
RR	248 kPa (36 psi)	3 mm (4/32 in)	Yes	None
RF	228 kPa (33 psi)	6 mm (8/32 in)	No	None

[5] Velocity Changes for B-pillar, C-pillar, and Floor represent the maximum recorded values

Vehicle Damage - 2002 Saturn SL2

The Saturn sustained moderate damage to the right side from the impacts with the Toyota (Events 1 and 2) and minor rear-end damage from the impact with the Dodge (Event 3).

Figure 12. Right side damage, 2002 Saturn SL2

The direct damage to the right side began 82.0 cm (32.2 in) forward of the front axle and extended rearward 346.0 cm (136.2 in) (**Figure 12**). The damage from the front impact with the Toyota and the subsequent sideslap overlapped damage from a previous crash. The damage from the various impacts could not be separated in the field and the crush profile was measured to include all damage. Later, the damage was estimated mathematically using known damage and damage locations from the striking subject vehicle. For the impact with the front of the Toyota (Event 1) the crush profile at the mid-door level was as follows: C_1 = 0 cm, C_2 = 5.0 cm (1.9 in), C_3 = 11.0 cm (4.3 in), C_4 = 19.0 cm (7.4 in), C_5 = 16.0 cm (6.3 in), and C_6 = 0 cm. The maximum crush was located between C_4 and C_5 and measured 22.0 cm (8.7 in). The plastic fascia on the right rear door was displaced and the right rear tire was canted inward. The height of the maximum door crush measured 51.0 cm (20.0 in), the sill height was 23.0 cm (9.0 in), and the Door Sill Differential (DSD) was 14.0 cm (5.5 in). The CDC was 02RPEW2.

The estimated CDC for the sideslap was 03RFLW1.

The direct damage to the rear of the Saturn (Event 3) began at the area above the right rear bumper corner and extended 45.0 cm (17.7 in) to the left. The Field L measured 124.0 cm (48.8 in). There was no bumper crush, but six crush measurements were taken at the trunk level as follows: C_1 = 0 cm, C_2 = 0 cm , C_3 = 2.0 cm (0.8 in), C_4 = 5.0 cm (1.9 in), C_5 = 9.0 cm (3.5 in), C_6 = 8.0 cm (3.1 in). There was insufficient above bumper crush to perform crush averaging. The coded crush values will be 0. The CDC for the impact with the Dodge was 05BRMW1.

EDR - 2002 Saturn SL2

Data in the vehicle's EDR was imaged using the Bosch Crash Data Retrieval Tool version 3.3 and reported using version 3.5.1. For this crash two events were recovered: a deployment event and a non-deployment event.

Data for the deployment event was summarized as follows:

- SIR warning lamp status was "off".
- Driver's belt switch status was "buckled".
- Passenger front air bag was not suppressed.
- The ignition cycles were 27202 at deployment and 27203 at investigation.
- The maximum recorded velocity change was -8.9 km/h (-5.52 mph).
- The Algorithm Enable (AE) to maximum SDM recorded velocity change was 97.5

ms.
- The time between non-deployment and deployment event in seconds was N/A[6].
- The time from AE to deployment command criteria met was 35 ms.
- The vehicle speed was 3.2 km/h (2.0 mph) five seconds before AE and accelerated to 25.7 km/h (16.0 mph) at one second before AE.
- The brake switch status was on 8-5 seconds before AE, was "off" at seconds 4-3, and then back "on" at seconds 2-1.

Data for the non-deployment event was summarized as follows:

- SIR warning lamp status was "off".
- Driver's belt switch status was "buckled".
- Passenger front air bag was not suppressed.
- The ignition cycles 27202 at deployment and 27203 at investigation.
- The maximum recorded velocity change was -3.7 km/h (-2.3 mph).
- The Algorithm Enable (AE) to maximum SDM recorded velocity change was 97.5 ms.
- The vehicle speed was 1.6 km/h (1.0 mph) five seconds before AE and accelerated to 25.7 km/h (16.0 mph) at two seconds before AE. The speed then dropped to 3.2 km/h (2.0 mph) prior to AE.
- The brake switch status was "on" 8-6 seconds before AE, "off" at seconds 5-4, "on" at seconds 3-2, and "off" at 1 second prior to AE.

Vehicle Data - 1999 Dodge Durango

The Durango was a four-door sport utility vehicle. The vehicle was equipped with a 5.2-liter, 8-cylinder engine and an automatic transmission. The vehicle was driven from the scene by the driver and was not inspected.

Occupant Demographics - 2010 Toyota Camry

Driver

Age/Sex:	61/Male
Height:	160 cm (63 in)
Weight:	61 kg (134 lbs)
Seat type:	Bucket
Seat track position:	Mid-track
Manual restraint use:	Lap and shoulder belt

[6]According to the CDR limitations page, N/A should be displayed if the time between a previous non-deployment event occurred before this deployment event and the time between the two events was greater than five seconds.

Usage source:	Vehicle inspection
Air bags:	Frontal and knee air bags deployed. Side IC air bag and seat-mounted side impact air bag did not deploy.
Alcohol, drug involvement:	None
Type of medical treatment:	None

Right Front Passenger

Age/Sex:	56/Female
Height:	Unknown
Weight:	Unknown
Seat type:	Bucket
Seat track position:	Mid-track
Manual restraint use:	Lap and shoulder belt
Usage source:	Vehicle inspection
Air bags:	Frontal air bag deployed. Side IC air bag and seat-mounted side impact air bag did not deploy.
Alcohol, drug involvement:	None
Type of medical treatment:	Transported, hospitalized for unknown number of days.

Occupant Injuries

Driver: Injuries obtained from interviewee (attorney via questionnaire).

Injury	Injury Severity (AIS 2005)	Injury Mechanism	Confidence Level
Unspecified injury, left leg	810099.1,2	Left instrument panel	Possible
Unspecified injuries, shoulders	710099.1,3	Unknown	Unknown
Unspecified injury, chest	410099.1,9	Unknown	Unknown
Unspecified injuries, upper and lower back	410099.1,6	Impact forces	Possible

Right front occupant: Injuries obtained from interviewee (attorney via questionnaire).

Injury	Injury Severity (AIS 2005)	Injury Mechanism	Confidence Level
Unspecified injury, right elbow	710099.1,1	Unknown	Unknown
Unspecified injury, chest	410099.1,9	Unknown	Unknown
Unspecified injuries, upper and lower back	410099.1,6	Impact forces	Possible
Unspecified injuries, both legs	810099.1,3	Unknown	Unknown

Occupant Kinematics - 2010 Toyota Camry

Driver Kinematics

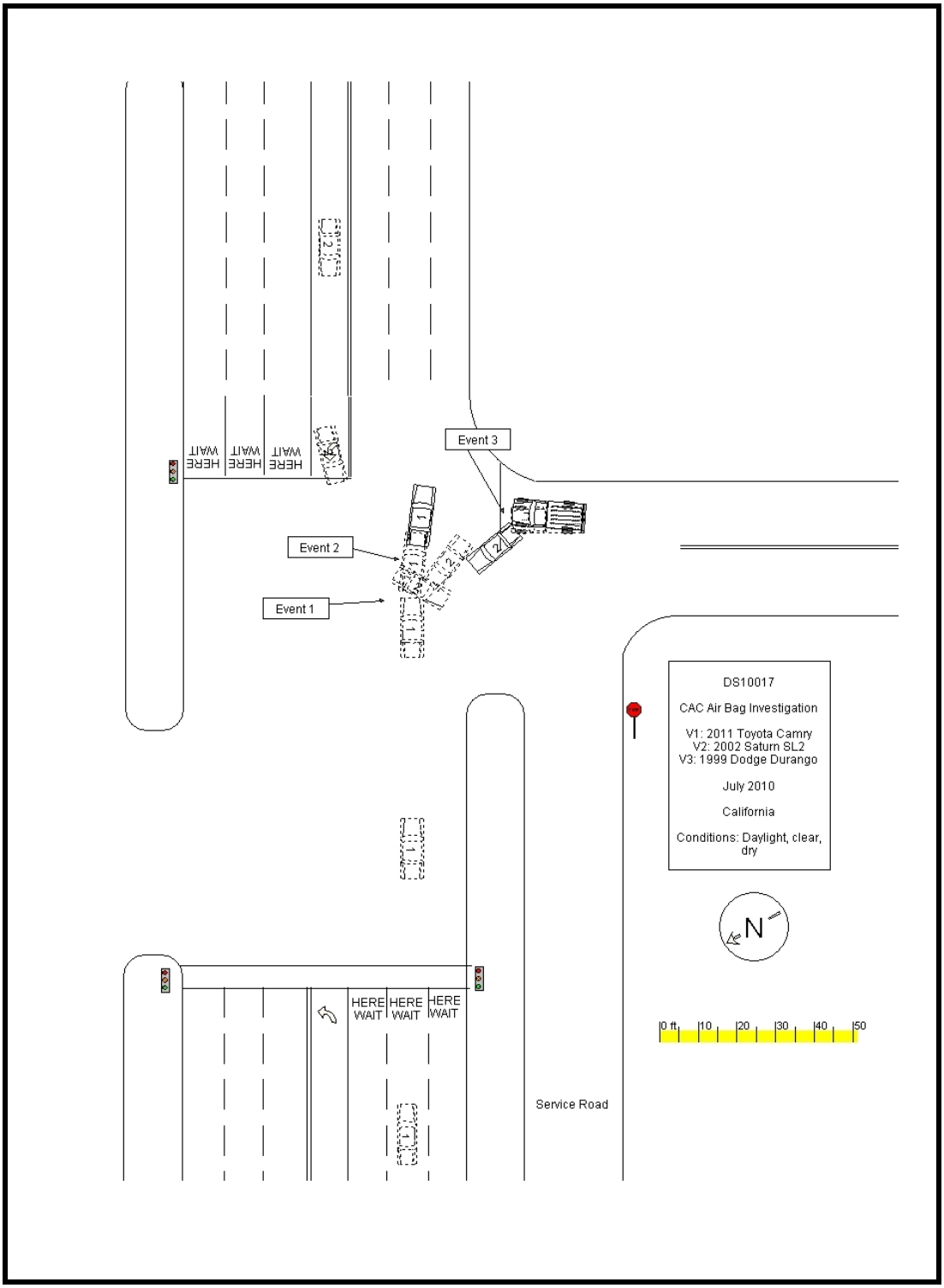
The 61-year-old male driver was seated in an unknown posture and was using the vehicle's lap and shoulder belt. He was actively braking the vehicle and his right foot was likely on the brake. The driver's seat track was set to the middle track position and his seat back was slightly reclined. At impact with the Saturn, the vehicle's frontal air bags and the driver's knee air bag deployed, the front safety belt pretensioners actuated, and the driver was displaced forward and to the left in response

to the 11'oclock direction of force. The driver loaded the safety belt the deployed air bag. The frontal air bag showed scuff marks and skin oil transfers. Both of the driver's knees loaded the deployed knee air bag and the lower instrument panel area. The driver sustained upper and lower back injuries that were possibly the result of impact forces. As the vehicle contacted the Saturn in a sideslap pattern, the driver was displaced slightly to the right. He was able to exit the vehicle under his own power.

Front Right Occupant Kinematics

The 56-year-old female front right occupant was seated in an unknown posture and was using the vehicle's lap and shoulder belt As the driver began braking, she was displaced forward slightly. At impact with the Saturn the frontal air bags deployed, the front safety belt pretensioners actuated, and the front right occupant was displaced forward and to the left in response to the 11'oclock direction of force. She loaded the safety belt and contacted the front right air bag with her face, depositing a makeup transfer. She sustained upper and lower back injuries that were possibly the result of impact forces. She also sustained unspecified injuries to both legs. As the vehicle contacted the Saturn in a sideslap pattern, this occupant was displaced slightly to the right. She was able to exit the vehicle with some assistance and was transported to a local hospital. She was hospitalized for an unknown number of days.

Attachment 1. Scene Diagram



Attachment 2. Bosch Report

IMPORTANT NOTICE: Robert Bosch LLC and the manufacturers whose vehicles are accessible using the CDR System urge end users to use the latest production release of the Crash Data Retrieval system software when viewing, printing or exporting any retrieved data from within the CDR program. Using the latest version of the CDR software is the best way to ensure that retrieved data has been translated using the most current information provided by the manufacturers of the vehicles supported by this product.

CDR File Information

User Entered VIN	1G8ZH52892Z******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS10017.CDR
Saved on	Friday, August 20 2010 at 12:25:54 PM
Collected with CDR version	Crash Data Retrieval Tool 3.3
Reported with CDR version	Crash Data Retrieval Tool 4.0
EDR Device Type	airbag control module
Event(s) recovered	Deployment Non-Deployment

Comments

No comments entered.

Data Limitations

Recorded Crash Events:

There are two types of Recorded Crash Events. The first is the Non-Deployment Event. A Non-Deployment Event records data but does not deploy the air bag(s). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event may be overwritten by another Non-Deployment Event. This event will be cleared by the SDM, after approximately 250 ignition cycle. This event can be overwritten by a second Deployment Event, referred to as a Deployment Level Event, if the Non-Deployment Event is not locked. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds before a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared by the SDM.

The second type of SDM recorded crash event is the Deployment Event. It also contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. If a Deployment Level Event occurs within five seconds after the Deployment Event, the Deployment Level Event will overwrite any non-locked Non-Deployment Event. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

Data:

-SDM Recorded Vehicle Longitudinal Velocity Change reflects the change in longitudinal velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Longitudinal Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. For Deployment Events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 150 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.

-SDM Recorded Vehicle Speed accuracy can be affected by various factors, including but not limited to the following:

- -significant changes in the tire's rolling radius
- -final drive axle ratio changes
- -wheel lockup and wheel slip

-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.

-Pre-Crash data is recorded asynchronously.

-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:

- -the SDM receives a message with an "invalid" flag from the module sending the pre-crash data
- -no data is received from the module sending the pre-crash data
- -no module present to send the pre-crash data

-Engine Speed is reported at two times the actual value in the following vehicles, if the vehicle is equipped with a 6.6L Duramax diesel engine (RPO LB7, LBZ, LLY, or LMM):

- -2001-2006 Chevrolet Silverado
- -2007 Chevrolet Silverado Classic
- -2001-2006 GMC Sierra
- -2007 GMC Sierra Classic

-2006-2007 Chevrolet Express
-2006-2007 GMC Savana
-2003-2009 Chevrolet Kodiak
-2003-2009 GMC Topkick

-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Driver's Belt Switch Circuit may be reported other than the actual state.
-Passenger Front Air Bag Suppression Switch Circuit Status indicates the status of the suppression switch circuit.
-The Time Between This Event and the Previous Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-If the vehicle is a 2000 - 2002 Chevrolet Cavalier Z24 or a Pontiac Sunfire GT, with a manual transmission (RPO MM5) and a 2.4L engine (RPO LD9), the Brake Switch Circuit Status data will be reported in the opposite state than what actually occurred, e.g. an actual brake switch status of "ON" will be reported as "OFF".
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.
-Brake Switch Circuit Status data is transmitted by either the ABS module or the PCM, via the vehicle's communication network, to the SDM.
-The SDM may obtain Belt Switch Circuit Status data a number of different ways, depending on the vehicle architecture. Some switches are wired directly to the SDM, while others may obtain the data from various vehicle control modules, via the vehicle's communication network.
-The Passenger Front Air Bag Suppression Switch Circuit is wired directly to the SDM.

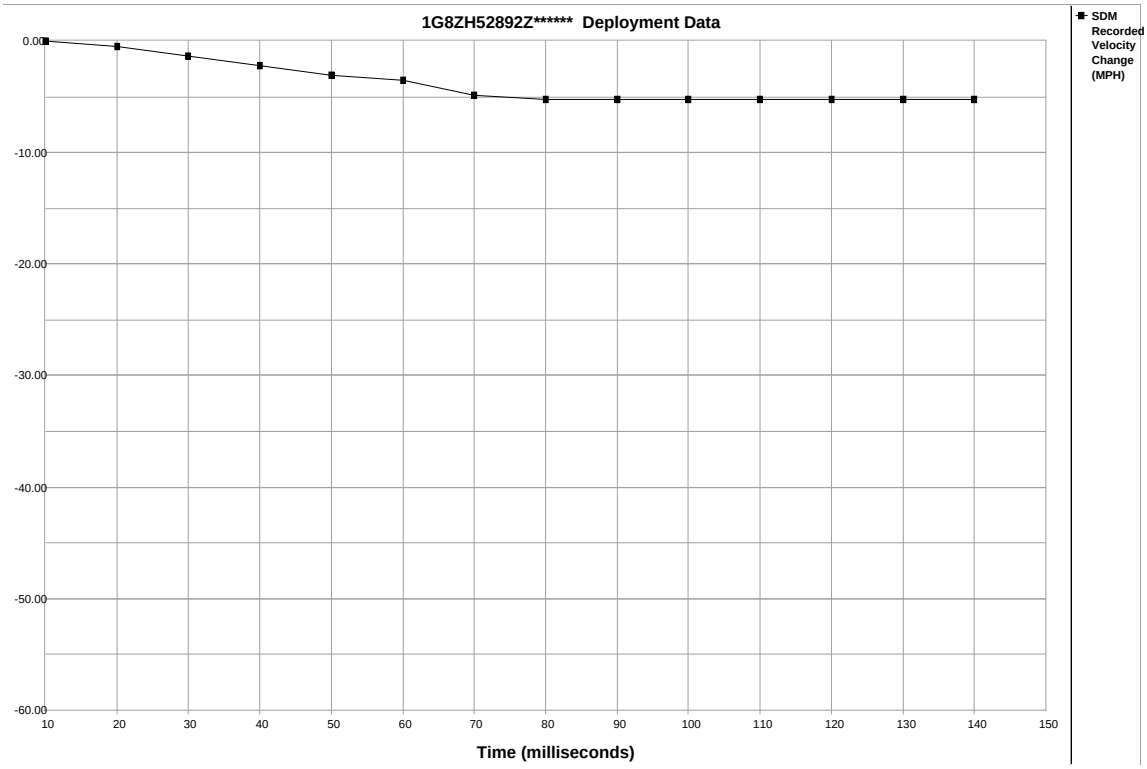
01025_SDMG-99JXZ09-10_r002

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger SIR Suppression Switch Circuit Status (if equipped)	Air Bag Not Suppressed
Ignition Cycles At Deployment	27202
Ignition Cycles At Investigation	27203
Maximum SDM Recorded Velocity Change (MPH)	-5.52
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	97.5
Time Between Non-Deployment And Deployment Events (sec)	N/A
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	35

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	2	896	0
-4	1	1600	19
-3	5	1920	19
-2	11	2560	53
-1	16	2880	73

Seconds Before AE	Brake Switch Circuit State
-8	ON
-7	ON
-6	ON
-5	ON
-4	OFF
-3	OFF
-2	ON
-1	ON



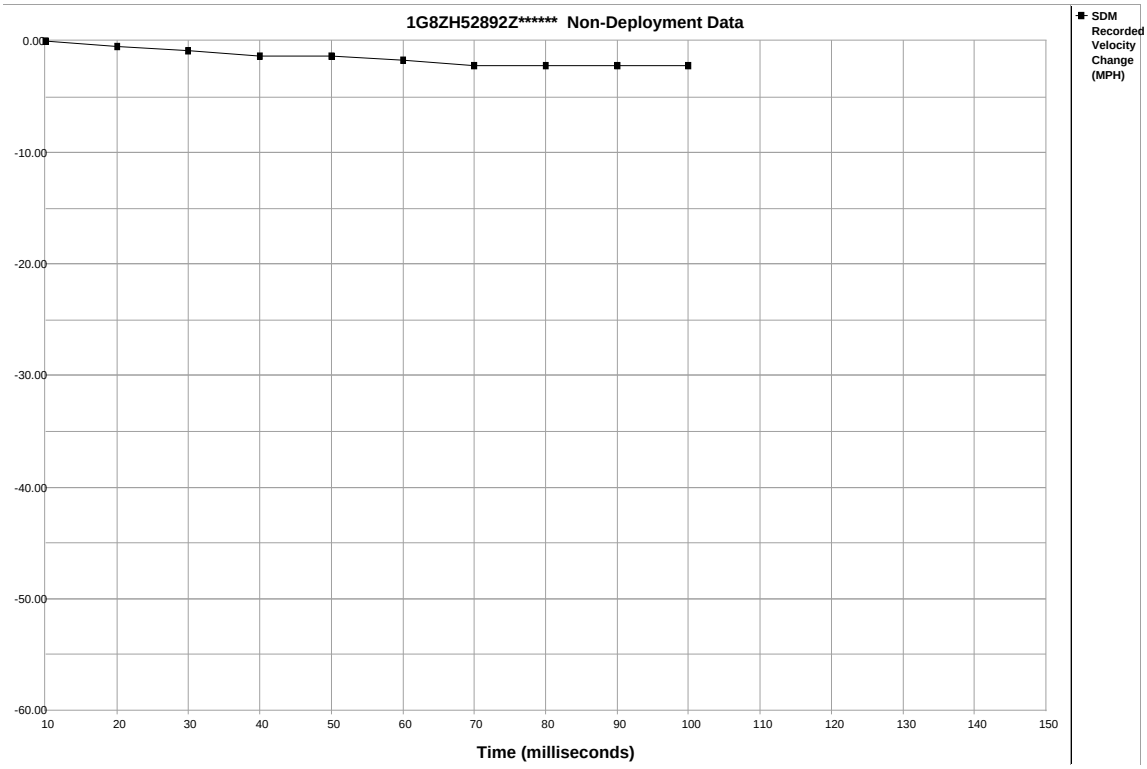
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Recorded Velocity Change	0.00	-0.44	-1.32	-2.19	-3.07	-3.51	-4.83	-5.27	-5.27	-5.27	-5.27	-5.27	-5.27	-5.27	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger SIR Suppression Switch Circuit Status (if equipped)	Air Bag Not Suppressed
Ignition Cycles At Non-Deployment	27202
Ignition Cycles At Investigation	27203
Maximum SDM Recorded Velocity Change (MPH)	-2.30
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	97.5

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	1	1600	19
-4	5	1920	19
-3	11	2560	53
-2	16	2880	73
-1	2	1024	0

Seconds Before AE	Brake Switch Circuit State
-8	ON
-7	ON
-6	ON
-5	OFF
-4	OFF
-3	ON
-2	ON
-1	OFF



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Recorded Velocity Change	0.00	-0.44	-0.88	-1.32	-1.32	-1.76	-2.19	-2.19	-2.19	-2.19	N/A	N/A	N/A	N/A	N/A