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Special Crash Investigations: On-Site Air Bag Inflator Rupture Investigation; Vehicle: 2002 Honda Civic; Location: Arizona; Crash Date: August 2020

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16. Abstract This report documents the on-site investigation of inflator ruptures of the frontal air bag modules that, according to the autopsy report, killed the unbelted 30-year-old female driver of a 2002 Honda Civic. This two-vehicle crash occurred in a four-leg intersection in Arizona in August 2020. It was dark at the time of the crash, but there were streetlights present and illuminated. The Honda was traveling east on a residential street and was stopped at a stop sign. A 2004 Ford Taurus, driven by a belted 40-year-old male, was traveling south. The Honda driver began to enter the intersection to turn left. The Ford driver saw the Honda enter the roadway and began to steer left. The front of the Honda struck the front right of the Ford. Both frontal air bags deployed in the Honda, which came to rest against a curb and caught fire. The driver's air bag module was examined. There were obvious signs of inflator rupture. Fragments of the inflator were found in the vehicle. A single fragment was removed from the driver's neck during the autopsy. The air bag itself was holed in multiple places from inflator fragments. The passenger's frontal air bag module was examined. It also had ruptured, and fragments from the inflator were found in the vehicle. The air bag was holed on the top and bottom from inflator fragments. These were OEM modules under recall that were not replaced. The Honda representative agreed that both air bag inflators ruptured as a result of this crash. The Takata air bag inflators were original and subject to open recalls but were never replaced.			
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**Special Crash Investigations
On-Site Air Bag Inflator Rupture Investigation
Office of Defects Investigation
Case Number: DS20013
Vehicle: 2002 Honda Civic
Location: Arizona
Crash Date: August 2020**

Background

This report documents the on-site investigation of inflator ruptures of the driver frontal air bag (Figure 1) and the passenger frontal air bag modules in a 2002 Honda Civic, which resulted in fatality to the 30-year-old female driver. The vehicle inspection documented the vehicle damage, the ruptured driver and passenger frontal air bag inflators, the air bags, and the steering wheel/column assembly. This investigation was initiated by the Office of Defects Investigation (ODI) in response to an attorney notification. The Special Crash Investigations (SCI) group of the National Highway Traffic Safety Administration assigned the case to Dynamic Science, Inc., in September 2020. The vehicle inspection was completed in September 2020 in a secure facility in Arizona. Present at the inspection were the SCI investigator, a Honda representative, the lead investigator from the local police department, and the family's attorney. The vehicle was not supported by the Bosch Crash Data Retrieval (CDR) system. The air bag control module (ACM) was not imaged by Honda. The decision was made not to image the ACM because it was not configured to capture or report pre-crash data.



Figure 1. The driver's frontal air bag, the 2002 Honda Civic

This two-vehicle crash occurred in a four-leg intersection in Arizona in August 2020 at night. It was dark at the time of the crash, but there were streetlights present and illuminated. The Honda driver, an unbelted 30-year-old female, was traveling east on a residential street and stopped at a stop sign. A 2004 Ford Taurus, driven by a belted 40-year-old male, was traveling south at a speed of 72 km/h (45 mph), according to the police. The Honda driver began to enter the intersection to turn left. The Ford driver saw the Honda enter the intersection and began to steer left. The front of the Honda struck the front right corner of the Ford. Both frontal air bags in the Honda deployed. There were no air bag deployments in the Ford. The Honda came to rest against a curb, and a fire began in the engine compartment.

Both frontal air bags and air bag inflators were examined during the vehicle inspection. The driver's frontal air bag module was removed and disassembled. There were obvious signs of an inflator rupture. Fragments of the inflator were found in the vehicle. A single fragment was removed from the driver's neck during the autopsy. The air bag fabric itself was holed in several places from inflator fragments. The passenger's frontal air bag module was examined. It also had ruptured, and fragments from the inflator were found in the vehicle. The air bag was holed on the top and bottom from inflator fragments. The Honda representative agreed that both air bag inflators ruptured as a result of this crash. These were OEM modules under recall that were not replaced.

Summary

Crash Site

The crash site was the intersection of a north/south arterial roadway and an east/west residential roadway. The two-way residential roadway did not have marked lanes. It was controlled by a stop sign for eastbound travel (Figure 2). The 7-lane arterial roadway was configured with three southbound lanes, three northbound lanes, and a reversible center lane (Figure 3). The travel lanes were marked with dashed white painted stripes. Fog lines and concrete curbs were present on both sides of the roadway. There were no traffic controls. Both asphalt roadways were straight and level. It was dark at the time of the crash, but there were streetlights present and illuminated. The speed limit was 74 km/h (45 mph) in all directions. The weather at the nearest reporting station was 28 degrees C (83 °F), 56 percent humidity, winds out of the south at 33 km/h (21 mph), and clear. A crash diagram is included at the end of this report.



Figure 2. Eastbound approach for the 2002 Honda Civic



Figure 3. Southbound approach for the 2004 Ford Taurus

Pre-Crash

The Honda was being driven by an unbelted 30-year-old female, traveling east on a residential street, and stopped at a stop sign. The Honda then began a left turn into the intersection to travel north and accelerated to 20 km/h (12.4 mph).¹ The Ford was traveling south in the first lane from the right at a speed of 72 km/h (45 mph) when it entered the intersection, according to the police.

Crash

As the Honda entered the intersection, the front of the Honda struck the front of the Ford (Event 1), and the frontal air bags in the Honda deployed. The “missing vehicle” algorithm of the

¹ Calculated using acceleration rate of 4.8 f/s/s and a distance traveled of 37 ft.

WinSMASH program calculated a total delta V of 34 km/h (21 mph) for the Honda. The longitudinal and lateral components were -22 km/h (-13 mph) and 26 km/h (16 mph), respectively. The collision fits the model, and the results appear reasonable. The WinSMASH program calculated a total delta- V of 27 km/h (16 mph) for the Ford. The longitudinal and lateral components were -23 km/h (-14 mph) and -14 km/h (-8 mph), respectively. The results appear borderline. The Honda was displaced to the east and appears to have been under power for part of this movement. The Honda continued east, crossed the northbound travel lanes, and struck a concrete curb (Event 2). The Honda overrode the curb, came to rest on the sidewalk facing east, and caught fire (Event 3). The Ford was displaced to the east and then south as it followed an arced path to final rest facing south in the middle turn lane (Figure 4).

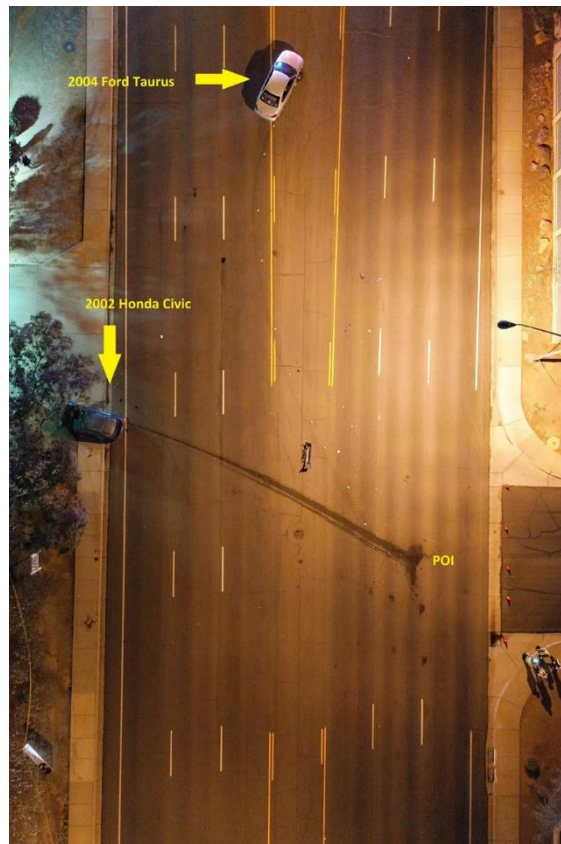


Figure 4. View of final rest for both vehicles, north toward the bottom of the image (police image)

Post-Crash

Passersby and the driver of the Ford responded to the burning Honda. Police also responded to the crash. The first responding officer saw people trying to extricate the driver. He could hear them saying it was very hot. The driver's door was open, but the driver was still inside. The officer took the driver's right arm, and a civilian took the driver's left arm. They pulled her from the vehicle and moved her from the vehicle and began first aid. They applied combat gauze to the driver's neck. She was not responsive at any point. Other officers arrived and attempted CPR until the fire department arrived and took over treatment. The first responding officer retrieved

his fire extinguisher from his police vehicle and put out the fire. The driver of the Honda was transported by ambulance to local trauma center, where she was pronounced deceased.

2002 Honda Civic

Description

The 2002 Honda Civic EX was a 5-passenger, 4-door sedan identified by the Vehicle Identification Number 1HGES26772Lxxxxxx and was manufactured in April 2002. The vehicle was equipped with a 1.6-liter 4-cylinder gasoline engine, automatic transmission, and front-wheel drive. The vehicle had an after-market engine “short ram” air intake system and after-market audio components. The vehicle manufacturer recommended tire size was P185/70R15 for the front and rear. The vehicle was equipped with Barum Brilantis P195/60R15 tires on the left front, right front, and right rear, and a Michelin P195/60R15 on the left rear. The tires were mounted on after-market MB Icon rims. The specific tire information was as follows:

Position	Measured Tread Depth	Restricted	Damage
LF	3 mm (4/32 in)	No	None
LR	2 mm (3/32 in)	No	None
RR	3 mm (4/32 in)	No	None
RF	3 mm (4/32 in)	No	None

Vehicle History

A CARFAX report indicated that the vehicle had three previous owners. The vehicle was first purchased in 2003. The second owner purchased the vehicle in 2006. An accident was reported in April 2006, involving another vehicle. The report indicated that this vehicle was functional. There were no indications of air bag deployments. In November 2010, a salvage title/certificate was issued. The third owner purchased the vehicle in 2013. In June 2013 and December 2013, rebuilt titles were issued.

Exterior Damage

The Honda sustained moderate front plane damage from the impact to the right plane of the Ford (Figure 5). The direct damage began at the left-front bumper corner and extended 103 cm (40.5 in) to the right. The Field L extended from bumper corner to bumper corner. The bumper backing bar was shifted 42 cm (16.5 in) to the right. Fourteen measurements were taken at bumper level by the Nikon Total Station, and the Faro Blitz program computed crush measurements in six increments as follows: $C_1 = 15$ cm (5.9 in), $C_2 = 21$ cm (11.0 in), $C_3 = 24$ cm (9.4 in), $C_4 = 28$ cm (11.0 in), $C_5 = 27$ cm (10.6 in), and $C_6 = 23$ cm (11.0 in). The maximum crush was located 36 cm (14.1 in) from the left bumper corner and measured 28 cm (9.0 in). The Collision Deformation Classification (CDC) was 10FDEW2. The Honda sustained minor damage to the front plane at the frame level from impacting the curb (Event 2). The direct damage began 50 cm (19.6 in) to the left of the right bumper corner and measured 30 cm (11.8 in). The CDC was 12FCLN1.



Figure 5. Front plane damage, the 2002 Honda Civic

NHTSA Recalls and Investigations

A search of the recall database using the Honda's VIN in March 2021 indicated that there was a manufacturer safety-related recall issued in May 2015 (NHTSA #15V-320) for the driver's frontal air bag. According to the recall, the frontal air bag inflator, when deploying in a crash, could rupture and break apart, possibly causing serious injury or fatality. The driver's frontal air bag inflator was not replaced prior to this crash. There was also a manufacturer safety-related recall issued in October 2015 (NHTSA #15V-370) for the passenger's frontal air bag. The passenger's frontal air bag was not replaced prior to this crash. There was also a recall (12V-136) that was unrelated to air bags that focused on vehicle lighting. There is currently an open investigation (EA15-001) regarding 2001–2011 Hondas with Takata air bags.

Interior Damage

The Honda sustained moderate interior damage from air bag inflator ruptures and a fire. Both frontal air bags had holes through the bags themselves, and portions of the inflators were found throughout the vehicle. The windshield was fractured, probably during the passenger's frontal air bag deployment. There was no deformation of the steering wheel rim or compression of the column. There were no deformations to any of the seats. All the doors remained closed and operational. The Honda sustained interior damage from a vehicle fire. The damage included the entire right instrument panel, the glove compartment, and the engine compartment bulkhead. The fire began as a result of interaction between heated inflator fragments and other vehicle components in and around the right instrument panel (Figure 6).

Manual Restraint Systems

The front row was equipped with driver and front right passenger lap and shoulder seat belts. The driver's belt was equipped with continuous loop belt webbing, a sliding latch plate, an emergency locking retractor (ELR), and an adjustable upper anchor that was in the full-up position. The passenger's belt was equipped with continuous loop belt webbing, a sliding latch plate, a locking retractor, and an adjustable upper anchor that was in the full-down position. Both front row seat belts were equipped with retractor pretensioners. The driver's pretensioner actuated and was found locked in the fully retracted position. This confirmed that the belt was not used in this crash. The passenger's seat belt pretensioner did not actuate.



Figure 6. Right instrument panel, the 2002 Honda Civic

Supplemental Restraint Systems

The Honda was equipped with supplemental restraint systems (SRS) consisting of dual-stage frontal air bags for the driver and front-passenger positions, retractor pretensioners for the front seat positions, sensors that can detect a moderate to severe frontal collision, an electronic system that continually monitors and records information about the sensors, the control unit, the air bag activators, and driver and passenger seat belt use when the ignition is on, and an emergency backup power in case the vehicle's electrical system is disconnected in a crash.

As a result of the front to front-right impact with the Ford, both frontal air bags deployed, and the driver's seat belt pretensioner actuated.

The driver's frontal air bag deployed from an H-configuration module cover located in the hub of the steering wheel rim. It was still attached to the hub. The air bag was circular and measured 47 cm (18.5 in) in diameter in its deflated state (Figure 7). The air bag was configured with two vent ports and was tethered. The air bag inflator ruptured during the air bag deployment. The air bag face was holed in two places at the 11 o'clock position. The holes were irregular and measured 2 cm (0.7 in) and 3 cm (1.1 in). The air bag face was also covered in blood, particularly on the left.



Figure 7. The driver's air bag, the 2002 Honda Civic

The passenger's frontal air bag deployed from the top of the instrument panel. The air bag was displaced from the instrument panel. The air bag measured 48 cm (18.8 in) seam-to-seam in its deflated state. The air bag was configured with two vent ports and was not tethered. The air bag inflator ruptured during the air bag deployment. There was a scorched 25 x 26 cm (9.8 x 10.2 in) hole on the top of air bag. There was a 10 x 18 cm (3.9 x 7.0 in) hole toward the bottom at the module side of the air bag.

Air Bag Inflator Rupture Discussion

The driver's air bag inflator was manufactured by Takata and was reported by Honda to be original to this vehicle. The inflator family was PSDI/PSPI with a build date of March 26, 2002. The air bag module was still attached to the steering wheel hub post-crash. The module was removed during the vehicle inspection. There was no damage to the wiring harness (Figure 8). The inflator was then removed from the module. The inflator ruptured during the air bag deployment (Figures 9–10).



Figure 8. The driver's frontal air bag, back of the module, the 2002 Honda Civic



Figure 9. The driver's frontal air bag, front of the inflator, the 2002 Honda Civic



Figure 10. The driver's frontal air bag, side of the inflator, the 2002 Honda Civic



Figure 11. Outer casing fragment, the 2002 Honda Civic

The front outer casing of the driver's frontal air bag inflator ruptured. The front casing fragment was located on the floor of the Honda during the vehicle inspection (Figure 11). Other fragments were found throughout the vehicle that came from both the driver's frontal air bag inflator and the passenger's frontal air bag inflator. A fragment from the interior of the inflator embedded itself into the neck of the driver and was removed during the autopsy (Figure 12).



Figure 12. Embedded fragment, the 2002 Honda Civic (police image)

The passenger's frontal air bag inflator ruptured during the air bag deployment (Figure 13). All the markings associated with the manufacturer of the inflator were destroyed by the rupture damage and subsequent fire.

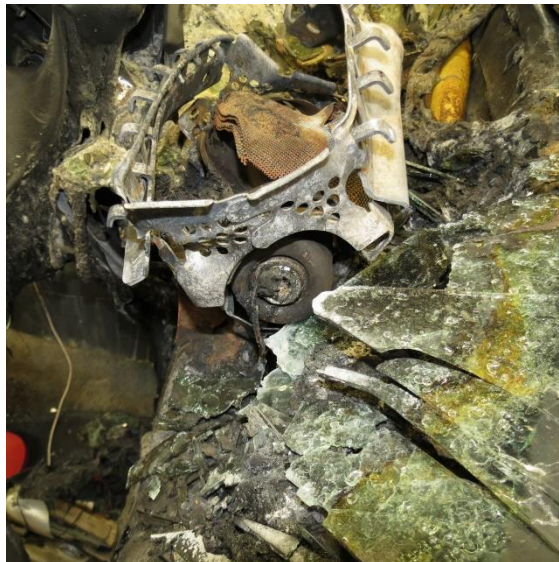


Figure 13. The passenger's frontal air bag inflator, the 2002 Honda Civic

Based on available evidence, it was determined that the driver's frontal air bag inflator ruptured during its deployment and displaced multiple inflator components rearward toward the driver. The manufacturer agreed with this assessment. The components penetrated the air bag's fabric. One fragment struck and penetrated the driver's neck, resulting in the fatal injuries.

2002 Honda Civic Occupant

Driver Demographics

Age/sex: 30 years/female
 Height: 170 cm (67 in)
 Weight: 59 kg (130 lbs)
 Eyewear: Unknown
 Seat type: Bucket
 Seat track position: Forward-most
 Manual restraint usage: Lap and shoulder belt available, not used
 Usage source: Vehicle inspection
 Air bags: Driver's frontal air bag deployed/module ruptured
 Alcohol/drug data: .09 grams per deciliter
 Egress from vehicle: Extricated by police and passerby
 Transport from scene: Transported by ambulance, pronounced deceased at hospital
 Type of medical treatment: CPR on scene

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Transection, right internal jugular vein	320806.3	Ruptured air bag inflator	Certain
2	Transection, right subclavian artery	421404.3	Ruptured air bag inflator	Certain
3	3 cm (1.1 in) defect to right side of trachea	341699.2	Ruptured air bag inflator	Certain
4	Transection, right omohyoid and sternocleidomastoid muscles. Sternohyoid and sternothyroid muscles also involved.	310602.1	Ruptured air bag inflator	Certain
5	Abrasions, bridge of nose and left periorbital region	210202.1	Driver air bag	Certain
6	Abrasion, dorsal aspect right hand	710202.1	Unknown	Unknown
7	Contusions, right knee and superior aspect right shin	810402.1	Lower instrument panel	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
8 9	Bilateral knee abrasions	810202.1 810202.1	Lower instrument panel	Probable
10	Contusion, right hip	810402.1	Unknown	Unknown
11	Sharp force injury on right anterior aspect of the neck, centered 21 cm (8.2 in) below top of head and 4 cm (1.5 in) right of anterior midline. It is a 5 x 2 cm (1.9 x 0.7 in) curvilinear defect that was approximately 7 cm (2.7 in) deep.	310602.1	Ruptured air bag inflator	Certain

Source: medical examiner report/autopsy.

Driver Kinematics

The 30-year-old female driver was seated in an unknown posture. She was unbelted, and the seat was adjusted to the forward-most track position. As the Honda entered the intersection and began a left turn, the front of the Honda struck the front-right corner of the Ford. The severity of the crash resulted in the deployment of the Honda's frontal air bag system.

During deployment the driver's frontal air bag inflator ruptured, and a fragment of the inflator penetrated through the air bag fabric and struck the right side of the driver's neck, cutting the jugular vein, according to the autopsy. The driver was displaced forward and left and contacted the lower instrument panel with her knees. The driver began bleeding profusely as the vehicle traveled east. The police noted some blood on the roadway along this path. Although SCI couldn't definitively determine the actions that led to the blood deposit (left-front door was closed and window intact), the police concluded that the driver had opened her door briefly before the vehicle came to rest. Police and passersby responded to the crash and removed the driver from the vehicle. Other officers began CPR, and she was transported by ambulance to a local trauma center, where she was pronounced deceased.

2004 Ford Taurus

Description

The 2004 Ford Taurus was a 4-door, 5-passenger sedan. The vehicle was identified by the VIN 1FAFP55S04Gxxxxxx. The vehicle was equipped with a 3.0-liter 6-cylinder gasoline engine, automatic transmission, and front-wheel drive.

Exterior Damage

The Ford sustained frontal plane damage from the impact to the front of the Honda (Figure 14). The damage continued along the right plane with the right-front tire being restricted and disabled with suspension damage, and the tire deflated (Figure 15). The contact damage extended from the right bumper corner to the leading edge of the front-right door. The CDC was 01FREE6.



Figure 14. Front plane damage, the 2004 Ford Taurus (police image)

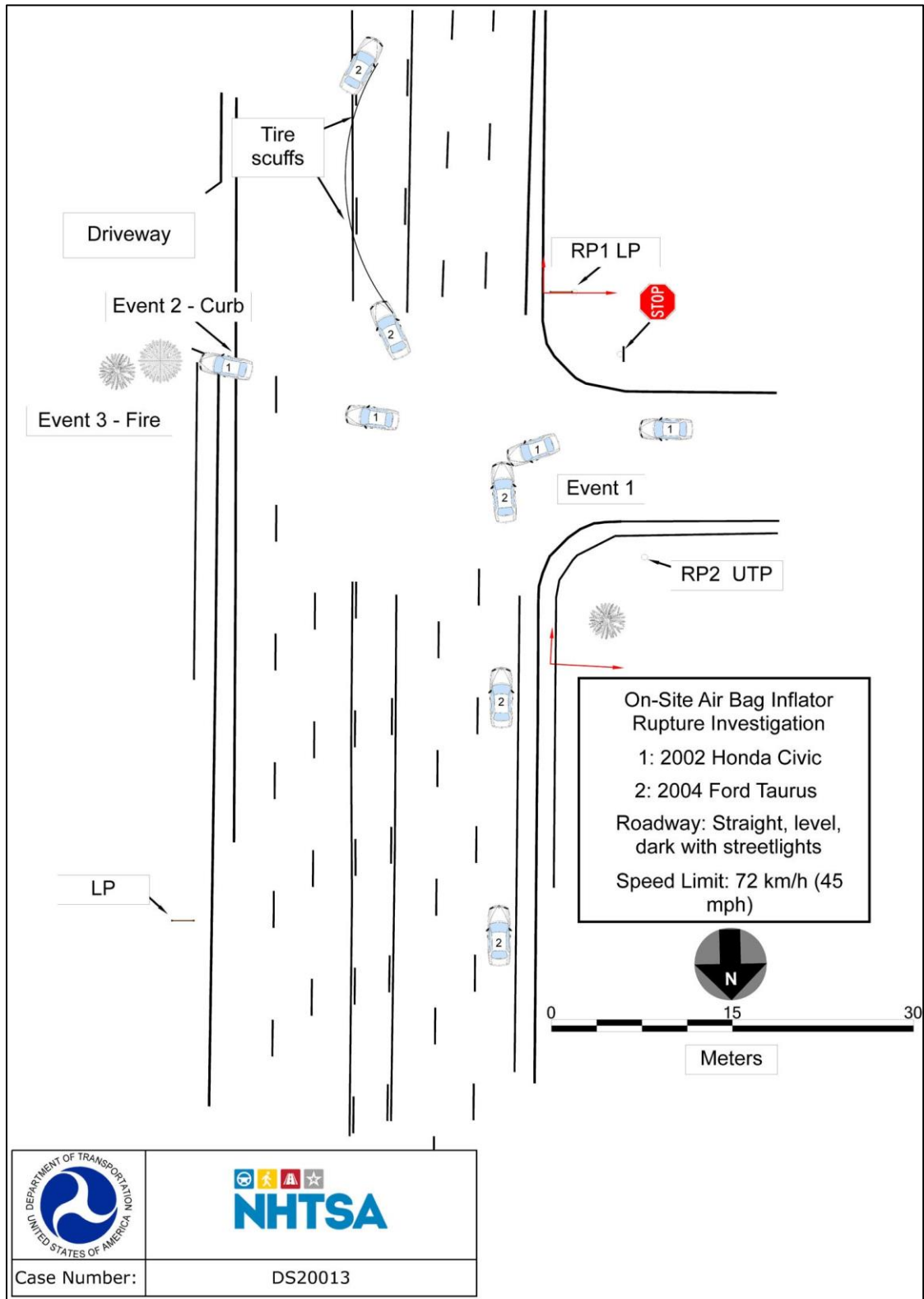


Figure 15. Right plane damage, the 2004 Ford Taurus (police image)

Occupant Data

The 2004 Ford Taurus was being driven southbound by a 40-year-old male. The police report indicated that the driver was belted and that he was not injured or transported.

Crash Diagram



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