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Special Crash Investigations: On-Site Air Bag Inflator Rupture Crash Investigation; Vehicle: 2009 Honda Civic; Location: Maryland; Crash Date: September 2017

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15. Supplementary Notes

Each crash represents a unique sequence of events, and 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.

16. Abstract

This report documents the on-site investigation of the rupture of the driver's frontal air bag inflator in a 2009 Honda Civic, which resulted in the death of a 55-year-old belted male driver. The Honda was involved in a T-configuration, intersection crash with the right plane of a 1995 Toyota Camry. The driver and a belted 86-year-old female front-right passenger were in the Honda. Moderate severity front-plane damage was sustained by the vehicle, which resulted in the deployment of the Honda's frontal air bags, left front-seat-mounted side-impact air bag, and left inflatable curtain (IC) air bag. During the deployment of the driver's frontal air bag, the inflator ruptured. Multiple metallic fragments were projected rearward and struck the driver's face, head, and neck, producing severe traumatic injuries. Both the driver and the front-right passenger were transported by ambulance to a regional trauma center. The driver was pronounced deceased shortly after arrival, while the front-right passenger was treated for non-incapacitating (B-level) injuries. Through the course of this investigation, it was apparent that the driver's frontal air bag and components in the Honda had been modified and were not entirely original manufacturer equipment. The manufacturer and supplier representatives present during the SCI inspection of the Honda concurred with the findings of the SCI investigator and corroborated these conclusions.

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BACKGROUND

This report documents the on-site investigation of the rupture of the driver's frontal air bag inflator in a 2009 Honda Civic, which resulted in the death of a 55-year-old belted male driver. The Honda was involved in a T-configuration, intersection crash with the right plane of a 1995 Toyota Camry. The driver and a belted 86-year-old female front right passenger were in the Honda. Moderate severity front plane damage (**Figure 1**) was sustained by the vehicle during the crash, which resulted in the deployment of the Honda's frontal air bags, left front seat-mounted side-impact air bag, and left Inflatable curtain (IC) air bag. During the deployment of the driver's frontal air bag, the inflator ruptured. Multiple metallic fragments were projected rearward and struck the driver's face, head, and neck, producing severe traumatic injuries. Both the driver and the front-right passenger were transported by ambulance to a regional trauma center. The driver was pronounced deceased shortly after arrival, while the front-right passenger was treated for non-incapacitating (B-level) injuries.

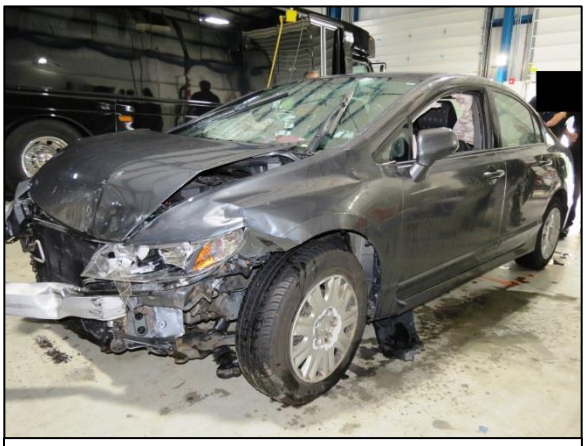


Figure 1. Front-left oblique view of the 2009 Honda Civic at the time of the SCI vehicle inspection.

Notification of the crash was provided to Crash Investigation Division of the National Highway Traffic Safety Administration, which forwarded the notification to the Special Crash Investigations (SCI) team in September 2017. Pursuant to cooperation with the investigating law enforcement agency, the on-site portion of this investigation occurred during September 2017. Representatives from the vehicle's manufacturer, Honda, and the vehicle manufacturer's air bag supplier, Autoliv, were present and participated in the inspection. The representatives provided original manufacturer components that made up the driver's frontal air bag module for exemplar comparison purposes. The on-site investigation involved an inspection of the Honda, including interior and exterior damage, an assessment of the manual and supplemental restraint systems, and the identification of occupant contact points. No data could be imaged from the Honda during the vehicle inspection process because its air bag control module (ACM) was not supported by the current software version of the Bosch Crash Data Retrieval (CDR) tool.

Through the course of this investigation, it was apparent that the driver's frontal air bag and components in the Honda had been modified and were not entirely original manufacturer

equipment. The manufacturer and supplier representatives present during the SCI inspection of the Honda concurred with the findings of the SCI investigator and corroborated these conclusions. Specifically, the SCI investigator found that the involved air bag inflator was not original manufacturer equipment. It was instead either a counterfeit replacement or had been removed from a different make/model vehicle and installed in the Honda. In either case, it was not designed for use in the 2009 Honda Civic's driver air bag module, and did not meet the specifications of the vehicle manufacturer or the air bag supplier's design criteria.

SUMMARY

Crash Site

The crash occurred at the intersection of a multi-lane, east/west roadway and a multi-lane, north/south roadway during the afternoon. According to the National Weather Service, conditions in the locale at the time of the crash were cloudy skies with a temperature of 22.8 °C (73 °F), a westerly breeze at 7.4 km/h (4.6 mph), and relative humidity of 73 percent. The physical environment of the roadway and roadside were documented during the SCI crash site inspection using a Nikon Nivo 5.M+ total station mapping system.

The east/west roadway was divided by a center median strip without a positive barrier. In the Honda's pre-crash travel trajectory, the eastbound portion consisted of two left-turn-only lanes, three through-travel lanes, and one right-turn-only lane. On average, the lanes were each approximately 3.5 m (11.5 ft) wide. The roadway curved slightly to the left on approach to the expansive intersection. Speed for the east/west roadway was regulated by a posted limit of 80 km/h (50 mph). **Figure 2** provides an east-facing view for the Honda's approach.

Figure 2. East-facing trajectory view of the roadway in the vicinity of the crash.

The north/south roadway was also divided by a median strip without a positive barrier. For the Toyota's trajectory, the southbound approach to the intersection was straight and consisted of a left-turn-only lane, two through-travel lanes, and a right-turn-only lane. The average lane width was 3.4 m (11.2 ft) wide. Speed on the north/south roadway was regulated by a posted limit of 56 km/h (35 mph). A crash diagram is included at the end of this technical report.

Pre-Crash

The 55-year-old male driver occupied the Honda along with the 86-year-old female front right passenger. Both used the manual seat belt systems for restraint. Specifics concerning their pre-crash activities remain unknown. The Honda traveled east on the multi-lane, east/west roadway and approached the intersection in the center travel lane. Simultaneously, the Toyota, driven by a 40-year-old male, traveled south on the multi-lane, north/south roadway on approach to the intersection. It was in the rightmost travel lane. The electronic traffic signal cycled to permit traffic on the north/south roadway to proceed through the intersection, while traffic on the east/west roadway was controlled/restricted.

The driver of the Honda did not react to the red phase of the signal for eastbound traffic. Instead, he maintained his travel speed and proceeded into the intersection. His intended path of travel was to continue eastbound through the intersection and maintain eastbound travel on the multi-lane roadway. With the green phase of the signal for southbound travel, the Toyota continued into the intersection. Its intended path of travel was to proceed across the entire intersection, exit through the south intersecting leg, and continue southbound on the multi-lane roadway.

Neither the driver of the Honda nor the driver of the Toyota recognized the cross-path trajectories of the vehicles prior to the crash. There was no evidence of avoidance steering or braking input by either driver.

Crash

The crash occurred as the front plane of the Honda struck the right plane of the Toyota in a T-configuration in the southeast quadrant of the intersection. Directions of force were in the 11 o'clock sector for the Honda and the 3 o'clock sector for the Toyota. This redirected the trajectories of both vehicles toward the northeast, and associated forces induced clockwise rotation about the vertical axis of each vehicle as they engaged. The Honda rotated 15 degrees clockwise from its original heading and came to final rest in the intersection, facing southeast. The Toyota rotated 75 degrees clockwise and came to final rest immediately south of the Honda, facing west (**Figure 3**).

Figure 3. View of the Honda and Toyota at final rest (on-scene image provided by the law enforcement agency).

Post-Crash

Local fire department, emergency medical services (EMS), and law enforcement personnel were dispatched to the crash scene. Upon their arrival, the male driver of the Honda was observed to be unresponsive, with severe head and facial injuries with profuse bleeding.

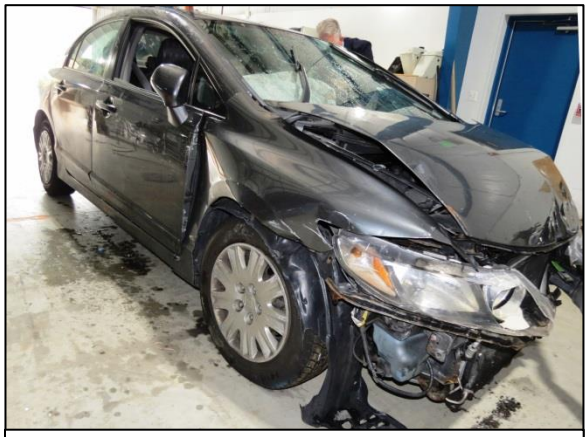


Figure 4. Front-right oblique view of the 2009 Honda Civic at the time of the SCI vehicle inspection.

EMS personnel immobilized the Honda's driver on a backboard and transported him by ambulance to a regional trauma center. He was pronounced deceased shortly after his arrival. The female front-right occupant of the Honda was also transported by ambulance to the regional trauma center, where she was hospitalized for treatment. The driver of the Toyota was transported by ambulance to a local hospital for treatment and released within hours of the crash. Both vehicles were removed from the crash site and towed to a local yard, where they were held pending completion of the law

enforcement investigation. They remained in possession of the law enforcement agency at the time of the SCI inspections.

2009 HONDA CIVIC

Description

The 2009 Honda Civic (**Figure 4**) was manufactured in November 2008 and was identified by the Vehicle Identification Number (VIN) 2HGFA16369Hxxxxxx. The Honda was a 4-door sedan equipped with the DX-level trim package. It was built on a 270 cm (106.3 in) wheelbase and had a gross vehicle weight rating (of 1,665 kg (3,671 lb). Front and rear axle ratings were 880 kg (1,940 lb) and 785 kg (1,731 lb), respectively. The Honda's curb weight was 1,199 kg (2,643 lb). Its powertrain consisted of a 1.8 liter, inline, 4-cylinder, internal combustion gasoline engine, which was linked to a 5-speed automatic transmission with front-wheel drive. The vehicle manufacturer's recommended tire size and cold tire pressure for all four axle positions were P195/65R15 at 210 kPa (30 PSI). All four equipped tires were of the recommended size, with specific data measured at the time of the SCI inspection summarized as follows:

Position	Tire Make/Model	DOT#	Tread Depth	Restriction	Damage
LF	Primewell PS830	Y9CA D8HX	6 mm (7/32 in)	No	None
LR	Goodyear Viva 2	PJC6 JA1R 0514	5 mm (6/32 in)	No	None
RR	Goodyear Viva 2	PJC6 JA1R 1914	3 mm (4/32 in)	No	None
RF	Primewell PS830	Y9CA D8HX 2516	6 mm (7/32 in)	No	None

The interior of the Honda was configured for the seating of five occupants (2/3). The front row consisted of forward-facing bucket seats with adjustable head restraints. At the time of the SCI inspection, the driver's seat was adjusted to a middle track position, while the front right seat was adjusted to a track position between middle and full-rear. Both front row seat backs were slightly reclined. The Honda's second row consisted of a non-adjustable bench seat. Manual safety features included 3-point lap and shoulder seat belts for all five seat positions. The front seat belts were equipped with retractor and buckle pretensioners.

The Honda was further equipped with supplemental restraint systems that consisted of advanced driver's and passenger's frontal air bags, as well as seat-mounted side-impact air bags in the outboard aspects of both front seats and IC air bags mounted in the vehicle's roof side rails.

Vehicle History

According to a vehicle history report obtained from a commercial service based on National Motor Vehicle Title Information System data, this specific 2009 Honda Civic had multiple owners during its lifetime. It was first titled and registered in Pennsylvania in April 2009 by a fleet/lease owner. It was then offered for sale in March 2011 and sold as a manufacturer-certified, pre-owned vehicle, with an odometer reading of 58,855 km (36,571 mi).

The second owner titled and registered the Honda in Delaware. The vehicle's first crash was reported in February 2012, involving a frontal impact. A total loss declaration was made by the Honda's insurer in March 2012. The Honda was then sold at auction with a salvage title/certificate in March 2012.

A rebuilt title was issued in Pennsylvania in June 2012, when the Honda was again offered for sale and sold to its third owner in New Jersey. A reconstructed title was issued with the odometer reading of 90,284 km (56,100 mi). The Honda's second crash was reported in August 2012, involving a right-side impact/sideswipe collision. Following this crash, the Honda received routine service and maintenance until a third crash was reported in April 2014. The April 2014 crash involved a right rear impact with another vehicle. Yet another crash, the Honda's fourth, was reported in May 2014. That crash involved a frontal impact with a guardrail. Further maintenance and service records led up to the issuance of a rebuilt title in Maryland in August 2015, with the reported odometer reading of 197,949 km (123,000 mi). Damage was reported to the front and right front of the Honda in November 2015, but not linked to a crash.

A lack of reporting data on the Honda existed from November 2015 until its transferal to its fourth owner in June 2016. At that time, it was issued a rebuilt title by Maryland, with a reported odometer reading of 201,686 km (125,322 mi). No reporting data concerning the Honda existed after its transferal to the fourth owner. A manufacturer's recall (NHTSA #17V-030) was issued on January 11, 2017, concerning the passenger's frontal air bag inflator.

Exterior Damage

Damage to the exterior of the Honda was located on the front plane, associated with the impact to the right plane of the Toyota. In the front plane damage pattern was moderate deformation. The bumper fascia was completely separated from the Honda and no longer with the vehicle. Both headlight assemblies were disintegrated. The bumper beam was separated from the right frame rail of the Honda and bent outward away from the vehicle, with minor deflection of the hood and the forward aspect of the left front/right front fenders. Direct contact damage associative to the crash event spanned the entire width of the front plane.

Due to partial separation of the bumper beam and its ability to be altered, a residual crush profile was measured to the leading edge of the deformed hood in front of the upper radiator support. The width of the direct and induced damage (Field-L) for the crush profile measured 110 cm (43.3 in), and produced the following resultant measurements: C1 = 23 cm (9.1 in), C2 = 18 cm (7.1 in), C3 = 16 cm (6.3 in), C4 = 13 cm (5.1 in), C5 = 13 cm (5.1 in), and C6 = 11 cm (4.3 in).

Figure 5. Frontal damage pattern to the 2009 Honda Civic sedan.

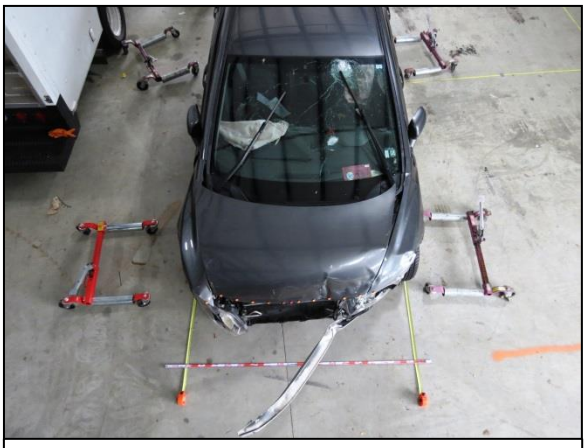


Figure 6. Overhead view of the frontal damage profile to the 2009 Honda Civic.

Based on the visible damage, the Collision Deformation Classification (CDC) assigned to the Honda for the Event 1 impact with the Toyota was 11FDEW2. **Figure 5** depicts the front plane damage pattern, while **Figure 6** depicts the damage profile from an overhead perspective.

The damage algorithm of the WinSMASH model was used to calculate the delta V of the impact for the Honda. The total calculated delta V was 23 km/h (14.3 mph). The longitudinal component of the calculated delta V was -20 km/h (-12.4 mph), with a lateral component of 12 km/h (7.5 mph).

Event Data Recorder

The 2009 Honda Civic was equipped with an ACM that commanded actuation/deployment of supplemental restraint systems (pretensioners and air bags). The ACM did not have event data recorder (EDR) capabilities supported by the Bosch CDR tool/software. Therefore, no EDR data was available.

Interior Damage

The interior of the Honda was inspected for crash-related intrusion, damage, and occupant contact. There was no intrusion into the occupant compartment space associated with the moderate frontal impact of the crash. Aside from pre-crash historical wear-and-tear to the vehicle's interior, the only discernable interior crash damage was related to the deployment of the supplemental restraint systems, rupture of the driver's frontal air bag inflator, and occupant contact. However, the occupant contact was not associated with loading of components or otherwise associated with their kinematic response to the crash forces.

Instead, the significant remnants of blood in the area of the driver's seat position were attributable to the driver and his profuse bleeding, resultant from injuries caused by the inflator rupture. Damage and occupant contact associated with the rupture of the driver's frontal air bag system are detailed in the Driver's Frontal Air Bag discussion of the Supplemental Restraint Systems section of this report.

The windshield was fractured by debris from the driver's frontal air bag inflator rupture, but all the other glazing was intact and undamaged. The front left and front right glazing were open at the time of the crash. All the Honda's doors remained closed during the crash and were operational at the time of the SCI inspection.

An area of blood spatter and what appeared to be small pieces of body tissue were observed on the driver's seat cushion. There was also significant dried blood on the cushion, frame, and adjustment handles of the driver's seat, as well as the floor, center console, and left door panel. Blood spatter was observed on the deployed driver's frontal air bag and driver's seat belt system. The entirety of the blood evidence in the Honda was attributable to the driver's injuries and corresponding bleeding caused by the ruptured air bag inflator.

Manual Restraint Systems

The Honda was equipped with 3-point lap and shoulder seat belt systems for all five seating positions. The front-seat belt systems used continuous loop webbing with sliding latch plates and adjustable D-rings. The driver's seat belt system retracted onto an emergency locking retractor (ELR), while the front-right passenger's seat belt used an ELR/automatic locking retractor (ALR). Both front seat belt systems were equipped with retractor and buckle pretensioners,

which actuated as a result of the crash. At the time of the SCI inspection, the driver's D-ring was adjusted fully upward and the front-right passenger's was adjusted fully downward. All three seat belt systems in the second row used continuous loop webbing with sliding latch plates and ELR/ALR retractors.

At the time of the SCI inspection, the driver's seat belt system was cut near the D-ring. A portion of the webbing remained in the D-ring and extended into the B-pillar, locked in position presumably due to the actuated status of the retractor pretensioner. The lower portion of the webbing extending from the lower anchor measured 154 cm (60.6 in). This section of webbing was entirely covered in blood. The latch plate remained engaged in the buckle.

The front-right passenger's seat belt system was locked in position with webbing extended from the retractor. There was some minor loading evidence (abrasions in the polymer surface) in the belt path of the polymer latch plate from the seat belt webbing. The webbing itself was unremarkable.

Based on the observations of the SCI investigator and the post-crash condition of the driver's and front-right passenger's seat belt systems, it was determined that both front-row occupants of the Honda were belted at the time of the crash.

Figure 7 depicts the driver's 3-point lap and shoulder seat belt system at the time of the SCI inspection. **Figure 8** depicts the latch plate of the front-right passenger's seat belt system.

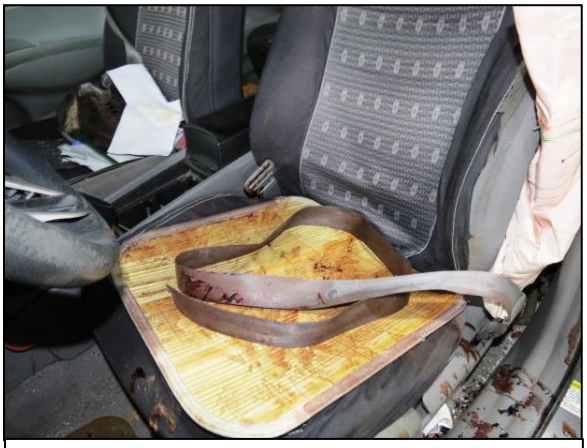


Figure 7. Driver's 3-point lap and shoulder seat belt system in the 2009 Honda Civic.

Figure 8. Loading evidence in the belt path of the front-right passenger's latch plate in the Honda.

Supplemental Restraint Systems

The Honda was equipped with front-seat belt retractor and lower anchor pretensioners, advanced driver's and passenger's frontal air bags, front-seat-mounted side-impact air bags, and side-impact sensing IC air bags. Based on a review of the vehicle's history report, the Honda was involved in at least four crashes prior to the incident crash. Although the vehicle had been declared a total loss in 2012, there were no records in the vehicle history report concerning maintenance/replacement/service to the Honda's supplemental restraint systems. The incident crash resulted in the actuation of the Honda's

multiple pretensioner systems and the deployment of its frontal air bags, left seat-mounted air bag, and left IC air bag.

Driver's Frontal Air Bag

The driver's frontal air bag had deployed from the steering wheel hub-mounted module. A rupture of the inflator and apparent over-pressurization of the system had resulted in the complete separation of the air bag fabric, cover flaps, and a portion of the inflator from the steering wheel hub module. This was evidenced by photographs taken by the investigating law enforcement agency at the crash site. **Figure 9** is an on-scene law enforcement image depicting that the air bag and some of the module's components had separated from the steering wheel hub during the crash.

Figure 9. View of the Honda's steering wheel hub, missing components of the driver's frontal air bag module (on-scene law enforcement image).

Figure 10 depicts the steering wheel hub at the time of the SCI inspection (note that the remainder of the air bag module was removed prior to the joint SCI/Honda/Autoliv inspection). The SCI investigator and representatives from Honda and Autoliv assembled the components of the involved Honda's air bag module for inspection. These OEM representatives were in possession of new manufacturer replacement components that served for exemplar purposes in order to identify the components of the involved air bag module and establish whether or not the components were genuine supplier parts.

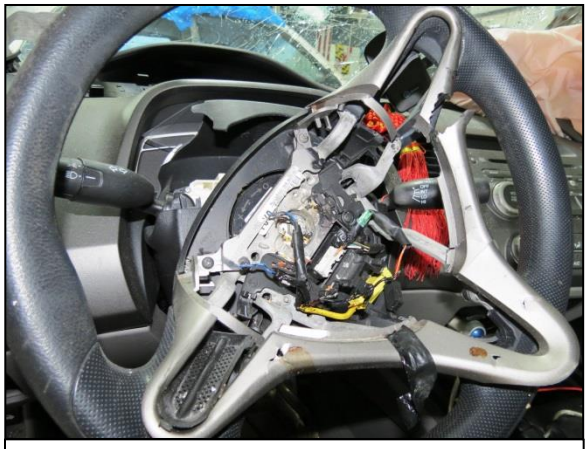


Figure 10. View of the Honda's steering wheel hub at the time of SCI inspection, evidentiary of prior removal of remaining air bag module components.

Inspection of the driver's frontal air bag module components revealed that the housing/frame and retaining bracket were genuine parts (**Figure 11**), and contained labels similar to those produced by the manufacturer. However, the cover flap/fascia of the involved driver's frontal air bag module did not match the original manufacturer's equipment (**Figure 12**). The involved cover flap/fascia lacked identifying markings, was devoid of polymer molding identifiers, and did not have the same structure as the original equipment (fewer molded supports).

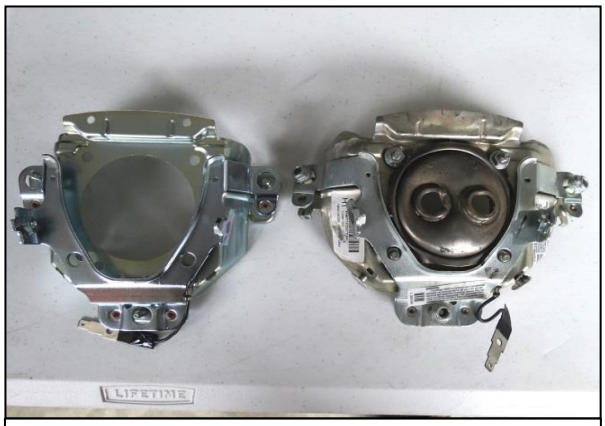


Figure 11. The exemplar frame/housing (left) and the Honda's involved frame/housing (right) had matching characteristics.

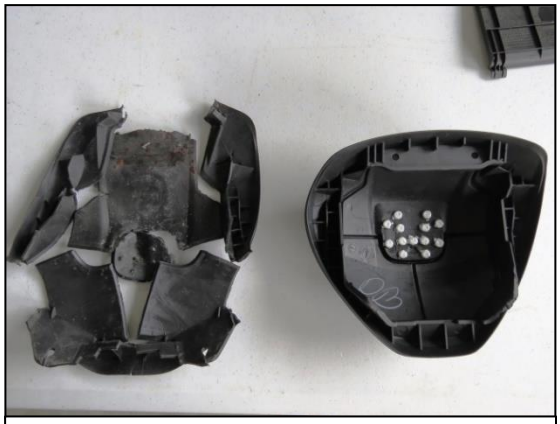


Figure 12. Characteristics of the involved cover flap/fascia (left) did not match those of a genuine component (right).

The fabric of the involved air bag was similar to the genuine component, and had a label similar to those found on manufacturer components. This label contained a barcode with the nomenclature "HGBV8B09ALF." However, the fabric also had multiple creases and appeared to have a far greater number of folds than original equipment should have had. There was also a large tear in the fabric left of center, where a portion of the inflator had penetrated out of the air bag during deployment.

Figure 13. View of the rear aspect of the Honda's air bag and the tears in its fabric associated with its complete separation from the assembled module during the crash.

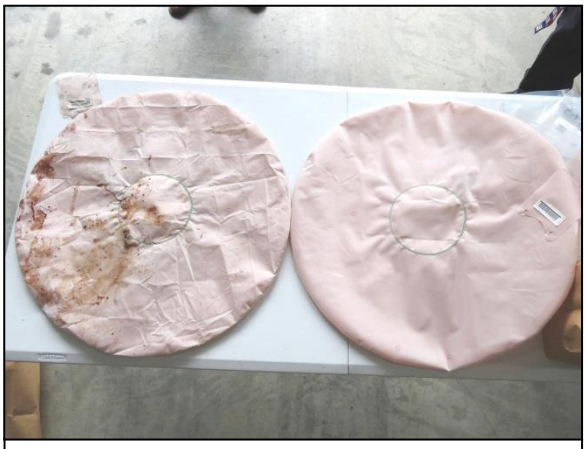


Figure 14. The involved Honda's air bag (left) had considerably more creases and folds in its fabric in comparison to the genuine component (right).

One of the internal tethers was separated, and the involved air bag fabric had torn away from the housing. This was evidenced by separation of the four fabric holes on the rear aspect of the fabric, where it attached to module (**Figure 13**). **Figure 14** depicts the involved Honda's air bag and the genuine component, for comparison purposes.

The inflator for the involved driver's frontal air bag and its internal components as found in the Honda did not match the manufacturer supplier's original components. Internal cushioning pieces (damper pad) were of a foreign material. The involved inflator had a damper pad that was made of a red rubber material, rather than the original manufacturer's soft, white fiberglass (**Figure 15**). Additionally, the squibs in the involved inflator did not match the size, shape, or ventilation pattern of the original manufacturer's equipment (**Figure 16**).

Figure 15. The involved Honda's cushioning piece (left) was an entirely different material and shape than the manufacturer component (right).

Filtering agent (wire mesh) was of a different construction than the original equipment (**Figure 17**). Holes for the squibs in the base of the inflator were symmetrical and identical in size, rather than offset like the original equipment. The wiring harness for the driver's frontal air bag inflator had been tampered with since the vehicle's date of manufacture. It had been cut in half, the squib connectors were discarded, and the ends of the red and yellow wires had been stripped. Pairs of blue and black wires had been soldered to the stripped ends and bound with black electrical tape (**Figure 18**), then soldered to the squibs of the foreign inflator. This modification was not certifiable or recommended by the manufacturer.

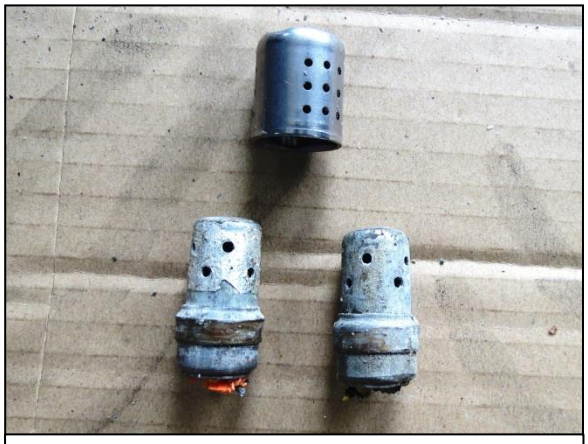


Figure 16. The size, shape, and characteristics of the genuine squib cap (top) were entirely different than the characteristics of the involved squibs (bottom).

As a result of the on-site inspection by the SCI investigator and manufacturer representatives from Honda and Autoliv, it was determined that the air bag and components in the Honda had been modified and were not completely original manufacturer equipment. Specifically, the involved Honda's air bag inflator was not the originally equipped inflator. It was instead either a counterfeit replacement, or was from a different make/model vehicle and not specifically designed for use in the 2009 Honda Civic.

Based on a review of a commercially available vehicle history report and the evidence documented and observed, it was concluded that the most probable explanation for the mixture of genuine and foreign/counterfeit components that made up the involved driver's frontal air bag module was that the air bag module had been rebuilt following a previous deployment. The rebuild had been completed using a foreign/counterfeit inflator, modified wiring harness, and an aftermarket/counterfeit cover flap/fascia piece. The manufacturer and supplier representatives concurred with the findings of the SCI investigator and corroborated these conclusions.

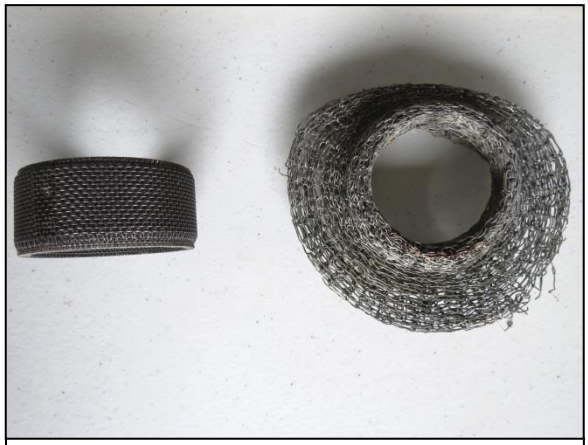


Figure 17. Original wire mesh (left) in comparison to the deformed wire mesh from the Honda (right), which was of different construction.

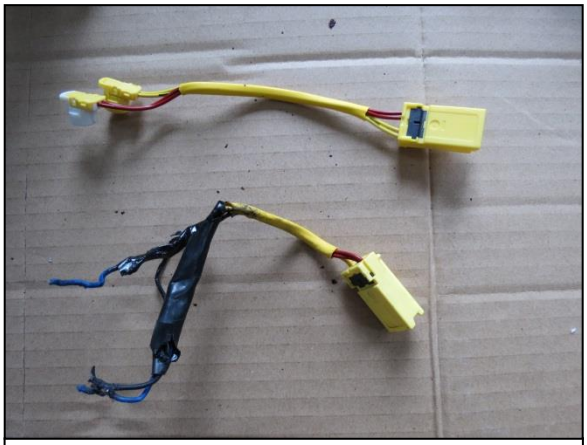


Figure 18. View of a genuine wiring harness (top) and the wiring harness from the Honda (bottom) that had been modified/tampered with by an unknown person.

Passenger's Frontal Air Bag

The passenger's frontal air bag deployed from the module in the top of the instrument panel through the H-configuration cover flaps without damage. In its deflated state, the air bag measured approximately 65 cm (25.6 in) wide and 70 cm (27.6 in) tall. The air bag was vented on both sides by 8 cm (3.1 in) diameter vents. There was no discernable occupant contact, markings, or any other crash-related damage to the passenger's frontal air bag. **Figure 19** depicts the deployed passenger's frontal air bag at the time of the SCI inspection.

NHTSA Recalls and Investigations

The commercially obtained vehicle history report indicated that this specific 2009 Honda Civic was subject to a manufacturer recall issued on January 11, 2017, concerning the passenger's frontal air bag inflator and the possibility of rupture during deployment of the passenger's frontal air bag. The history report identified the recall using NHTSA #17V-030.

A query of the 2009 Honda Civics' VIN on www.nhtsa.gov/recalls also identified the aforementioned recall. This likely indicated that the recall had not yet been resolved. There were no other active recalls or open investigations concerning this specific 2009 Honda Civic as of the date of this report.

Figure 19. Deployed passenger's frontal air bag in the 2009 Honda Civic.

2009 HONDA CIVIC OCCUPANT DATA

Driver Demographics

Age/sex:	55 years/male
Height:	175 cm (69 in)
Weight:	95 kg (209 lb)
Eyewear:	Unknown
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Middle
Manual restraint usage:	3-point lap and shoulder seat belt system
Usage source:	Vehicle inspection
Air bags:	Advanced frontal, seat-mounted side-impact, and left IC air bags available; all deployed
Alcohol/drug data:	None
Egress from vehicle:	Removed from vehicle while unresponsive
Transport from scene:	Ambulance to a regional trauma center
Type of medical treatment:	Pronounced deceased shortly after arrival at trauma center

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Transection of brain stem at level of midbrain	140218.6	Fragments of ruptured inflator	Certain
2	Pulpification of left frontal and temporal lobes	140692.5	Fragments of ruptured inflator	Certain
3	Fractured left frontal bone; fractured left parietal bone; fractured left occipital bone; fractured left anterior cranial fossa	150406.4	Fragments of ruptured inflator	Certain
4	Fractured left side of sphenoid bone	150206.4	Fragments of ruptured inflator	Certain
5	Complete diastasis of left lambdoidal suture; partial diastasis of right lambdoidal suture	150402.2	Fragments of ruptured inflator	Certain
6	Diffuse mild to moderate subarachnoid hemorrhage	140693.2	Fragments of ruptured inflator	Certain
7	Left cerebral scalp and subgaleal hemorrhage	110600.1	Fragments of ruptured inflator	Certain
8	Gaping defect encompassing left orbit and left maxilla resulting in pulpification of left eye and	216004.2	Fragments of ruptured inflator	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
8 (Cont.)	extrusion of brain matter through the defect			
9	Fractured left maxilla	250800.2	Fragments of ruptured inflator	Certain
10	Fractured left orbital bones	251200.2	Fragments of ruptured inflator	Certain
11	Laceration of skin and soft tissue on left side of face	210600.1	Fragments of ruptured inflator	Certain
12	Contusions to face, NFS	210402.1	Fragments of ruptured inflator	Certain
13	Abrasions to face, NFS	210202.1	Fragments of ruptured inflator	Certain
14	Contusions to front of neck	310402.1	Fragments of ruptured inflator	Certain
15	Abrasions to front of neck	310202.1	Fragments of ruptured inflator	Certain
16	Abrasions to chest in seatbelt distribution	410202.1	Seat belt system	Certain
17	Contusions to upper right extremities, NFS	710402.1	Left instrument panel	Probable
18	Contusions to upper left extremities, NFS	710402.1	Left instrument panel	Probable
19	Abrasions to upper right extremities, NFS	710202.1	Left instrument panel	Probable
20	Abrasions to upper left extremities, NFS	710202.1	Left instrument panel	Probable
21	Contusions to lower right extremities, NFS	810402.1	Left lower instrument panel	Certain
22	Contusions to lower left extremities, NFS	810402.1	Left lower instrument panel	Certain
23	Abrasions to lower right extremities, NFS	810202.1	Left lower instrument panel	Certain
24	Abrasions to lower left extremities, NFS	810202.1	Left lower instrument panel	Certain

Source: medical examiner report (internal).

Driver Kinematics

The 55-year-old male was positioned in the driver's seat of the 2009 Honda Civic. He had adjusted the seat to a middle track position, with the seat back slightly reclined and the adjustable head restraint approximately 7 cm (2.8 in) upward. He used the 3-point lap and shoulder seat belt system for manual restraint. The driver's use of the seat belt was determined based on the post-crash condition of the seat belt system as observed by the SCI investigator during the vehicle inspection.

The driver remained in position as the Honda approached the intersection from the west. He did not respond to the controlled status of the traffic signal, and instead maintained the Honda's eastbound travel speed and entered the intersection. A lack of an attempted avoidance maneuver indicated that the driver likely did not detect or respond to his entrance into the controlled intersection and imminent cross-paths trajectory with other traffic. At impact with the right plane of the Toyota, the driver initiated a forward and slightly leftward trajectory. The driver's seat belt retractor and buckle pretensioners actuated, which took up any slack in the driver's seat belt webbing and restricted his forward movement.

The driver's frontal air bag system deployed, but experienced an over-pressurization that resulted in the rupture of the inflator and separation of the entire air bag module from the steering column. Metallic components of the inflator were projected rearward, penetrating out of the air bag toward the driver. Multiple fragments struck and penetrated the driver's head/face, producing numerous soft tissue, skeletal, and internal injuries. These severe injuries instigated profuse bleeding.

During the impact engagement and the rupture/separation of the air bag, the driver's head/face came in contact with the fabric of the air bag and its other remnants. His upper extremities contacted the left instrument panel, while his lower extremities contacted the left lower instrument panel. These contacts produced soft tissue injuries. Following impact, the Honda initiated a clockwise rotation and was redirected toward the south aspect of the intersection. Due to his restrained status, the driver remained in the area of the driver's seat. He was positioned displaced slightly forward as the Honda came to final rest. Injuries to his head and face caused significant blood loss, which covered the driver's seat belt system, seat cushion, and surrounding components.

Emergency response personnel removed the unresponsive driver from the vehicle and immobilized him on a long spine board. He was then transported by ground ambulance to a regional trauma center, where he was pronounced deceased shortly after his arrival. An internal post-mortem examination was performed by a qualified medical professional, which substantiated the injuries documented and discussed in this report.

Front-Row Right Occupant Demographics

Age/sex:	86 years/female
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Between middle and rear position
Manual restraint usage:	3-point lap and shoulder seat belt system
Usage source:	Vehicle inspection
Air bags:	Advanced frontal, seat-mounted side-impact, and right IC air bags available; frontal air bag deployed
Alcohol/drug data:	None
Egress from vehicle:	Assisted from vehicle
Transport from scene:	Ambulance to a regional trauma center
Type of medical treatment:	Hospitalized for treatment (unknown duration)

Front-Row Right Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
-	Unknown	N/A	N/A	N/A

Source: multiple requests for records denied by the treating facility.

Front-Row Right Occupant Kinematics

The 86-year-old female was positioned in the front-row right seat position in the 2009 Honda Civic. Her seat was adjusted to a track position between middle and rear, with the seat back slightly reclined and the adjustable head restraint approximately 4 cm (1.6 in) upward. She used the 3-point lap and shoulder seat belt system for manual restraint, determined based on the post-crash condition of the seat belt system as observed during the vehicle inspection.

The front-row right occupant remained in position as the Honda approached the intersection from the west. At impact with the right plane of the Toyota, she initiated a forward and slightly leftward trajectory. The front-right passenger's seat belt retractor and buckle pretensioners actuated, which took up any slack in the seat belt webbing and restricted her forward movement. The passenger's frontal air bag system deployed from the top instrument panel. It is possible that the occupant contacted the deployed air bag; however, there was no evidence discernable at the time of the SCI inspection to support such interaction. She remained restrained during the impact and subsequent CW redirection.

After the Honda came to final rest, the front-right occupant was assisted from the vehicle by responding emergency services personnel. She was transported by an ambulance to the regional trauma center, where she was hospitalized for care. Records concerning her injuries and course of treatment were requested from the facility where she was transported to following the crash. However, the facility was non-cooperative and denied multiple requests.

1995 TOYOTA CAMRY

Description

The 1995 Toyota Camry (**Figure 20**) was manufactured in March 1995 and identified by the VIN JT2SK11E2S0xxxxxx. It was a 4-door sedan built on a 262 cm (103.1 in) wheelbase and had a gross vehicle weight rating of 1,882 kg (4,150 lb). Front and rear gross axle weight ratings were both 1,088 kg (2,400 lb). The Toyota's curb weight was 1,330 kg (2,932 lb). Its powertrain consisted of a 2.2 liter, inline, 4-cylinder, internal combustion gasoline engine, which was linked to a 4-speed automatic transmission with front-wheel-drive. There was no placard on the vehicle concerning the manufacturer's recommended tire size/pressure.

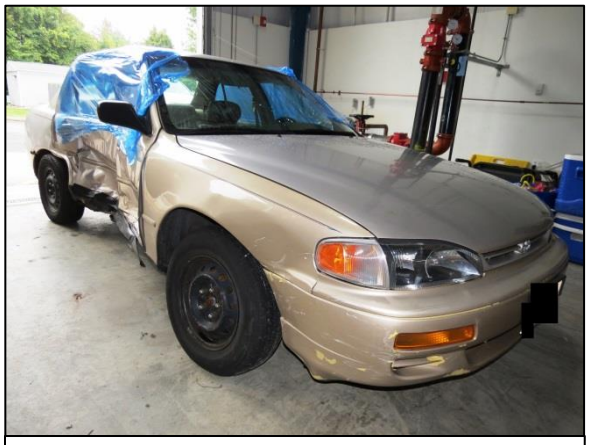


Figure 20. Front-right oblique view of the 1995 Toyota Camry at the time of the SCI vehicle inspection.

At the time of the inspection, the Toyota was equipped with the four tires in size P195/70R14 with the following specific tire data.

Position	Tire Make/Model	DOT#	Tread Depth	Restriction	Damage
LF	Goodyear Invicta GL	MKRW EC4R 393	2 mm (3/32 in)	No	None
LR	Triangle CNTT GLS	2VPN	2 mm (3/32 in)	No	None
RR	Triangle CNTT GLS	2VPN 1213	3 mm (4/32 in)	No	None
RF	Guardsman III All Season TE	Unknown	3 mm (4/32 in)	No	None

The interior of the Toyota was configured for the seating of five occupants (2/3). The front row consisted of forward-facing bucket seats with adjustable head restraints, while the second row consisted of a non-adjustable bench seat. Manual safety features included 3-point lap and shoulder seat belts for all four outboard seat positions, with a lap belt for the second-row center position. The Toyota was equipped with single-stage frontal air bags for both front-row positions.

Exterior Damage

Damage to the exterior of the Toyota was located on the right plane, associative to the impact by the front plane of the Honda. In the damage pattern was moderate deformation to the right doors, with corresponding lateral intrusion in the Toyota's interior. The impact damage pattern began at the A-pillar and extended rearward to the C-pillar area. Direct contact damage measured 225 cm (88.6 in), while the direct and induced damage (Field-L) measured 230 cm (90.6 in). Deformation was centered 51 cm (20.1 in) rearward of the center of the wheelbase. A damage profile documented to the mid-door level produced the following resultant measurements: C1 = 4 cm (1.6 in), C2 = 19 cm (7.5 in), C3 = 31 cm (12.2 in), C4 = 26 cm (10.2 in), C5 = 19 cm (7.5 in), and C6 = 1 cm (0.4 in). Based on the visible damage, the CDC assigned to the Toyota for the Event 1 impact with the Honda was 03RPEW3. **Figure 21** depicts the right plane damage pattern, while **Figure 22** depicts the damage profile from an overhead perspective.

Figure 21. Right-plane damage pattern to the 1995 Toyota Camry.

Figure 22. Overhead view of the right-plane damage profile to the 1995 Toyota Camry.

The damage algorithm of the WinSMASH model was used to calculate the delta V of the impact for the Toyota. The total calculated delta V was 24 km/h (14.9 mph). The longitudinal component of the calculated delta V was -4 km/h (-2.5 mph), with a lateral component of -24 km/h (-14.9 mph).

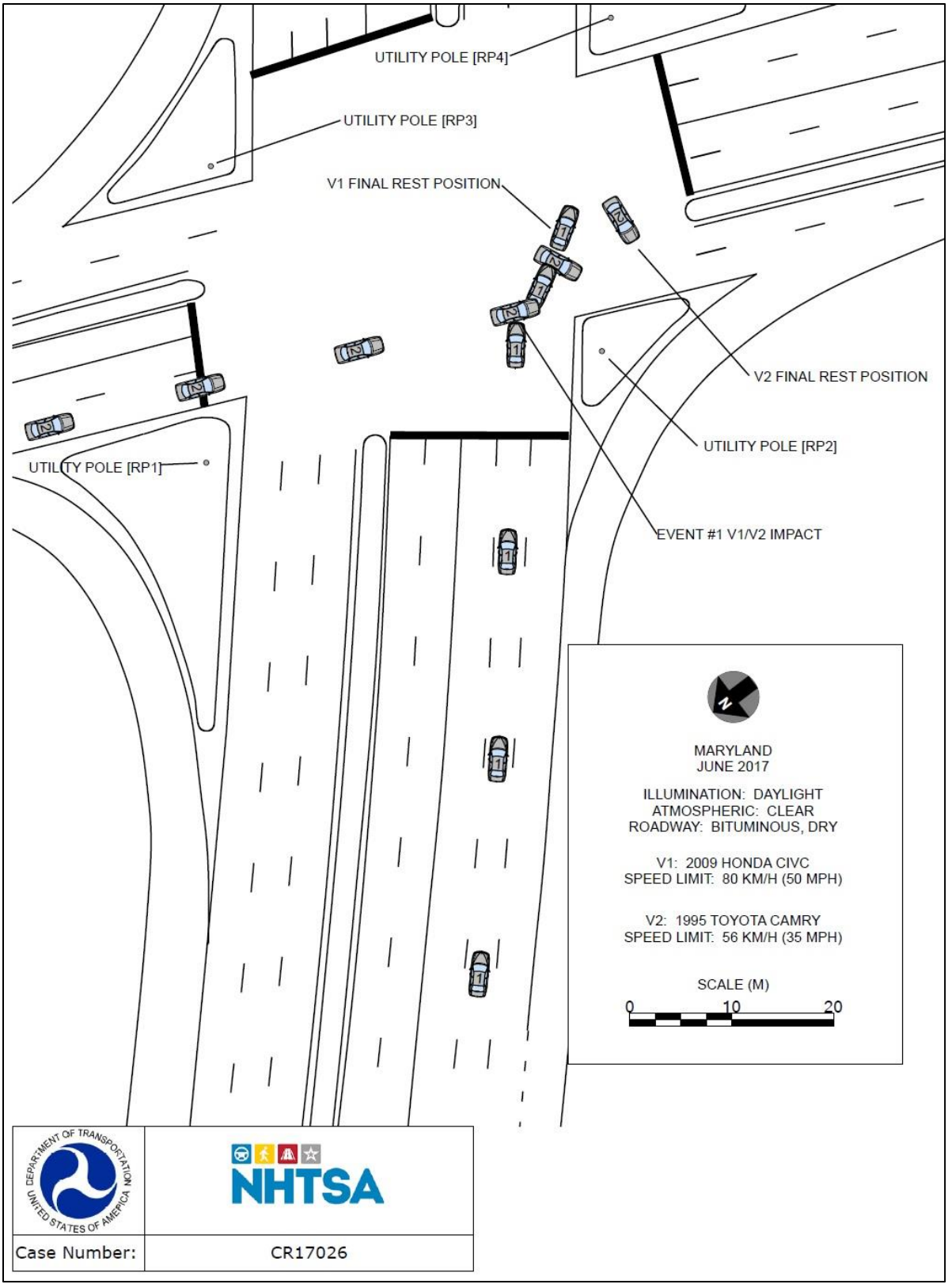
Event Data Recorder

Due to its model year, the 1995 Toyota Camry was not equipped with an EDR. No data could be obtained from the vehicle.

Occupant Data

The Toyota was driven by the 40-year-old male. According to law enforcement documentation of the crash, he was belted by the vehicle's 3-point lap and shoulder seat belt system at the time of the crash. No supplemental restraint systems in the Toyota deployed as a result of the lateral crash. The driver exited the Toyota without assistance and was transported by a ground ambulance to a local hospital. He was evaluated, treated, and released from the hospital within hours of the crash.

CRASH DIAGRAM



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**National Highway
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