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Each crash represents a unique sequence of events, and generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicles or their safety systems. This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was submitted.

16. Abstract

This report documents the investigation of the rupture of the driver's frontal air bag inflator in a 2002 Honda Accord. The Honda was making a left turn from east-to-north in a controlled 4-way intersection and had a front-to-side crash with a 2009 Hyundai Genesis traveling west. The Honda had dual-stage driver and passenger frontal air bags. Impact forces resulted in the deployment of the Honda driver's frontal air bag, which experienced an explosive rupture of its inflator that propelled a metallic fragment rearward. It struck the face of the 35-year-old belted driver, lodged in his throat obstructing the airway, and resulted in his death. A search of the NHTSA recall database www.nhtsa.gov/recalls indicated that the vehicle under investigation had an open recall at the time of the crash. The recall, NHTSA Campaign Number 15V-320, was issued May 2, 2015, and involved the recall of certain Honda vehicles equipped with driver's frontal air bags that fell in the Takata air bag defect population.

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Special Crash Investigations
On-Site Driver's Frontal Air Bag Inflator Rupture Crash Investigation
Office of Defects Investigation
Case Number: CR21011
Vehicle: 2002 Honda Accord
Location: South Carolina
Crash Date: January 2021

Background

This report documents the investigation of the crash of a 2002 Honda Accord (Figure 1) and the ruptured deployment of its driver's frontal air bag inflator. The Honda was involved in an intersection crash with a 2009 Hyundai Genesis in January 2021. The Honda had manual 3-point lap and shoulder seat belts with front retractor pretensioners and dual-stage driver's and passenger's frontal air bags. The crash forces resulted in the actuation of the driver's seat belt retractor pretensioner and deployment of the frontal air bags. The driver's frontal air bag inflator had an explosive rupture during deployment that propelled a metallic fragment rearward, striking the belted 35-year-old male driver in the face. The projectile lodged in his throat, obstructing his airway and resulted in his death. The driver was removed from the vehicle and transported by ambulance to a hospital where he was pronounced deceased. An autopsy was performed the following day.

Figure 1. Left front oblique view of the Honda

Notification of the January 2021 crash was received by the National Highway Traffic Safety Administration in March 2021 and an on-site crash investigation was assigned to the Special Crash Investigations team at Crash Research & Analysis, Inc., in April 2021. After the crash the Honda had been towed from the scene to a secure location and placed under the possession of the coroner. The SCI team contacted the coroner and scheduled an inspection of the vehicle that took place in April 2021. Technical representatives for Honda America also attended and participated in the vehicle inspection.

A search of the NHTSA recall database www.nhtsa.gov/recalls showed this vehicle had an open recall, NHTSA Recall Number 15V-320, issued May 2, 2015, and involved the recall of certain Honda vehicles equipped with driver frontal air bags that fell within the Takata air bag defect population. It was unknown if the vehicle's owner was aware of the safety recall.

The on-site activities included an inspection of the Honda to document the exterior and interior damage, identify points of occupant contact, and evaluate the manual and supplemental restraint systems. The driver's frontal air bag assembly had been removed from the vehicle by the coroner and a limited non-destructive examination of the parts was conducted by a third-party engineering consulting firm. Due to its age, the Honda was not equipped with an event data recorder (EDR) supported by the Bosch Crash Data Retrieval tool; no crash data could be imaged from the vehicle. The Honda representative also stated this vehicle's EDR did not record data. Additional activity included the documentation of the crash site via photographs and a total station mapping system. The Hyundai was deemed a total loss by its insurer and sold prior to SCI crash notification; it was not available for inspection.

Summary

Crash Site

The crash occurred at night in January 2021. The environmental conditions reported by the National Weather Service included clear skies with a temperature of 0°C (32°F), no wind, and relative humidity of 93 percent. The police reported conditions as clear, dry, and dark with artificial overhead lighting. The crash occurred in the westbound lanes at the 4-leg intersection of two multi-lane roadways. The intersection was controlled by overhead traffic signals. The east/west roadway was divided by a grass median and had four lanes approaching the intersection and two lanes leaving the intersection. The four approach lanes were a right turn only, two lanes for continuing traffic and a left turn only. The north/south roadway consisted of four lanes, two lanes in either direction. The east and west left turn only lanes were separated from the adjacent lane by a painted median. The profile of the asphalt highway (viewed from overhead) was straight and the grade was level. The posted speed limit was 72 km/h (45 mph). A crash diagram is included at the end of this report. Figure 2 is an east-looking trajectory for the Honda from the left turn lane/eastbound approach. Figure 3 is a west-looking trajectory view for the Hyundai.

Figure 2. East-looking trajectory view for the Honda at the intersection

Figure 3. West-looking trajectory view for the Hyundai

Pre-Crash

The Honda was in the left-hand turn lane of the eastbound traffic flow driven by the belted 35-year-old male, the sole occupant of the vehicle. The Hyundai was traveling west in the right continuing traffic lane and was driven by a 68-year-old male driver and a 62-year-old female passenger. The police report stated the Hyundai occupants were belted. Based on the crash environment conditions, opposite direction traffic approaching either vehicle was likely visible to each driver. As the vehicles entered the intersection, the Honda attempted to turn left across the path of the Hyundai. The police report estimated that the pre-crash speed of the Honda was approximately 24 km/h (15 mph). The police report estimated the speed of the Hyundai to be 72km/h (45mph). The traffic light sequence was not determined by the police investigation.

Crash

The front of the Honda struck the left side of the Hyundai. The direction of force was in the 2 o'clock sector for the Honda and 11 o'clock for the Hyundai. The collision and engagement of the vehicles caused the Honda to rotate approximately 115 degrees counterclockwise as it traveled to its final rest position in the westbound lanes. The Hyundai was deflected to its right as it separated from the impact continuing west. It then departed the right side of the road and came to rest in the northwest quadrant of the intersection. The frontal air bags in the Honda deployed due to the force of the impact. During the deployment sequence, the driver's frontal air bag inflator ruptured and a metallic fragment from the inflator struck the driver in the face.

Post-Crash

The police and emergency response arrived at the scene. The Honda driver was unresponsive and removed through the front left door by EMS. Cardiopulmonary resuscitation was initiated and he was transported by ambulance to the emergency room of a nearby hospital. Upon arrival, his Glasgow Coma Score was 3 and he was absent life signs. It was observed that the driver had severe extensive facial trauma with a foreign metal body lodged deep in his throat obstructing his airway. The county coroner initiated a death investigation.

The driver and passenger of the Hyundai were not injured. At the conclusion of the police and coroner's investigations, the Honda and Hyundai were removed from the scene. The Honda remained in the possession of the coroner, where it was inspected for this SCI investigation. The Hyundai could not be located and was not inspected.

2002 Honda Accord

Description

The 2002 Honda Accord (Figure 4) was manufactured in January 2002 and was identified by Vehicle Identification Number JHMCG66852Cxxxxxx. The Honda had the EX-level trim. The powertrain was a 2.2-liter, transverse-mounted, 4-cylinder gasoline engine linked to a 4-speed automatic transmission. The wheelbase measured 272 cm (107.1 in). Standard equipment included power-assisted front disc/rear drum brakes with four-wheel ABS and electronic brakeforce distribution, traction control, and power steering. The gross vehicle weight rating for this vehicle was 1,830 kg (4,035 lb) with gross axle weight ratings of 989 kg (2,180 lb) front and 870 kg (1,920 lb) rear. At inspection, the Honda had the recommended size tires (P195/65R15) at all four axle locations. The tires had four different manufacturers. Starting at the left front and proceeding counterclockwise the tires were: Lassa Snoways, Zenna Sportline, Michelin Energy Saver, and Continental Contact. The tread depth of the left front was marginal at 2 mm (3/32). The tread depths of the other tires were all greater than 4 mm (6/32). There was no damage at any tire location.

The Honda's interior had seating for five occupants with front bucket seats and a three-passenger rear bench seat. The driver seat was adjusted in a mid-to-rear track position measuring 7 cm (2.8 in) forward of full rear with the seatback relined 40 degrees aft of vertical. The front row right seat was adjusted mid-track. All seating surfaces were cloth with both front buckets seats covered by seat covers. The head restraints in the front row were adjustable (fully down). Manual restraint was provided by 3-point lap and shoulder seat belts for the five seat positions. The front seat belts were equipped with retractor pretensioners. Supplemental restraint consisted of dual-stage driver's and passenger's frontal air bags. The Honda did not have side impact or inflatable curtain air bags.

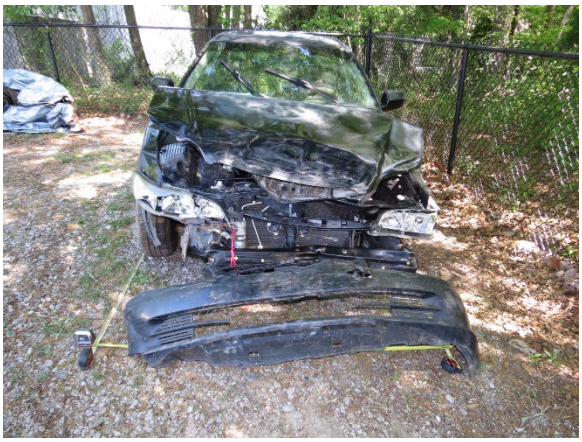


Figure 4. Front view of the damaged Honda

NHTSA Recalls and Investigation

A query of the NHTSA website www.nhtsa/recalls using the Honda's VIN during April 2021 and again in November 2022 determined that there were two open (incomplete) recalls.

NHTSA Recall 05V-025, Ignition interlock, was issued January 27, 2005, on certain passenger vehicles, stating the interlock operation of the ignition switch may not function properly, making

it possible to turn the ignition key to the "off" position and remove the key without shifting the transmission to park. Two closed investigations were paired with this recall.

NHTSA Recall 15V-320, driver's front air bag inflator, was issued May 27, 2015 – the driver's front air bag inflator, when deployed in a crash, could rupture and break apart, sending metal fragments through the air bag cushion material toward the driver and passenger, possibly causing serious injury or fatality. Past ruptures like this have killed or seriously injured vehicle drivers. An open investigation (EA15001) and two closed investigations (RQ09004 and PE14016) were paired with this recall.

Vehicle History

A Carfax history report stated that the Honda had seven ownership periods over its service life. The Honda was not involved in any previous crashes and there was no history of air bag deployment or air bag maintenance. The stated ownership periods follow.

- Owner 1 – September 2002 to August 2005, California registration. In January 2005, NHTSA recall 05V-025 was issued and remained unrepaired.
- Owner 2 – August 2005 to November 2011, California registration.
- Owner 3 – November 2011 to September 2014. In October 2013, a service record indicated that the vehicle had been relocated to Florida. The odometer read 235,548 km (146,367 miles) at that time. NHTSA recall 15V-320 was issued during this ownership on June 9, 2015 and remained unrepaired.
- Owner 4 – September 2015 to December 2015, Florida registration.
- Owner 5 – December 2015 to January 2017. In December 2016, the Honda was relocated to South Carolina.
- Owner 6 – January 2017 to October 2020, South Carolina registration.
- Owner 7 – October 2020, vehicle purchased. The crash under SCI investigation occurred in January 2021.

The Honda was sold and purchased four times after the driver's frontal air bag recall was issued and a remedy was never completed.

Exterior Damage

The Honda sustained moderate damage to the front plane during the Event 1 impact with the Hyundai (Figure 5). The direct contact damage spanned the 152 cm (60.0 in) end width of the vehicle encompassing the fascia, front bumper components, both headlamp assemblies and hood. The lateral component of the impact force deformed both attachments of the bumper reinforcement bar 23 cm (9.0 in) to the left. The forward third of the hood tented vertical with an abraded area measuring 86 cm x 20 cm (34.0 in x 7.9 in). The fascia and bumper reinforcement separated during the impact. The bumper reinforcement was repositioned in order to measure an approximate crush profile. The Field L measured 99 cm (39.0 in). The residual crush profile measured across the deformed reinforcement was as follows: C1 = 3 cm (1.2 in), C2 = 18 cm (7.1 in), C3 = 24 cm (9.4 in), C4 = 25 cm (9.8 in), C5 = 16 cm (6.3 in), C6 = 0. The maximum crush was located 5 cm (2.0 in) left of the centerline and measured 25 cm (9.8 in). The wheelbase measurements were unchanged. The windshield was intact. All doors were operational. The collision deformation classification (CDC) assigned to the frontal damage pattern was 02FDEW2. The delta V calculated by the missing vehicle algorithm of the

WinSMASH program was 32 km/h (20 mph). The longitudinal and lateral components were -20 km/h (-12 mph) and -24 km/h (-15 mph), respectively. NHTSA coding rules require that a crash reconstruction, which is completed using the WinSMASH missing vehicle algorithm, needs to be coded as a borderline reconstruction. However, the results of the calculation were considered reasonable based on SCI field experience.

Figure 5. Frontal crush of the Honda

Figure 6. Left interior view of the Honda

Event Data Recorder

The Honda had an air bag control module that was mounted on the center tunnel below the center instrument panel. The module monitored the diagnostics of the vehicle's air bag systems and controlled its deployment. It had been determined through previous SCI research that Honda vehicles manufactured during this period were equipped with rudimentary EDRs that had very limited capabilities. It did not have the capability to record pre-crash data. The Honda representative attending the inspection confirmed this information. Bosch CDR tool support to image Honda EDR data did not begin until the 2012 model year; therefore, EDR data was not available to the SCI investigator.

Interior Damage

The interior damage consisted of the deployments of the frontal air bags and minor occupant contact evidence of the lower instrument panel (Figure 6). There was no intrusion of the occupant space. The steering wheel rim was undamaged. The tilt adjustment of the steering column was in the full up position and there was no displacement of the shear capsules. The knee bolster panel was scuffed over a 5 cm (2.0 in) square area from the driver's left knee. The scuffed area was located 17 cm (6.7 in) left of the steering column centerline and 38 cm (15.0 in) above the floor.

Manual Safety Systems

The Honda had 3-point lap and shoulder seat belts for all five seating positions. The front seat belt systems used continuous loop webbing with sliding latch plates, adjustable D-rings and retractor pretensioners. The driver's D-ring was at its lowest adjustment. The driver's seat belt system retracted onto an emergency locking retractor (ELR), while the front right passenger's seat belt utilized an ELR/automatic locking retractor (ALR). All three second row systems were equipped with ELR/ALR retractors.

At the time of the SCI inspection, the driver's belt was extended from its retractor and the webbing was locked by the actuation of the retractor pretensioner. The webbing had been cut in two places by the first responders during rescue activities. It was cut 6 cm (2.4 in) below the D-ring and 44 cm (17.3 in) above the floor anchor. The total length of the extended webbing (Figure 7) measured 167 cm (65.7 in) from the floor anchor to the D-ring. The webbing was cupped at the buckle location and the buckle hardware was abraded from driver loading. The webbing was soaked with blood. Based on the observed physical evidence, the SCI investigator concluded the driver was belted at the time of the crash.

Figure 7. Image depicting the Honda driver's seat belt

Supplemental Restraint Systems

The Honda had dual-stage frontal air bags which deployed in the intersection crash. The driver's frontal air bag inflator ruptured during the deployment sequence. The passenger's frontal air bag deployed as designed.

During the coroner's death investigation, the driver's frontal air bag module was removed from the vehicle and inspected by a consulting analytical laboratory. The components were then returned and retained as evidence by the coroner, who allowed SCI and Honda a limited visual inspection of the components. The driver's frontal air bag components and the inflator rupture are discussed below.

The passenger's frontal air bag module was located in the top of the right instrument panel. The deployed air bag (Figure 8) measured 61 cm x 66 cm (24.0 in x 26.0 in), width by height with a 33 cm (13.0 in) rearward excursion. The air bag was not tethered and was vented by two posts on the side panels. There was no residual occupant contact evidence. The following nomenclature was embossed on the air bag fabric: BN2401, PF1Y30B-7, and 211201-P.

During the inspection the glove box was removed to access the passenger air bag module and the manufacturing label (Figure 9). The manufacture date was January 2002. denoted by the arrow in the figure. It was confirmed by the Honda representative that this air bag was original to the vehicle.

Figure 8. Image of the deployed passenger's frontal air bag in the Honda

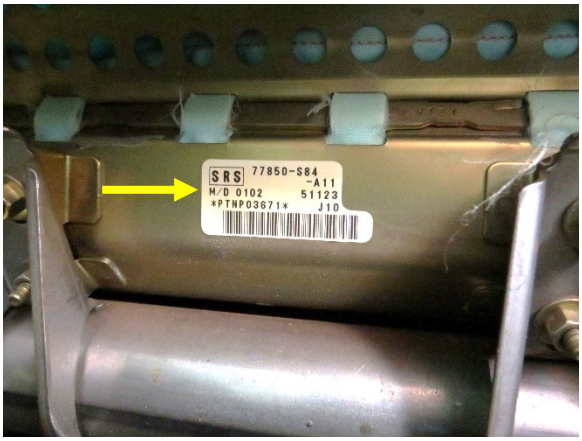


Figure 9. Manufacturer's label for the passenger's frontal air bag in the Honda

Driver's Frontal Air Bag Inflator Rupture Discussion

The driver's frontal air bag deployed at impact with the Hyundai. During its deployment sequence the air bag inflator ruptured. The body of the inflator separated from its base, which remained secured to the module housing by four fasteners. The inflator body penetrated through the inflating air bag fabric, striking the driver in the face and becoming lodged in his throat.

Prior to SCI involvement, the coroner removed the driver's frontal air bag module from the steering wheel and had the components, along with the separated inflator, examined by a scientific analytical consulting firm. Through examination of the physical components, it was determined that all of the components were originally packaged as a complete assembly and separated by rupture. The components were then returned to the coroner and retained as evidence. During the SCI vehicle inspection, the coroner facilitated a limited visual inspection of the components.

The driver's frontal air bag fabric (Figure 10) remained secured to the module housing. There was no damage to either of the cover flaps. The deployed air bag measured approximately 61 cm (24 in) in diameter and was tethered and vented by two ports. The following nomenclature was embossed onto the fabric: BBN2883 PF1X17C-1 and 101201-1. Examination of the fabric determined it was holed during the inflator rupture in its 8 o'clock sector. The hole measured approximately 8 cm (3 in) in diameter and was located radially 14 cm (5.5 in) from the center of the fabric. The air bag fabric was scorched and melted in an 8 cm (3 in) ring pattern at the 12 o'clock sector from the heated/displaced wire mesh filter. The filter, two metal separators, and particulates of the generate were removed from the fabric during the forensic examination conducted by the consultant.

The inflator separated along its circumferential seam through a vent hole during the rupture. The separated body of the inflator (Figures 11 and 12) was propelled through the air bag fabric, striking the driver in the jaw and lodging in his throat. The deformed bottom half of the inflator (Figures 13 and 14) remained attached to its mounted location in the module. This portion of the inflator was labeled by the manufacturer Air Bag Gas Generator, Inflation Systems Inc, La Grange, GA. The words Takata and Honda appeared on two labels. The manufacture date was 2001. The Honda representative confirmed the inflator and air bag were original equipment.

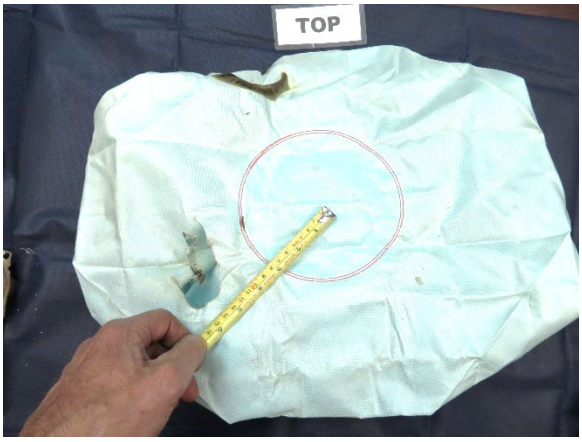


Figure 10. Image depicting the holed driver's frontal air bag from the Honda

Figure 11. Side view of the body of the Honda's ruptured inflator

Figure 12. Interior surface of the body of Honda's ruptured inflator

Figure 13. Interior side of the bottom half to the Honda's ruptured inflator

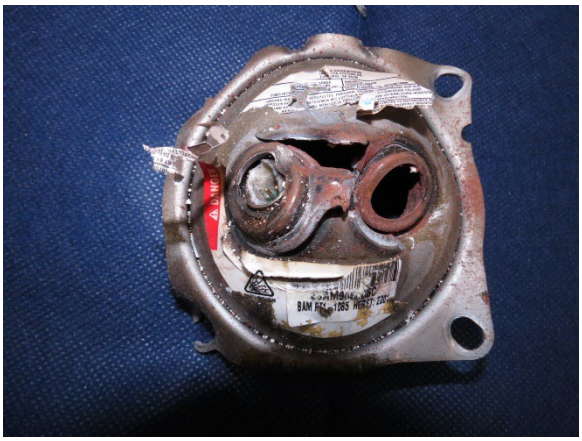


Figure 14. Bottom half of the Honda's rupture inflator and the manufacture labels

2002 Honda Accord Sedan Occupant Data

Driver Demographics

Age/sex:	35 years/male
Height:	173 cm (68 in)
Weight:	80 kg (177 lb)
Eyewear:	None
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	Between middle and rear most
Manual restraint usage:	Lap and shoulder belt
Usage source:	Vehicle inspection
Air bags:	Front steering wheel hub air bag available; deployed
Alcohol/drug involvement:	Alcohol=.327 g/dl; positive for Delta-9 THC
Egress from vehicle:	Removed by EMS
Transport from scene:	Transported to level 1 trauma center
Medical treatment:	None; deceased on arrival

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Asphyxia with cardiac arrest	020006.5	Isolated IPC Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
2	Severe left lower facial trauma with heavy bleeding and destruction to lips	210804.2	Isolated IPC Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
3	Severe left lower facial trauma with heavy bleeding and destruction to left cheek	210804.2	Isolated IPC Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
4	Severe left lower facial trauma with heavy bleeding and destruction to tongue	243404.2	Isolated Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
5	Left mandible fracture, NFS	250610.2	Isolated IPC Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
6	7 x 3 cm circular metal object lodged deep in oropharynx; throat injury	340699.2	Isolated Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
7	Severe left lower facial trauma with heavy bleeding and destruction to mouth	243099.1	Isolated Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
8	Severe left lower facial trauma with heavy bleeding and destruction to teeth	251404.1	Isolated Left Air Bag – Steering wheel hub (ruptured air bag inflator)	Certain
9	Right flank ecchymosis	510402.1	Isolated Interior – Center console first row	Possible

Source: Emergency room record and coroner's report (external)

Driver Kinematics

The belted 35-year-old Honda driver was seated in a mid-to-rear-track position. He initiated a left turn at the intersection where the crash occurred. At impact, the driver responded to the 2 o'clock force of the impact with a forward and right trajectory. The seat belt's retractor pretensioner actuated and both of the vehicle's frontal air bags deployed. The driver loaded the tensioned seat belt webbing with his torso evidenced by the observed loading evidence to the webbing and latch plate.

During the driver's frontal air bag deployment, the inflator ruptured, causing the body of the inflator to separate from the bottom half secured to the module. The separated inflator body was propelled rearward toward the driver. It holed the air bag fabric and struck the left side of the driver's face. The impact lacerated his cheek and tongue, and fractured his mandible and teeth. The body of the inflator became lodged deep in the oropharnx, obstructing his airway.

EMS arrived and observed the driver in cardiac arrest. They removed the driver from the vehicle and transported him to a local hospital as they attempted CPR. They were unable to open his airway. The driver was pronounced deceased at the hospital.

2009 Hyundai Genesis

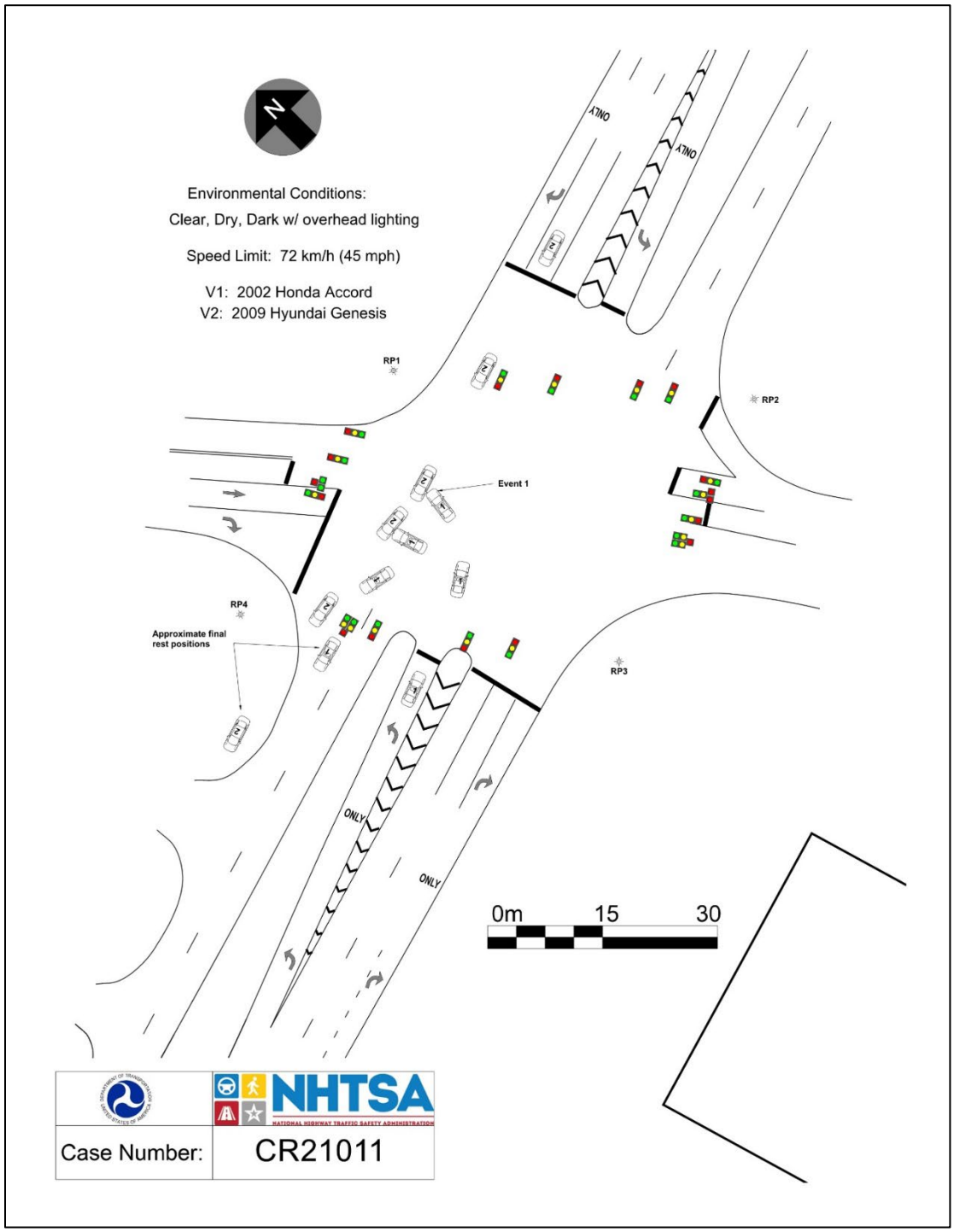
Description

The Hyundai Genesis 4-door sedan was identified by the Vehicle Identification Number KMHGC46E19Uxxxxxx. The rear-wheel drive platform was configured on a 294 cm (115.7 wheelbase and had a 3.8-liter, V6 engine. It had seating for 5 occupants (2/3), manual seat belts, and frontal air bags.

Occupant Data

The police report stated that a 68-year-old male driver and a 62-year-old female passenger occupied the vehicle. The report indicated both occupants were belted and uninjured.

Crash Diagram



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**National Highway
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