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# Special Crash Investigations On-Site Air Bag Non-Deployment Crash Investigation Vehicle: 2006 Toyota Scion tC Location: Florida Crash Date: May 2017

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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 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 vehicles or their safety systems.

This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.

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**SPECIAL CRASH INVESTIGATIONS**
**CASE NO: CR17015**
**OFFICE OF DEFECTS INVESTIGATION**
**ON-SITE ALLEGED AIR BAG NON-DEPLOYMENT CRASH INVESTIGATION**
**VEHICLE: 2006 TOYOTA SCION tC**
**LOCATION: FLORIDA**
**CRASH DATE: MAY 2017**

## BACKGROUND

An on-site investigation of the driver's seat belt system and the non-deployment of the air bag systems in a 2006 Toyota Scion tC coupe (**Figure 1**) during an extended rollover crash. Further interest was the fatality of the Scion's belted 20-year-old female driver and incapacitating injuries to the belted 20- year-old female front row right occupant. The crash occurred as the Scion traveled northbound on a divided roadway. At the onset of a sweeping right curve, the Scion departed the roadway into the median, yawed across a median crossover at an intersection, and initiated a right side-leading, multiple quarter-turn rollover sequence over an extended distance. Notification of the crash was provided to the National Highway Traffic Safety Administration in May 2017, by the family of the deceased driver. The individual providing notification reported that the driver's seat belt retractor did not lock and that none of the Scion's supplemental restraint systems (including pretensioner systems and air bags) actuated/deployed in the crash. NHTSA's Crash Investigation Division (CID) assigned an on-site investigation to the Special Crash Investigations (SCI) team at Crash Research & Analysis, Inc., in June 2017. Through the course of this investigation, it was determined that the involved Scion was equipped with front seat belt retractor pretensioners, driver and passenger frontal air bags, and a driver knee air bag. None of these devices actuated/deployed in the crash due to the lack of a sufficient longitudinal deceleration during the crash sequence. The Scion was not equipped with rollover protection (inflatable curtain air bags) or side-impact protection (front seat-mounted air bags). There were no anomalies identified concerning the driver's seat belt system.

**Figure 1:** Front left oblique view of the 2006 Toyota Scion tC at the time of the SCI inspection.

The on-site portion of this investigation occurred in June 2017. This included an inspection of the Scion at the vehicle salvage facility where it was located, which consisted of the documentation and measurement of the vehicle's exterior and interior damage, occupant compartment intrusion, identification of points of occupant contact, and an assessment of the manual and supplemental restraint systems.

Although the Scion was equipped with an air bag control unit (ACU), the ACU had been removed by the investigating law enforcement agency prior to the SCI vehicle inspection. The Scion's ACU had event data recorder (EDR) capabilities. The SCI investigator was unable to access the ACU as it was retained by the law enforcement agency as evidence. However, an electronic (PDF) copy of the imaged data report was obtained for analysis. After inspecting the vehicle, the SCI investigator documented the physical environment of the crash site and interviewed several family members of the driver and front right occupant.

## CRASH SUMMARY

### *Crash Site*

The crash occurred on a north/south divided roadway during nighttime hours. Law enforcement documentation reported clear skies and dry roadway surfaces, with dark and unlighted conditions. According to the National Weather Service, conditions at the time of the crash in the rural locale included partly cloudy skies with a temperature of 25.6 °C (78 °F), 74 percent relative humidity, and 20.4 km/h (12.7 mph) southerly winds. A Nikon Nivo 5.M+ total station was used to document the physical environment of the roadway and crash site during the SCI inspection.

Both the northbound and southbound portions of the divided roadway consisted of two travel lanes. For the Scion's northbound trajectory (**Figure 2**), the left lane was 3.5 m (11.5 ft) wide and the right lane was 3.8 m (12.5 ft) wide. A 1.6 m (5.2 ft) wide shoulder supported the outboard (right) travel lane, while a 0.4 m (1.2 ft) wide shoulder bordered the travel lanes on the median side. The median itself was a depressed grass swale that measured approximately 7.5 m (24.6 ft) wide and was 46 cm (18 in) deep on average. The travel lanes were delineated by a single dashed-white dividing line, single solid-yellow median line, and a single solid-white fog line. Speed was regulated by a posted limit of 97 km/h (60 mph).

**Figure 2:** Northbound trajectory view of the Scion in the area of the crash.

In the area of the crash, the divided roadway curved to the northeast and was intersected from the northwest by a two-lane local roadway. The radius of curvature measured approximately 840 m (2,756 ft). A median crossover with 3.5 m (11.5 ft) wide left turn lanes served the intersection. Within the median on the south side of the intersection was a concrete basin/storm drain. The dimensional center of the basin was located 11.7 m (38.4 ft) south of the tip of the median at the intersection crossover. The level of the basin was approximately 61 cm (24 in) below the level of the roadway surface. Within the tip of the median crossover was a yield sign to control northbound left turning traffic, as well as a white polymer delineator marker. A crash diagram is included at the end of this report.

***Pre-Crash***

Two 20-year-old females occupied the Scion as they traveled toward a residence where one of them lived, located off the local roadway that intersected the multi-lane divided roadway. Both occupants were familiar with the locale. The driver operated the Scion northbound in the left lane of the multi-lane divided roadway. She continued along the straight and level section of roadway as the vehicle approached the sweeping right curve and intersection with the local roadway. The driver's route of travel should have caused her to slow the vehicle, negotiate the onset of the right curve, merge left into the turn lane, and then turn left at the intersection. However, she instead maintained her travel speed on a straight trajectory. The Scion departed the left roadway edge and entered the grass median in advance of the left turn-only lane.

This errant trajectory was evidenced by tire marks documented by the investigating law enforcement agency following the crash. The tire marks initiated a sweeping right trajectory along the curvature of the median, indicative that the driver recognized the Scion's errant trajectory as it began to traverse the median and had steered to the right. She maintained a consistent steering input that kept the Scion in a tracking attitude as in continued along the right curvature of the median. The Scion continued on an arching northbound trajectory through the median for approximately 130 m (427 ft) from the location of initial roadside departure.

***Crash***

The first crash event occurred as the Scion's left tires overrode the concrete basin within the median. Engagement of the left tires/wheels with the concrete form was of sufficient magnitude to induce a counterclockwise rotation to the Scion. Data imaged from the Scion's EDR indicated that although the impact was likely recognized as a crash trigger by the vehicle's ACU, it was not of sufficient magnitude to actuate/deploy supplemental restraint devices. Based on tire marks on the concrete basin observed during the SCI crash site inspection, it is also possible that the impact deflated at least one of the Scion's left tires.

The Scion maintained a northbound trajectory through the median on approach to the intersection crossover as it began to yaw counterclockwise. The second and third crash events occurred in close proximity as the left front corner aspect of the Scion lightly struck the non-breakaway post of the yield sign (Event #2) and the non- breakaway polymer delineator post (Event #3). These impacts were of insufficient magnitude to affect or otherwise alter the Scion's trajectory. **Figure 3** depicts the Scion's tire marks and the impacted objects at the time of the SCI crash site inspection.

**Figure 3:** Location of the Scion's first, second, and third crash events along its errant northbound trajectory.

The Scion entered the median crossover of the intersection from the south and maintained an increasing counterclockwise yaw. As it continued to the north, the counterclockwise rotation was likely accentuated by a left steering input from the driver as she attempted to steer the vehicle. While crossing the 40 m (131 ft) wide intersection crossover, the Scion achieved a right side-leading attitude and approached the roadway edge of the crossover.

**Figure 4:** North-facing view of gouge marks within the median that evidenced the Scion's rollover trajectory.

An abrupt instability was created as the Scion's right side tires transitioned from the asphalt intersection crossover and furrowed into the soft soil/vegetation surface on the edge of the roadway. This tripped the vehicle into a rapid right side-leading rollover sequence. The Scion rolled an uninterrupted minimum of 16 quarter-turns through the median and into the southbound portion of the roadway. Gouge marks in the median (**Figure 4**) evidenced the Scion's rolling trajectory. The vehicle ultimately came to final rest facing west and on its wheels within the center of the southbound lanes, approximately 60 m (197 ft) north of the initial trip point.

***Post-Crash***

The local emergency response system received multiple communications reporting the crash and dispatched firefighting, emergency medical, and law enforcement personnel to the scene. The first arriving law enforcement officer found the driver unresponsive and the front row right occupant disoriented. Emergency response personnel used hydraulic rescue tools to force both of the Scion's doors open. The occupants were removed from the vehicle and transported by ambulances to a local hospital for treatment of police-reported incapacitating (A-level) injuries. The driver succumbed to her injuries and was pronounced deceased 17 hours after the crash.

Following the law enforcement's on-scene investigation, the Scion was removed from the crash site and towed to a local tow yard. It was later transferred to the insurance vehicle salvage facility where it was located at the time of the SCI inspection.

**2006 TOYOTA SCION tC**

***Description***

The 2006 Toyota Scion tC was a two-door coupe manufactured in April 2006, identified by the Vehicle Identification Number JTKDE177960xxxxxx. Its electronic odometer reading could not be obtained during the SCI vehicle inspection due to electrical system inoperability. The front-wheel drive Scion was powered by a 2.4 L, inline four-cylinder gasoline engine. It was equipped with a center-console-mounted shift lever for its four-speed automatic transmission.

**Figure 5:** Front right oblique view of the 2006 Toyota Scion at the time of the SCI vehicle inspection.

The Scion (**Figure 5**) had a 270 cm (106.3 in) wheelbase with a gross vehicle weight rating (GVWR) of 1,789 kg (3,945 lb). The front and rear gross axle weight ratings (GAWR) were 966 kg (2,130 lb) and 832 kg (1,835 lb), respectively. Its curb weight was 1,347 kg (2,970 lb). The vehicle manufacturer's recommended tire size was P215/45ZR17, with recommended cold tire pressures of 220 kPa (32 PSI) for the front tires and 200 kPa (29 PSI) for the rear. At the time of the SCI inspection, the Scion was equipped with Primewell Valera Sport tires of the recommended size at the left front and left rear positions, with matching Tire Identification Numbers of 9ULR 00A. Although both were flat, neither was restricted. The right front and right rear wheels were separated from the Scion, and the corresponding tires were missing.

The Scion's interior was configured for the seating of up to five occupants. The driver and front right seats were cloth-surfaced, forward-facing bucket seats with adjustable head restraints and manual seat track/seatback recline adjustments. At the time of the SCI inspection, the driver's seat was adjusted to a position between middle and rear, while the front right seat was adjusted to a forward-third position. The driver's head restraint was fully down, while the front right was adjusted 0.8 in (2 cm) upward. The second row of the Scion consisted of a non-adjustable, three-passenger bench seat. The seat track and seatback were fixed in position, and there were adjustable head restraints available for each position. All seat positions within the Scion were equipped with 3-point lap and shoulder seat belt systems, as are described in the *Manual Restraint Systems* section of this report on **Page 10**. The vehicle was also equipped with a supplemental restraint system that included frontal air bags and front seat belt pretensioners, which are described in the *Supplemental Restraint Systems* section of this report.

### *Vehicle History*

A commercially-available vehicle history report was obtained from an independent company that used registration and reported title information. According to this history report, the Scion had a total of four separate owners during its history.

Records indicated that the vehicle had remained registered in Florida and Georgia for its lifetime. The most recent ownership period had begun in 2016 for approximately 7 months leading up to the date of the crash. At the time of the last ownership transfer in October 2016, the Scion's reported odometer reading was 159,222 km (98,936 mi). The most recent reported odometer reading was 165,125 km (102,604 mi) in March 2017, when routine maintenance service was performed at an authorized dealership.

***Exterior Damage***

All planes of the Scion exhibited damage from the multiple event, multiple quarter-turn rollover crash. Any damage associative to the first impact events with the concrete drainage basin, yield sign, and polymer delineator post was masked by the subsequent severe rollover sequence. The Collision Deformation Classification (CDC) assigned to the Scion for the Event 1 impact was 00UDLU99. Impacts with the non-breakaway yield sign post and polymer delineator post (Events 2 and 3) were masked and overlapped by the severe rollover event. Based on tire marks within the median visible at the time of the SCI crash site inspection, the Event 2 impact was located at the rear aspect of the Scion's left plane and the Event 3 impact was located in the center aspect of the left plane. Associated forces were estimated to be within the 12 o'clock sector for both impacts. The CDC's assigned for Events 2 and 3 were 12LBES1 and 12LPES1, respectively.

Damage from the rollover event was present on all planes of the Scion. The front bumper fascia, bumper filler, grille, both headlights, and surrounding components were completely separated from the Scion's front plane. A visual inspection of the exposed bumper beam revealed that there was no discernable longitudinal deformation to the bumper beam or surrounding front plane structure of the vehicle.

The left front fender displayed slight lateral crush, with at least two patterns of overlapping abrasions. Evidence indicated that the left front door remained closed during the crash sequence, but was forced open by the emergency response personnel to facilitate medical removal of the driver. The side mirror was fractured from its stalk and hung by its wires, but the exterior surface of the left door was largely unscathed. A pattern of abrasions was visible on its concave surface, with two distinct patterns of overlapping abrasions visible at sill level. The top of the left door frame was deflected inward. Along the left roof side rail, the SCI investigator distinguished at least three distinct patterns of abrasions. There was corresponding vertical and lateral crush to the side rail and left pillars. Severe vertical and lateral crush was apparent to the left quarter panel/fender and left C-pillar (**Figure 6**).

**Figure 6:** Left plane damage and rollover crush to the Scion's left roof side rail and left C-pillar.

On the back plane, the rear bumper fascia, bumper filler, and surrounding body panels were completely separated from the Scion. Both taillight assemblies were disintegrated. The trunk/hatch was severely crushed in a vertical fashion, biased to the left side. The exposed rear bumper beam had no discernable longitudinal deformation.

On the right plane of the Scion, both right side wheels were fractured and the tires were missing. The rear quarter panel was slightly buckled, with minor surface scratches/abrasions. The exterior panel was missing from the right door, and the upper aspect of the door frame was bent outward from the vehicle (**Figure 7**). The right side mirror was fractured from its mount and separated from the vehicle. At least four distinct patterns of abrasions were visible along the right roof side rail, with minor vertical and lateral deformation. Minor deformation was also observed to the right front fender.

**Figure 7:** Right plane damage to the Scion.

Top plane damage to the Scion consisted of vertical deflection of the windshield header and center roof support. The sunroof glazing frames were deformed and partially separated from the vehicle. Vertical rollover crush was apparent to the backlight header and left rear aspect of the roof. There was no significant damage to the top surface of the hood. **Figures 8 and 9** depict the rollover damage to the Scion from an overhead perspective.

**Figure 8:** Front overhead view of the Scion from a front perspective.

**Figure 9:** Rear view of the Scion's top plane and visible rollover damage from a rear perspective.

Maximum vertical magnitude of the rollover crush measured 35 cm (13.8 in), located at the left C-pillar/left rear quarter panel area above the left rear axle position. This was also the location of the maximum lateral deformation, which measured 25 cm (9.8 in) in magnitude. Based on the SCI reconstruction of the crash, the Scion completed a minimum of 16 quarter-turns, uninterrupted, during the rollover sequence. The total distance of the rollover measured approximately 60 m (197 ft). The CDC assigned to the Scion for the damage associated with the rollover was 00TDDO5. No delta-V calculations could be performed for any of the impacts because their dynamics were beyond the scope of the WinSMASH program.

***Event Data Recorder***

The 2006 Toyota Scion tC was equipped with an air bag control unit (ACU) that was mounted to the floor on the center tunnel, beneath the center console. The ACU monitored the diagnostic functions of the vehicle's restraint systems (air bags and seat belt pretensioners) and controlled the deployment/actuation of those devices dependent upon crash event trigger severity. The ACU also had EDR capabilities to record crash event data for longitudinal crash events.

At the time of the SCI vehicle inspection, the Scion's ACU had been removed by the investigating law enforcement agency following the crash and retained as evidence. It was imaged and read by the law agency using the Bosch Crash Data Retrieval (CDR) software and tool, version 16.3, via a direct-to-module connection in a controlled environment. Because the module remained in the agency's evidence log, the SCI investigator was unable to image any data from the ACU. The investigating law enforcement agency provided the SCI investigator with an electronic (PDF) file of the imaged ACU data, a sanitized version of which is included at the end of this technical report as **Appendix A**.

The Scion's EDR could store up to two crash event records, termed either "Non-Deployment Trigger Event," "Air Bag Deployment Event," and/or "Non-Air Bag Deployment Event." By definition, a non-deployment trigger event was any event that met the recording threshold, but did not result in the deployment/actuation of any safety device. An air bag deployment event deployed inflatable restraints and actuated the seat belt pretensioner systems. Non-air bag deployment event types were those that met actuation/deployment threshold, but did not result in air bag deployment or pretensioner actuation.

Non-deployment trigger event types were subject to overwrite by subsequent events of greater severity or typing, whereas air bag deployment and non-air bag deployment event types could not be overwritten. If power supply to the ACU was lost following a crash event, all or part of the data may not have been recorded to the EDR's memory. The Scion's EDR had the capacity to record up to three pages (triggers) for front/rear event types. Because it was not equipped with side impact or rollover restraint devices, it was not capable of recognizing or recording those trigger types.

The imaged data contained three events, all identified as front/rear trigger types. These events were termed "Most Recent," "1st Prior," and "Prior." Respectively, they were identified as trigger counter numbers 13, 12, and 9. There were no diagnostic trouble codes (DTCs) present at the time of data imagery. Event recording was complete, and no freeze signal had been issued. This meant that the recorded data was not locked to memory and was capable of being overwritten by future events. All three recorded events were non-deployment event types. The status of the driver and front passenger's seat belt switch was recorded as "buckled" for all the recorded events. There was no pre-crash buffer data.

The recorded events all occurred within several seconds. Triggers 10 and 11 had been overwritten by triggers 12 and 13. An analysis of the time interval data indicated that at least triggers 8, 9, 10, 11, 12, and 13 were related to the crash. No conclusions concerning triggers 1 through 7 could be drawn. There were 920 milliseconds between triggers 8 and 9, unknown time intervals between both 9 and 10 and between 10 and 11, 640 milliseconds between 11 and 12, and 980 milliseconds between 12 and 13. Recorded maximum longitudinal delta-V data is included in the following chart.

| TRG Number | Delta-V | Time Interval |
|---|---|---|
| 13 | -1.6 km/h (-1.0 mph) | 20 milliseconds |
| 12 | 3.4 km/h (2.1 mph) | 40 milliseconds |
| 9 | -16.5 km/h (-10.3 mph) | 150 milliseconds |

The SCI investigator concluded that trigger counter number 9 most likely corresponded to SCI Event 1 of the crash (impact with the concrete drainage basin). It is likely that many, if not all, of the overwritten event triggers (1 to 7) were artifacts related to the undulation of the vehicle during its extended off-road pre-crash trajectory through the median. The SCI investigator further concluded that triggers 12 and 13, the "Most Recent" and "1st Prior" events, probably were ground contact during the multiple quarter-turn rollover event.

***Interior Damage***

The interior of the Scion was inspected for crash-related damage and occupant contact. However, the more than two-month passage of time since the date of the crash and the open exposure of the vehicle's interior to the elements masked any physical evidence of occupant contact that may have existed. The SCI investigator was able to identify probable occupant loading to the left door panel by the driver's left flank and to the left roof side rail by the driver's head. Also discernable was probable occupant loading to the right door panel by the front row right occupant's right flank and to the right roof side rail by the front row right occupant's head. The SCI investigator attempted to photograph these probable contacts using yellow masking tape to highlight areas of focus, but the tape would not stick to the dirty surfaces inside the vehicle in such humid weather. **Figures 10 and 11** depict the occupant door loading to the Scion.

**Figure 10:** Driver loading to the Scion's left front door.

**Figure 11:** Front right occupant loading to the right door.

Both of the Scion's doors remained closed and became jammed shut by deformation associated with the crash. They were forced open by emergency response personnel using hydraulic rescue tools. All the Scion's side, roof, and backlight glazing had disintegrated during the crash sequence. The windshield glazing completely fractured from crash forces, but remained in place after the vehicle came to final rest. It was removed from the vehicle post-crash.

Significant intrusion into the occupant compartment of the Scion was documented associative to the multiple quarter-turn rollover event. The greatest deformation was located at the left rear aspect of the Scion, in the area of the left C-pillar, left roof side rail, and backlight header. The Scion's occupant compartment intrusions were documented as follows.

| Component | Magnitude | Direction |
|---|---|---|
| Left roof side rail @ 2,1 | 20 cm (7.9 in) | Vertical |
| Left roof side rail @ 2,1 | 15 cm (5.9 in) | Lateral |
| Windshield header @ 1,3 | 10 cm (3.9 in) | Vertical |
| Left C-pillar @ 2,1 | 24 cm (9.4 in) | Vertical |
| Left C-pillar @ 2,1 | 21 cm (8.3 in) | Lateral |
| Backlight header @ 2,1 | 19 cm (7.5 in) | Vertical |
| Left B-pillar @ 1,1 | 13 cm (5.1 in) | Lateral |
| Right roof side rail @ 1,3 | 7 cm (2.6 in) | Lateral |

Despite the significant intrusions at the second row, occupant compartment space for the front row positions was largely unaffected by the intrusions (**Figure 12**). However, the seatback of the second row left position was deformed as the left rear roof and C-pillar structure engaged the seatback (**Figure 13**).

**Figure 12:** Crossing view of the Scion's front row at the time of the SCI vehicle inspection.

**Figure 13:** Deformed seat at the second row left position of the Scion.

### *Manual Restraint Systems*

The Scion was equipped with 3-point lap and shoulder seat belt systems for all five seat positions. Both the driver's and front right occupant's seat belt systems used continuous loop webbing with sliding latch plates, and were fixed height at their respective B-pillar-mounted D-ring positions. The driver's seat belt system retracted onto an emergency locking retractor (ELR), while the front right seat belt used an ELR/automatic locking retractor (ALR). Both were equipped with retractor pretensioners, neither of which was actuated.

At the time of the SCI vehicle inspection, the driver's seat belt system was cut in two locations that created three separate sections. The first section remained attached to the lower anchor and measured 43 cm (16.9 in) in length. There was no visible loading evidence on the webbing of the lower anchor section. A free-floating section created by the two cut locations measured 123 cm (48.4 in) long. It contained the sliding latch plate, which had loading evidence from the webbing visible within the belt path (**Figure 14**). The free-floating section of the webbing was covered in dust, mold, and dirt residue, which prevented the SCI investigator from discerning specific loading patterns on the webbing (**Figure 15**).

**Figure 14:** Loading evidence within the belt path of the driver's latch plate in the Scion.

**Figure 15:** View of the cut driver's seat belt system within the Scion at the time of the SCI inspection.

The final section was retracted into the B-pillar and spooled onto the retractor. The SCI investigator extended the webbing from the retractor for examination. There was no visible loading evidence on the final section of webbing. However, it was determined that the location of the cut was between the D-ring and retractor, such that this section of webbing was likely not exposed to a form of loading that would be expected to be visually evident. Attempts by the SCI investigator to rapidly spool webbing from the retractor engaged its speed-sensitive mechanism. There was no evidence to suggest that the ELR mode of the retractor did not function as designed. While in the process of extending the final portion of webbing for photographic documentation, the webbing slipped from the SCI investigator's grasp and entirely retracted such that the SCI investigator was unable to retrieve it.

Based on the post-crash condition of the driver's seat belt system as observed by the SCI investigator, it was apparent that the driver was belted at the time of the crash. This conclusion was supported by the data imaged from the Scion's EDR. There was no anomaly of the seat belt system detected or evidence to suggest malfunction of the seat belt system during the crash. No evidence was found by the SCI investigator to support the allegation concerning the driver's seat belt system made by the person who reported the crash.

The front right occupant's seat belt system remained functional and was loosely stowed against the B-pillar. The webbing was clean, and it spooled freely from and loosely retracted into the ELR/ALR retractor. A nearly 85 cm (33.5 in) length of the webbing was waffled ("cupped") from occupant loading, beginning 100 cm (39.4 in) above the lower anchor. There was corresponding heavy loading evidence visible within the belt path of the front right passenger's latch plate (**Figure 16**). Based on the post-crash condition of the front passenger's seat belt system at the time of the SCI inspection, it was apparent that the front row right occupant was belted at the time of the crash. This conclusion was supported by the EDR data imaged from the Scion.


**Figure 16:** Heavy loading evidence in the belt path of the front right passenger's seat belt system within the Scion.

### *Supplemental Restraint Systems*

The Scion was equipped with supplemental restraints that included a frontal air bag system and a driver knee air bag. The dual-stage frontal air bag system included front seat belt retractor pretensioners, seat track position sensors, and seat belt buckle switch sensors. The Scion was not equipped with side impact or inflatable curtain (IC) air bags. Due to the characteristics of the crash sequence, none of the Scion's supplemental restraint systems were commanded to actuate or deploy during the multiple event crash.

### *Air Bag Non-Deployment Discussion*

The lack of supplemental restraint actuation/deployment within the Scion as a result of the multiple event crash was explained through a review of the imaged EDR data and an analysis of the vehicle's equipment. Foremost, the Scion was not equipped with side impact or rollover protection. It was equipped only with frontal air bags and front seat belt retractor pretensioners.

Although the vehicle recognized and recorded multiple crash events, none of the recognized event triggers involved crash forces sufficient enough to warrant supplemental restraint system actuation/deployment commands from the Scion's ACU. Furthermore, this earlier generation system's logic tied pretensioner actuation to inflatable supplemental restraint deployment.

Actuation of the pretensioner systems was possible only in conjunction with air bag deployment, because the sensing of the air bag and pretensioner systems were not independent of one another. That is, the pretensioner systems were actuated only for event triggers that met deployment threshold and resulted in ACU air bag deployment commands.

Therefore, based on a review of the Scion's recorded EDR data and the evidence gathered during this investigation, the SCI investigator was unable to identify any anomaly in the performance of the Scion's supplemental restraint systems.

**2006 TOYOTA SCION tC OCCUPANT DATA**

***Driver Demographics***

| | |
|---|---|
| Age/Sex: | 20 years / female |
| Height: | 157 cm (62 in) |
| Weight: | 67 kg (147 lb) |
| Eyewear: | Unknown |
| Seat Type: | Forward-facing bucket seat with adjustable head restraint |
| Seat Track Position: | Between middle and rear |
| Manual Restraint Usage: | 3-point lap and shoulder belt |
| Usage Source: | Vehicle inspection, EDR data |
| Air Bags: | Dual-stage frontal and knee air bags available; none deployed |
| Alcohol/Drug Involvement: | BAC = .222 g/dL |
| Egress From Vehicle: | Removed from vehicle due to perceived serious injuries |
| Transport From Scene: | Ambulance to a local hospital |
| Type of Medical Treatment: | Pronounced deceased 17 hours after the crash |

***Driver Injuries***

| Injury No. | Injury | AIS 2015 | Involved Physical Component (IPC) | IPC Confidence Level |
|---|---|---|---|---|
| 1 | Left-sided subdural hematoma measuring 14 mm in maximal thickness; trace right-sided subdural hematoma; small parafalcine subdural hematoma as well as hemorrhage layering along the tentorium; 9 mm of left right midline shift | 140655.5 | Left roof side rail/left B-pillar junction | Probable |
| 2 | Diffuse loss of gray-white matter throughout and obliteration of basilar cisterns | 140666.5 | Left roof side rail/left B-pillar junction | Probable |
| 3 | Subarachnoid hemorrhage throughout right cerebral hemispheres extending into ventricular system | 140693.2 | Left roof side rail | Probable |
| 4 | Subarachnoid hemorrhage throughout left cerebral hemispheres extending into ventricular system | 140693.2 | Left roof side rail/left B-pillar junction | Probable |

| Injury No. | Injury | AIS 2015 | Involved Physical Component (IPC) | IPC Confidence Level |
|---|---|---|---|---|
| 5 | Fracture through right anterior temporal bone and right skull base; fracture to right orbital roof | 150200.3 | Left roof side rail | Probable |
| 6 | Mildly displaced and comminuted right frontotemporal skull fracture | 150404.3 | Left roof side rail | Probable |
| 7 | Large right-sided scalp hematoma | 110402.1 | Left roof side rail | Probable |
| 8 | Fractures involving right orbital wall and right orbital floor | 251205.2 | Left roof side rail | Probable |
| 9 | Slightly depressed posterior left nasal bone fracture | 251000.1 | Left roof side rail | Probable |
| 10 | Laceration to nose | 210600.1 | Left roof side rail | Probable |
| 11 | Minimally displaced right zygomatic arch fracture | 251806.1 | Left roof side rail | Probable |
| 12 | Hemorrhage in right retrobulbar orbit | 240499.1 | Left roof side rail | Probable |
| 13 | Hemorrhage in left retrobulbar orbit | 240499.1 | Left roof side rail | Probable |
| 14 | Right periorbital region ecchymotic | 210402.1 | Left roof side rail | Probable |
| 15 | Carotid arteries crushed | 320299.3 | Left B-pillar | Possible |
| 16 | Cervical spine fracture C3 | 650216.2 | Left B-pillar | Possible |
| 17 | Multiple right rib fractures | 450200.1 | Seat belt system | Probable |
| 18 | Right hemothorax | 442200.3 | Seat belt system | Probable |
| 19 | Pulmonary contusion on right upper lobe | 441406.2 | Seat belt system | Probable |
| 20 | Pulmonary contusion on right superior segment of right lower lobe | 441406.2 | Seat belt system | Probable |
| 21 | Tiny anterior pneumothorax on right | 442202.2 | Seat belt system | Probable |
| 22 | Tiny anterior pneumothorax on left | 442202.2 | Seat belt system | Probable |
| 23 | Tiny focus pneumomediastinum anteriorly | 442209.2 | Seat belt system | Probable |
| 24 | Chest contusion | 410402.1 | Seat belt system | Probable |
| 25 | Abrasion to left lower back | 410202.1 | Seatback | Probable |
| 26 | Mid-shaft left clavicular fracture | 750621.2 | Seat belt system | Probable |
| 27 | Right humeral head dislocated anteriorly and inferiorly with respect to the glenoid | 771030.2 | Unknown | N/A |
| 28 | Fracture of right superior lateral aspect of right humeral head | 751171.2 | Unknown | N/A |
| 29 | Left wrist fracture | 751900.2 | Left door panel | Probable |
| 30 | Right 2nd metacarpal fracture | 752521.2 | Unknown | N/A |

*Source – Hospital Records*

***Driver Kinematics***

The 20-year-old female was positioned in the driver's seat of the Scion. She had adjusted the seat to a track position between middle and rear, with the seat back slightly reclined and the adjustable head restraint fully down. She was restrained by the available 3-point lap and shoulder belt system.

The driver's use of the manual restraint was determined from the loading evidence and post-crash condition of the seat belt system observed during the SCI vehicle inspection. This was corroborated by the data imaged from the vehicle's EDR, which reported that the driver's seat belt status was "Buckled." Post-crash medical data revealed that the driver had a blood alcohol concentration (BAC) of .222 g/dL.

The driver operated the Scion northbound in the left lane. While her route of travel should have caused her to slow the vehicle and prepare to turn left at the intersection, the driver maintained her travel speed on a straight trajectory. She remained belted in the driver's seat as the Scion entered the median. Tire marks indicated that the driver became alerted to the Scion's off- road trajectory and attempted to regain the roadway by steering right. She likely held the steering wheel firmly as the Scion tracked along the arching median.

At impact with the concrete drainage basin, the driver initiated a slight forward trajectory. Her use of the manual restraint system kept her within the area of the driver's seat. She did not sustain contact or injury associative to the first event. The second and third crash events with the yield sign and non-breakaway delineator post were of insufficient magnitude to elicit a kinematic response from the driver or induce injury.

It is likely that the driver provided a left steering input as the vehicle traversed the median crossover, which exacerbated the vehicle's counterclockwise rotation. The abrupt tripping force at the right side tires/wheels momentarily displaced the driver laterally toward the right. She lightly loaded the seat belt system as the Scion initiated a rapid rollover sequence.

During the violent rollover, centrifugal forces of the roll directed the driver away from the rolling vehicle's center of mass. Her head contacted and loaded the left roof side rail in the area of its junction with the left B-pillar, immediately left of/above the driver's seat. It should be noted that despite the driver's height, due to the vehicle type and size, the driver's head was in close proximity to the roof and left roof side rail even when in a normal seated posture and not subject to a kinematic response. Thus, the significant forces of the roll and driver's kinematic response away from the vehicle's center of mass further subjected her head to such contact. The SCI investigator considered the possibility that the driver's head became partially ejected through the left front glazing opening during the rollover and contacted the roadway surface. However, there was a lack of evidence documented by the medical record data (no mention of dirt or debris) to substantiate or otherwise support such a possibility.

The driver's left flank also contacted and loaded the left door panel. The driver's head and left flank contacts and associated loading for the duration of the rollover produced numerous head and neck injuries. Although her use of the manual restraint system restricted her movement during the rollover and prevented her ejection, the severe forces of the rollover and her corresponding loading of the seat belt system induced multiple chest injuries.

The driver rebounded against the seatback as the Scion came to final rest on its wheels. Emergency response personnel forced the left door open and removed the driver from the vehicle, then transported her by ambulance to a local hospital. The driver was admitted for treatment, but ultimately succumbed to her extensive injuries. She was pronounced deceased 17 hours after the crash.

***Front Row Right Occupant Demographics***

| | |
|---|---|
| Age/Sex: | 20 years / female |
| Height: | 157 cm (62 in) |
| Weight: | 54 kg (120 lb) |
| Eyewear: | Unknown |
| Seat Type: | Forward-facing bucket seat |
| Seat Track Position: | Forward third |
| Manual Restraint Usage: | 3-point lap and shoulder belt |
| Usage Source: | Vehicle inspection, EDR data |
| Air Bags: | Dual-stage frontal air bag available; not deployed |
| Alcohol/Drug Involvement: | BAC = .045 g/dL; positive for cannabinoids |
| Egress From Vehicle: | Removed from vehicle due to perceived serious injuries |
| Transport From Scene: | Ambulance to a local hospital |
| Type of Medical Treatment: | Hospitalized for four days; discharged to rehab |

***Front Row Right Occupant Injuries***

| Injury No. | Injury | AIS 2015 | Involved Physical Component (IPC) | IPC Confidence Level |
|---|---|---|---|---|
| 1 | Pulmonary contusions throughout much of right lung; minimal contusions in left upper lobe | 441412.4 | Right door panel | Probable |
| 2 | Right pneumothorax | 442202.2 | Seat belt system | Probable |
| 3 | Left pneumothorax | 442202.2 | Seat belt system | Probable |
| 4 | Torn terminal ilium and second large rent denuding section of mid jejunum requiring resection | 541423.3 | Seat belt webbing | Possible |
| 5 | Morel Lavallee lesion of anterior abdominal wall; transection of right obliques and rectus | 510100.2 | Seat belt system | Probable |
| 6 | Grade 3A open left tibia shaft fracture with 8 cm (3.1 in) segmental bone loss | 854272.3 | Right lower instrument panel | Probable |
| 7 | Displaced left fibular shaft fracture | 854471.2 | Right lower instrument panel | Probable |
| 8 | Comminuted displaced right inferior and superior pubic ramus fractures: right sacral fracture | 856151.2 | Right door panel | Probable |
| 9 | Slight irregularity of proximal/mid cervical right internal carotid artery | 320299.3 | Seat belt system | Probable |

| Injury No. | Injury | AIS 2015 | Involved Physical Component (IPC) | IPC Confidence Level |
|---|---|---|---|---|
| 10 | Complete rupture of left anterior cruciate ligament | 840502.2 | Right lower instrument panel | Probable |
| 11 | Partial tear of left posterior cruciate ligament | 840501.2 | Right lower instrument panel | Probable |
| 12 | Partial tear of distal quadriceps tendon | 840801.2 | Right lower instrument panel | Probable |
| 13 | Subconjunctival hemorrhage right sclera | 241299.1 | Unknown | N/A |
| 14 | Left ankle laceration 11 cm (4.3 in) | 810602.1 | Right lower instrument panel | Probable |
| 15 | Right wrist laceration, NFS | 710600.1 | Right door panel | Possible |
| 16 | Right parietal scalp hematoma, NFS | 110402.1 | Right roof side rail | Probable |
| 17 | Neck contusions, NFS | 310402.1 | Seat belt system | Probable |

*Source – Hospital records*

***Front Row Right Occupant Kinematics***

The 20-year-old female front row right occupant was positioned in the front passenger's seat of the Scion. She had adjusted the seat to a forward third track position, with the seat back slightly reclined and the adjustable head restraint 2 cm (0.8 in) upward. She was restrained by the available 3-point lap and shoulder belt system. Her usage of the seat belt system was determined from the loading evidence and post-crash condition of the seat belt system observed during the SCI vehicle inspection, and corroborated by the imaged EDR data.

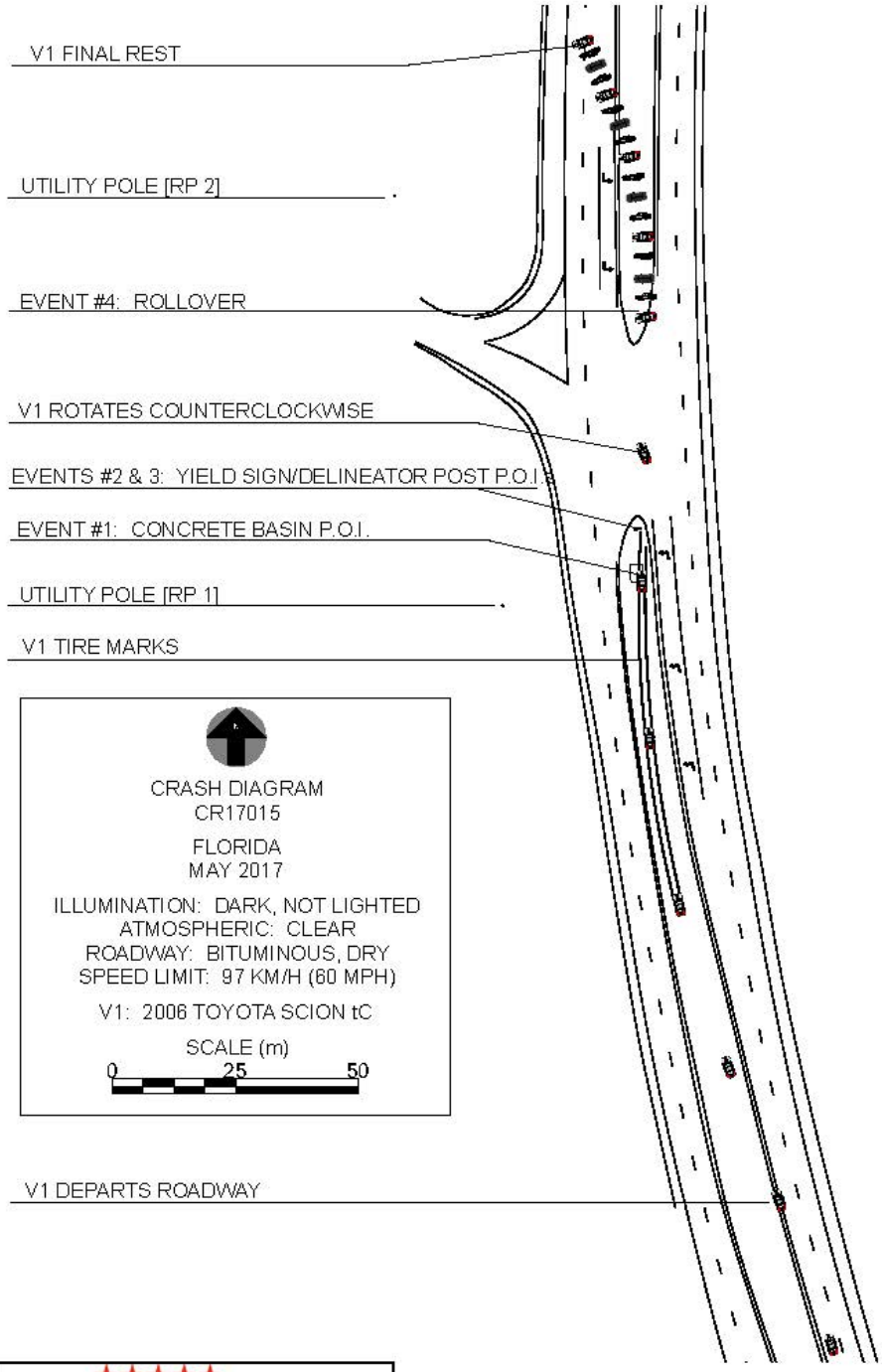
The front row right occupant remained belted in her seat position as the Scion entered the median. She remained there as the Scion traversed along the grass median. At impact with the concrete drainage basin, the front row right occupant likely initiated a slight forward trajectory. Her use of the manual restraint system kept her in the area of the front passenger's seat. She did not sustain contact or injury associative to the first event. The second and third crash events with the yield sign and non-breakaway delineator post were of insufficient magnitude to elicit a kinematic response from the front row right occupant or induce injury.

The front row right occupant initiated a sharp right trajectory in response to the abrupt tripping force at the right side tires/wheels. She loaded the seat belt system and contacted the right door panel as the Scion initiated a rapid rollover sequence. During the violent rollover, centrifugal forces directed the front row right occupant toward the right, away from the rolling vehicle's center of mass. Her lower legs contacted and loaded the right lower instrument panel, resulting in multiple left lower leg injuries. She also loaded the right door panel, producing abdominal and pelvic injuries and deforming the door.

The front row right occupant's use of the manual restraint system restricted her movement during the rollover and prevented her ejection. However, the severe forces of the rollover and her corresponding loading of the seat belt system induced multiple chest and abdominal injuries.

The front row right occupant rebounded against the seatback as the Scion came to final rest on its wheels. Emergency response personnel removed her from the vehicle and transported her by ambulance to a local hospital, where she was admitted for treatment. The front row right occupant was released from the hospital after four days and discharged with a treatment course that included rehabilitation.

## CRASH DIAGRAM




| | |
|---|---|
| | NHTSA www.nhtsa.gov |
| Case Number: | CR17015 |

# APPENDIX A: 2006 Toyota Scion tC Event Data Recorder Report[1]

[1] The EDR Report contained in this technical report was imaged by the police investigating the crash with the Bosch CDR tool. The CDR report contained in the associated Crash Viewer application may differ relative to this 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/Frame Number | JTKDE177960xxxxxx |
| User | |
| Case Number | |
| EDR Data Imaging Date | |
| Crash Date | |
| Filename | CR17015_V1_ACM.PDF |
| Saved on | |
| Collected with CDR version | Crash Data Retrieval Tool 16.3 |
| Reported with CDR version | Crash Data Retrieval Tool 16.3 |
| EDR Device Type | Airbag Control Module |
| Event(s) recovered | Front/Rear (3) |

## Comments

None.

## Data Limitations

**CDR Record Information:**

- Due to limitations of the data recorded by the airbag ECU, such as the resolution, data range, sampling interval, time period of the recording, and the items recorded, the information provided by thi s data may not be sufficient to capture the entire crash.
- Pre-Crash data is recorded in discrete intervals. Due to different ref resh rates within the vehicle's electronics, the data recorded may not be synchronous to each other.
- Airbag ECU data should be used in conjunction with other physical evidence obtained from the vehicle and the surrounding circumstances.
- If the airbags did not deploy or the pretensioners did not operate during an event that meets a specified recording threshold, it is called a Non-Deployment Event. Data from a Non-Deployment Event can be overwritten by a succeeding event that mee ts the specified recording threshold. If the airbag(s) deploy or the pre tensioners are operated, it is called a Deployment Event. Deployme nt Event data cannot be overwritten or deleted by the airbag ECU following that event.
- If power supply to the airbag ECU is lost during an event, all or part of the data may not be recorded.
- "Diagnostic Trouble Codes" are information about faults when a rec ording trigger is established. Various diagnostic trouble codes could be set and recorded due to component or system damage during an accident.
- The airbag ECU records only diagnostic information related to the airbag system. It does not record diagnostic information related to other vehicle systems.
- The TaSCAN, Global TechStream, or Intelligent Tester II devices (o r any other Toyota genuine diagnostic tool) can be used to obtain detailed information on the diagnostic trouble codes from the airb ag system, as well as diagnostic information from other systems. However, in some cases, the diagnostic trouble codes of the airbag system recorded by the airbag ECU when the event occurred may not match the diagnostic trouble codes read out when the diagn ostic tool is used.

**General Information:**

- The data recording specifications of Toyota's airbag ECUs are divi ded into the following eight categories. The specifications for 12EDR or later are designed to be compatible with NHTSA's 49CFR Pa rt 563 rule.
  - 00EDR / 02EDR / 04EDR / 06EDR / 10EDR / 12EDR / 13EDR / 15EDR
- The airbag ECU records data for all or some of the following accid ent types: frontal crash, rear crash , side crash, and rollover events. Depending on the installed airbag ECU, data for side cras h and/or rollover events may not be recorded.
- The airbag ECU records post-crash data and may record pre-crash data in the event of a frontal/rear crash. In addition, it may record post-crash data in the event of a side crash or rollover.
- The airbag ECU has the following recording pages (memory maps) for each accident type to store event data: three pages for frontal or rear crash, one page for a side crash (if airbag ECU is applica ble) , and one page for rollover events. (if airbag ECU is applica ble)
- The data recorded by the airbag ECU in the event of a frontal/rear crash includes information that indicates the sequence and interval of each previously-occurring frontal/rear crash event.
  - Time from Previous TRG
  - TRG Count
- The point in time at which the recording trigger is established is regarded as time zero for the recorded data. For the time indicated in "Lateral Delta-V", "Roll Angle" or "Lateral Acceleration", the first sampling poi nt after the recording trigger establishment is regarded as time zero. The time zero of the data and the recording trigger establishment do not always occur simultaneously.

- The recording trigger judgment threshold value differs depending on the collision type (i.e., frontal crash, rear crash, side crash, or rollover event).
- Some of the data recorded by the airbag ECU is transmitted to the airbag ECU from various vehicle control modules by the vehicle's Controller Area Network (CAN).
- In some cases, the airbag ECU part number printed on the ECU label may not match the airbag ECU part number that the CDR tool reports. The part number retrieved by the CDR tool should be consi dered as the official ECU part number.
- The sampling interval of "Roll Angle" and "Lateral Acceleration" i s 8 [ms] or 128 [ms]. A field indicating the sampling interval is not provided. The graph scaling can assist with derterming the sample rate. The time zero is indicated by count (0).
- "Prior Event" is the event that occurred before the "1st Prior Eve nt" that reached the greatest MAX Delta-V. Therefore, "Prior Event" is not always the prior event of "1st Prior Event".

**Data Element Sign Convention:**
The following table provides an explanation of the sign notation for data elements that may be included in this CDR report.

| Data Element Name | Positive Sign Notation Indicates |
|---|---|
| Max. Longitudinal Delta-V | Forward |
| Longitudinal Delta-V | Forward |
| Roll Angle Peak | Clockwise Rotation |
| Roll Angle | Clockwise Rotation |
| Lateral Acceleration , Airbag ECU Sensor * | Right to Left |

* For sensing a rollover

**Data Definitions:**
1)

- The "ON" setting for the "Freeze Signal" indicates a state in whic h the non-volatile memory can not be overwritten or deleted by the airbag ECU. After "Freeze Signal" has been turned ON, subsequent events will not be recorded.
- "Recording Status" indicates a state in which all recorded event d ata has been written into the non-volatile memory, or a state in which this process was interrupted and not fully written into the non-volatile memory. If "Recording Status" is "Incomplete", recorded event data may not be valid.
- "Time to Deployment Command" indicates the time between recording trigger establishment and the determination of airbag deployment. This value may differ from the actual time it takes f or the airbag to fully deploy.
- Even if an airbag/pretensioner did not deploy due to the "front passenger airbag disable switch and/or "RSCA Disable Switch" in the ON position or other disabling criteria are met, the "Time to depl oyment command" data element for that airbag/pretensioner may still be recorded.
- "Engine RPM" indicates the number of engine revolutions, not the n umber of motor revolutions. The recorded value has an upper limit of 6,000 rpm. Resolution is 400 rpm and the value is rounde d down and recorded. For example, if the actual engine speed is 799 rpm, the recorded value will be 400 rpm.
- The upper limit for the recorded "Vehicle Speed" value is 126 km/h (78.3mph). Resolution is 2km/h (1.2mph) and the value is rounded down and recorded. The accuracy of the "Vehicle Speed" value can be affected by various factors. These include, but not limited, to the following.
  - Significant changes in the tire's rolling radius
  - Wheel lock and wheel slip
- The "Accelerator Rate" value is recorded as a voltage or level. I n the case of voltage, the voltage increases as the driver depress es the accelerator. In case of the level, the following three levels are recorded.
  - FULL / MIDDLE / OFF
- "Accelerator Rate" may be recorded as "OFF" even if the accelerato r pedal is depressed lightly. In addition, "FULL" may be recorded when the accelerator pedal is depressed strongly but not fully.
- The "Drive" setting for the "Shift Position" value indicates the s hift position state is other than "R,"(Reverse), "N" (Neutral), or "P" (Park). It also includes communication disruption. Regardless of a n actual shift position, "Drive" is always set for M/T vehicles because the shift position signal is not available.
- Depending on the type of occupant sensor installed in the vehicle, one of the following three recording formats for "Occupancy Status, Passenger" will be utilized.
  - Occupied / Not Occupied
  - Adult / Child / Not Occupied
  - AM50 / AF05 / Child / Not Occupied
- Resolution of the "Air Bag Warning Lamp ON Time Since DTC was Set" is 15 minutes, and the value is rounded down and recorded.
- "Longitudinal Delta-V" indicates the change in forward speed after establishment of th e recording trigger. This does not refer to vehicle speed, and it does not include the change in speed during the period from the start of the actual collision to establishment of the recording trigger.
- "Roll Angle peak" may not always match the peak value within the " Roll Angle" sampling points due to differences in data calculation method.
- For "Lateral Delta-V", the sensor location (B-pillar, front door, C-pillar, and slide door) shows the outline of a typical sensor posi tion. Sensory location can be confirmed using the repair manual.
- "TRG Count" indicates the number of frontal/rear recording trigger s that have been established. The calculated value does not include the number of times side or rollover recording triggers ha ve been established. The sequence in which each frontal/rear event occurred can be verified from the "TRG Count". The lesser the "TR G Count" value, the older the data. The upper limit for the recorded value is 255 times. When more than one event reaches the upper limit, the actual "TRG Count" may be greater than what is

displayed for that event.

- Resolution of the "Time from Pre-Crash to TRG" is 100 [ms], and the value is rounded down and recorded.
- For "Time from Previous TRG", the recording trigger of side crash and rollover is not considered. The upper limit for the recorded value is 5000 [ms] or 5100 [ms] depending on the ECU part number. Resolution is 20 [ms] and the value is rounded down and recorded. When it's displayed as 5100ms, the actual "Time from P revious TRG" may be longer than what is displayed for that event.
- If 2 or more frontal/rear events occur successively within a perio d of 5000ms (or 5120ms for ECUs with 1.024 data sampling intervals), the actual sample time before the trigger is not displ ayed for subsequent events. The sample time before trigger will o nly be displayed for the first event of the successive events. For su bsequent events (i.e second event or later events), the pre-crash "Time (sec)" data is replaced by integers -5 through -1 and the heading "Time (sec)" is replaced with "Sample Count". T he time between "Sample Count" integers (-5 through -1) cannot be determined. The time between the last integer and TR G cannot be determined.
- "Pre-Crash Data Status" indicates data communication status of the vehi cle. If communication disruption or other failure is occur, "Invalid" is set. Moreover, "Invalid" is set for some M/T vehicles because the shift position signal is not transmitted for them eve n if the other data is valid.

05002_ToyotaDENSO_r025

## System Status at Time of Retrieval

| | |
|---|---|
| ECU Part Number | 89170-21070 |
| ECU Generation | 02EDR |
| Recording Status, All Pages | Complete |
| Diagnostic Trouble Codes Exist | No |
| Total Number of Front/Rear Crash Events | 3 |
| Freeze Signal | OFF |

## Front/Rear Event Record Summary at Retrieval

| Events Recorded | TRG Count | Crash Type | Time (msec) | Event & Crash Pulse Data Recording Status |
|---|---|---|---|---|
| Most Recent Frontal/Rear Event | 13 | Front/Rear Crash | 0 | Complete (Front/Rear Page 0) |
| 1st Prior Frontal/Rear Event | 12 | Front/Rear Crash | -980 | Complete (Front/Rear Page 2) |
| Prior Frontal/Rear Event | 9 | Front/Rear Crash | N/A | Complete (Front/Rear Page 1) |

## System Status at Front Airbag Deployment

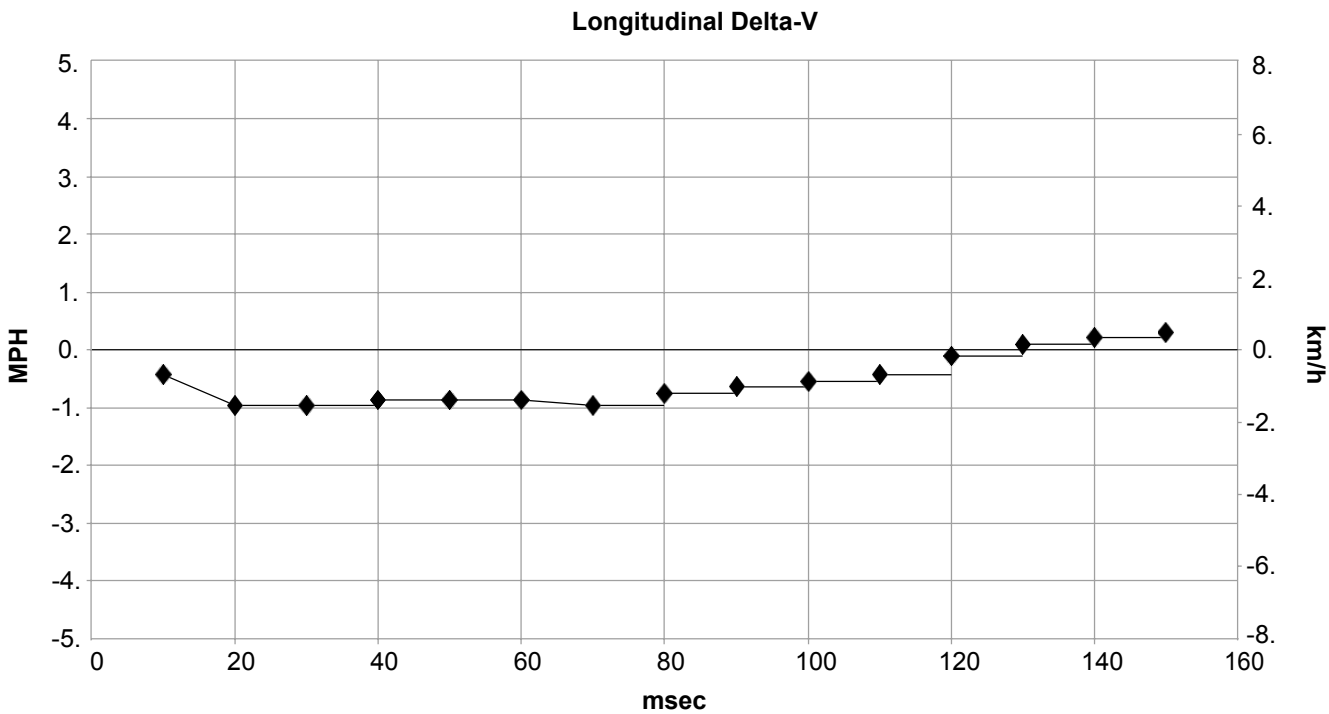
| | |
|---|---|
| Time to Deployment Command, Front Airbag, Driver (msec) | Not Commanded |
| Time to Deployment Command, Front Airbag, Passenger (msec) | Not Commanded |
| Event Severity Status, Driver | N/A |
| Event Severity Status, Passenger | N/A |

## System Status at Event (Most Recent Frontal/Rear Event, TRG 13)

| | |
|---|---|
| Recording Status, Front/Rear Crash Info. | Complete |
| TRG Count | 13 |
| Time From Previous TRG (msec) | 980 |
| Buckle Switch, Driver | Buckled |
| Buckle Switch, Passenger | Buckled |
| Seat Position, Driver | Rearward |

## Longitudinal Crash Pulse (Most Recent Frontal/Rear Event, TRG 13 - table 7 of 2)

| | |
|---|---|
| Max Longitudinal Delta-V (MPH [km/h]) | -1.0 [-1.6] |



## Longitudinal Crash Pulse (Most Recent Frontal/Rear Event, TRG 13 - table 8 of 2)

| Time (msec) | Longitudinal Delta-V (MPH [km/h]) |
|---|---|
| 10 | -0.4 [-0.7] |
| 20 | -1.0 [-1.6] |
| 30 | -1.0 [-1.6] |
| 40 | -0.9 [-1.4] |
| 50 | -0.9 [-1.4] |
| 60 | -0.9 [-1.4] |
| 70 | -1.0 [-1.6] |
| 80 | -0.8 [-1.2] |
| 90 | -0.6 [-1.0] |
| 100 | -0.5 [-0.9] |
| 110 | -0.4 [-0.7] |
| 120 | -0.1 [-0.2] |
| 130 | 0.1 [0.2] |
| 140 | 0.2 [0.3] |
| 150 | 0.3 [0.5] |

## DTCs Present at Start of Event (Most Recent Frontal/Rear Event, TRG 13)

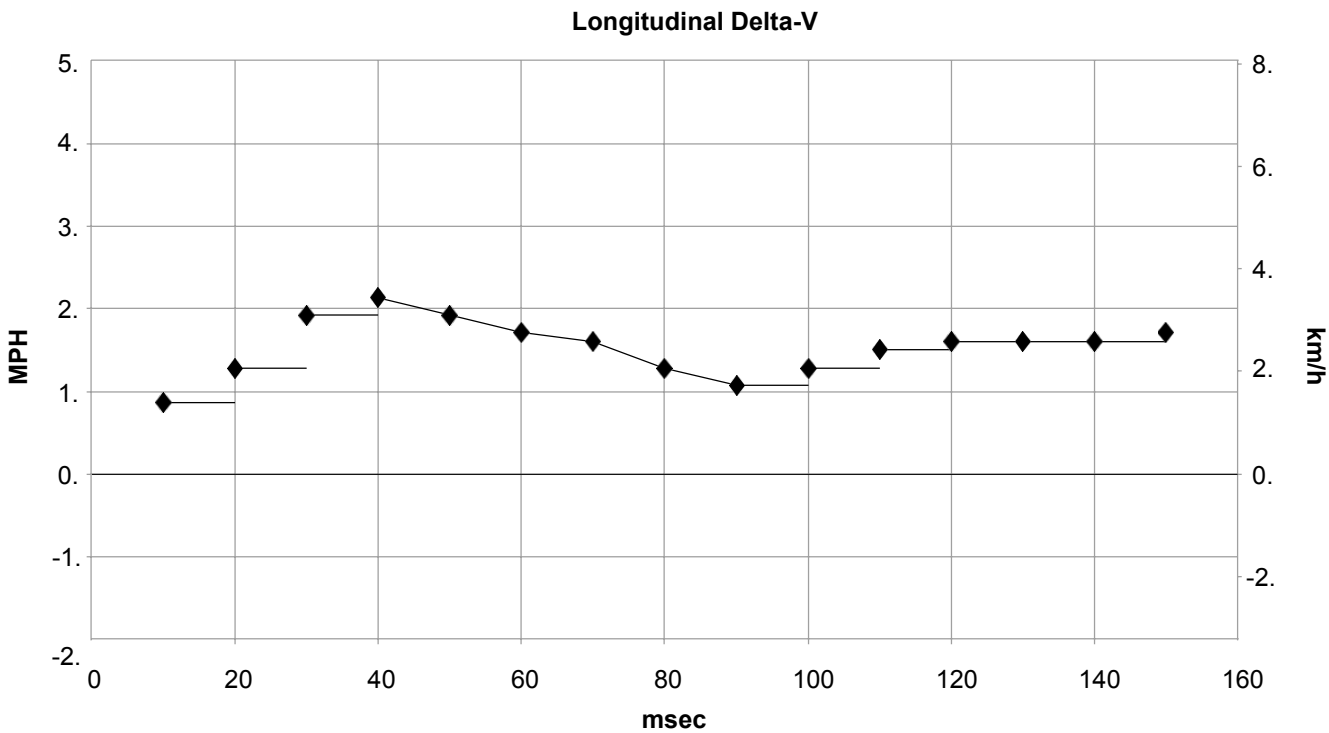
| | |
|---|---|
| Ignition Cycle Since DTC was Set (times) | 1 |
| Airbag Warning Lamp ON Time Since DTC was Set (min) | 15 |
| Diagnostic Trouble Codes | None |

## System Status at Event (1st Prior Frontal/Rear Event, TRG 12)

| | |
|---|---|
| Recording Status, Front/Rear Crash Info. | Complete |
| TRG Count | 12 |
| Time From Previous TRG (msec) | 640 |
| Buckle Switch, Driver | Buckled |
| Buckle Switch, Passenger | Buckled |
| Seat Position, Driver | Rearward |

## Longitudinal Crash Pulse (1st Prior Frontal/Rear Event, TRG 12 - table 10 of

| | |
|---|---|
| Max Longitudinal Delta-V (MPH [km/h]) | 2.1 [3.4] |



## Longitudinal Crash Pulse (1st Prior Frontal/Rear Event, TRG 12 - table 11 of

| Time (msec) | Longitudinal Delta-V (MPH [km/h]) |
|---|---|
| 10 | 0.9 [1.4] |
| 20 | 1.3 [2.1] |
| 30 | 1.9 [3.1] |
| 40 | 2.1 [3.4] |
| 50 | 1.9 [3.1] |
| 60 | 1.7 [2.8] |
| 70 | 1.6 [2.6] |
| 80 | 1.3 [2.1] |
| 90 | 1.1 [1.7] |
| 100 | 1.3 [2.1] |
| 110 | 1.5 [2.4] |
| 120 | 1.6 [2.6] |
| 130 | 1.6 [2.6] |
| 140 | 1.6 [2.6] |
| 150 | 1.7 [2.8] |

## DTCs Present at Start of Event (1st Prior Frontal/Rear Event, TRG 12)

| | |
|---|---|
| Ignition Cycle Since DTC was Set (times) | 1 |
| Airbag Warning Lamp ON Time Since DTC was Set (min) | 15 |
| Diagnostic Trouble Codes | None |

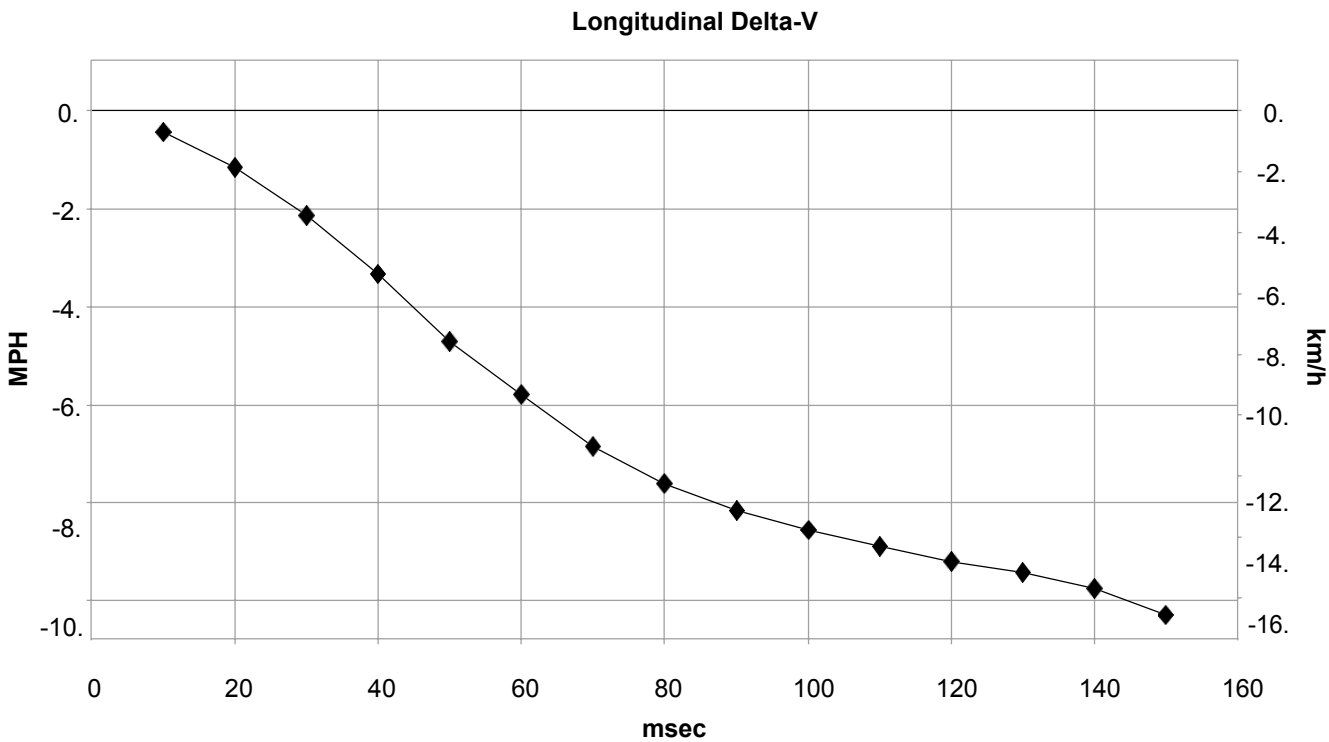
* "Invalid" may be set for M/T vehicle

## System Status at Event (Prior Frontal/Rear Event, TRG 9)

| | |
|---|---|
| Recording Status, Front/Rear Crash Info. | Complete |
| TRG Count | 9 |
| Time From Previous TRG (msec) | 920 |
| Buckle Switch, Driver | Buckled |
| Buckle Switch, Passenger | Buckled |
| Seat Position, Driver | Rearward |

## Longitudinal Crash Pulse (Prior Frontal/Rear Event, TRG 9 - table 13 of

| | |
|---|---|
| Max Longitudinal Delta-V (MPH [km/h]) | -10.3 [-16.5] |



## Longitudinal Crash Pulse (Prior Frontal/Rear Event, TRG 9 - table 14 of

| Time (msec) | Longitudinal Delta-V (MPH [km/h]) |
|---|---|
| 10 | -0.4 [-0.7] |
| 20 | -1.2 [-1.9] |
| 30 | -2.1 [-3.4] |
| 40 | -3.3 [-5.3] |
| 50 | -4.7 [-7.6] |
| 60 | -5.8 [-9.3] |
| 70 | -6.9 [-11.0] |
| 80 | -7.6 [-12.2] |
| 90 | -8.1 [-13.1] |
| 100 | -8.6 [-13.8] |
| 110 | -8.9 [-14.3] |
| 120 | -9.2 [-14.8] |
| 130 | -9.4 [-15.2] |
| 140 | -9.7 [-15.7] |
| 150 | -10.3 [-16.5] |

## DTCs Present at Start of Event (Prior Frontal/Rear Event, TRG 9)

| | |
|---|---|
| Ignition Cycle Since DTC was Set (times) | 1 |
| Airbag Warning Lamp ON Time Since DTC was Set (min) | 15 |
| Diagnostic Trouble Codes | None |

## Hexadecimal Data

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR system.

PIDs

| PID | Data |
|---|---|
| 00 | BC 00 00 01 |
| 01 | 00 |
| 03 | 32 31 30 37 30 30 30 30 30 30 30 30 30 30 30 |
| 04 | FF FF 02 |
| 05 | 02 |
| 06 | 00 |
| 20 | 80 00 00 01 |
| 21 | 00 01 |
| 40 | 00 00 00 01 |
| 60 | 00 00 00 01 |
| 80 | 00 00 00 01 |
| A0 | 00 00 00 01 |
| C0 | 00 00 00 01 |
| E0 | C0 10 00 00 |
| E1 | 0B 0B |
| E2 | 00 5B 1F 11 00 |
| EC | FF |

EEPROM

(-- = data not imaged from ECU)
(** = no response from ECU)

| Address | Data |
|---|---|
| 0 | -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- |
| 10 | -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- |
| 20 | -- -- -- -- -- -- -- -- -- -- -- -- -- -- 80 01 |
| 30 | 00 00 FF FF 00 80 80 01 00 00 00 00 00 00 FF FF |
| 40 | AA 04 04 05 00 00 00 FF 00 00 00 00 00 01 00 FE |
| 50 | 00 FF 00 FF 00 FF 00 FD 00 FE 00 FF 00 FF 00 FF |
| 60 | 00 31 00 0D 00 00 00 00 00 00 00 00 00 00 00 00 |
| 70 | 00 00 80 01 80 01 00 00 AA 04 04 07 00 09 00 0B |
| 80 | 00 0D 00 0A 00 0A 00 07 00 05 00 04 00 03 00 03 |
| 90 | 00 02 00 03 00 05 00 06 00 2E 00 09 00 00 00 00 |
| A0 | 00 00 00 00 00 00 00 00 00 00 80 01 80 01 00 00 |
| B0 | AA F8 04 FC 00 FA 00 FE 00 02 00 02 00 01 00 03 |
| C0 | 00 02 00 FE 00 FE 00 FF 00 00 00 00 00 FF 00 FF |
| D0 | 00 20 00 0C 00 00 00 00 00 00 00 00 00 00 00 00 |
| E0 | 00 00 80 01 80 01 00 00 |

## Disclaimer of Liability

The users of the CDR product and reviewers of the CDR reports and exported data shall ensure that data and information supplied is applicable to the vehicle, vehicle's system(s) and the vehicle ECU. Robert Bosch LLC and all its directors, officers, employees and members shall not be liable for damages arising out of or related to incorrect, incomplete or misinterpreted software and/or data. Robert Bosch LLC expressly excludes all liability for incidental, consequential, special or punitive damages arising from or related to the CDR data, CDR software or use thereof.

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**National Highway
Traffic Safety
Administration**

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