

On-Site Potential Unintended Acceleration Investigation  
Dynamic Science, Inc. Case Number DS10024  
Office of Defects Investigation  
2008 TOYOTA CAMRY  
Utah  
November 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.

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16. Abstract  The investigation focused on the alleged unintended acceleration and the crash dynamics surrounding the single vehicle crash of a 2008 Toyota Camry. The crash site was an off-ramp of an interstate highway. The off-ramp intersects a north/south roadway that was bordered on one side by a rock-covered embankment. The Toyota was being driven by a restrained 66-year-old male. There were three additional occupants in the vehicle. A restrained 61-year-old female was seated in the front right seat position. An unrestrained 38-year-old female was seated in the second row left seat and an unrestrained 34-year-old male was seated in the second row right seat. The Toyota was initially traveling westbound on an interstate highway and then entered an off-ramp on the right. There were statements from other occupants that the driver attempted to brake. The Toyota continued west on the off-ramp, passed two vehicles stopped at the intersection, crossed the intersection, and impacted a curb and a rock embankment. The vehicle came to rest at an upward angle with its front tires on the embankment and the rear tires on the adjacent sidewalk. The driver and the second row left passenger were fatally injured. The driver was declared deceased at the scene. The second row left passenger and the two other occupants were transported to an area trauma center by air. The 38-year-old passed away the following day. The other two occupants were transported from the scene. The front right passenger was hospitalized for six days and the second row right passenger was examined and released.					
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**Dynamic Science, Inc.  
Crash Investigation  
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## BACKGROUND

The investigation focused on the alleged unintended acceleration and the crash dynamics surrounding the single vehicle crash of a 2008 Toyota Camry (**Figure 1**). The crash occurred at 1800 hours in November 2010. The crash site was an off-ramp of an interstate highway. The off-ramp intersects a north/south roadway that was bordered on one side by a rock-covered embankment. The Toyota was being driven by a restrained 66-year-old male. The driver was a diabetic but there were no reports of any medically related episodes in this crash. There were three additional occupants in the vehicle. A restrained 61-year-old female was seated in the front right seat position. An unrestrained 38-year-old female was seated in the second row left seat and an unrestrained 34-year-old male was seated in the second row right seat.



**Figure 1.** 2008 Toyota Camry

The Toyota was initially traveling westbound on an interstate highway and then entered an off-ramp on the right. At five seconds prior to impact, the Event Data Recorder (EDR) reported speed was 89.9 km/h (55.9 mph). There were statements from other occupants that the driver attempted to brake. The police reported that there were brake marks on the off-ramp that were related to this crash. The SCI investigation revealed that while there were brake marks on the off-ramp they were not related to this crash and there were no skid marks of any kind leading to the impact area. The track width of the brake marks on the ramp did not match the track width of the Toyota. Based on the roadway evidence and the EDR report, it is probable that the cruise control was on and there was no braking.

The Toyota continued west on the off-ramp, passed two vehicles stopped at the intersection, crossed the intersection, and impacted a curb and a rock embankment. The vehicle came to rest at an upward angle with its front tires on the embankment and the rear tires on the adjacent sidewalk.

The driver and the second row left occupant were fatally injured. The driver was declared deceased at the scene. The second row left occupant and the two other occupants were transported to an area trauma center by air. The 38-year-old passed away the following day. The other two occupants were transported from the scene. The front right passenger was hospitalized for six days and the second row right passenger was examined and released.

This investigation was initiated in response to a report to the National Highway Traffic Safety Administration's (NHTSA) Office of Defects Investigation (ODI) that alleged a multiple fatality crash related to the unintended acceleration of a 2008 Toyota Camry. Dynamic Science, Inc. (DSI) was notified of the crash on November 15, 2010. Permission to image the Event Data Recorder (EDR) was obtained from the vehicle owner by the investigating police agency. The vehicle was inspected on November 19, 2010. Present at the inspection were the DSI investigator, four Toyota representatives, five officers from the investigating police agency, and the tow facility operator.

The vehicle's EDR was supported by the Toyota Readout Tool (ROT) and the EDR was imaged as part of the vehicle inspection. A summary of the readout data is included in this report. Toyota personnel imaged Techstream data from the vehicle and also imaged the EDR during the inspection and provided copies of the data to the DSI investigator and to the police.

## SUMMARY

### *Crash Site*

This single vehicle crash occurred at the junction of an interstate off-ramp and a north/south roadway. The off-ramp had a heading angle of approximately 261 degrees and the north/south roadway had a heading angle of approximately 350 degrees. This formed an 89 degree angle between the two roadways.

The westbound single-lane off-ramp was 4.3 m (14.1 ft) wide, straight as it approached the intersection, and was bordered on both sides by a combination of asphalt shoulders, gravel shoulders, and rock embankments (**Figure 2**). Nearer the intersection, the roadway was bordered by raised concrete curbs. A 305.0 cm (120.0 in) high stop sign was located on the north side of the roadway, 13.1 m (43.0 ft) east of a white painted stop line. The roadway had an ascending grade of 1.9 percent at the stop line. At 15.2 m (50.0 ft) east the stop line the grade was negative 1.3 percent, at 30.4 m (100.0 ft) it was negative 1.4 percent, and at 60.9 m (200.0 ft) it was negative 4 percent. The distance from the off-ramp exit area of the intersection to the north/south street was approximately 213.3 m (700.0 ft) (**Figure 3**).

The north leg of the north/south roadway was comprised of a northbound travel lane, a painted center median, and a southbound travel lane. The roadway was bordered on the west by an asphalt shoulder, a 15.9 cm (6.2 in) high concrete curb, a 2.1 m (7.0 ft) wide concrete sidewalk, and a 54 degree ascending rock embankment. The roadway had a descending north to south grade of 3.1 percent.

It was clear and dry at the time of the crash. The police reported the temperature to be 5.5° C (42° F), humidity 73 percent, and the winds out of the



**Figure 2.** Westbound approach to end of exit ramp



**Figure 3.** Look back view looking east toward exit ramp

northwest at 3.2 km/h (2.0 mph).

### ***Pre-Crash***

The front right occupant drove the Toyota from her place of business to her son's residence. At this time her husband took over as driver. He drove approximately 58 km (36 miles) before stopping for a restroom break and to get something to drink. The vehicle continued westbound on an interstate highway for an additional 180 km (112 miles). The Toyota then entered an off-ramp on the right. At five seconds prior to impact the EDR reported speed was 89.9 km/h (55.9 mph), the brake switch status was "OFF", the acceleration status was "OFF", the accelerator voltage was 0.87v, and the engine rpm was 1200. The vehicle continued west on the off-ramp, passed two stopped vehicles, and entered the intersection. At one second prior to impact the EDR reported speed was 88.0 km/h (54.7 mph), the brake switch status was "OFF", the acceleration status was "OFF", the accelerator voltage was 0.87v, and the engine rpm was 1200.

### ***Crash***

After passing through the intersection, the Toyota impacted the concrete curb with its front tires (Events 1 and 2). The Toyota continued forward and impacted the embankment with its front end (Event 3). This impact resulted in sufficient longitudinal deceleration to command the actuation of the front safety belt pretensioners and the deployment of the frontal air bags.

The EDR recorded the maximum longitudinal Delta-V of -56 km/h (-34.8 mph) at 200 milliseconds (ms). The Damage Only algorithm of the WinSMASH program computed the Total Delta-V of 62.0 km/h (38.5 mph); the longitudinal and lateral components were -62.0 km/h (-38.5 mph) and 0 km/h (0 mph), respectively. The speedometer was locked in place at approximately 72 km/h (45 mph). The WinSMASH results appear reasonable based on the crush profile and the additional resultant damage from the ascending the embankment.

After impacting the embankment the vehicle then impacted the concrete curb with its rear tires (Events 4 and 5). As the vehicle climbed the ascending embankment the rear undercarriage and bumper contacted the side walk (Event 6).

### ***Post-Crash***

The Toyota came to rest at an upward angle with its front tires on the embankment and the rear tires on the adjacent sidewalk (**Figure 4**). On scene photos show brake lights and 4-way flashers were on at vehicle final rest.

EMS was called at 1807 hours and arrived at 1809 hours.

The 66-year-old male driver was fatally injured. The driver was removed from the vehicle by fire personnel using extrication equipment. At 1852 hours, the driver was declared deceased. According to the certificate of death, the cause of death was due to head injuries. No autopsy was conducted.



**Figure 4.** Toyota at final rest (police photo)

The 61-year-old female front right occupant was removed from the vehicle by fire personnel using extrication equipment. She was transported from the scene by ground ambulance to a local airport where she was then transported by air to a Level 1 trauma center. She arrived with a Glasgow Coma Score (GCS) of 15 and had sustained an open tibia/fibular fracture, rib and sternum fractures, and multiple contusions and abrasions. She was hospitalized for six days.

The 38-year-old female second row left occupant was removed from the vehicle by fire personnel. She was transported from the scene initially by ground ambulance. Medical personnel conducted CPR while en route. This occupant was transferred to a helicopter approximately 53 kilometers (33 miles) east of the crash site and then transported to a Level 1 trauma center. She was declared deceased at 0112 hours the following day, seven hours post-crash. According to the certificate of death, the cause of death was cardiopulmonary arrest due to traumatic brain injury. No autopsy was conducted.

The 34-year-old male second row right occupant was able to exit the vehicle with some assistance. He was transported from the scene to a local airport where he was then transported by air to a Level 1 trauma center. He arrived with a GCS of 15 and denied any loss of consciousness. He complained of pain to his left foot and lower back. A FAST<sup>1</sup> exam and X-rays did not reveal any injuries. He was discharged at 2258 hours, approximately five hours post-crash.

## **2008 TOYOTA CAMRY**

### ***Description***

The Toyota Camry LE four-door sedan was identified by the Vehicle Identification Number (VIN): 4T1BE46K98Uxxxxxx. The vehicle date of manufacture was September 2007 and the mileage was 73,9593 kilometers (45,730 miles). According to a CARFAX report, there were no previous crashes or damage. The vehicle was equipped with a 2.4-liter, 4-cylinder engine, five-speed automatic transmission, 4-wheel disc brakes with ABS, daytime running lights, and power steering with tilt and telescoping functionality. The vehicle was also equipped with cruise control. The cruise control lever is located on the right side of the steering column and is activated by the pressing the ON/OFF button located at the end of the lever. Speed is increased/decreased by moving the lever up and down. Acceleration can be canceled manually by pulling the lever towards the driver or by applying the brakes. The set speed is automatically canceled if the actual vehicle speed falls more than 16 km/h (10 mph) below the preset speed, the actual speed is below 40 km/h (25 mph), or vehicle stability control is activated.

The vehicle manufacturer's recommended tire size was P215/60R16 with a recommended cold tire pressure of 221 kPa (32 psi) for both front and rear tires. The Toyota was configured with Michelin Energy MXV4 tires of the recommended size mounted on original equipment steel rims. The tire manufacturer's maximum recommended tire pressure was 303 kPa (44 psi). The specific tire information was as follows:

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<sup>1</sup>Focused Assessment with Sonography for Trauma



Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Tire Flat	6 mm (7/32 in)	Yes	De-beaded, cut in sidewall
LR	Tire Flat <sup>2</sup>	5 mm (6/32 in)	No	De-beaded
RR	Tire Flat	6 mm (7/32 in)	No	De-beaded
RF	Tire Flat	6 mm (8/32 in)	No	De-beaded

The seating in the Toyota was configured with cloth-covered front bucket seats and a split folding rear seat. Adjustable head restraints were available for all seating positions.

### ***Exterior Damage***

There were a total of six events in this crash. Events 1 and 2 involved front tires to curb impacts. The left front tire was de-beaded and the rim was deformed in three locations. The first deformation measured 18.0 x 5.0 cm (7.0 x 1.9 in), the second 23.0 x 5.0 cm (9.0 x 1.9 in), and the third 10.0 x 3.0 cm (3.9 x 1.2 in). The right front tire was de-beaded and the rim was deformed in two locations (**Figure 5**). The first deformation measured 18.0 x 4.0 cm (7.0 x 1.6 in) and the second 10.0 x 2.0 cm (3.9 x 0.8 in). The Collision Deformation Classifications (CDCs) for the curb impacts were 12FLWN3 and 12FRWN3, respectively.



**Figure 5.** Right front tire/rim damage

The Toyota sustained severe damage to the front plane from the impact with the embankment (Event 3). The direct damage began at the front left backing bar corner and extended 120.0 cm (47.2 in) to the right (**Figure 6**). Six crush measurements were documented at the backing bar as follows:  $C_1 = 81.0$  cm (31.8 in),  $C_2 = 79.0$  cm (31.1 in),  $C_3 = 83.0$  cm (32.7 in),  $C_4 = 74.0$  cm (29.1 in),  $C_5 = 64.0$  cm (25.1 in),  $C_6 = 60.0$  cm (23.6 in). The maximum crush was located at  $C_3$ . The CDC for the frontal impact with the embankment was 12FDEW4.



**Figure 6.** Frontal damage

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<sup>2</sup>Tire flat at time of vehicle inspection (14 days post-crash). Tire appears to be inflated in on-scene images.

Due to the frontal impacts, the wheelbase was shortened by 42.0 cm (16.5 in) on the left and 24.0 cm (9.4 in) on the right.

Events 4 and 5 involved rear tires to curb impacts. The left rear tire was de-beaded and the rim was deformed. The deformation measured 12.0 x 2.0 cm (4.7 x 0.8 in). The right rear tire was de-beaded and the rim was deformed. The deformation measured 10.0 x 2.0 cm (3.9 x 0.8 in). The CDCs for the rear tire curb impacts were 12FLWN9 and 12FRWN9, respectively.

The Toyota sustained minor damage to the rear bumper and undercarriage from contact with the sidewalk as the vehicle climbed the embankment (Event 6) (**Figure 7**). The direct damage began at the right corner of the vehicle and extended laterally along the undercarriage 130.0 cm (51.1 in). The direct damage included scratches along the rear face of the rear bumper fascia. The CDC for this impact was 00UBDW2.

### ***Interior Damage***

The Toyota sustained moderate interior damage as a result of passenger compartment intrusion and occupant contacts. The vehicle sustained longitudinal intrusions to the toe pan, lower A-pillar, and instrument panel and vertical intrusions to the floor. Prior to the vehicle inspection, the police and rescue personnel had used extrication tools to move vehicle components on the driver's side of the vehicle to access the foot controls. The accelerator pedal was broken and removed from the vehicle during this effort. There was also longitudinal intrusion to the rear seat due to cargo movement. The windshield was cracked but remained intact. The driver's door appeared to be jammed shut and the remaining doors remained closed and operational. The steering wheel rim was deformed forward due to occupant loading (**Figure 8**). The lower instrument panel fascia was displaced. There were scuffs and skin transfers to the roof and roof side rails. The first was located aft of the B-pillar (**Figure 9**) and measured 30.0 x 8.0 cm (11.8 x 3.1 in). The second was located 32.0 cm (12.6 in) right of the side rail and 13.0 cm (5.1 in) forward of the B-pillar and measured 7.0 x 3.0 cm (2.8 x 1.2 in).



**Figure 7.** Undercarriage damage



**Figure 8.** Driver seated area and deformed steering wheel rim



**Figure 9.** Occupant contact along left roof side rail

The third was located to the right of the interior roof light. There were scuffs documented to both seat backs (**Figure 10**). The first was located at the upper right corner of the driver seat back and measured 10.0 cm (3.9 in) along the side of the seat back. There was a 14.0 x 10.0 cm (5.5 x 3.9 in) scuff at the left upper passenger seat back and a 21.0 x 20.0 cm (8.3 x 7.9 in) scuff on the right upper seat back. Both front row seat backs were partially reclined at the time of the vehicle inspection. The right front seat back was deformed and the seat was loose in its mount and could be moved forward and back. The rear of the center console was deformed.



**Figure 10.** Occupant contacts to rear of front seat backs

### ***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. Both front seat pretensioners actuated and the safety belts were being used at the time of the crash. 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 three rear seat positions were equipped with lap and shoulder belts with switchable ELR/ALR.

The driver's and front right occupant's safety belts exhibited evidence of historical usage in the form of scratches on the latch plates. The driver's belt had been cut 30.0 cm (11.8 in) above the stop button. The anchorage adjustment was in the full-down position. The front right passenger's safety belt was locked in the spooled out position. There was evidence of loading in the form of a 4.0 cm (1.6 in) scuff located 52.0 cm (20.5 in) from the stop button. There was an 11.0 cm (6.8 in) area of fraying below the anchorage adjustment. The anchorage adjustment was in the full-down position.

The second row outboard seats exhibited evidence of historical usage in the form of scratches on the latch plates. The second row left seat did not have any evidence of usage in this crash. A 13.0 cm (5.1 in) scuff was located 14.0 cm (5.5 in) from the stop button on the second row right seat. Based on the vehicle inspection, however, the occupant in the second row right seat position was not using the safety belt.

### ***Supplemental Restraint Systems***

This vehicle's Supplemental Restraint System (SRS) included an air bag control module (ACM), driver and passenger frontal air bags, a driver knee air bag, seat-mounted side air bags for the front row, side impact inflatable curtain (IC) air bags, and retractor-mounted safety belt pretensioners for the front row. The Toyota was equipped with advanced frontal air bags. The multi-stage air bags were certified by the manufacturer to be compliant with the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The driver's air bag was located within the steering wheel hub and the front right passenger air bag was located within the right instrument panel. The driver and passenger frontal air bags and the driver's knee air bag deployed during the impact with the embankment. The seat-mounted side air bags and side impact IC air bags did not deploy.

The driver’s air bag deployed from the center of the steering wheel hub through H-configuration cover flaps (**Figure 11**). The deployed air bag measured 49.0 cm (19.2 in) in diameter in its deflated state. The air bag was tethered by a single internal strap. The tether was attached to a stitched 23.0 cm (9.0 in) diameter circle in the center of the front panel. Two circular 3.0 cm (1.2 in) vent ports were located at the 11 and 1 o’clock aspects on the rear panel. The air bag and module covers were not damaged. There were areas of blood on the face of the bag, primarily in the upper half. There was a rectangular diagonal scuff mark measuring 7.0 x 3.0 cm (2.7 x 1.2 in) located at the upper left quadrant of the circular stitching. The driver’s knee air bag deployed from the lower instrument panel. The deployed air bag measured 53.0 cm (20.8 in) in width and 24.0 cm (9.4 in) height. The front right passenger’s air bag deployed from the top of the instrument panel through a rectangular module cover (**Figure 12**). The deployed air bag measured 39.0 cm (15.3 in) in width seam-to-seam, 52.0 cm (20.5 in) in height, and had a maximum excursion of 53.0 cm (20.8 in). There was no damage to either air bag.



**Figure 11.** Driver’s air bag



**Figure 12.** Front right passenger air bag

***Event Data Recorder***

The Toyota’s EDR was removed from the vehicle by the police and placed into evidence. The EDR was imaged during the SCI vehicle inspection by connecting the Toyota Prototype Read Out Tool (ROT) directly to the EDR. The data was imaged and reported using software version 1.4.1.1. The module number listed on the EDR was 06200. This number was entered into the tool and several passwords were entered before the imaging could begin. Later, a Toyota representative also imaged the data using the same software version. However, his version automatically populated the EDR field in the software which indicated that the module number and passwords were associated with module number 33490. A copy of the imaged data was provided to DSI and to the investigating police agency. The data imaged by DSI and Toyota was the same with the exception of the module number. Per Toyota, this module records two frontal events but only one frontal event was recorded by the EDR.

A summary of the EDR data is as follows:

<b>Latest Pre-Crash Page0</b>	
System Information	
Page No. of Latest Pre-Crash Data	Page.0

Time from Previous Pre-Crash TRG <sup>3</sup> Event	16381 ms
Freeze Signal	Freeze
AB Deployment Flag	Frontal AB and Pretensioner
Occupant Data	
Belt Switch Status Driver	Belted
Belt Switch Status Passenger	Belted
Occupant Detection	AM50 <sup>4</sup>
Seat Position	RW <sup>5</sup>
Shift Position	Others (Not park, neutral, reverse)
PAB Manual Cut Off (N/A)	(N/A)
R/O CSA-Manual Cut Off (N/A)	(N/A)
Writing Flag for Pre-Crash/Occupant	Finished Writing

Pre-Crash Data						
Time (sec)	-5	-4	-3	-2	-1	0
Speed (mph)	55.9	55.9	55.9	55.9	54.7	53.4
Brake	OFF	OFF	OFF	OFF	OFF	OFF
Accelerator (volts)	0.87	0.87	0.87	0.87	0.87	0.87
Accelerator	OFF	OFF	OFF	OFF	OFF	OFF
Engine (rpm)	1200	1200	1200	1200	1200	1200

<b>Frontal Crash Page 0</b>	
Max delta-Vx	34.8 (mph) <sup>6</sup>
TGR Counter	1 (times)

<sup>3</sup> Presumed to mean Trigger

<sup>4</sup> Presumed to mean Adult Male 50<sup>th</sup> percentile

<sup>5</sup> Presumed to indicated rearward

<sup>6</sup> Maximum Post-crash Delta-V occurred at 200 ms

Previous Event	No Event
Linked Pre-Crash Date Page No.	Page 0
Time from Pre-Crash to TGR	0 ms
Frontal AB Deployment Time	97 ms
Pretensioner Deployment Time	96 ms
Deployment Stage Driver	High
Deployment Stage Passenger	Ex Low
Writing Flag for Frontal Crash	Finished Writing

### Frontal Crash Page 1 - No data

<b>Side Crash Page 0</b>	
Post-Crash Data (Vel Chg) B-Pillar	-2.6 (mph) at 73 ms <sup>7</sup>
Post-Crash Data (Vel Chg) C-Pillar	0.3 (mph) at 65 ms
Post-Crash Data (Vel Chg) Floor	-0.9 (mph) at 69 ms
TGR Counter	1 (times)
Previous Event	No Event
Linked Pre-Crash Date Page No.	Page 1
Time from Pre-Crash to TGR	0 (ms)
Deployment Time (B-Pillar)	Not Fired
Deployment Time (C-Pillar)	Not Fired
Deployment Side	Driver's side
Writing Flag for Side Crash	Finished Writing

### Side Crash Page 1 - No data

#### *Techstream Data*

During the vehicle inspection, Toyota technicians attempted to image techstream data from the vehicle. Due to damage, not all the data was available. A total of six Diagnostic Trouble Codes (DTSs) were detected. Three of the codes (B1423, B1442, and B1443) were related to the air conditioning system. DTC B1780 is recorded when a malfunction is detected in the front occupant

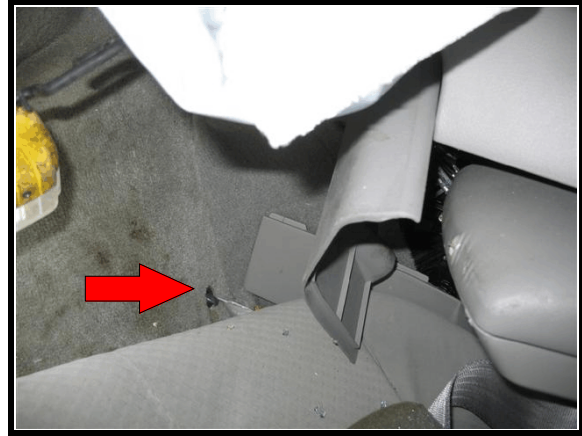
---

<sup>7</sup> Velocity Changes for B-pillar, C-pillar, and Floor represent the maximum recorded values

classification sensor LH circuit. DTC 1790 is recorded when a malfunction is detected in the center air bag sensor communication circuit. DTC 1330 is recorded when there is an open circuit in the right front speed sensor circuit. The speed sensor detects a wheel speed and sends the appropriate signals to the ECU. These signals are used to control the ABS and VSC system.

### ***Floor Mat/Foot Controls***

An original equipment manufacturer (OEM) floor mat was installed and was held in place by the retaining clips (**Figure 13**). The floor mat consisted of a carpeted top side and a textured rubber under side. The floor mat was contoured to fit within the left floor pan. Prior to the vehicle inspection, the forward portion of the mat had been pulled away by the police from toe pan area to access the foot controls. This vehicle was not equipped with an all-weather type mat. According to ODI the 90L recall (possible floor mat replacement) was not performed.



**Figure 13.** Floor mat retaining clip

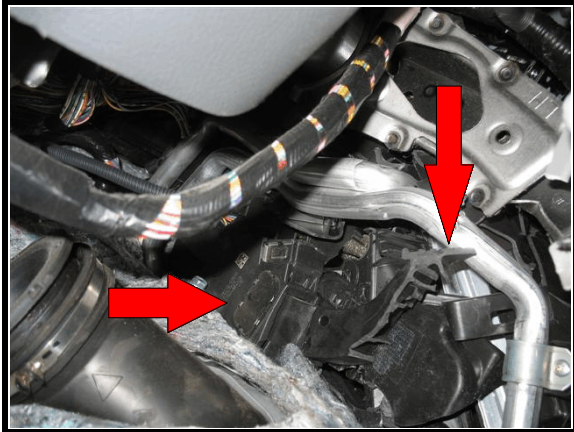
The accelerator pedal was manufactured by CTS and was inspected for damage and unusual wear patterns and none were observed (**Figure 14**). The pedal had been broken by the police during their examination effort as stated on page 6 of this report. The accelerator body had been displaced upward and to the right by the frontal and undercarriage impacts with the rock embankment (**Figure 15**). The pedal was manipulated by hand. The movement forward and back was smooth and there were no impingements. According to ODI the AOA recall (accelerator pedal steel reinforcement) was performed on February 4, 2010.



**Figure 14.** Accelerator pedal

The throttle was examined and the butterfly valve was found in the closed position. The valve moved freely by hand.

The brake pedal was restricted by the intruding toe pan and could not be operated (**Figure 16**). Mechanics were, however, able to by-pass the pedal and put pressure on the linkage behind the pedal. When pressure was applied they were able to restrict the movement of the rear tires. The front tires were not tested in this way.



**Figure 15.** CTS accelerator pedal body. Side arrow shows metal tab associated with CTS pedal. Down arrow shows where the pedal assembly had been broken away.



**Figure 16.** Overview of floor and brake

All the wheels were removed from the vehicle and the disc brakes were examined (**Figures 17-20**). The rotor wear did not appear unusual. The right front rotor did exhibit scoring and discoloration differences when compared to the left front. The police reported that the right front brake rotor appeared to have brake pad resin build-up on the outer surface as well as heat transfer indications on the top of the rib of the inside (length of pad). They stated that these may be indicators that the right front brake was heavily used at the time of the crash. Based on the EDR and scene evidence obtained during the SCI investigation, there were no indications of brake usage.



**Figure 17.** Left front brake rotor



**Figure 18.** Right front brake rotor



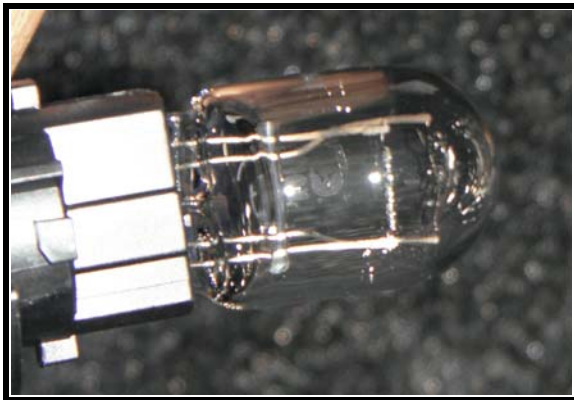


**Figure 19.** Left rear brake rotor

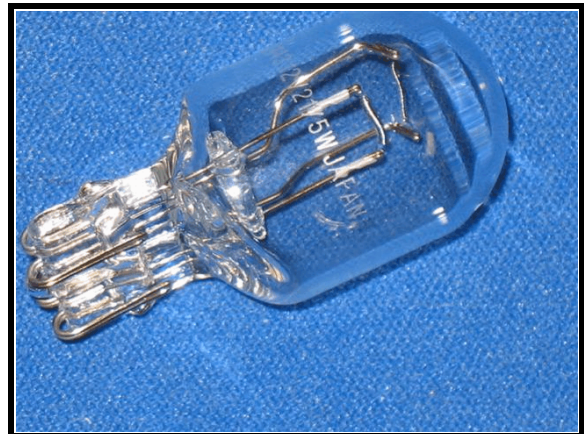


**Figure 20.** Right rear brake rotor

During the mechanical inspection, the police investigators removed and photographed the vehicle tail light lamps (**Figure 21**). The vehicle was equipped with two-filament lamps. The smaller of the two filaments is for the tail lights and the larger (lower) filament is for brake lights, turn signals or a combination of both. If the filaments are incandescent or hot at impact it will stretch out, uncoil, or break. The result deformation is called “hot shock”. There were no indications of hot shock when the photographed lamps were compared to an exemplar lamp (**Figure 22**).



**Figure 21.** Left rear tail light lamp from subject vehicle (police photo)



**Figure 22.** Exemplar tail light lamp

## 2008 TOYOTA CAMRY OCCUPANTS

### *Driver Demographics*

Age/Sex:	66 years/Male
Height:	183 cm (72 in)
Weight:	162 kg (358 lbs)
Eyewear:	Unknown
Seat Type:	Bucket
Seat Track Position:	Between middle and rear most position
Manual Restraint Usage:	Lap and shoulder belt
Usage Source:	Vehicle inspection, EDR report

Air Bags: Frontal air bag and knee air bag deployed. Side IC and seat-mounted side air bags did not deploy.

Alcohol/Drug Involvement: None

Egress from Vehicle: Remained in vehicle

Transport from Scene: Declared deceased at scene

Medical Treatment: EMS effort on site

### ***Driver Injuries***

<b>Inj. No.</b>	<b>Injury</b>	<b>AIS 2005/08</b>	<b>Injury Source</b>	<b>Confidence Level</b>
1	Head injury	100999.9,0	Unknown	Unknown

*Source: Certificate of death*

### ***Driver Kinematics***

The 66-year-old male was seated in an unknown posture and was wearing the manual 3-point lap and shoulder belt. The seat was between middle and rear most track position and the seat back position was unknown. The driver was actively steering but the positions of his feet are unknown. There were statements from other occupants of the vehicle that he was braking but there were no skid marks or EDR data to support their statements. Based on the EDR and scene data it is this investigator's opinion that the driver was not braking. As the vehicle approached the end of the off-ramp and the intersection the driver may have tried to steer to the right in order to avoid collision with two vehicles stopped at the intersection. The vehicle crossed through the intersection and impacted the curb with the two front tires. The driver was displaced minimally. After crossing the sidewalk the vehicle impacted a rock embankment with its front end. At impact with the embankment the driver's frontal air bag and knee air bag deployed and the safety belt pretensioners actuated. The driver was displaced forward, contacted the deployed air bags, and loaded the safety belt. The vehicle then impacted the curb with the rear tires and ascended the rock embankment. The driver likely moved downward into the seat cushion and the undercarriage of the vehicle contacted the rock embankment. The driver was declared deceased at the scene. According to the certificate of death, the cause of death was due to head injuries. No autopsy was conducted.

### ***Front Right Occupant Demographics***

Age/Sex: 61 years/Female

Height: 170 cm (67 in)

Weight: 95 kg (209 lbs)

Eyewear: Unknown

Seat Type: Bucket

Seat Track Position: Between middle and rear most track position

Manual Restraint Usage: Lap and shoulder belt used

Usage Source: Vehicle inspection and EDR report

Air Bags: Frontal air bag deployed. Side IC and seat-mounted side air bags did not deploy.

Alcohol/Drug Involvement: None reported

Egress from Vehicle: Emergency personnel

Transport from Scene: Ground ambulance

Medical Treatment: Hospitalized for six days

***Right Front Occupant Injuries***

<b>Inj. No.</b>	<b>Injury</b>	<b>AIS2005/08</b>	<b>Injury Source</b>	<b>Confidence Level</b>
1	Left, open comminuted moderately displaced segmental fracture of the distal tibia diaphysis of with apex anteriomedial angulation	854272.3,2	Center console	Probable
2	Left, rib fractures 2-6	450203.3,2	Seat belt webbing	Certain
3	Left, open comminuted fracture of fibular head which extends into the proximal tibial fibular articulation	854462.2,2	Center console	Probable
4	Left, comminuted fracture of the distal fibular diaphysis with apex anteriomedial angulation	854471.2, 2	Center console	Probable
5	Sternal fracture	450804.2,4	Seat belt webbing	Probable
6	L1 right transverse process avulsion fracture	650620.2,8	Seat cushion	Probable
7	Small right pleural pneumothorax	442202.2,1	Seat belt webbing	Possible
8	Chest wall abrasion	410202.1,9	Seat belt webbing	Probable
9	Corneal abrasion, right	240602.1,1	Passenger air bag	Probable
10	Abrasion, right neck	310202.1,1	Seat belt webbing	Certain
11 12	Abrasion right shoulder and waist	710202.1,1 510202.1,9	Seat belt webbing	Certain
13	Laceration, tip of tongue	243400.1,8	Impact forces	Probable

	Bibasilar subsegmental dependent atelectasis	(not codeable) <sup>8</sup>		
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Source: Emergency room report, discharge summary, radiology report, operative report.

### ***Right Front Occupant Kinematics***

The 61-year-old female was seated in an unknown posture and was wearing the manual 3-point lap and shoulder belt. The seat was between middle and rear most track position and the seat back position was unknown. The vehicle crossed through the intersection and impacted the curb with the two front tires. This occupant was displaced minimally and, after crossing the sidewalk, the vehicle impacted a rock embankment with its front end. At impact with the embankment the front right occupant's frontal air bag deployed and the safety belt retractor pretensioner actuated. The front right occupant was displaced forward, contacted the deployed air bag, and loaded the safety belt causing abrasions to her neck, shoulder, and chest. She also sustained multiple rib fractures from seat belt loading. She sustained a tongue laceration from impact forces and an L1 fracture from the seat cushion. During the embankment impact, her left lower leg contacted the center console and she sustained an open, comminuted tibia/fibula fracture. The vehicle then impacted the curb with the rear tires and ascended the rock embankment. This occupant likely moved downward into the seat cushion and the undercarriage of the vehicle contacted the rock embankment. She was removed from the vehicle by fire personnel and was transported from the scene to a local airport where she was then transported by air to a Level 1 trauma center. She arrived with a Glasgow Coma Score (GCS) of 15 and was hospitalized for six days.

### ***Second Row Left Occupant Demographics***

Age/Sex:	38 years/Female
Height:	168 cm (66 in)
Weight:	70 kg (155 lbs)
Eyewear:	Unknown
Seat Type:	Split bench with folding back
Seat Track Position:	N/A
Manual Restraint Usage:	Lap and shoulder belt not used
Usage Source:	Vehicle inspection
Air Bags:	Side IC air bag did not deploy.
Alcohol/Drug Involvement:	None reported
Egress from Vehicle:	Removed by EMS personnel
Transport from Scene:	Ground ambulance, helicopter
Medical Treatment:	Hospitalized and died seven hours post-crash

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<sup>8</sup>Diminished volume affecting all or part of lung. Source: <http://emedicine.medscape.com>

***Second Row Left Occupant Injuries***

<b>Inj. No.</b>	<b>Injury</b>	<b>AIS2005/08</b>	<b>Injury Source</b>	<b>Confidence Level</b>
1	Traumatic brain injury	100099.9,0	Roof side rail	Probable

*Source: Certificate of death*

***Second Row Left Occupant Kinematics***

The 38-year-old female was seated in an unknown posture and was not wearing the manual 3-point lap and shoulder belt. The vehicle crossed through the intersection and impacted the curb with the two front tires. This occupant was displaced minimally and, after crossing the sidewalk, the vehicle impacted a rock embankment with its front end. This occupant was displaced forward out of her seat and slightly left. Her head contacted the left roof side rail aft of the B-pillar and the driver's seat back. She was probably displaced minimally as the vehicle's rear tires impacted the curb. Her final rest location in the vehicle is not known. She was removed from the vehicle by fire personnel. She was breathing but did not respond to police questions. She was transported from the scene initially by ground ambulance and then helicopter to a Level 1 trauma center. She was declared deceased at 0112 hours the following day, seven hours post-crash. According to the certificate of death, the cause of death was cardiopulmonary arrest due to traumatic brain injury. No autopsy was conducted.

***Second Row Right Occupant Demographics***

Age/Sex: 34 years/Male  
 Height: 193 cm (76 in)  
 Weight: 122 kg (269 lbs)  
 Eyewear: Unknown  
 Seat Type: Split bench with folding back  
 Seat Track Position: N/A  
 Manual Restraint Usage: Lap and shoulder belt not used  
 Usage Source: Vehicle inspection  
 Air Bags: Side IC air bag did not deploy  
 Alcohol/Drug Involvement: None reported  
 Egress from Vehicle: Under own power with some assistance  
 Transport from Scene: Ground ambulance  
 Medical Treatment: Treated and released

***Second Row Right Occupant Injuries***

<b>Inj. No.</b>	<b>Injury</b>	<b>AIS2005/08</b>	<b>Injury Source</b>	<b>Confidence Level</b>
	Pain, left foot and lower back	Not codeable		

*Source: Discharge summary and radiology reports*

***Second Row Right Occupant Kinematics***

The 34-year-old male was seated in an unknown posture and was not wearing the manual 3-point lap and shoulder belt. The vehicle crossed through the intersection and impacted the curb with the

two front tires. This occupant was displaced minimally and, after crossing the sidewalk, the vehicle impacted a rock embankment with its front end. At impact with the embankment he was displaced forward and to the left and contacted the backs of the front seats and probably the back of the center console. He was probably displaced minimally as the vehicle's rear tires impacted the curb. His final rest location in the vehicle is not known. He was transported from the scene to a local airport where he was then transported by air to a Level 1 trauma center. He arrived with a GCS of 15 and denied any loss of consciousness. He complained of pain to his left foot and lower back. A FAST exam and X-rays did not reveal any injuries. He was discharged at 2258 hours, approximately five hours post-crash.

Attachment 1. Scene Diagram

