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SPECIAL CRASH INVESTIGATIONS

CASE NO.: CR15019

ON-SITE AMBULANCE CRASH INVESTIGATION

VEHICLE: 2008 FORD E350
AMBULANCE BODY: SJC INDUSTRIES TYPE II

LOCATION: NEW JERSEY

CRASH DATE: JULY 2015

Contract No. DTNH22-12-C-00269

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
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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 are 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.

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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16. Abstract The primary interest of this on-site investigation was the intersection crash of a 2008 Ford E350 Type II ambulance and the resulting fatality of an unrestrained 22-year-old female front right Emergency Medical Services (EMS) occupant. The ambulance became involved in a multiple-event crash at a controlled intersection when the unrestrained 24-year-old male driver entered the controlled intersection while operating the ambulance with its emergency warning lights and sirens activated. A 2013 Toyota Prius, which was proceeding through the intersection with a green traffic signal, impacted the ambulance on the forward aspect of its right plane. The ambulance was redirected and rotated counterclockwise (CCW), then tripped into a one quarter-turn, right side-leading rollover. It then slid toward and impacted a stationary 2011 Subaru Legacy before coming to final rest. The ambulance was equipped with a frontal air bag system for the driver and front right occupant; neither deployed in the crash. During the rollover, the unrestrained front right occupant was partially ejected through the right front window opening. She sustained fatal injuries and was pronounced deceased at the crash scene. The driver of the ambulance and the 58-year-old female driver of the Toyota were both transported by other ambulances to local hospitals for the treatment of police-reported possible (B-level) injuries. The 43-year-old female driver of the Subaru was not injured.			
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BACKGROUND

The primary interest of this on-site investigation was the intersection crash of a 2008 Ford E350 Type II ambulance and the resulting fatality of an unrestrained 22-year-old female front right Emergency Medical Services (EMS) occupant. The ambulance became involved in a multiple-event crash at a controlled intersection when the unrestrained 24-year-old male driver entered the controlled intersection while operating the ambulance with its emergency warning lights and sirens activated. A 2013 Toyota Prius, which was proceeding through the intersection with a green traffic signal, impacted the ambulance on the forward aspect of its right plane. The ambulance was redirected and rotated counterclockwise (CCW), then tripped into a one quarter-turn, right side-leading rollover. It then slid toward and impacted a stationary 2011 Subaru Legacy before coming to final rest (**Figure 1**). The ambulance was equipped with a frontal air bag system for the driver and front right occupant; neither deployed in the crash. During the rollover, the unrestrained front right occupant was partially ejected through the right front window opening. She sustained fatal injuries and was pronounced deceased at the crash scene. The driver of the ambulance and the 58-year-old female driver of the Toyota were both transported by other ambulances to local hospitals for the treatment of police-reported possible (B-level) injuries. The 43-year-old female driver of the Subaru was not injured.

Figure 1: Overturned ambulance at final rest (*image obtained from the investigating law enforcement agency*).

The crash was identified by the National Highway Traffic Safety Administration's (NHTSA) Office of EMS. After receiving notification, the Crash Investigation Division (CID) assigned the crash for on-site investigation by the Special Crash Investigations (SCI) team on July 27, 2015. The SCI team contacted the investigating law enforcement agency and achieved cooperation on the same day to inspect all three vehicles involved in the crash. The on-site portion of this investigation occurred July 29-30, 2015, and involved an inspection of the ambulance, Toyota, Subaru, and crash site. Only the Toyota was equipped with an Event Data Recorder (EDR) supported by the Bosch Crash Data Retrieval (CDR) tool. Although the law enforcement agency did not permit the SCI Investigator to image data during the vehicle inspection, they provided an electronic copy (*.CDRx*) of the Toyota's imaged data at a later date.

CRASH SUMMARY

Crash Site

The crash occurred at the intersection of a north/south multi-lane primary roadway and an east/west multi-lane local roadway in a suburban locale. According to the National Weather Service observations, conditions at the time of the morning-hours crash included clear skies with a temperature of 11.7 °C (77 °F), 53% relative humidity, and calm winds. The bituminous roadway surfaces were dry. For the ambulance's pre-crash travel trajectory, the east intersection leg consisted of two travel lanes that were divided by a raised grass median and curved to the right. Approximately 90 m (295 ft) east of the intersection, the westbound travel lane transitioned into three lanes: a 3.5 m (11.5 ft) left turn-only lane, a 3.7 m (12.1 ft) center-through lane, and 3.8 m (12.5 ft) right turn-only lane. A 1.2 m (3.9 ft) wide raised grass median separated the westbound lanes from the 3.8 m (12.1 ft) and 4.2 m (13.8 ft) wide eastbound travel lanes. The ambulance approached the intersection (**Figure 2**) and maintained its westbound travel in the center-through lane. Speed on the local roadway was regulated by a posted limit of 64 km/h (40 mph). The intersection was controlled by an overhead electronic signal.

Figure 2: Westbound trajectory view of the ambulance's pre-crash travel path on approach to the intersection.

Figure 3: Southbound trajectory view of the Toyota's approach to the intersection.

The west leg of the intersection (on the opposite side of the intersection with respect to the ambulance's approach) consisted of three eastbound lanes and a single westbound lane. The Subaru was stopped in the 3.7 m (12.1 ft) wide center-through lane at the time of the crash. There also was a 3.8 m (12.5 ft) left turn-only lane and a 4.1 m (13.5 ft) right turn-only lane. The 3.9 m (12.8 ft) wide westbound lane was separated from the eastbound lanes by a 1.2 m (3.9 ft) wide raised grass median. The road shoulders measured 3.6 m (10.8 ft).

The Toyota's southbound pre-crash travel direction (**Figure 3**) on the primary roadway consisted of four lanes at the north intersection leg. This included a 3.5 m (11.5 ft) left turn-only lane, two 3.6 m (11.8 ft) through lanes, and a 3.8 m (12.5 ft) right turn-only lane. This roadway was designated as a 72 km/h (45 mph) zone. A Crash Diagram is included on **Page 27** of this technical report.

Ambulance Agency, Crew, and Transport Description

The private ambulance agency was a single-tiered medical transport service not associated with any particular medical treatment center, capable of providing Basic Life Support (BLS) care and EMS transportation. It employed an all career (non-volunteer) staff of management personnel and Emergency Medical Technicians (EMTs). The agency itself was the primary response for any EMS request within its district.

The agency required all EMTs to hold current State EMS certification, as well as current cardiopulmonary resuscitation (CPR) certification. All EMS providers had to complete yearly practical skills and Continuing Education Units (CEUs). In order to operate vehicles, staff also had to complete a Certified Emergency Vehicle Operations (CEVO) course that specialized in defensive driving skills and emergency vehicle handling techniques. The agency had a written policy dictating that all staff must utilize manual restraint systems at all times when traveling in any of the agency's apparatus. An additional policy concerned the complete usage of the multi-point harness system for restraint of patients at all times when on wheeled ambulance cots.

Newly hired staff members were not allowed to drive until approximately 1-2 months after hire, and only once they had completed the required course and learned the names and layout of roadways within the geographic area. The process to train a driver took an additional 1-2 months, after which a supervisory training officer had to certify the driver before they were allowed to operate a vehicle independently. The agency had a remediation process in place, such that any driver for which a complaint was received or an unsafe operation was observed, their driving privileges were suspended. Pending recertification by the in-house training officer, a suspended driver could regain their driving status.

At the time of this crash, the agency's working hours were divided into three 8-hour shifts. Employees were allowed to work up to two shifts consecutively, but could not exceed 16 hours. The agency was in the process of switching to a 12-hour shift format, and planned to no longer allow staff to be on-duty for consecutive shifts. Each shift was staffed by three employees: two EMTs in an ambulance and an EMT supervisor in a support vehicle.

Pre-Crash

On the day of the crash, the agency had received a mutual aid request to respond to a motor vehicle crash in an adjacent agency's district. The 2008 Ford ambulance and its crew, consisting of the unrestrained 22-year-old female front right occupant and the unrestrained 24-year-old male driver, responded to the request. Both occupants were certified EMTs and possessed current CPR cards. According to the agency, the driver had fulfilled his requirements and was certified to operate the ambulance. He had been on-duty for approximately 9.5 hours, while the front right occupant had begun her workday less than 2 hours prior to the crash. As the ambulance responded, the driver operated the vehicle westbound on the local roadway. He negotiated several curves and maintained his westbound travel en route to the mutual aid request.

The driver activated the ambulance's emergency warning lights and sirens as the vehicle entered the transition to multiple travel lanes and approached the intersection. According to several witnesses to the crash, the electronic traffic signal had cycled to the red phase to control east/west traffic at the intersection. The ambulance's use of emergency warning lights and sirens afforded it the opportunity, based on local vehicle and traffic laws, to overtake other traffic stopped at the intersection and proceed through the controlled intersection once it had obtained the right of way. An analysis was performed based on the post-impact trajectory of the ambulance (**Attachment A**), which yielded a calculated pre-crash speed of 68 km/h (42 mph).

The Subaru was stopped in the right eastbound through lane of the west intersection leg by the controlled signal. It was operated by the 43-year-old restrained female driver, who was waiting for the electronic signal to cycle and permit her to resume eastbound travel and cross through the intersection.

The Toyota traveled southbound on the multi-lane primary roadway on approach to the intersection. It was operated in the right through-lane by the restrained 58-year-old female driver, who intended to proceed southbound and cross through the intersection.

There was no physical evidence at the crash site to support avoidance steering or braking by either the driver of the ambulance or the driver of the Toyota prior to impact. Data imaged from the Toyota's EDR indicated that it was traveling 103 km/h (64.8 mph) at 4.8 seconds prior to Algorithm Enable (AE). This speed was reduced via engine braking only (no driver input) to 97 km/h (60.3 mph) at 0.3 seconds prior to AE. Steering data indicated a right input of 18-degrees by the Toyota's driver at the same 0.3-second time interval.

Crash

The first crash event occurred within the intersection (**Figure 4**) as the front plane of the Toyota impacted the forward aspect of the ambulance's right plane in a near right-angle orientation. Associated crash forces were within the 2 o'clock sector for the ambulance and 11 o'clock sector for the Toyota. Impact engagement induced a rapid CCW rotation to the ambulance and a rapid clockwise (CW) rotation to the Toyota. The ambulance's trajectory was redirected to the southwest, while the Toyota's trajectory was redirected westward. Damage was sustained by the ambulance's right front wheel/axle, right front door, and right front fender. The right front window glazing was disintegrated by the impact forces.

Figure 4: West-facing view of the area of initial impact within the intersection.

Lateral forces displaced both unrestrained occupants within the ambulance to the right. The front right occupant contacted the right B-pillar area, and her head and right shoulder became partially ejected through the opening created by the disintegration of the right front glazing. As the ambulance was redirected and rotated CCW, forces associated with the crash relative to the vehicle's elevated center of gravity induced a roll-moment about its longitudinal axis. Instability was created, and the vehicle began to roll to the right about its longitudinal axis. As the Toyota simultaneously rotated CW, its left plane impacted the right plane of the ambulance in a side-slapping configuration (Event 2). Associated forces were within the 3 o'clock sector for the ambulance and the 9 o'clock sector for the Toyota. This impact likely exacerbated the partial ejection of the ambulance's front right occupant.

The ambulance and Toyota separated along their redirected trajectories. As the Toyota was displaced west, it continued to rotate CW. It then slid to final rest within the westbound lane of the west intersection leg, facing northwest. The ambulance rolled one-quarter turn onto its right plane, uninterrupted (Event 3). As the right plane contacted the roadway surface, the partially ejected front right occupant became entrapped between the ambulance's right plane and the roadway surface. The ambulance then slid southwest on its right plane into the west intersection leg.

The final crash event occurred as the rear aspect of the ambulance's top plane impacted the front of the stationary Subaru (Event 4). These forces were non-horizontal in nature for the ambulance, but within the 12 o'clock sector for the Subaru. Engagement between the vehicles displaced and rotated the Subaru approximately 2.0 m (6.6 ft) rearward and 15 degrees CW from its stationary position, where it came to final rest in the eastbound lane, facing east. The ambulance came to final rest with its top plane in contact with the front plane of the Subaru, facing southwest. At this final rest position, the head, upper extremities, and upper torso of the partially ejected front right occupant were entrapped beneath the over-turned ambulance. **Figure 5** depicts an on-scene overhead view of the ambulance, Toyota, and Subaru at final rest.

Figure 5: East-looking overhead view of the crash site and the involved vehicles at final rest (*image provided by the investigating law enforcement agency*).

Post-Crash

The local emergency response system received multiple communications reporting the crash and dispatched local fire department, EMS, and law enforcement personnel to the scene. Upon the arrival of EMS personnel, the partially-ejected female EMS provider was observed to be partially entrapped beneath the overturned vehicle. She did not have any palpable vital life signs. Firefighters removed the windshield glazing from the ambulance and assisted the unrestrained driver from the vehicle.

The driver of the Toyota was immobilized on a long spine board with cervical collar. Both she and the driver of the ambulance were transported by other ambulances to local hospitals. The driver of the Subaru denied injury and was not medically treated or transported. Following an extensive process to lift the vehicle, the female EMS provider was pronounced deceased. Her body was removed from the crash scene and transferred to a local office for post-mortem examination. All three vehicles were removed by a local recovery service to a local yard, where they were held in impound by the investigating law enforcement agency.

2008 FORD E350 TYPE II AMBULANCE

Description

The 2008 Ford E350 (**Figure 6**) was manufactured in March of 2008 and was identified by the Vehicle Identification Number (VIN): 1FDSS34P88Dxxxxxx. It was manufactured as an incomplete vehicle chassis equipped with Ford's Ambulance Prep Package and the Super Duty trim and suspension equipment. A placard confirmed that the vehicle conformed to all applicable Federal Motor Vehicle Safety Standards (FMVSS) in effect as of its date of manufacture. Its digital odometer reading could not be obtained during the SCI vehicle inspection due to electrical system inoperability.

Figure 6: Left plane view of the 2008 Ford E350 ambulance at the time of the SCI inspection.

The ambulance had a single-wheel rear drive axle and was built on a 351 cm (138.0 in) wheelbase. Its powertrain consisted of a 6.0-liter V-8 diesel engine that was linked to a 5-speed automatic transmission with overdrive. The vehicle manufacturer's recommended tire size was LT245/75R16E front and rear, with recommended cold tire pressures of 414 kPa (60 PSI) front and 556 kPa (80 PSI) rear. All four tires were Bridgestone Duravis R500HD tires of the recommended size, with matching Tire Identification Numbers (TINs) of "EHA3 JBJ 4912." Specific tire data measured during the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	421 kPa (61 PSI)	8 mm (10/32 in)	No	None
LR	558 kPa (81 PSI)	6 mm (7/32 in)	No	None
RR	538 kPa (78 PSI)	6 mm (7/32 in)	No	None
RF	Tire Flat	6 mm (8/32 in)	N/A	None visible

The interior of the Ford's cab was configured for the seating of two occupants. Both seats were forward-facing, box-mounted seats with manual seat track and seat back recline adjustments, and featured integral head restraints. Each was equipped with a folding armrest mounted to the inboard aspect of the seatback.

At the time of the SCI inspection, both front seats were adjusted to their rearmost track positions. The driver's armrest was stowed, while the front right armrest was in its downward position. Occupant protection systems included 3-point lap and shoulder safety belts with buckle pretensioners, as well as driver and front right passenger frontal air bags. Between the two seats and beneath the instrument panel's stereo and climate controls was a center console with an array of switches and communications equipment related to the ambulance's emergency response and operations activities.

SJC Industries Corporation Patient Compartment

The Ford's chassis was completed as a Type II Certified "Star of Life" ambulance during secondary manufacturing by SJC Industries Corporation of Elkhart, Indiana in June of 2008. This consisted of the affixation to the Ford's cargo area with a raised fiberglass roof structure to the cargo area of the vehicle, as well as the completion of the interior as a patient compartment. Emergency services operations equipment, such as warning lights, sirens, and radio communications, were installed in the cab. The patient compartment was equipped as a mobile emergency medical care unit, configured for the seating of up to four occupants and with a centralized patient cot. There were multiple cabinets and a counter area mounted to the left wall and bulkhead area of the interior. The layout included double rear-entry doors for cot loading and double right entry doors. A placard confirmed that the Type II ambulance conformed to the Federal Specifications KKK-A-1822 in effect on its date of manufacture.

Interior cabinets were constructed of plywood and aluminum components of varying thicknesses, bonded together using a variety of glue, wooden pegs, and metallic screws. Surfaces were covered with a laminate finish, and all cabinets were outfitted with clear polymer sliding doors. Aluminum corner bead was used for edge trim. Fiberglass and foam insulation provided thermal and acoustic protection from the outside environment. Seating included a three-passenger, left-facing bench seat mounted on the right wall above the right rear axle position, as well as a rear-facing single position bench at the front of the patient compartment, directly forward of the patient cot. A pass-through to the cab of the ambulance was located adjacent to this positon.

Vehicle Weight/Payload

The Ford chassis was placarded by its manufacturer with a Gross Vehicle Weight Rating (GVWR) of 4,309 kg (9,500 lb). This was distributed as Gross Axle Weight Ratings (GAWR) front and rear of 2,087 kg (4,600 lb) and 2,760 kg (6,084 lb), respectively. The placard posted by the secondary manufacturer declared that the total curb weight of the completed ambulance was 3,660 kg (8,068 lb). It further declared that the total useable payload was 650 kg (1,432 lb). During the SCI vehicle inspection, the SCI Investigator estimated the combined weight of the EMS equipment and supplies on-board the involved ambulance to be approximately 204 kg (450 lb). Based on the vehicle's placarded available payload and the SCI Investigator's assessment of the EMS equipment and supplies, the calculated available payload for occupants and personal belongings was 445 kg (982 lb). It was therefore concluded that the ambulance was not operating in excess of its available payload capacity at the time of the crash.

Exterior Damage

The SCI inspection of the ambulance identified multiple areas of impact and rollover damage, which were directly related to the multiple events of the crash. Relative to the Event 1 impact was lateral crush to the right front fender, right front door, and surrounding components. The right front wheel was collapsed and the entire wheel, tire, and axle assembly were separated from the vehicle. A black tire transfer mark was visible at the center aspect of the right front door, attributable to engagement with the Toyota's left front tire. The lower right A-pillar and door were crushed laterally, such that the door was jammed shut and intruded into the interior.

Figure 7: View of the Event 1 damage profile to the ambulance, as viewed from the approximate angle of the impact force.

Direct contact damage associative to the first impact event with the front plane of the Toyota began 31 cm (12.2 in) aft of the right front bumper corner and extended 155 cm (61.0 in) rearward. The direct and induced damage width measured 212 cm (83.5 in), beginning 14 cm (5.5 in) aft of the right front bumper corner and extending rearward. A residual crush profile was documented at sill level using the half-width method (**Figure 7**). This crush profile produced the following resultant measurements: C1 = 1 cm (0.4 in), C2 = 28 cm (11.0 in), C3 = 27 cm (10.6 in), C4 = 51 cm (20.1 in), C5 = 43 cm (16.9 in), C6 = 17 cm (6.7 in). Maximum crush was observed at the C4 measurement location. The Collision Deformation Classification (CDC) assigned to the ambulance for the Event 1 impact with the Toyota was 02RYEW3. Due to the ambulance's weight and characteristics, the vehicle type was beyond the scope of the WinSMASH model. However, the Damage Algorithm of the model was used to calculate a reconstruction of the crash for analysis purposes. The calculated delta-V of the ambulance for the Event 1 impact was 18 km/h (11.2 mph), with longitudinal and lateral components of -9 km/h (-5.6 mph) and -16 km/h (-9.9 mph), respectively. The Barrier Equivalent Speed (BES) was 27 km/h (17 mph). These results appeared underestimated.

Distinct side-slap damage was visible on the ambulance's right plane. The profile of the rear aspect of the Toyota's left plane was sharply outlined on the ambulance's right plane (**Figure 8**). Within the damage pattern was lateral deformation to the right plane of the ambulance, with surface scratches and abrasions in the painted surface. An I-shaped perforation into the body panel was located within the right rear quarter panel area, attributable to the side profile of the Toyota's rear bumper beam.

Figure 8: Right plane view of the ambulance and the resultant side-slap (Event 2) damage profile.

A circular tire mark, attributable to the Toyota's rotating left rear tire, was visible on the right rear quarter panel area of the ambulance immediately rearward of the right rear axle position. Direct contact damage associative to the side-slap event began 29 cm (11.4 in) forward of the right rear axle position and extended 147 cm (57.9 in) rearward. The direct and induced damage width measured 187 cm (73.6 in), beginning 45 cm (17.7 in) forward of the right rear axle position and extending rearward. A residual crush profile was documented at upper door level using the half-width method. This crush profile produced the following resultant measurements: C1 = 4 cm (1.6 in), C2 = 15 cm (5.9 in), C3 = 26 cm (10.2 in), C4 = 20 cm (7.9 in), C5 = 15 cm (5.9 in), C6 = 6 cm (2.4 in). Maximum crush was observed at the C3 measurement location. The CDC assigned to the ambulance for the Event 2 side-slap with the Toyota was 03RBAW3.

Due to the ambulance's weight and characteristics, the vehicle type was beyond the scope of the WinSMASH model. However, the Damage Algorithm of the model was used to calculate a reconstruction of the crash for analysis purposes. The delta-V of the ambulance for the Event 2 impact was 7 km/h (4 mph), with longitudinal and lateral components of zero and -7 km/h (-4 mph), respectively. The BES was 10 km/h (6 mph). These results appeared underestimated.

Rollover damage was visible across the entire right plane. This included surface scratches, abrasions, and minor deformation. The stalk of the right side mirror was fractured at its mount and as a result, the mirror hung down against the vehicle. Abrasions to the body surface were parallel and in an angular orientation, from the forward upper aspect toward the rear lower aspect. No measurable lateral crush associative to the rollover was definitive due to the overlapping nature of the right plane damage patterns. The CDC assigned to the ambulance for the Event 3 damage pattern was 00RDAO2. No WinSMASH calculations could be performed for the rollover due to the non-horizontal nature of the associated forces.

Figure 9: Right rear oblique overhead view of the ambulance's top plane and the Event 4 damage.

Damage associative to the fourth impact event with the front plane of the Subaru was located on the top plane of the ambulance, to the raised fiberglass roof structure. This included fracture of the fiberglass right of centerline, at the rear aspect of the roof. In conjunction with the fractured fiberglass, multiple emergency warning lights at the upper aspect of the rear plane were displaced from their housing within the fiberglass structure. There was also a pattern of abrasions to the painted surface of the fiberglass, with black polymer and red paint transfer. The black polymer transfer matched the shape and dimension of the Subaru's front license plate frame (**Figure 9**). The CDC assigned to the ambulance for the Event 4 impact with the Subaru was 00TBDW2. No WinSMASH calculations could be performed for this impact as the impact configuration was beyond the scope of the program.

Event Data Recorder

The 2008 Ford E350 was equipped with a Restraints Control Module (RCM) designed for the diagnostics, sensing, and control of the vehicle's supplemental restraint systems. However, it did not have EDR capabilities that were supported by the Bosch Crash Data Retrieval (CDR) tool. No data could be imaged from the Ford.

Interior Damage

The cab of the ambulance was inspected for occupant contact, intrusion, and crash related damage. Occupant contact evidence was located throughout the cab's interior, and highlighted the unrestrained occupants' kinematic responses to the crash forces. Contact evidence attributable to the driver was observed to the center console, roof, partition between the cab and patient compartment, and armrest of the right front seat. The center console was deformed and multiple operational switches were displaced and/or damaged by loading from the driver's right flank and right lower extremity (**Figure 10**). A bracket mounted to the console that served as the securement for a two-way mobile communications radio was bent to the right. Scuffs to the roof from contact by the driver's head were also visible. On the clear polymer panel of the partition separating the cab from the patient compartment was a scuff oriented from the lower left corner toward the upper right corner (**Figure 11**). This was attributed to contact from the driver's back. Lastly, the right armrest on the left aspect of the front right seat back was deformed to the right. It is probable that this resulted from contact with the displaced driver's right flank.

Figure 10: Interior damage to the center console within the ambulance's cab attributable to driver contact.

Figure 11: Driver contact to the roof and rear partition within the ambulance's cab.

Significant contact evidence described the unrestrained front right occupant's trajectory. Loading, deformation, and blood transfer were visible to the upper quadrants of the right front door panel. A scuff with hair and skin transfer was observed on the right B-pillar, attributable to contact from the front right occupant's head. Hair was also embedded between the weather-stripping and headliner on the right roof side rail, also attributable to contact from the female's head. The right lower instrument panel was deformed slightly forward, likely as the result of contact and loading by the front right occupant's knees.

Blood transfer, splatter, and smears were visible on the right roof side rail and right upper A-pillar (**Figure 12**). On the exterior of the ambulance and extending in an angular fashion from the right front glazing opening toward the lower aspect of the right rear loading doors was blood, hair, and body tissue. This resulted from contact by the partially ejected front right occupant with the ambulance and roadway surface as the vehicle slid on its right plane from the rollover until final rest.

Figure 12: Front right occupant contact evidence to the roof, A-pillar, B-pillar, and right roof side rail within the cab of the ambulance.

Intrusion into the interior occupant space was measured within the cab of the ambulance. This included 5 cm (2.0 in) lateral intrusion of the forward upper quadrant of the right front door, 12 cm (4.7 in) lateral intrusion of the forward lower quadrant of the right front door, and 14 cm (5.5 in) lateral intrusion of the floor pan adjacent to the right sill and right lower A-pillar. All three intrusions were associative to the first impact event with the Toyota. Intrusion was also observed within the patient compartment of the ambulance, attributable to the side-slap and top plane impact events. Maximum lateral intrusion was approximately 18 cm (7.1 in), located to the right wall above the right rear axle position. Vertical intrusion was immeasurable due to the partial separation of the roof fascia and post-impact rebound of the fiberglass roof structure.

Secondary damage, associated to the crash sequence, was sustained by the interior of the patient compartment. This included separation of the cabinetry and storage compartments on the right plane, inclusive of the three-passenger left-facing bench seat and on-board oxygen storage tank (located within a compartment at the right rear corner). Left wall cabinetry and storage remained largely intact and undamaged. Unsecured medical equipment and supplies were strewn about the patient compartment's interior (**Figure 13**).

Figure 13: Forward-facing view of the patient compartment's interior at the time of the SCI investigation.

During the vehicle inspection, it was noted that the AS1 laminated windshield glazing had been removed by emergency response personnel to obtain entry to the ambulance's cab and provide a means of egress for the driver. However, it is probable that the windshield glazing was fractured by the crash forces prior to its post-crash removal. The right front glazing disintegrated as a result of the first impact event, and provided the portal through which the unrestrained front right occupant was partially ejected.

Remaining right side glazing, consisting of that within the right dual-entry doors, was disintegrated either during the side-slap event or rollover. None of the ambulance's rear or left plane glazing sustained damage during the crash sequence. The right front door was jammed shut associative to the Event 1 impact. Based on the observed damage, it is probable that the rear right loading door came open during the crash sequence. All other doors remained closed during the crash and were operational at the time of inspection.

Manual Restraint Systems

The manual restraints for the driver and front right passenger positions consisted of 3-point lap and shoulder safety belts with buckle pretensioners. Both safety belt systems utilized continuous loop webbing with sliding latch plates and adjustable D-rings. The driver's manual restraint was equipped with an Emergency Locking Retractor (ELR), while the front right passenger's manual restraint was equipped with a switchable ELR/Automatic Locking Retractor (ALR). The driver's D-ring was adjusted fully upward, while the front right was full-down.

At the time of the SCI inspection, the driver's safety belt system was found hanging loosely from the B-pillar with the majority of its slack retracted. The functional retractor spooled webbing freely. There was evidence of historical wear, but the system was devoid of crash-related loading evidence. The front right safety belt system was hanging loosely against the B-pillar. The retractor was locked in ELR mode, likely the result of deformation to the exterior surface of the right B-pillar. Historical wear was evident on the latch plate, but no loading evidence was identifiable. Neither pretensioner was actuated. It was apparent that neither front safety belt system was in use at the time of the crash.

Supplemental Restraint Systems

The ambulance was equipped with a frontal air bag system that provided supplemental inflatable restraint for the driver and front right passenger. This system consisted of dual-stage air bags that were mounted within the steering wheel hub and top right instrument panel, respectively. The vehicle was not subject to the advanced air bag portion of FMVSS No. 208; therefore, the air bag system was not Certified Advanced 208-Compliant (CAC). Both air bags were installed by the manufacturer and had not required or received any service or maintenance prior to the incident crash.

The frontal air bags did not deploy during the multiple event crash sequence. However, deployment of the frontal air bag system would not be expected as a result of the lateral impact with the Toyota. Because the Ford was not equipped with side impact or Inflatable Curtain (IC) air bags, nor did it have roll sensing capabilities, no deployment of any air bag systems would be expected in relation to the rollover crash event or the non-horizontal forces from the impact with the Subaru.

Patient Cot and Fastening System

Figure 14: Stryker MX-Pro R3 cot within the focus ambulance at the time of the SCI inspection.

The patient cot was a MX-Pro R3 Model 6082 wheeled ambulance cot (**Figure 14**) that was manufactured by Stryker. Its serial number was S/N: 09044xxxx, indicative that it was manufactured in April of 2009. It should be noted that the cot was not occupied at the time of the crash. The Stryker cot was constructed of a tubular aluminum frame with circumferential weld joints and steel hardware fasteners. The X-frame supporting the mattress platform featured manual raise/lower capabilities with height positions between a minimum of 34 cm (13.5 in) and a maximum of 95 cm (37.5 in). The mattress platform itself featured positive backrest angular adjustment between 2- and 73-degrees via a manually controlled gas-pressure cylinder. The leg portion featured 14 degrees of positive angular adjustment. Overall dimensions of the cot were 58 cm (23.0 in) wide and 205 cm (80.7 in) long. A placard declared that the load capacity limit of the cot was 295 kg (650 lb).

Figure 15: Shoulder straps of the Stryker cot bound tightly behind the back of the cot.

The Stryker cot was equipped with a multi-point harness system for manual restraint of its occupant (patient). This system consisted of a lateral leg strap, a lateral lap/thigh strap, and two shoulder straps that buckled into a lateral chest strap. All straps were constructed of fixed length webbing that included either locking latch plates or sewn buckles. At the time of the SCI inspection, the lateral straps were all loosely bucked across the mattress. The shoulder restraint straps were wrapped end-over-end, bound tightly with medical tape, and tucked behind the back portion of the mattress platform (**Figure 15**). Exposed surfaces of the tape were soiled, and edges were lightly frayed. It was therefore apparent that the shoulder harness straps of this particular cot likely were habitually not used by the EMS agency or its providers in the restraint of patients.

The cot was secured in place within the patient compartment via a Ferno Cot Fastener, which was identified by the S/N: 14N-3088xx. The system consisted of a forward antler bracket and rear locking rail-clamp mechanism. The antler bracket cradled the forward portion of the cot's frame, while the vertically-oriented locking mechanism secured the pin affixed to the lower frame rail of the cot. Combined, these two components were intended to restrict the lateral and longitudinal movement of the cot within the ambulance.

No apparent damage was visible to the Stryker cot associative to the multiple event crash sequence. The adjustment functions of the mattress platform remained functional. Similarly, there was no visible damage to the cot fastener system. The Stryker cot remained secured by the Ferno cot fastener, with the forward aspect of the cot within the antler bracket.

2008 FORD E350 TYPE II AMBULANCE OCCUPANTS

Driver Demographics

Age / Sex:	24 years / Male
Height:	Unknown
Weight:	90 kg (198 lb)
Eyewear:	Unknown
Seat Type:	Forward-facing box-mounted (MMUCC* Position 1)
Seat Track Position:	Rearmost
Manual Restraint Usage:	None used; 3-point lap and shoulder safety belt available
Usage Source:	SCI inspection
Air Bags:	None deployed; dual-stage frontal air bag available
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Exited vehicle with some assistance
Transport from Scene:	Ambulance to a local hospital
Medical Treatment:	Evaluated, treated, and released

** - Based on the Model Minimum Uniform Crash Criteria, Appendix N: Ambulance Diagram*

Driver Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	3 cm laceration to anterior left scalp	110602.1,2	Windshield	Probable
2	Laceration to left eye, superior orbit	240620.1,2	Windshield	Probable
3	Laceration to left eyebrow region	210602.1,7	Windshield	Probable
4	Multiple contusions to top of head	110402.1,9	Roof/headliner	Probable
5	Multiple abrasions to top of head	110202.1,9	Roof/headliner	Probable
6	Contusion to dorsum of right hand	710402.1,1	Center console, instrument panel	Probable

Source: Emergency department records

Driver Kinematics

The 24-year-old male driver was positioned within the driver's seat of the ambulance. The driver's seat was adjusted to its rearmost track position, with the seat back slightly reclined. Although a 3-point lap and shoulder safety belt system was available for manual restraint, the driver was unrestrained. His restraint usage was determined through a combination of the post-crash condition of the safety belt system and interior contact evidence.

While operating the ambulance on approach to the intersection, the driver toggled the vehicle's emergency warning siren. He remained within the driver's position as the vehicle entered the intersection. At impact with the Toyota, the driver initiated a forward and right lateral trajectory in response to the 2 o'clock direction of force. The driver was subject to unrestricted movement in response to crash forces due to his unrestrained status. His right lower extremity, inclusive of his thigh, contacted and loaded the center console and emergency vehicle operations equipment. This contact was evidenced by deformation to the console and displacement of multiple components. His right upper extremity likely contacted the center console and center instrument panel, resulting in a soft tissue injury. The driver's torso began to flex forward and right. It is probable that the driver contacted the windshield with his head and face, which produced several soft tissue injuries.

As the ambulance was redirected left by the initial impact force and rotated CCW, the driver maintained loading of the center console and its components. His trajectory continued as the ambulance side-slapped the Toyota. Centrifugal forces initiated a vertical trajectory to the driver as the ambulance began to roll right. The driver was directed toward the partition and roof by the associated forces. His back contacted and scuffed the partition, while his head engaged the headliner. This contact produced soft tissue contusion and abrasion injuries to the driver's head.

The driver maintained this trajectory as the ambulance fell onto its right plane. Forces of gravity directed the driver downward, and his right flank contacted the inboard armrest of the front right seat. This deformed the armrest, but it did not produce an associative injury. While the vehicle slid on its right plane, it is certain that the displaced driver contacted the partially ejected front right occupant. The driver was held within the front right space of the overturned ambulance as it slid into the west intersection leg. The fourth impact event with the Subaru did not produce sufficient forces to further displace the driver or induce injury.

The driver remained within the front right space of the ambulance as it came to final rest. Upon the arrival of emergency services personnel, the windshield of the ambulance was removed and the driver was assisted from the overturned vehicle through the resulting opening. He was then transported by ambulance to a local hospital for evaluation and treatment of his injuries.

Front Row Right Occupant Demographics

Age / Sex:	22 years / Female
Height:	169 cm (66.5 in)
Weight:	71 kg (157 lb)
Eyewear:	None
Seat Type:	Forward-facing box-mounted (MMUCC* Position 3)
Seat Track Position:	Rearmost
Manual Restraint Usage:	None used; 3-point lap and shoulder safety belt available
Usage Source:	SCI inspection
Air Bags:	None deployed; dual-stage frontal air bag available
Alcohol/Drug Involvement:	
Egress from Vehicle:	Partially ejected during crash sequence
Transport from Scene:	None
Medical Treatment:	Pronounced deceased at the crash scene

Front Row Right Occupant Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Lacerated brain stem due to skull fracture	140212.6,8	Exterior surface of occupant's vehicle	Certain
2	Calvarium bisected transversely by a widely displaced linear fracture that extends across the right and left frontal bones	150406.4,5	Exterior surface of occupant's vehicle	Certain
3	Calvarium bisected transversely by a widely displaced linear fracture that extends across the right temporal bones	150406.4,1	Exterior surface of occupant's vehicle	Certain
4	Calvarium bisected transversely by a widely displaced linear fracture that extends across the left temporal bones	150406.4,2	Exterior surface of occupant's vehicle	Certain
5	Skull base is shattered with numerous fractures extending to the foramen magnum	150206.4,8	Exterior surface of occupant's vehicle	Certain
6	Cerebellum lacerated due to skull fracture	140474.3,6	Exterior surface of occupant's vehicle	Certain
7	Inferior surface of right frontal and temporal lobes lacerated due to skull fractures	140688.3,1	Exterior surface of occupant's vehicle	Certain
8	Inferior surface of left frontal and temporal lobes lacerated due to skull fractures	140688.3,2	Exterior surface of occupant's vehicle	Certain
9	Fracture to left maxilla	250804.2,8	Exterior surface of occupant's vehicle	Certain

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
10	Numerous fractures along left side and posterior aspects of cervical spine	650216.2,6	Exterior surface of occupant's vehicle	Certain
11	Left side of hyoid is fractured	350200.2,5	Exterior surface of occupant's vehicle	Certain
12	Exposed soft tissue over left maxilla and left mandible fractures	210804.2,8	Roadway surface	Certain
13	5 inch laceration on the top of left hand exposes the underlying tendons and muscles	710804.2,2	Roadway surface	Probable
14	Fracture to left mandible	250602.1,2	Exterior surface of occupant's vehicle	Certain
15	Left frontal, parietal, and temporal scalp shredded due to confluent abrasion and laceration	110600.1,0	Roadway surface	Certain
16	Left frontal, parietal, and temporal scalp shredded due to confluent abrasion and laceration	110202.1,0	Roadway surface	Certain
17	Left lateral side of face lateral to the eye shredded due to confluent abrasion and laceration	210600.1,7	Roadway surface	Certain
18	Left lateral side of face lateral to the eye shredded due to confluent abrasion and laceration	210202.1,7	Roadway surface	Certain
19	Left side of neck shredded due to confluent abrasion and laceration	310600.1,2	Roadway surface	Certain
20	Left side of neck shredded due to confluent abrasion and laceration	310202.1,2	Roadway surface	Certain
21	Left side of tongue is lacerated	243400.1,8	Roadway surface	Certain
22	3 inch area on upper aspect of right upper arm contains multiple superficial lacerations	710602.1,1	Roadway surface	Certain
23	A 5x4 inch area on the left shoulder contains multiple superficial and overlapping lacerations; 2 inch laceration on the extensor surface of the left wrist	710602.1,2	Roadway surface	Certain

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
24	Left clavicular region, left shoulder, and proximal portion of left upper arm are covered by red abrasion; on extensor surface of left forearm, several linear depressed brown abrasions up to 3x1/4 inch; confluent red and pink abrasion covers much of extensor surface of left forearm and back of left hand	710202.1,2	Roadway surface	Certain
25	Faint horizontal and oblique linear brown and red abrasions on the right and left upper back are up to 5 inches in length	410202.1,6	Roadway surface	Certain
26	Confluent red abrasion extends over lateral aspect of right upper chest	410202.1,7	Roadway surface	Certain
27	Confluent red abrasion extends over right shoulder, and upper right arm; several dried yellow abrasions on the distal flexor surface of the upper right arm are up to 3x2 inches in greatest dimension	710202.1,1	Roadway surface	Certain
28	Right side of forehead has multiple brown and red abrasions that range from ½ inch to 3 inches in greatest dimension	210202.1,7	Roadway surface	Certain
29	Right cheek has multiple brown and red abrasions that range from ½ inch to 3 inches in greatest dimension	210202.1,1	Roadway surface	Certain

Source: Autopsy Report (internal) and Autopsy photos

Front Row Right Occupant Kinematics

The 22-year-old female EMS provider was positioned in the front right seat, with the track full-rear and the seat back slightly reclined. She did not utilize the available 3-point lap and shoulder safety belt system. Her lack of manual restraint usage was determined through an inspection of the post-crash condition of the safety belt system, interior contact evidence, and her partially ejected status.

At impact with the Toyota, the front right occupant initiated a right lateral trajectory in response to the 2 o'clock direction of force. Her right flank contacted and loaded the right door panel, while her head contacted and loaded the right roof side rail. This contact were evidenced by deformation and scuffing, with the front right occupant's long dark hair embedded between the weather-stripping and the headliner. Although it is possible that this contact may have induced soft tissue or other injury, any associative injuries were masked and/or exacerbated by subsequent events.

Disintegration of the right front glazing associative to the initial impact force resulted in loss of integrity to the ambulance's cab. Subsequently, as the ambulance began to rotate CCW and was redirected by the impact, the front right occupant's head and right upper extremity contacted the right B-pillar and became partially ejected through the right front glazing opening. Her partial ejection and contact with the B-pillar was exacerbated by the side-slap event, and her right flank continued to load the right door panel. The front right occupant's head, right upper extremity and shoulders contacted the asphalt surface of the roadway as the ambulance rolled one-quarter turn onto its right plane. Associated friction resulted in further ejection of the occupant as the vehicle slid into the west intersection leg, and induced multiple injuries. The front right occupant then became entrapped beneath the overturned vehicle for the remainder of the crash sequence, in contact with both the roadway surface and a portion of the ambulance's right plane. This was evidence by blood and tissue transfer on the roadway and exterior of the ambulance, and resulted in numerous head, torso, and upper extremity injuries.

The fourth impact event did not affect the front right occupant's kinematics. As the ambulance came to final rest, the partially ejected female's entire torso, head, and upper extremities were entrapped beneath the overturned ambulance. She did not display any life signs and was pronounced deceased at the crash scene. The vehicle was lifted and her body was removed from the crash scene by the medical examiner and transferred for autopsy.

2013 TOYOTA PRIUS

Description

The 2013 Toyota Prius (**Figure 16**) was manufactured in October of 2012 and was identified by the VIN: JTDKN3DU5D5xxxxxx. Its digital odometer reading could not be obtained during the SCI vehicle inspection due to electrical system inoperability. The Toyota was a front-wheel drive platform built on a 271 cm (106.7 in) wheelbase. Its powertrain consisted of a 1.8 liter inline 4-cylinder gasoline engine that was linked to a continuously variable transmission (CVT).

Figure 16: Front left oblique view of the 2013 Toyota Prius at the time of the SCI inspection.

The vehicle manufacturer's recommended tire size was P195/65R15 front and rear, with recommended cold tire pressures of 241 kPa (35 PSI) front and 228 kPa (33 PSI) rear. At the time of the SCI inspection, all four tires were Yokohama Avid S33 tires of the recommended size, with matching TINs of "FC9N N5P 3812." Specific tire data measured during the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	234 kPa (34 PSI)	6 mm (7/32 in)	No	None
LR	248 kPa (36 PSI)	6 mm (7/32 in)	No	None
RR	234 kPa (34 PSI)	6 mm (7/32 in)	No	None
RF	228 kPa (33 PSI)	6 mm (7/32 in)	No	None

The interior of the Toyota was equipped for the seating of up to five occupants. It was configured with two front row bucket seats and a three-passenger bench seat with folding seat backs in the second row. All seats were cloth-surfaced. The front seats featured seat track and seat back recline adjustments, and were equipped with adjustable head restraints. The second row was equipped with adjustable head restraints for all three positions.

Occupant protection systems included 3-point lap and shoulder safety belts for all five seat positions. Supplemental restraint systems included front safety belt retractor pretensioners, a CAC frontal air bag system for the driver and front right occupant, front knee air bags, front seat-mounted side-impact air bags, and side-impact sensing IC air bags.

Exterior Damage

Damage to the Toyota was present on both the front and left planes, attributable to the first and second crash events with the ambulance. Within the front damage profile was longitudinal and lateral deformation to the bumper beam, hood, left front fender, and under-hood components (**Figure 17**). The front bumper fascia and grille were separated from the Toyota. Direct contact damage began at the left front bumper corner and extended 109 cm (42.9 in) to a point located 22 cm (8.7 in) right of the vehicle's centerline. The right aspect of the bumper beam was separated from its mounting location at the end of the right frame rail. However, the beam's center aspect and the area within the direct contact damage were embedded within the radiator and surrounding components. The left aspect of the beam remained mounted to the left frame rail. Therefore, even though the residual crush profile was documented to the partially separated front bumper beam, the damage measurements remain valid.

Figure 17: Overhead view of the Toyota's front plane damage pattern.

The Field-L utilized spanned the damaged bumper beam's 96 cm (37.8 in) deformed width, and produced the following resultant measurements: C1 = 27 cm (10.6 in), C2 = 41 cm (16.1 in), C3 = 52 cm (20.5 in), C4 = 32 cm (12.6 in), C5 = 10 cm (3.9 in), and C6 = 0 cm (0 in). Maximum crush was observed at the C3 measurement location. The CDC assigned to the Toyota for the Event 1 impact with the ambulance was 10FYEW3.

Due to the ambulance's weight and characteristics, its vehicle type was beyond the scope of the WinSMASH model. However, the Damage Algorithm of the model was used to calculate a reconstruction of the crash for analysis purposes. The calculated delta-V of the Toyota for the Event 1 impact was 52 km/h (32.3 mph). Longitudinal and lateral components of this calculated delta-V were -40 km/h (-24.9 mph) and 34 km/h (21.1 mph), respectively. The BES was 42 km/h (26 mph). These values appeared reasonable.

Side-slap damage was located on the rear aspect of the Toyota's left plane. Remnants of transfer from the vinyl graphics on the right side plane of the ambulance were distinctly visible on the left rear quarter panel and C-pillar area of the Toyota. Lateral deformation was present on the left rear door, left rear quarter panel, hatchback, and rear bumper. The left taillight assembly was disintegrated. At the left rear bumper corner, an outward perforation to the bumper fascia attributable to the end profile of the bumper beam was visible. This aligned with the penetration observed on the right side plane of the ambulance.

Figure 18: Left plane view of the side-slap damage to the Toyota.

Direct contact damage associative to the side-slap event (**Figure 18**) measured 178 cm (70.1 in), beginning at the left rear bumper corner and extending forward. A residual crush profile was documented using a Field-L width of the same dimension, which produced the following resultant measurements: C1 = 15 cm (5.9 in), C2 = 13 cm (5.1 in), C3 = 10 cm (3.9 in), C4 = 10 cm (3.9 in), C5 = 6 cm (2.4 in), C6 = 0 cm (0 in). Maximum crush was observed at the C1 measurement location. The CDC assigned to the Toyota was 09LZAW2.

Due to the ambulance's weight and characteristics, its vehicle type was beyond the scope of the WinSMASH model. However, the Damage Algorithm of the model was used to calculate a reconstruction of the crash for analysis purposes. The total calculated delta-V of the Toyota for the Event 2 side-slap was 21 km/h (13 mph), with longitudinal and lateral components of zero and 21 km/h (13 mph), respectively. The BES was 15 km/h (9 mph). These values appeared reasonable.

Event Data Recorder

The 2013 Toyota Prius was equipped with an Electronic Control Unit (ECU) that performed the diagnostic, sensing, and control of the vehicle's supplemental restraint systems (pretensioner and air bags). This ECU also had EDR capabilities, as it was a module designed to be compatible with the requirements of Federal Motor Vehicle Safety Standard 49CFR Part 563. The Toyota's EDR had the capability to record multiple Non-Deployment and Deployment events that could occur in both planar (front/rear/side) and non-planar (rollover) crashes. Data was imaged from the Toyota's EDR by the investigating law enforcement agency using the Bosch Crash Data Retrieval (CDR) tool and software, version 16.1.1. The data was collected through a hardware connection to the Toyota's Diagnostic Link Connector (DLC), with application of external 12-volt power. An electronic (.CDRx) file was provided to the SCI Investigator by the law enforcement agency, and the imaged data was subsequently reported using software version 16.6. The reported data is attached at the end of this technical report as **Attachment B**.

Data recording consisted of elements descriptive of the accelerations and velocity changes (delta-V) related to the physical crash event(s). A Non-Deployment was any crash event which did not meet the criteria required to deploy a supplemental safety device. Deployment events, by definition, resulted in either the deployment of an air bag system or the actuation of a safety belt pretensioner. Data for a Deployment event became locked and could not be overwritten by subsequent events. Non-Deployment data remained volatile and could be overwritten by a subsequent event of greater severity once all memory buffers were full. The EDR's post-crash recording memory buffers included capacity for up to two front/rear events, two side events, and two rollover events. Linked to each recorded event was a pre-crash buffer with up to five seconds of asynchronous data, recorded in approximate 0.5-second intervals. This data was descriptive of the vehicle's pre-crash operation and its elements included: vehicle speed, accelerator pedal position, engine throttle percentage, engine RPM, brake circuit status, steering input, transmission shift position, and other data points. The EDR had the capacity to store up to two pre-crash data sets.

The EDR used the concepts of triggers to describe the order of detected events. The lowest trigger number was related to the event which occurred earliest in the time history of the overall sequence of detected crash events. A review of the imaged data indicated that the sensors coupled to this EDR had detected three events. All three of these detected events, termed triggers 1-3, occurred on Ignition Cycle 2,372. The data was imaged on Ignition Cycle 2,373.

At the time of the crash (Ignition Cycle 2,372), the air bag warning lamp within the instrument cluster was "Off" and there were no Diagnostic Trouble Codes (DTCs) present. The safety belt status for the driver and front right passenger positions were "On" and "Off," respectively. The front right passenger seat was reported as "Not Occupied." A field within each recording reported that the data was "Completely Written" to memory, and the memory was frozen (locked). Three pre-crash data sets were recorded. Due to the time history of the recorded events (Triggers), the pre-crash data sets included the same data outputs.

Pre-Crash Data

Data parameters of particular interest from the pre-crash data buffers are listed in the following table. This table combines the data buffers (Attachment A, pages 12, 21, and 27) into a single time line relative to the time of Trigger 1.

Time (sec)	-4.8	-4.3	-3.8	-3.3	-2.8	-2.3	-1.8	-1.3	-0.8	-0.3	0 (TRG)
Vehicle Speed MPH [km/h]	64.0 [103]	63.4 [102]	63.4 [102]	62.8 [101]	62.1 [100]	62.1 [100]	61.5 [99]	60.9 [98]	60.9 [98]	60.3 [97]	56.5 [91]
Accelerator Pedal (% full)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engine RPM	3,200	2,300	1,500	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Service Brake	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
Steering (deg)	0	0	0	0	3	3	0	0	0	-18	21

The pre-crash data indicates that the Toyota was coasting as it traveled south. Its speed slowly decreased from 103 km/h (64.0 mph) at 4.8-seconds prior to Trigger 1 to 98 km/h (60.9 mph) at 0.8-seconds prior to Trigger 1. The steering input at the final 0.3-second sample was associated with a right (CW) steering input. Coupled with the reported "On" status of the service brakes at Trigger 1, the pre-crash data was indicative of a right steering and braking input by the driver within milliseconds of the initial impact.

Trigger 1

Trigger 1 was a deployment event, evoked by the frontal impact sensors and attributed to the Toyota's frontal impact with the right plane of the ambulance. A maximum longitudinal delta-V of -81.1 km/h (-50.4 mph) was reported at 233 milliseconds. No corresponding lateral delta-V was reported. Associated with Trigger 1 were the following supplemental restraint system deployments:

Device	Time after Trigger (milliseconds
Front Safety Belt Pretensioners	4
Driver Frontal Air Bag, 1st stage	4
Driver Frontal Air Bag, 2nd stage	14
Side Curtain, Left	54
Side Curtain, Right	54

Although not reported in the data output, the Toyota's left front seat-mounted and knee bolster air bags deployed. It is most probable that the knee air bag deployment occurred in conjunction with the first stage of the driver's frontal air bag. Similarly, it is most probable that the seat-mounted side-impact air bag deployed in conjunction with the left side curtain air bag.

Trigger 2

Event Trigger 2 was a non-deployment event, evoked by the left side impact sensors. This was attributed to the engagement and rotation associated with the frontal impact with the ambulance, referenced as Event 1 of the SCI reconstruction. It was recognized 106 milliseconds after Trigger 1. The crash pulse data was recorded primarily by the B-pillar sensor, which reported a maximum lateral delta-V of 15.9 km/h (9.9 mph) at 68 milliseconds. No corresponding longitudinal delta-V was reported.

Trigger 3

Event Trigger 3 was recognized 96 milliseconds after Trigger 2 as a non-deployment event. This was attributed to the side-slap impact with the right plane of the ambulance (Event 2 of the SCI reconstruction). The maximum reported lateral delta-V at the B-pillar sensor and C-pillar sensor was 13.7 km/h (8.5 mph) and 10.5 km/h (6.5 mph), respectively. No corresponding longitudinal delta-V was reported.

Occupant Data

The Toyota was occupied by its restrained 58-year-old female driver. Her restraint usage was documented by the observations of emergency response personnel and the law enforcement investigation, and later confirmed by the observations of the SCI Investigator during the SCI vehicle inspection and a review of the imaged EDR data. Multiple supplemental restraint systems actuated and deployed as a result of the multiple event crash. The driver responded to the initial impact with a forward trajectory, and loaded the safety belt system and deployed frontal supplemental restraints. She was then directed left as the Toyota rotated CW and side-slapped the ambulance.

The driver's left flank loaded the deployed left IC and left front seat-mounted air bags. Her multiple contacts with supplemental restraints, loading of the safety belt system, and associated crash forces resulted in multiple unknown injuries. The driver remained restrained within the driver's seat position as the Toyota slid to final rest. She was semi-responsive at the scene and was unable to exit the Toyota under her own power. Emergency response personnel utilized hydraulic rescue tools and removed the Toyota's left front door. They then immobilized her cervical spine and removed her from the vehicle by placing her on a long spine board. An ambulance transported the Toyota driver to a local hospital, where she was admitted for treatment for an unknown time period.

2011 SUBARU LEGACY

Description

The 2011 Subaru Legacy was manufactured in June of 2011. It was identified by the VIN: 4S3BMBC62B3xxxxxx. It was an all-wheel drive platform built on a 275 cm (108.3 in) wheelbase. The powertrain consisted of a 2.5 liter inline 4-cylinder gasoline engine that was linked to continuously variable transmission (CVT).

Figure 19 depicts the 2011 Subaru Legacy at the time of the SCI inspection. The vehicle manufacturer's recommended tire size was P205/60R16 front and rear, with recommended cold tire pressures of 228 kPa (33 PSI) front and 221 kPa (32 PSI) rear. At the time of the SCI inspection, all four tires were Firestone Affinity Touring tires of the recommended size. The left side tires had matching TINs "W2XV A1A 1615," while the right side tires had matching TINs of "1V20 DDB 0215." Specific tire data measured during the SCI inspection was as follows:

Figure 19: Front right oblique view of the 2011 Subaru Legacy at the time of the SCI inspection.

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	228 kPa (33 PSI)	8 mm (10/32 in)	No	None
LR	228 kPa (33 PSI)	8 mm (10/32 in)	No	None
RR	228 kPa (33 PSI)	8 mm (10/32 in)	No	None
RF	234 kPa (34 PSI)	8 mm (10/32 in)	No	None

The interior of the Subaru was equipped for the seating of up to five occupants. It was configured with two front row bucket seats and a second row three-passenger bench seat, all of which were cloth-surfaced. The front seats featured adjustable seat track and seat back recline adjustments, and were equipped with adjustable head restraints. Occupant protection systems included 3-point lap and shoulder safety belts for all five seat positions, front safety belt pretensioners, a CAC frontal air bag system, front seat-mounted side-impact air bags, and side-impact sensing IC air bags.

Exterior Damage

Damage to the exterior of the Subaru associative to the focus crash was minimal, limited to minor body surface damage to the vehicle's front plane. Relative to the fourth crash event with the top plane of the ambulance, damage involved only the bumper fascia, grill, and hood of the Subaru. This consisted of the fracture of the black polymer license plate frame and surface abrasions and scratches to the bumper fascia (**Figure 20**). The grille was slightly deformed, and the leading edge of the hood was displaced slightly rearward on the left aspect. Direct contact measured 82 cm (32.3 in) wide, starting at the left front bumper corner and ending 16 cm (6.7 in) right of the vehicle's centerline.

Figure 20: View of the Event 4 damage to the front plane of the Subaru.

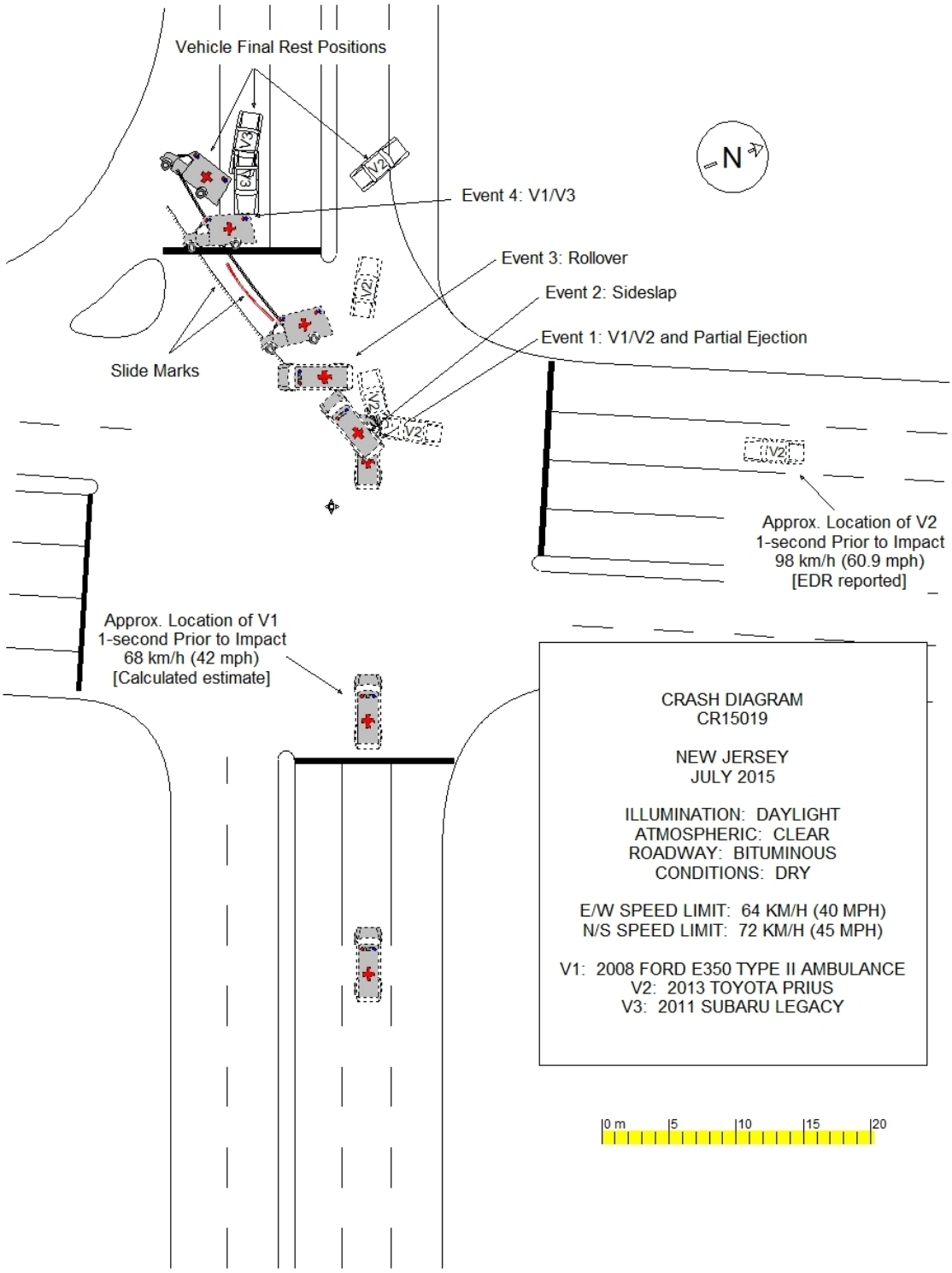
There was no visible deformation (crush) to the vehicle associative to the crash. The CDC assigned to the Subaru for the Event 4 damage was 11FYEW1. No WinSMASH calculations could be performed due to the minor severity of the impact and insufficient residual damage.

Occupant Data

The Subaru was occupied by its restrained 43-year-old female driver. Her restraint usage was documented by the law enforcement investigation. None of the vehicle's supplemental restraint systems were actuated or deployed by the minor severity impact.

The driver of the Subaru remained restrained and within position for the duration of the crash event, during which the Subaru's front plane was impacted by the top plane of the ambulance and the vehicle was displaced rearward approximately 2.0 m (6.5 ft) and rotated 15 degrees CW by the associated forces. The driver of the Subaru exited her vehicle without assistance and denied injury at the scene. She did not receive any medical treatment at the crash site and was not medically transported.

CRASH DIAGRAM



Attachment A

Pre-Crash Vehicle Speed Calculations

Pre-Crash Vehicle Speed Calculations

Vehicle: 2008 Ford E350 Type II Ambulance

SIMPLE

For the simple speed (s), which is given by the equation:

$$s = 5.5 \sqrt{(C_d * L)}$$

C_d is a frictional coefficient and L is the distance from impact to final rest.

Whereas:
The averaged normal frictional coefficient is equivalent to 0.75
The distance from impact to final rest is 80.38 ft (24.5 m)

Therefore:

$$s = 5.5 \sqrt{(0.75 * 80.38)}$$

s = 42.7 mph (68.7 km/h) or 62.63 ft/s (19.09 m/s)

COMPOUND

For the compound speed (S), which is given by the equation:

$$S = \sqrt{(30)} * \sqrt{[(C_d * L)_1 + (C_d * L)2_+ (C_d * L)_3]}$$

C_d is a frictional coefficient and L is the distance from impact to final rest,
And 1 relates to the distance from event 1 to event 2, 2 relates to the distance from event 2 to event 3, and so on, leading to final rest.

Whereas:
1 relates to the 24.18 ft distance from impact to roll, at a standard asphalt coefficient of 0.72,
2 relates to the 41.11 ft distance of slide from roll to tertiary impact, at a kinetic coefficient of 0.68,
and 3 relates to the 15.09 ft distance from tertiary impact to rest at a coefficient of 0.85.

Therefore:

$$S = \sqrt{(30)} * \sqrt{[(0.72 * 24.18) + (0.68 * 41.11) + (0.85 * 15.09)]}$$

S = 41.78 mph (67.2 km/h) or 61.28 ft/s (18.68 m/s)

Attachment B

2013 Toyota Prius Event Data Recorder (EDR) 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	JTDKN3DU5D5******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CR15019_V2_ACM.CDRX
Saved on	Wednesday, August 19 2015 at 12:18:34
Collected with CDR version	Crash Data Retrieval Tool 16.1.1
Reported with CDR version	Crash Data Retrieval Tool 16.6
EDR Device Type	Airbag Control Module
Event(s) recovered	Front/Rear (1), Side (2)

Comments

No comments entered.

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 this data may not be sufficient to capture the entire crash.
- Pre-Crash data is recorded in discrete intervals. Due to different refresh 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 any of the front passenger seat airbags, side airbags, or Curtain Shield Airbags have deployed, data will not be overwritten or deleted by the airbag ECU following that event. If none of the airbags have deployed, the data of that event may be overwritten by a following event even if other airbags (pretensioner, rear seat airbag, etc.) have deployed.
- 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 recording 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 (or any other Toyota genuine diagnostic tool) can be used to obtain detailed information on the diagnostic trouble codes from the airbag 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 diagnostic tool is used.

General Information:

- The data recording specifications of Toyota's airbag ECUs are divided into the following eight categories. The specifications for 12EDR or later are designed to be compatible with NHTSA's 49CFR Part 563 rule.
  - 00EDR / 02EDR / 04EDR / 06EDR / 10EDR / 12EDR / 13EDR / 15EDR
- The airbag ECU records data for all or some of the following accident types: frontal crash, rear crash , side crash, and rollover events. Depending on the installed airbag ECU, data for side crash and/or rollover events may not be recorded.
- This airbag ECU records record pre-crash data and post-crash data.
  - If a single event occurs independently, the data for that event is recorded on a one-to-one basis.
  - If multiple events occur successively (within a period of approximately 500ms), the establishment of the recording trigger for the first event is defined as the "pre-crash recording trigger". Pre-crash data for the first event and post-crash data for each successive event is then recorded.
- The airbag ECU has two recording pages (memory maps) to store pre-crash data. Additionally, to store post-crash data, the airbag ECU has two recording pages for each accident type: two pages for frontal and rear crash, two pages for a side crash, and two pages for rollover event.
- The data recorded by the airbag ECU includes correlating information between each previously occurring event (i.e., information that clarifies the collision event sequence. This correlation information consists of the following items.
  - Time from Previous Pre-Crash TRG
  - Linked Pre-Crash Page
  - Time from Pre-Crash TRG
  - TRG Count

- Previous Crash Type

- In frontal and rear collision events, the first point where a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached is regarded as time zero for the recorded data. In side impact collision and rollover events, the point in time at which the recording trigger is established is regarded as time zero for the recorded data.
- 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 considered as the official ECU part number.
- In frontal and rear collision events, the record time varies depending on the period during which a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached, and time series data is recorded for up to 250 ms. The record time described above is indicated as "Length of Delta-V". "Delta-V, Longitudinal" outside the record time is indicated by area shaded in the table, and not indicated in the graph.

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
Maximum Delta-V, Longitudinal	Forward
Delta-V, Longitudinal	Forward
Maximum Delta-V Lateral, Side Satellite Sensor 1	Left to Right
Maximum Delta-V Lateral, Side Satellite Sensor 2	Left to Right
Maximum Delta-V Lateral, Side Satellite Sensor 3	Left to Right
Maximum Delta-V Lateral, Side Satellite Sensor 4	Left to Right
Delta-V Lateral, Side Satellite Sensor 1	Left to Right
Delta-V Lateral, Side Satellite Sensor 2	Left to Right
Delta-V Lateral, Side Satellite Sensor 3	Left to Right
Delta-V Lateral, Side Satellite Sensor 4	Left to Right
Roll Angle Peak	Clockwise Rotation
Roll Angle at the Time of TRG	Clockwise Rotation
Roll Rate	Clockwise Rotation
Lateral Acceleration , Airbag ECU Sensor *	Left to Right
Longitudinal Acceleration , VSC Sensor	Forward
Yaw Rate	Left Turn
Steering Input	Left Turn

* For sensing a rollover

1) **Data Definitions:**
2)

- The "ON" setting for the "Freeze Signal" indicates a state in which 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 data 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.
- If the "Occupant Size Classification, Front Passenger" displays "Child" or "Not Occupied", "Side Air Bag Deployment, Time to Deploy" and "Pretensioner Deployment, Time to Fire" may indicate a time even if deployment did not occur on the for following part no's:
  - 89170-07280, 35400, 35410, 35470, 42660, 0R120, 0R080, 0R081, 0R150
- "Engine RPM" indicates the number of engine revolutions, not the number of motor revolutions. The recorded value has an upper limit of 12,800 rpm. Resolution is 100 rpm and the value is rounded down and recorded. For example, if the actual engine speed is 799 rpm, the recorded value will be 700 rpm.
- If the electric vehicle is using a calculated/virtual engine RPM for drivetrain control, "Engine RPM" may be recorded, but should not be used during data analysis.
- The upper limit for the recorded "Vehicle Speed" value is 200 km/h (125mph). Resolution is 1km/h (0.6mph) 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
- "Accelerator Pedal" has two recording specifications. Both the recorded value increases as the driver depresses the accelerator.
  - Percentage of accelerator pedal depressed (recorded as 0-100(%)).
  - Output voltage of accelerator pedal module (recorded as 0-5(V)).
- If M/T transmission vehicle of some limited model, "Shift Position" may display "Drive" regardless of the actual shift position.
- Depending on the type of occupant sensor installed in the vehicle, one of the following three recording formats for "Occupant Size Classification, Front Passenger" will be utilized.
  - Occupied / Not Occupied
  - AM50 / AF05 / Child / Not Occupied
  - AM50 / AF05 / Child or Not Occupied
- "Cruise Control Status" indicates whether the cruise control system is actuated or not. OFF indicates that the cruise control system is not actuated, but can also indicates that the vehicle is not equipped with the system.

- "Air Bag Warning Lamp, On/Off", "Ignition Cycle, Crash", "Seat Track Position Switch, Foremost, Status, Driver", "Occupant Size Classification, Front Passenger", "Safety Belt Status, Driver", "Safety Belt Status, Front Passenger", "Frontal Air Bag Suppression Switch Status, Front Passenger", and "RSCA Disable Switch" indicate the state approximately 1 second before time zero. They may not always indicate the state at the moment of collision.
- The upper and lower limits for the recorded value of "Motor RPM" is 17,500 rpm and -7,500 rpm respectively. Resolution is 100 rpm and the value is rounded down and recorded.
- "Brake Oil Pressure" has an upper limit of 12.14 Mpa. In the case of the vehicle that has not VSC system, "0 Mpa" or "Invalid" may be displayed.
- "Longitudinal Acceleration , VSC Sensor" has upper and lower limits for the recorded value of 8.973 m/s^2 and -8.973 m/s^2 respectively. This acceleration sensor does not sense collisions.
- "Sequential Shift Range" displaying "Undetermined" indicates the shift range is undetermined or was not being used.
- Some vehicles will not be equipped with all "Drive Mode" types indicated in the "Drive Mode" table. If some or all drive modes are not applicable to vehicle, "OFF" or "Invalid" may be displayed. The item in the "Drive Mode" table may not match the name of switch or indicator that equipped the vehicle.
- The upper and lower limits for the recorded value of "Steering Input" is 375 deg and -375 deg respectively. Resolution is 3 deg and the value is rounded down and recorded.
- Resolution of the "Air Bag Warning Lamp ON Time Since DTC was Set" is 15 minutes, and the value is rounded down and recorded.
- "Delta-V, Longitudinal" indicates the change in forward speed after time zero. 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 time zero.
- "Location of Side Satellite Sensor" shows the outline of a typical sensor position. Sensory location can be confirmed using the repair manual.
- For "Lateral Delta-V", the acceleration sensor installed in the airbag ECU is not used but the satellite sensor is used for the "Lateral Delta-V" calculation.
- "Time from Previous Pre-Crash TRG" indicates the time between the establishment of an event's pre-crash recording trigger to the establishment of a more recent event's pre-crash recording trigger. The upper limit for the recorded value is 16,381 milliseconds. In the event of establishment of the first pre-crash recording trigger after the ignition is switched ON, the upper limit value(max value) is recorded.
- "TRG Count" indicates a calculated value of the number of times recording triggers have been established for all crash types. The sequence in which each event occurred can be verified from the "TRG Count". The smaller the "TRG Count" value, the older the data. The upper limit for the recorded value is 65,533 times. When more than one event reaches the upper limit, the actual "TRG Count" may be greater than what is displayed for that event.
- "Linked Pre-Crash Page" is used to link 'paged" pre-crash data with 'paged" post-crash data. When old pre-crash data is overwritten by new pre-crash data, the "Linked Pre-Crash Page" value may record a page number that is not actually linked.
- Resolution of the "Time from Pre-Crash to TRG" is 50 [ms], and the value is rounded up and recorded.
- "Roll Angle at the Time of TRG" and "Roll Angle Peak" do not represent the actual roll angle of the vehicle. These values are used internally by the airbag ECU for sensing a rollover.

05012_ToyotaS03std_r025

System Status at Time of Retrieval

ECU Part Number	89170-47280
EDR Generation	12EDR
Complete File Recorded	Yes
Freeze Signal	ON
Freeze Signal Factor	Front Airbag Deployment
Diagnostic Trouble Codes Exist	No
Ignition Cycle ,Download (times)	2373
Multi-event, number of events (times)	2 or greater
Time from event 1 to 2 (s)	0.096
Time from Previous Pre Crash TRG (msec)	16381 or greater
Latest Pre-Crash Page	0
Contains Unlinked Pre-Crash Data	No

Event Record Summary at Retrieval

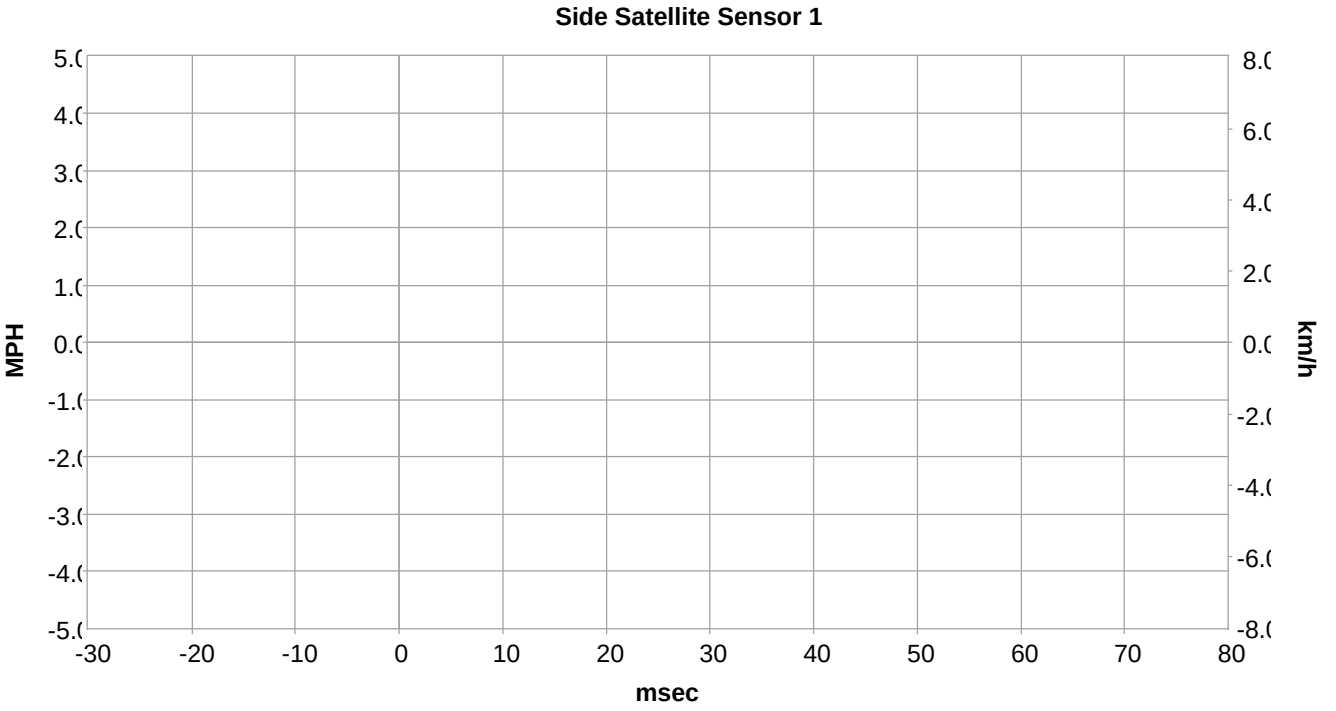
Events Recorded	TRG Count	Crash Type	Time (msec)	Pre-Crash & DTC Data Recording Status	Event & Crash Pulse Data Recording Status
Most Recent Event	3	Side Crash	0	Complete (Page 0)	Complete (Side Page 1)
1st Prior Event	2	Side Crash	-96	Complete (Page 0)	Complete (Side Page 0)
2nd Prior Event	1	Front/Rear Crash	-106	Complete (Page 0)	Complete (Front/Rear Page 0)

System Status at Event (Most Recent Event, TRG 3)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	3
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	102
Linked Pre-Crash Page	0
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Pretensioner Deployment, Time to Fire (msec)	SNA
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

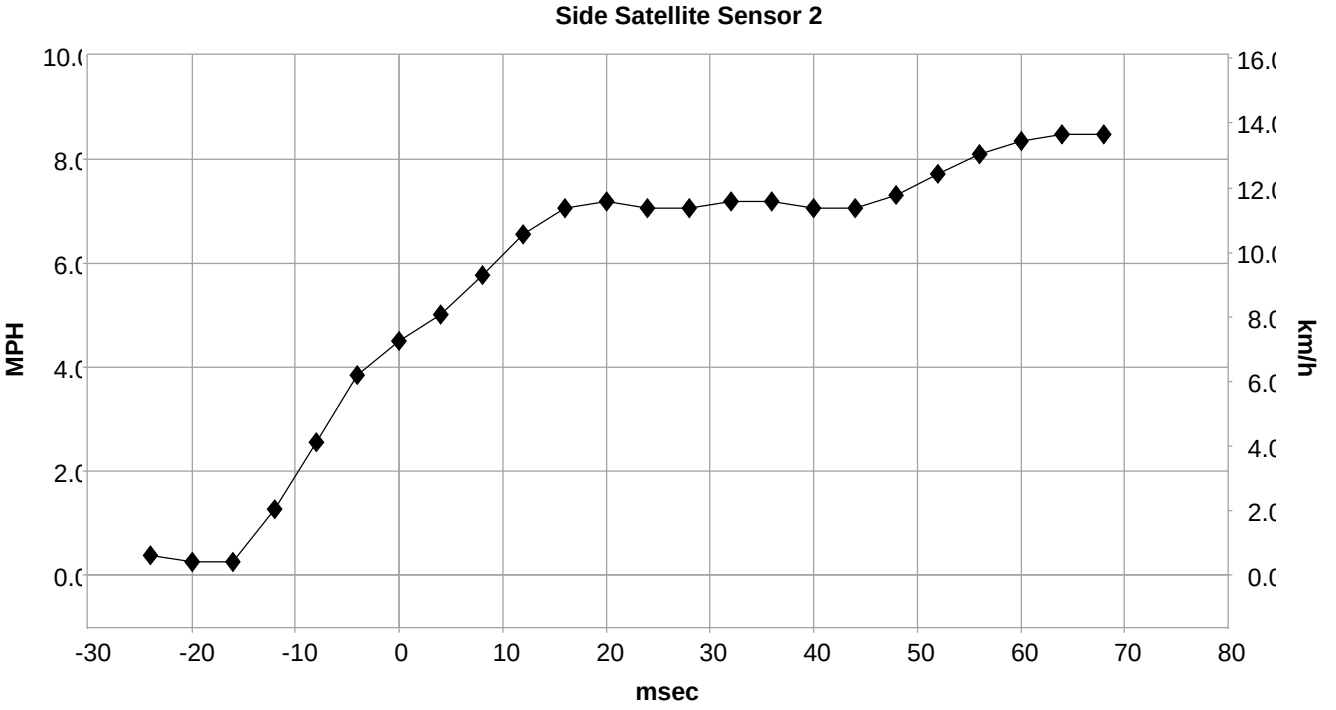
Lateral Crash Pulse (Most Recent Event, TRG 3 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Left Side
Time from TRG to Next Sample (msec)	0
Location of Side Satellite Sensor 1	Not Equipped
Location of Side Satellite Sensor 2	B-Pillar
Location of Side Satellite Sensor 3	Not Equipped
Location of Side Satellite Sensor 4	C-Pillar
Maximum Delta-V Lateral, Side Satellite Sensor 1 (MPH [km/h])	N/A
Maximum Delta-V Lateral, Side Satellite Sensor 2 (MPH [km/h])	8.5 [13.7]
Maximum Delta-V Lateral, Side Satellite Sensor 3 (MPH [km/h])	N/A
Maximum Delta-V Lateral, Side Satellite Sensor 4 (MPH [km/h])	6.5 [10.5]



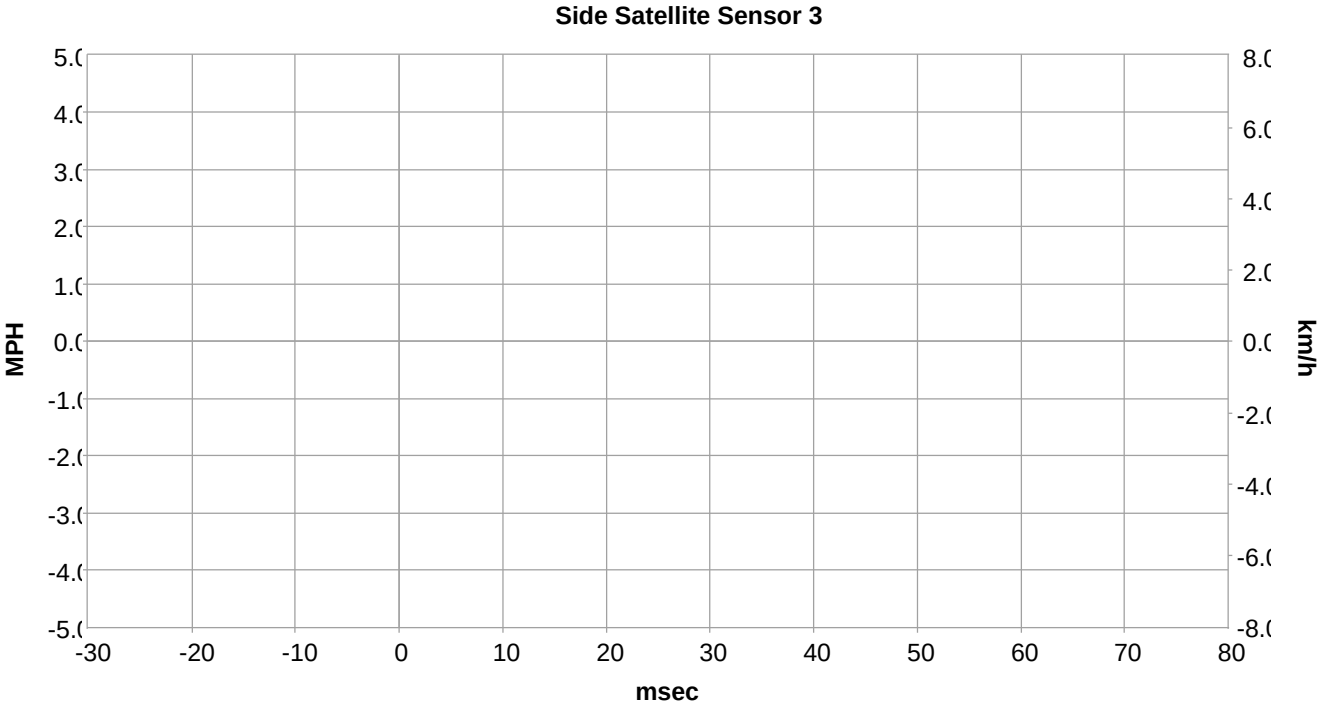
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



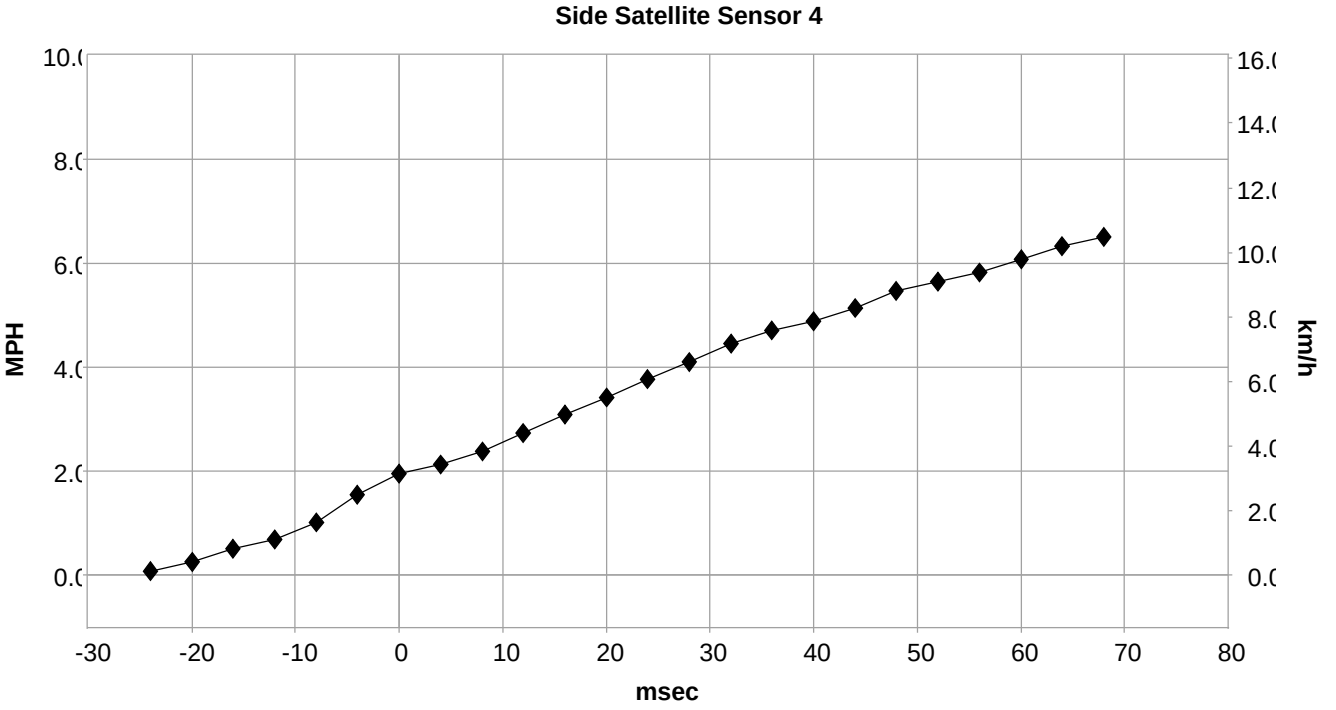
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag

Lateral Crash Pulse (Most Recent Event, TRG 3 - table 2 of 2)

Time (msec)	Delta-V Lateral, Side Satellite Sensor 1 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 2 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 3 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 4 (MPH [km/h])
-24	SNA [SNA]	0.4 [0.6]	SNA [SNA]	0.1 [0.1]
-20	SNA [SNA]	0.3 [0.4]	SNA [SNA]	0.3 [0.4]
-16	SNA [SNA]	0.3 [0.4]	SNA [SNA]	0.5 [0.8]
-12	SNA [SNA]	1.3 [2.1]	SNA [SNA]	0.7 [1.1]
-8	SNA [SNA]	2.6 [4.1]	SNA [SNA]	1.0 [1.7]
-4	SNA [SNA]	3.9 [6.2]	SNA [SNA]	1.5 [2.5]
0	SNA [SNA]	4.5 [7.2]	SNA [SNA]	2.0 [3.2]
4	SNA [SNA]	5.0 [8.1]	SNA [SNA]	2.1 [3.4]
8	SNA [SNA]	5.8 [9.3]	SNA [SNA]	2.4 [3.9]
12	SNA [SNA]	6.6 [10.6]	SNA [SNA]	2.7 [4.4]
16	SNA [SNA]	7.1 [11.4]	SNA [SNA]	3.1 [5.0]
20	SNA [SNA]	7.2 [11.6]	SNA [SNA]	3.4 [5.5]
24	SNA [SNA]	7.1 [11.4]	SNA [SNA]	3.8 [6.1]
28	SNA [SNA]	7.1 [11.4]	SNA [SNA]	4.1 [6.6]
32	SNA [SNA]	7.2 [11.6]	SNA [SNA]	4.5 [7.2]
36	SNA [SNA]	7.2 [11.6]	SNA [SNA]	4.7 [7.6]
40	SNA [SNA]	7.1 [11.4]	SNA [SNA]	4.9 [7.9]
44	SNA [SNA]	7.1 [11.4]	SNA [SNA]	5.1 [8.3]
48	SNA [SNA]	7.3 [11.8]	SNA [SNA]	5.5 [8.8]
52	SNA [SNA]	7.7 [12.4]	SNA [SNA]	5.7 [9.1]
56	SNA [SNA]	8.1 [13.0]	SNA [SNA]	5.8 [9.4]
60	SNA [SNA]	8.4 [13.5]	SNA [SNA]	6.1 [9.8]
64	SNA [SNA]	8.5 [13.7]	SNA [SNA]	6.3 [10.2]
68	SNA [SNA]	8.5 [13.7]	SNA [SNA]	6.5 [10.5]

DTCs Present at Time of Event (Most Recent Event, TRG 3)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (Most Recent Event, TRG 3)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	300
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	2372

Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 3)

Time (sec)	-4.8	-4.3	-3.8	-3.3	-2.8	-2.3	-1.8	-1.3	-0.8	-0.3	0 (TRG)
Vehicle Speed (MPH [km/h])	64 [103]	63.4 [102]	63.4 [102]	62.8 [101]	62.1 [100]	62.1 [100]	61.5 [99]	60.9 [98]	60.9 [98]	60.3 [97]	56.5 [91]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Engine RPM (RPM)	3,200	2,300	1,500	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Motor RPM (RPM)	7,600	7,500	7,500	7,500	7,400	7,400	7,300	7,300	7,200	7,200	6,900
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.14
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.861	-0.646	-0.718	-0.646	-0.718	-0.861	-0.646	-0.646	-0.502	-0.646	-8.183
Yaw Rate (deg/sec)	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	-1.95	0.00
Steering Input (degrees)	0	0	0	0	3	3	0	0	0	-18	21
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

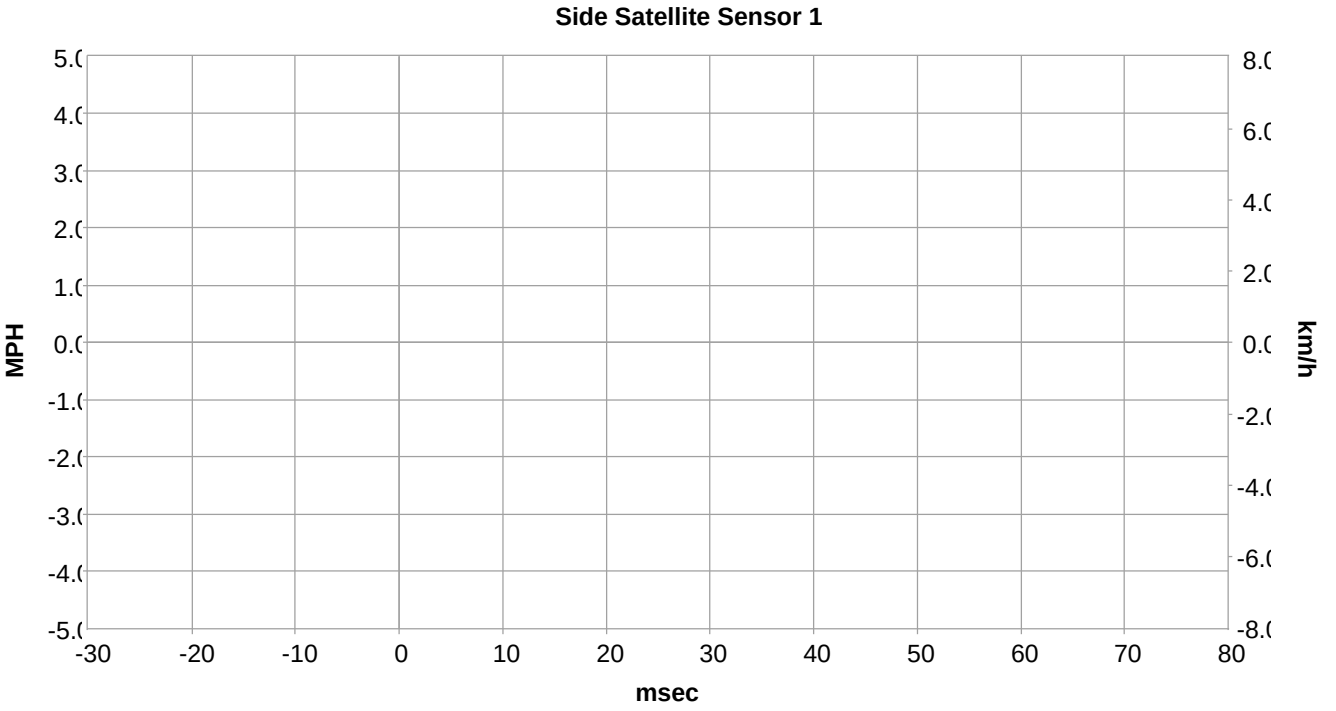
Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (1st Prior Event, TRG 2)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	2
Previous Crash Type	Front/Rear Crash
Time from Pre-Crash TRG (msec)	6
Linked Pre-Crash Page	0
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Pretensioner Deployment, Time to Fire (msec)	SNA
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

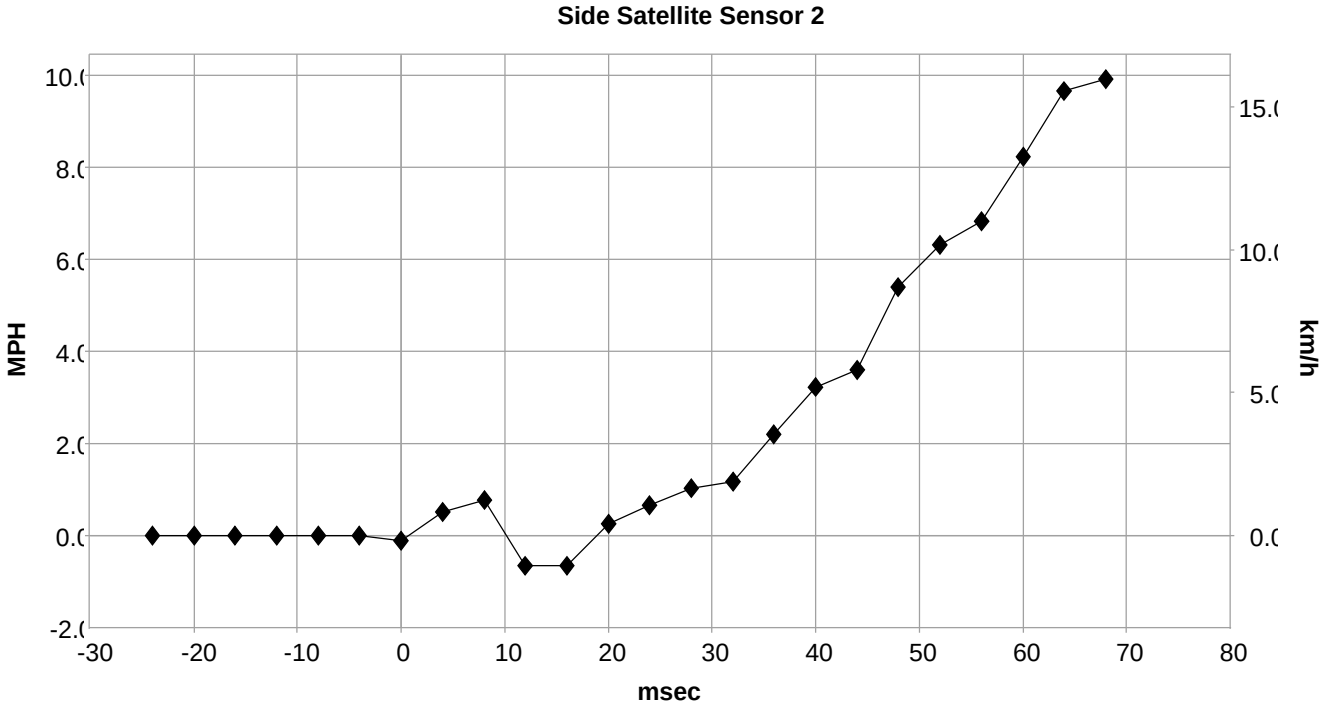
Lateral Crash Pulse (1st Prior Event, TRG 2 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Left Side
Time from TRG to Next Sample (msec)	0
Location of Side Satellite Sensor 1	Not Equipped
Location of Side Satellite Sensor 2	B-Pillar
Location of Side Satellite Sensor 3	Not Equipped
Location of Side Satellite Sensor 4	C-Pillar
Maximum Delta-V Lateral, Side Satellite Sensor 1 (MPH [km/h])	N/A
Maximum Delta-V Lateral, Side Satellite Sensor 2 (MPH [km/h])	9.9 [15.9]
Maximum Delta-V Lateral, Side Satellite Sensor 3 (MPH [km/h])	N/A
Maximum Delta-V Lateral, Side Satellite Sensor 4 (MPH [km/h])	0.9 [1.5]



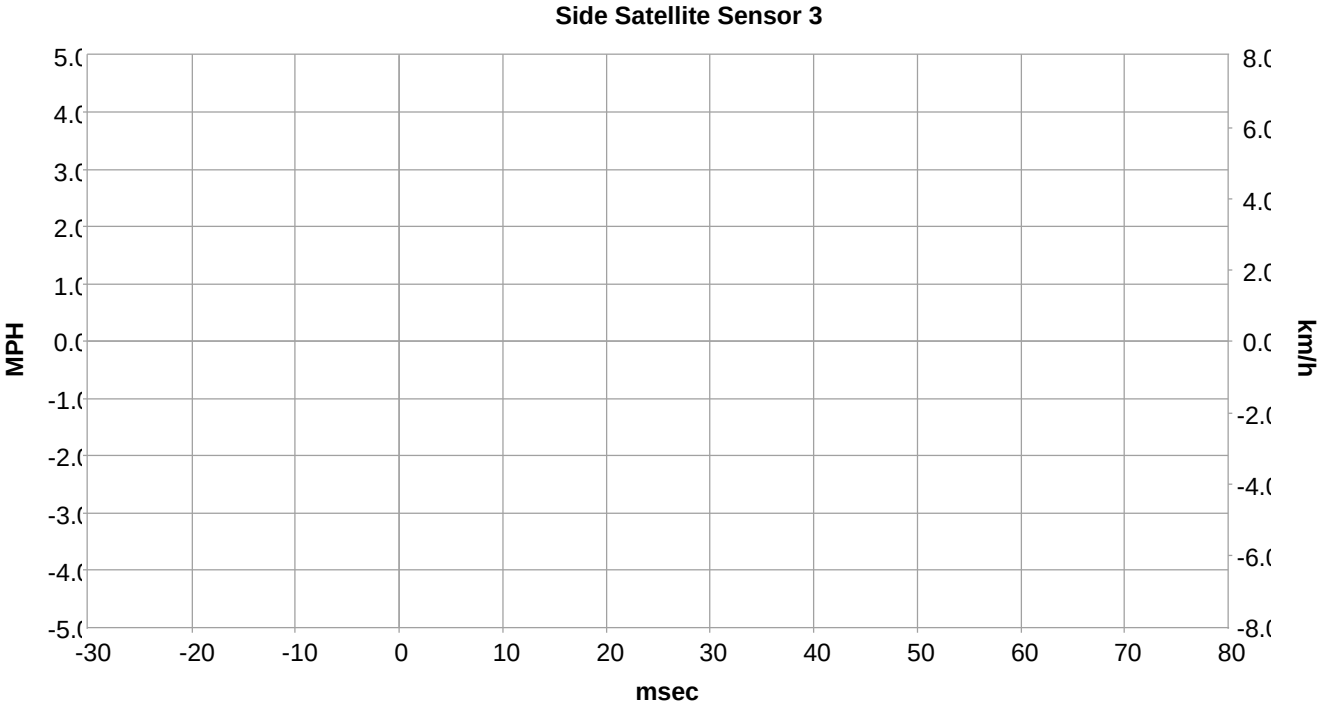
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



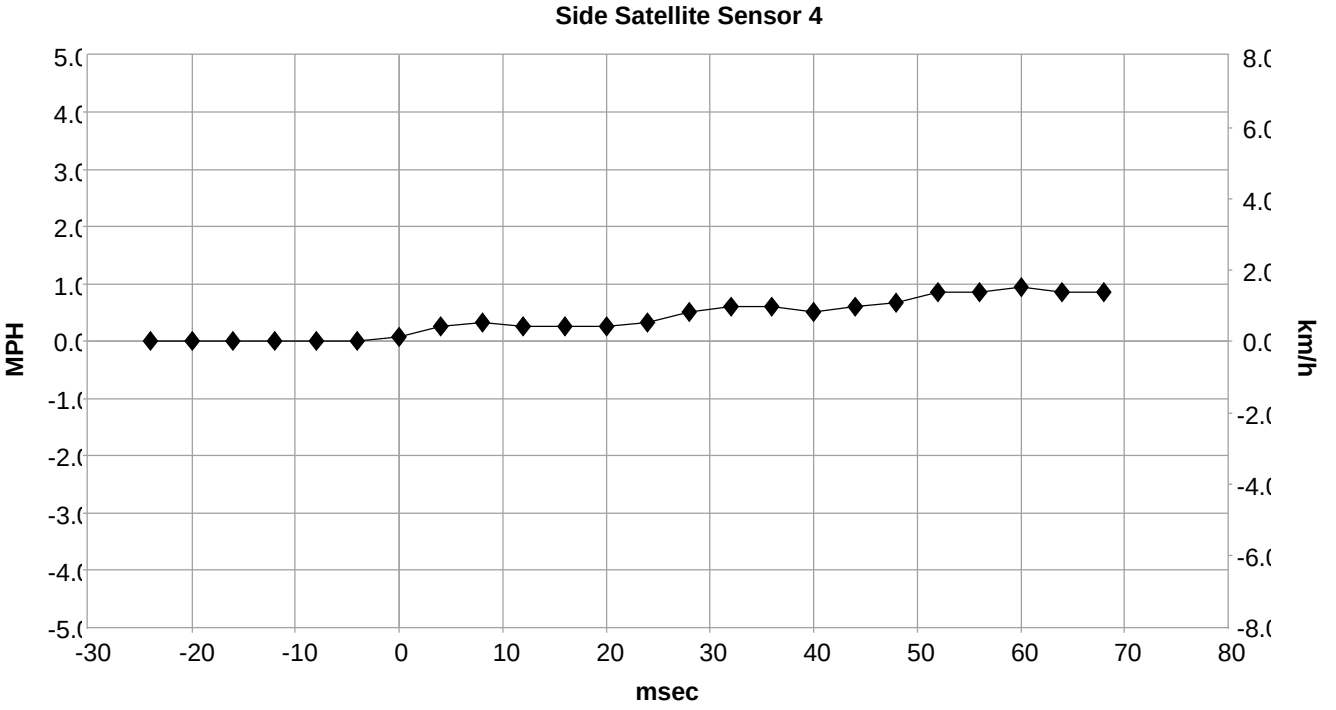
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag

Lateral Crash Pulse (1st Prior Event, TRG 2 - table 2 of 2)

Time (msec)	Delta-V Lateral, Side Satellite Sensor 1 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 2 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 3 (MPH [km/h])	Delta-V Lateral, Side Satellite Sensor 4 (MPH [km/h])
-24	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
-20	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
-16	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
-12	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
-8	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
-4	SNA [SNA]	0.0 [0.0]	SNA [SNA]	0.0 [0.0]
0	SNA [SNA]	-0.1 [-0.2]	SNA [SNA]	0.1 [0.1]
4	SNA [SNA]	0.5 [0.8]	SNA [SNA]	0.3 [0.4]
8	SNA [SNA]	0.8 [1.2]	SNA [SNA]	0.3 [0.6]
12	SNA [SNA]	-0.6 [-1.0]	SNA [SNA]	0.3 [0.4]
16	SNA [SNA]	-0.6 [-1.0]	SNA [SNA]	0.3 [0.4]
20	SNA [SNA]	0.3 [0.4]	SNA [SNA]	0.3 [0.4]
24	SNA [SNA]	0.6 [1.0]	SNA [SNA]	0.3 [0.6]
28	SNA [SNA]	1.0 [1.7]	SNA [SNA]	0.5 [0.8]
32	SNA [SNA]	1.2 [1.9]	SNA [SNA]	0.6 [1.0]
36	SNA [SNA]	2.2 [3.5]	SNA [SNA]	0.6 [1.0]
40	SNA [SNA]	3.2 [5.2]	SNA [SNA]	0.5 [0.8]
44	SNA [SNA]	3.6 [5.8]	SNA [SNA]	0.6 [1.0]
48	SNA [SNA]	5.4 [8.7]	SNA [SNA]	0.7 [1.1]
52	SNA [SNA]	6.3 [10.1]	SNA [SNA]	0.9 [1.4]
56	SNA [SNA]	6.8 [11.0]	SNA [SNA]	0.9 [1.4]
60	SNA [SNA]	8.2 [13.2]	SNA [SNA]	0.9 [1.5]
64	SNA [SNA]	9.6 [15.5]	SNA [SNA]	0.9 [1.4]
68	SNA [SNA]	9.9 [15.9]	SNA [SNA]	0.9 [1.4]

DTCs Present at Time of Event (1st Prior Event, TRG 2)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (1st Prior Event, TRG 2)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	300
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	2372

Pre-Crash Data, -5 to 0 seconds (1st Prior Event, TRG 2)

Time (sec)	-4.8	-4.3	-3.8	-3.3	-2.8	-2.3	-1.8	-1.3	-0.8	-0.3	0 (TRG)
Vehicle Speed (MPH [km/h])	64 [103]	63.4 [102]	63.4 [102]	62.8 [101]	62.1 [100]	62.1 [100]	61.5 [99]	60.9 [98]	60.9 [98]	60.3 [97]	56.5 [91]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Engine RPM (RPM)	3,200	2,300	1,500	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Motor RPM (RPM)	7,600	7,500	7,500	7,500	7,400	7,400	7,300	7,300	7,200	7,200	6,900
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.14
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.861	-0.646	-0.718	-0.646	-0.718	-0.861	-0.646	-0.646	-0.502	-0.646	-8.183
Yaw Rate (deg/sec)	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	-1.95	0.00
Steering Input (degrees)	0	0	0	0	3	3	0	0	0	-18	21
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

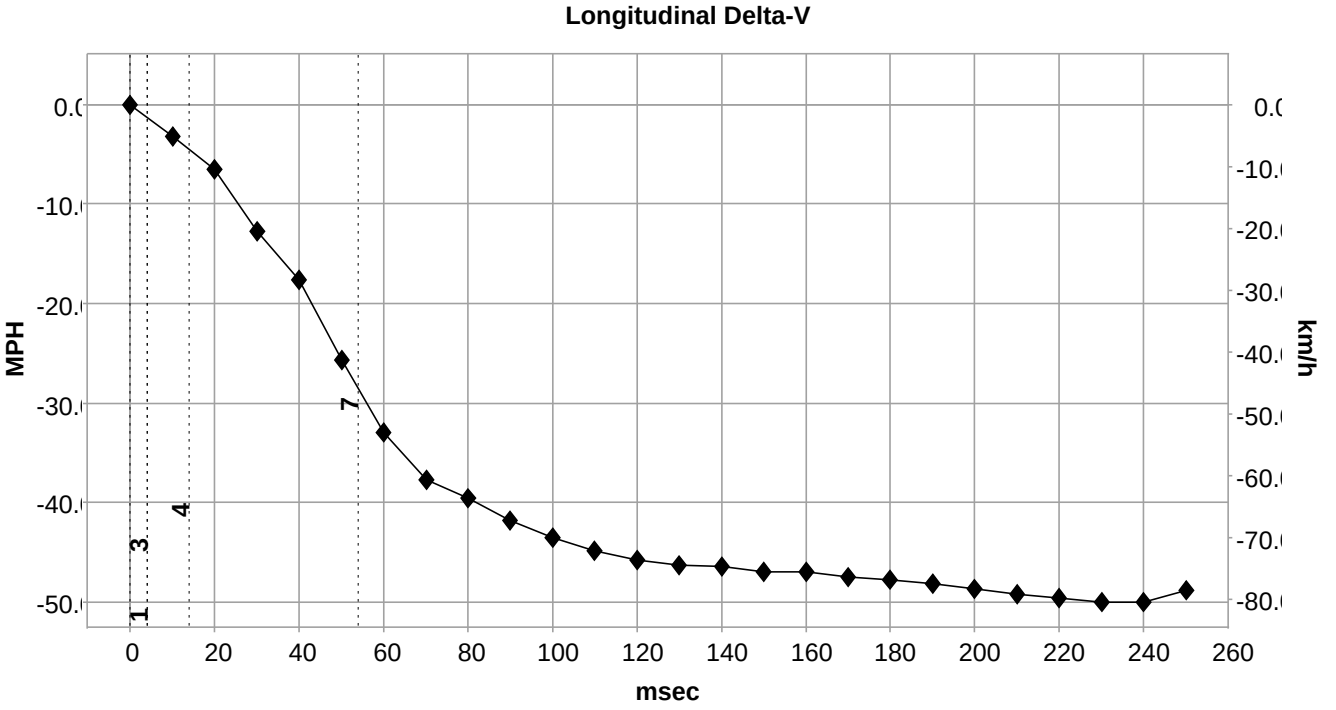
Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (2nd Prior Event, TRG 1)

Recording Status, Front/Rear Crash Info.	Complete
Crash Type	Front/Rear Crash
TRG Count (times)	1
Previous Crash Type	No Event
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	0
Frontal Airbag Deployment, Time to 1st Stage Deployment, Driver (msec)	4
Frontal Airbag Deployment, Time to 1st Stage Deployment, Front Passenger (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	4
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	No
Frontal Airbag Deployment, Time to 2nd Stage, Driver (msec)	14
Frontal Airbag Deployment, Time to 2nd Stage, Front Passenger (msec)	N/A
Active Head Restraint, Time to Deploy, Driver (msec)	SNA
Active Head Restraint, Time to Deploy, Front Passenger (msec)	SNA
Side Curtain Airbag Deployment, Time to Deploy, Driver (msec)	54
Side Curtain Airbag Deployment, Time to Deploy, Passenger (msec)	54
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

Longitudinal Crash Pulse (2nd Prior Event, TRG 1 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from Time Zero to TRG (msec)	4.0
Length of Delta-V (msec)	250
Max. Longitudinal Delta-V (MPH [km/h])	-50.4 [-81.1]
Time, Maximum Delta-V, Longitudinal (msec)	233.0
Power Supply Status at Max. Delta-V	ON



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver/Passenger CSA
8	Rear Window Airbag Deployment Time

Longitudinal Crash Pulse (2nd Prior Event, TRG 1 - table 2 of 2)

Time (msec)	Longitudinal Delta-V (MPH [km/h])	Power Supply Status
0	0.0 [0.0]	ON
10	-3.3 [-5.2]	ON
20	-6.5 [-10.5]	ON
30	-12.7 [-20.4]	ON
40	-17.7 [-28.4]	ON
50	-25.7 [-41.4]	ON
60	-32.9 [-53.0]	OFF
70	-37.7 [-60.7]	OFF
80	-39.6 [-63.7]	OFF
90	-41.8 [-67.3]	OFF
100	-43.5 [-70.1]	OFF
110	-44.9 [-72.3]	OFF
120	-45.8 [-73.6]	ON
130	-46.3 [-74.5]	ON
140	-46.4 [-74.7]	ON
150	-47.0 [-75.6]	ON
160	-47.0 [-75.6]	ON
170	-47.5 [-76.4]	ON
180	-47.8 [-77.0]	ON
190	-48.2 [-77.5]	ON
200	-48.7 [-78.3]	ON
210	-49.2 [-79.2]	ON
220	-49.7 [-80.0]	ON
230	-50.0 [-80.5]	ON
240	-50.0 [-80.5]	ON
250	-48.8 [-78.6]	ON

DTCs Present at Time of Event (2nd Prior Event, TRG 1)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (2nd Prior Event, TRG 1)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	300
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	2372

Pre-Crash Data, -5 to 0 seconds (2nd Prior Event, TRG 1)

Time (sec)	-4.8	-4.3	-3.8	-3.3	-2.8	-2.3	-1.8	-1.3	-0.8	-0.3	0 (TRG)
Vehicle Speed (MPH [km/h])	64 [103]	63.4 [102]	63.4 [102]	62.8 [101]	62.1 [100]	62.1 [100]	61.5 [99]	60.9 [98]	60.9 [98]	60.3 [97]	56.5 [91]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Engine RPM (RPM)	3,200	2,300	1,500	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Motor RPM (RPM)	7,600	7,500	7,500	7,500	7,400	7,400	7,300	7,300	7,200	7,200	6,900
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.14
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.861	-0.646	-0.718	-0.646	-0.718	-0.861	-0.646	-0.646	-0.502	-0.646	-8.183
Yaw Rate (deg/sec)	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	-1.95	0.00
Steering Input (degrees)	0	0	0	0	3	3	0	0	0	-18	21
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

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.

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PIDs         PID    Data
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                    30 30 30 30 30 30 30 30 30 30 30 30 30
              04    FF FF FF FF
              05    01
              06    16
              0A    01
              0B    00
              20    80 00 00 01
              21    02 9F
              40    00 00 00 01
              60    FF FF F0 01
              61    02 03 E8 00 88 80 05 00 00 00 00 00 03 55 03 55 00 00 00 00 05 00
                    05 00 00 00 00 00 00 00 80 00
              62    A5 01 3F FD 09 45 00 00 00 00
              63    55 14 09 44 10 10 00 00 11 11 11 11 11 10 67 66 66 65 64 64 63 62
                    62 61 5B 00 00 00 00 00 00 00 00 00 00 00 00 00 04 20 17 0F 0B 0B
                    0B 0B 0B 0B 0B 0B 00 00 00 00 00 00
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                    00 00 00 00 00 00 00 00 00 00 00 00
              65    55 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              66    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              67    55 E0 00 00 01 04 04 04 0A 1E 55 FD FD 00 36
              68    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              69    00 08 1A 00 00 00 13 00 26 00 4A 00 67 00 96 C0 C0 C0 DC C0 E7 C0
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                    1C 01 1F 01 22 01 24 01 24 01 1D 01 26 01 D2
              6A    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              6B    55 00 06 00 02 FE FE FE FE 55 00 00 00 00 00 00 00 00 00 00 00 00
                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              6C    55 10 66 00 03 FE FE FE FE 55 00 00 00 00 00 00 00 00 00 00 00 00
                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              6D    00 00 00 00 00 00 FF 05 02 F5 00 07 03 03 01 08 08 03 0E 07 04 0B
                    0B 02 00 00 00 00 00 00 01 02 01 FF 00 00 01 02 01 00 FF 01 01 02
                    00 01 FF 00 00 FE
              6E    03 FF 00 08 0A 0A 05 04 06 06 04 01 FF 00 01 00 FF 00 02 03 03 02
                    01 00 01 02 03 02 04 06 05 02 03 04 04 04 04 04 04 03 02 03 04 02
                    02 03 03 02 00 FE
              6F    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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              71    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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              72    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
              73    00 00 00 00 00 00 00 00 00 00 FD 00 00 00 00 01 01 00 00 00 FA 07
                    00 00 01 00 00 00 00 00 00 FC 00 F4 F7 F6 F7 F6 F4 F7 F7 F9 F7 8E
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      00 00 00 00 00 00 00 00 00 00 00 00 00 00
80    00 00 00 01
A0    0C 00 00 01
A5    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      97 96 96 96 95 95 94 94 93 93 90 14 14 14 14 14 14 14 14 14 14
      FE FE FE FE FE FE FE FE FE FE FE
A6    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00 00 00 00
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