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

16. Abstract

This report documents the on-site investigation of the non-deployment of the air bag systems in a 2012 Honda Accord involved in a front impact crash with the rear of a 2014 Dodge Journey. The crash occurred on a multi-lane, limited-access roadway when the Honda attempted to merge to the right. The Dodge had entered the limited-access roadway from the far right, merged left in advance of the Honda, and then slowed in response to slowing traffic ahead. The Honda's 49-year-old belted male driver looked but did not initially see the slower moving Dodge, and subsequently struck its rear plane with the front plane of the Honda. The Honda had front-seat belt pretensioners, certified advanced 208-compliant frontal air bags, front seat-mounted side impact air bags, and side impact-sensing inflatable curtain air bags. The driver's seat belt retractor pretensioner actuated, but none of the inflatable supplemental restraints in the Honda deployed as a result of the crash.

Based on SCI expertise and the data collected and analyzed by this investigation, the SCI investigator concluded that the lack of air bag deployment in the Honda under the circumstances of this crash was by vehicle design. The Honda's impact with the Dodge involved non-structural front-plane components, which resulted in an elongated crash pulse that apparently did not achieve the magnitude required for the Honda's systems to predict that air bag deployment was warranted. The SCI investigator's conclusions were corroborated by the proprietary data retrieved from the Honda by the manufacturer representative during the SCI vehicle inspection process.

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Special Crash Investigations
On-Site Air Bag Non-Deployment Crash Investigation
Office of Defects Investigation
Case Number: CR19005
Vehicle: 2012 Honda Accord
Location: North Carolina
Crash Date: September 2019

Background

This report documents the on-site investigation of the non-deployment of the air bag systems in a 2012 Honda Accord (Figure 1) involved in a front impact crash with the rear of a 2014 Dodge Journey. The crash occurred on a multi-lane, limited-access roadway when the Honda attempted to merge to the right. The Dodge had entered the limited-access roadway from the far right, merged left in advance of the Honda, and then slowed in response to slowing traffic ahead. The Honda's 49-year-old belted male driver looked but did not initially see the slower moving Dodge, and subsequently struck its rear plane with the front plane of the Honda. The Honda had front-seat belt pretensioners, certified advanced 208-compliant (CAC) frontal air bags, front seat-mounted side impact air bags, and side impact-sensing inflatable curtain (IC) air bags. The driver's seat belt retractor pretensioner actuated, but none of the inflatable supplemental restraints in the Honda deployed as a result of the crash.

Figure 1. Left-front oblique view of the Honda at the time of the SCI vehicle inspection

Notification of the crash was provided to the National Highway Traffic Safety Administration in September 2019 by the Honda vehicle's owner. The notification was forwarded to the Special Crash Investigations (SCI) group and assigned for an on-site investigation in October 2019. Cooperation was established with the vehicle's insurer to inspect the Honda at the facility where it was held pending auction. The on-site investigation included an inspection of the Honda to measure exterior and interior damage/intrusion, to document interior occupant contact evidence, and to examine the manual and supplemental restraint systems. The Honda's year/make/model was not supported by the Bosch crash data retrieval (CDR) tool/software due to its date of manufacture; therefore, no Event Data Recorder (EDR) data could be imaged from the Honda by

the SCI investigator. However, a technical representative from the Honda's manufacturer participated in the vehicle inspection and imaged data using a proprietary tool/software. The proprietary data required translation by the manufacturer, and a sanitized version was later provided to the SCI investigator. The Dodge was repaired prior to SCI case assignment and could not be located for inspection. Additional on-site activities included documentation of the crash site. An interview of the driver was conducted via telephone.

Based on SCI expertise and the data collected and analyzed by this investigation, the SCI investigator concluded that the lack of air bag deployment in the Honda under the circumstances of this crash was by vehicle design. The Honda's impact with the Dodge involved non-structural front-plane components, which resulted in an elongated crash pulse that apparently did not achieve the magnitude required for the Honda's systems to predict that air bag deployment was warranted (see the Air Bag Non-Deployment Discussion section of this report). The SCI investigator's conclusions were corroborated by the proprietary data retrieved from the Honda by the manufacturer representative during the SCI vehicle inspection process.

Crash Site

This crash occurred on a multi-lane, limited-access roadway during the afternoon. Reported weather conditions in the locale included partly cloudy skies, a temperature of 31 ºC (88 ºF), a 31-percent relative humidity, and 23 km/h (14.0 mph) southwesterly winds. Due to the type of roadway, its location, and a lack of physical evidence, the SCI crash site inspection was limited to drive-by documentation using a windshield-mounted digital video recorder.

Figure 2. Eastbound view of the Honda's pre-crash approach to the crash site

The limited-access roadway consisted of three travel lanes in each travel direction, separated by a concrete jersey-style median barrier. In the vicinity of the crash, an entrance ramp combined with the eastbound travel lanes from the right. The entrance ramp lane then merged into/with the travel lanes and disappeared a short distance beyond the crash site. Based on scaled, high-resolution satellite images, the three travel lanes were each approximately 3.5 m (11.5 ft) wide. They were delineated by broken white lane lines, with a single yellow median lane line and single solid white fog line. The entrance ramp/merge lane was approximately 3.7 m (12.1 ft) wide. In the vicinity of the crash, the lanes were supported by an approximate 1.9 m (6.2 ft) wide

median shoulder and an approximate 2.3 m (7.5 ft) wide outboard shoulder. Speed was regulated by a posted limited of 89 km/h (55 mph). Figure 2 depicts the limited-access roadway for the Honda's pre-crash travel trajectory. A crash diagram is included at the end of this report.

Pre-Crash

The Honda's 49-year-old belted male driver traveled east on the limited-access roadway. According to the driver during the SCI interview, he operated the vehicle in the center travel lane and maintained a speed of 72 to 80 km/h (45 to 50 mph). Numerous other vehicles traveled in the same direction surrounding the Honda, typical of the heavy traffic volume for the area at the mid-afternoon time of the crash. One of those was the Dodge, which traveled east in the right travel lane in advance of the Honda. The Dodge was driven by a belted 40-year-old female with a belted 47-year-old male front-row right occupant.

As the female driver approached and paralleled the entrance ramp in the right lane, she slowed the Dodge in response to the high volume of traffic and maintained a straight travel trajectory. The Honda continued eastbound, and its driver began to merge the vehicle right into the right travel lane. According to the driver, he directed the Honda to the right as he merged right from his travel lane and looked but did not initially see the slower moving Dodge. He recognized the Dodge immediately prior to impact and provided a panic braking and right steering input.

Crash

The Honda's front-plane left aspect struck the Dodge's rear plane, center/right aspect. Due to the attempted avoidance maneuver by the Honda's driver, the front plane of the Honda had pitched downward. This caused the Honda's front plane to "submarine" under the rear plane of the Dodge (underride orientation) and minimally accelerated the Dodge forward. Both drivers then brought their vehicles to controlled stops in the roadway.

Post-Crash

The local emergency response system received several calls reporting the crash. Law enforcement, fire department, and emergency medical services personnel responded to the crash scene. All occupants had exited their respective vehicles under their own power, without assistance. The Honda driver was evaluated at the crash scene and transported by ambulance to a local hospital for treatment of his C-level (possible) injuries. During the evaluation, underlying medical conditions were discovered that necessitated further care. These medical conditions, however, were unrelated to the minor soft tissue injuries the driver sustained in the crash. Following the on-scene law enforcement investigation, the Honda was towed from the crash site. It was later transferred to a regional insurance vehicle salvage facility, where it was located for this SCI investigation.

2012 Honda Accord

Description

The 2012 Honda Accord (Figure 3), manufactured in January 2012, was identified by the vehicle identification number (VIN) 1HGCP2F38CAxxxxxx. At the time of the SCI vehicle inspection, the electronic odometer reading was 247,091 km (153,535 mi). The Honda was a front-wheel-drive platform equipped with the LX trim package. The powertrain was 2.4 liter, inline, 4-cylinder gasoline engine linked to an automatic transmission. Its service brakes were power-assisted, 4-wheel disc with antilock brakes, while the steering was hydraulic power-assisted rack and pinion. Additional features included traction control, electronic stability control, and a tire pressure monitoring system.

Figure 3. Left-plane view of the 2012 Honda Accord during the SCI vehicle inspection

The gross vehicle weight rating (GVWR) was 1,950 kg (4,299 lb), with gross axle weight ratings of 1,060 kg (2,337 lb) front and 915 kg (2,017 lb) rear. The vehicle manufacturer's recommended tire size was P215/60R16, with recommended cold tire pressures of 210 kPa (30 PSI) for all four axle positions. At the time of the SCI inspection, the Honda had Douglas All-Season tires at the left front, left rear, and right rear positions, with a Stradai Vercelli tire at the right front position. All four tires were of the vehicle manufacturer's recommended size, remained inflated, and were not damaged or restricted. Of note, the right front tire had less than 2 mm (2/32 in) of tread.

The interior of the Honda had seating of up to five occupants (2/3), with front-row bucket seats and a second-row bench seat that featured split forward-folding seatbacks. All seating surfaces were cloth and equipped with adjustable head restraints. According to the Honda's driver during interview, at the time of the crash the driver's seat was adjusted to its full-rear track position, with the seatback slightly reclined. SCI observed that the adjustable head restraint was 9 cm (3.5 in) above the seatback. Manual restraint systems in the Honda included 3-point lap and shoulder seat belts for all five seat positions. Supplemental restraint systems included the front seat belt retractor pretensioners, CAC frontal air bag system, front seat-mounted side impact air bags, and IC air bags. Only the driver's seat belt retractor pretensioner actuated; none of the inflatable supplemental restraint systems deployed as a result of the crash.

Vehicle History

A commercially obtainable vehicle history for this specific 2012 Honda Accord indicated that the vehicle had a total of three separate owners over its lifespan. There was no reported service

or replacement of the vehicle's supplemental restraint systems over its lifespan. The vehicle was first purchased new in North Carolina in February 2012. The first owner operated the vehicle for 15 months, with routine maintenance reported. The vehicle was offered for sale and then sold to its second owner in North Carolina during August 2013 at an odometer reading of 10,108 km (6,281 mi). The second owner operated the vehicle and conducted routine maintenance until the vehicle was offered for sale in March 2014. It was sold to its third owner in North Carolina in April 2014 with an odometer reading of 80,823 km (50,221 mi). A crash was reported in December 2015, consisting of minor severity right front corner damage without supplemental restraint (air bag) deployment. A second crash was reported in June 2017, consisting of minor front damage without air bag deployment after the Honda had rear-ended another vehicle. Routine service and maintenance were conducted leading up to the crash under investigation.

Exterior Damage

This crash involved the Honda's front plane, and the damage pattern resembled an underride profile. This damage profile resulted from the forward pitch of the Honda immediately prior to impact caused by the driver's panic braking avoidance attempt. Combined with the higher profile of the vehicle it struck, the front plane of the Honda submarined under the rear plane of the Dodge.

Direct contact damage began on the left front bumper corner of the Honda and extended 80 cm (31.5 in) rightward to 24 cm (9.4 in) right of center. The direct contact damage on the Honda's hood began on the left leading edge and extended right to the vehicle's centerline. Within the damage pattern was longitudinal deformation to the left-front fender, hood, upper radiator support, radiator, and underhood components. There was minimal deformation to the bumper beam (Figure 4). The left-front headlight assembly was disintegrated, and the bumper fascia assembly was separated from the front plane. A rectangular impression was discernable in the hood immediately left of the Honda's centerline, which resembled the rear license plate of the struck vehicle and was evidentiary of the vehicles' alignment at impact.

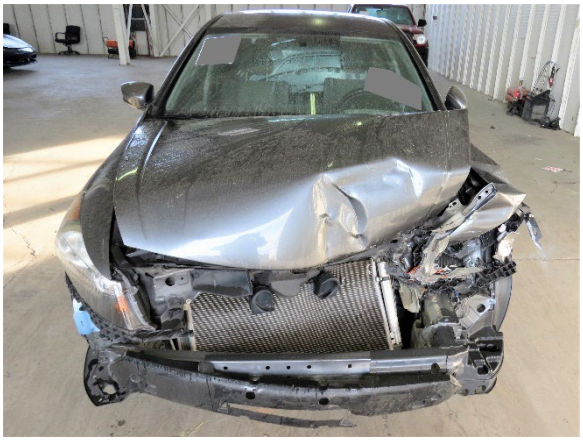


Figure 4. Front-plane damage profile to the Honda

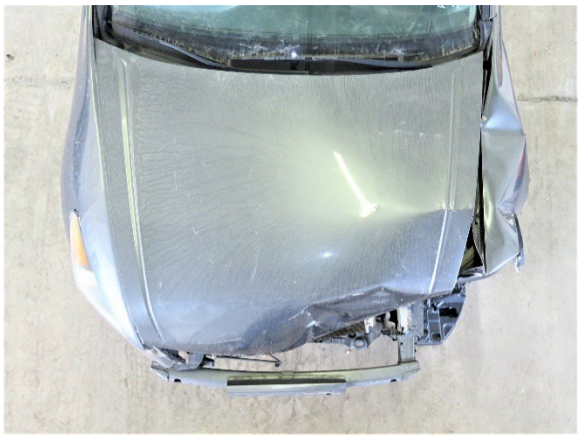


Figure 5. Overhead perspective of the damage profile

A residual crush profile was documented to the bumper beam and upper radiator support of the Honda using a Field-L width of 112 cm (44.1 in). The resultant underride crush profile produced the following averaged measurements: C1 = 14 cm (5.5 in), C2 = 11 cm (4.3 in), C3 = 9 cm (3.5 in), and C4 – C6 = 0 cm (0 in). Maximum crush was 26 cm (10.2 in), observed to the upper radiator support above the vehicle's left front bumper corner (Figure 5). A corresponding collision deformation classification (CDC) of 12FYEW2 was assigned to the Honda's crash damage profile.

The missing vehicle algorithm of the WinSMASH model was used to calculate the borderline severity of the crash. The total vehicle velocity change (delta V) was 21 km/h (13.0 mph), with specific longitudinal and lateral components of -21 km/h (-13.0 mph) and 4 km/h (2.5 mph), respectively. Based on SCI expertise and observed vehicle damage, these results were overestimated.

Event Data Recorder

The 2012 Honda Accord had an air bag control module (ACM) that had EDR capabilities to record crash data. However, the EDR was not supported by any commercially available tool/software due to the date of manufacture. Therefore, the SCI investigator had no means by which to image crash data from the Honda. A representative from the Honda's manufacturer attended the vehicle inspection and used a proprietary tool/software to image the vehicle's data. The data, saved electronically to a proprietary platform, were forwarded to the vehicle's manufacturer for interpretation and translation. The manufacturer later forwarded a sanitized copy of the data and agreed to allow SCI to include the sanitized version in this report. The sanitized data are included at the end of this report as Appendix A.

The Honda's data indicated that there were no stored current or historical diagnostic trouble codes (DTCs). The driver was belted at the time of the crash, and there was no front right passenger present. It was further indicated that both the vehicle's frontal and side algorithms were enabled by a detected crash event. The event achieved the ACM's criteria for actuation of the driver's seat belt pretensioner system. However, deployment criteria for the driver's frontal air bag were not achieved. Actuation/deployment commands for the front-row right position were suppressed automatically due to the unoccupied status of that seat position. No vehicle velocity change (delta V) values were included in the sanitized copy of the data.

Interior Damage

Interior inspection of the Honda revealed that there was no intrusion into the occupant compartment of the vehicle and no loss of integrity. Historical wear-and-tear to the vehicle was evident, with discoloration to frequently touched/contacted surfaces such as the door panels, left B-pillar, steering wheel, seats, and vehicle controls. One area of occupant contact was identified, located on the left aspect of the Honda's left instrument panel. The driver's left knee had contacted and engaged the instrument panel during the crash, fracturing and deforming the plastic molded surface and panel surrounding an electronic switch for the vehicle's electronic traction control and a small storage compartment (Figure 6). This contact had resulted in corresponding soft tissue injuries to the driver's left knee. No other occupant contact evidence or damage related to the crash was found during the SCI vehicle inspection.

Figure 6. Driver's left knee contact damage to the left aspect of the Honda's left instrument panel

Manual Restraint Systems

The Honda had 3-point continuous loop lap and shoulder seat belt systems for all five seat positions. They all used sliding latch plates, and the front-row (driver's and front-right passenger's) systems were configured with adjustable D-rings. The driver's seat belt retracted onto an emergency locking retractor (ELR), while the four other systems used switchable ELR/automatic locking retractors (ALR). Both front-seat belt systems were equipped with retractor pretensioners.

At the time of the SCI vehicle inspection, the driver's D-ring was adjusted full-down, and 167 cm (65.7 in) of webbing was extended from the retractor. There was significant historical wear on components of the driver's seat belt system. A distinct loading abrasion was visible in the belt path on the latch plate (Figure 7). The retractor was locked in position, related to the actuation of the retractor pretensioner. It was apparent to the SCI investigator that the driver used the Honda's seat belt system for manual restraint at the time of the crash.

Figure 7. Loading abrasion in the belt path on the latch plate of the Honda's driver seat belt system

Supplemental Restraint Systems

The Honda had a CAC frontal air bag system, front seat-mounted side impact air bags, and side impact-sensing IC air bags. The CAC system consisted of dual-stage driver's and passenger's frontal air bags, front-seat track position sensors, front-seat belt buckle switches, front retractor pretensioners, and a front-right occupant classification sensor. The driver's frontal air bag was mounted in the hub of the four-spoke steering wheel, while the passenger's frontal air bag was a top-mount design mounted in the right instrument panel. The front seat-mounted side impact air bags were mounted in the outboard aspect of each front seat adjacent to the B-pillars and provided supplemental protection for lateral (side) crash forces. The IC air bags were mounted to the roof side rails and concealed by the vehicle's headliner, designed to provide outboard protection for both of the Honda's seating rows. Labeling molded into the polymer surfaces of the pillar trim panels identified the presence of the IC air bags. The supplemental restraints (air bags and pretensioners) were controlled and monitored by the center tunnel-mounted air bag control module. Only the driver's seat belt retractor pretensioner actuated as a result of the crash. None of the Honda's air bags deployed.

NHTSA Recalls and Investigations

A VIN-based query of NHTSA's www.nhtsa.gov/recalls database for the 2012 Honda Accord as of the May 2022 date of this report indicated that there were no open recalls or investigations pertaining to this specific vehicle.

Air Bag Non-Deployment Discussion

The Honda's front-seat belt retractor pretensioners actuated as a result of this crash. However, none of the inflatable supplemental restraint systems (air bags) deployed. With regard to the SCI reconstruction of the crash, it was apparent that the damage profile to the Honda had resulted from an underride crash configuration. This had occurred as a direct result of the combination of the higher profile of the Dodge in relation to the Honda, and the kinetic response of the Honda to its driver's panic braking and right steering input immediately prior to impact.

The avoidance attempt caused the Honda to pitch forward, compressing the front suspension and further reducing the exposed overall height of its front plane in relation to the Dodge's back

plane. In this manner, the front plane of the Honda struck and "shoveled" beneath the rear plane of the Dodge.

This impact type therefore involved non-structural, front-plane components of the Honda, including the hood, left-front fender, headlight, and upper radiator support. The underride impact type produced a softer, elongated crash pulse in comparison to a crash pulse that might have occurred had the Honda's front bumper been in height alignment with the Dodge's rear bumper. Impact forces were sufficient for the Honda's systems to determine that actuation of the front-seat belt retractor pretensioners was warranted. However, the crash did not produce forces either of sufficient magnitude or over a short enough timeframe for the Honda's systems to predict that air bag deployment was warranted. Therefore, because the forces apparently did not meet the air bag algorithm's threshold, the air bags were not commanded to deploy. The sanitized data from the Honda provided to SCI by the vehicle's manufacturer corroborated this determination.

Based on SCI expertise and the data collected and analyzed by this investigation, the SCI investigator concluded that the lack of air bag deployment in the Honda under the circumstances of this crash was by vehicle design. The SCI investigator's conclusions were corroborated by the proprietary data retrieved from the Honda by the manufacturer representative during the SCI vehicle inspection process.

2012 Honda Accord Occupant

Driver Demographics

Age/sex:	49 years/male
Height:	180 cm (71 in)
Weight:	100 kg (220 lbs)
Eyewear:	Prescription eyeglasses
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Rearmost track position
Manual restraint usage:	3-point lap and shoulder seat belt with retractor pretensioner
Usage source:	Vehicle inspection
Air bags:	Frontal, seat-mounted side impact, and IC air bags available; none deployed
Alcohol/drug data:	None (no test given)
Egress from vehicle:	Exited vehicle without assistance
Transport from scene:	Ambulance to a local hospital
Type of medical treatment:	Treated for crash-related injuries, hospitalized due to other ongoing medical conditions

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Minor lacerations to left knee	810602.1	Isolated IPC; Front – Left lower instrument panel (includes knee bolster)	Certain
2	Chest contusion	410402.1	Isolated IPC; Interior – Shoulder portion of belt restraint	Certain
3	Left shoulder contusion	710402.1	Isolated IPC; Interior – Shoulder portion of belt restraint	Certain

Source: driver interview.

Driver Kinematics

The 49-year-old male was seated in the driver's seat of the Honda. According to the driver during the SCI interview, he had adjusted the seat to its rearmost track position with the seatback slightly reclined. The driver used the available 3-point lap and shoulder seat belt system for manual restraint. His use of the seat belt system was determined by the post-crash SCI inspection of the Honda's manual restraints.

He drove the Honda eastbound on the limited-access roadway. He directed the Honda to the right as he merged right from his travel lane and looked but did not initially see the slower moving Dodge. He recognized the Dodge immediately prior to impact and provided a panic braking and right steering input in an attempt to avoid a collision. This initiated a forward trajectory for the

driver as the Honda pitched forward, and also likely engaged the ELR mode of the driver's seat belt retractor.

At impact with the rear plane of the Dodge, the driver began to load the Honda's seat belt system. Actuation of the retractor pretensioner restricted the driver's forward displacement. The driver loaded the seat belt system with his torso, producing soft tissue contusions to his left shoulder and chest. The driver's left knee contacted and engaged the left aspect of the left instrument panel, which fractured and deformed the polymer surface and resulted in minor lacerations to his left knee.

The driver remained belted and in the driver's seating position as the vehicles came to final rest. He unbuckled the seat belt system and exited the Honda without assistance. The driver was then transported to a local hospital by ambulance for evaluation and treatment. The driver stated during the interview that through the course of receiving evaluation for the minor soft tissue injuries he sustained as a result of the crash, other unspecified medical conditions were identified and diagnosed. He was subsequently hospitalized for the treatment of those medical conditions, which were unrelated to the injuries he sustained in the crash.

2014 Dodge Journey

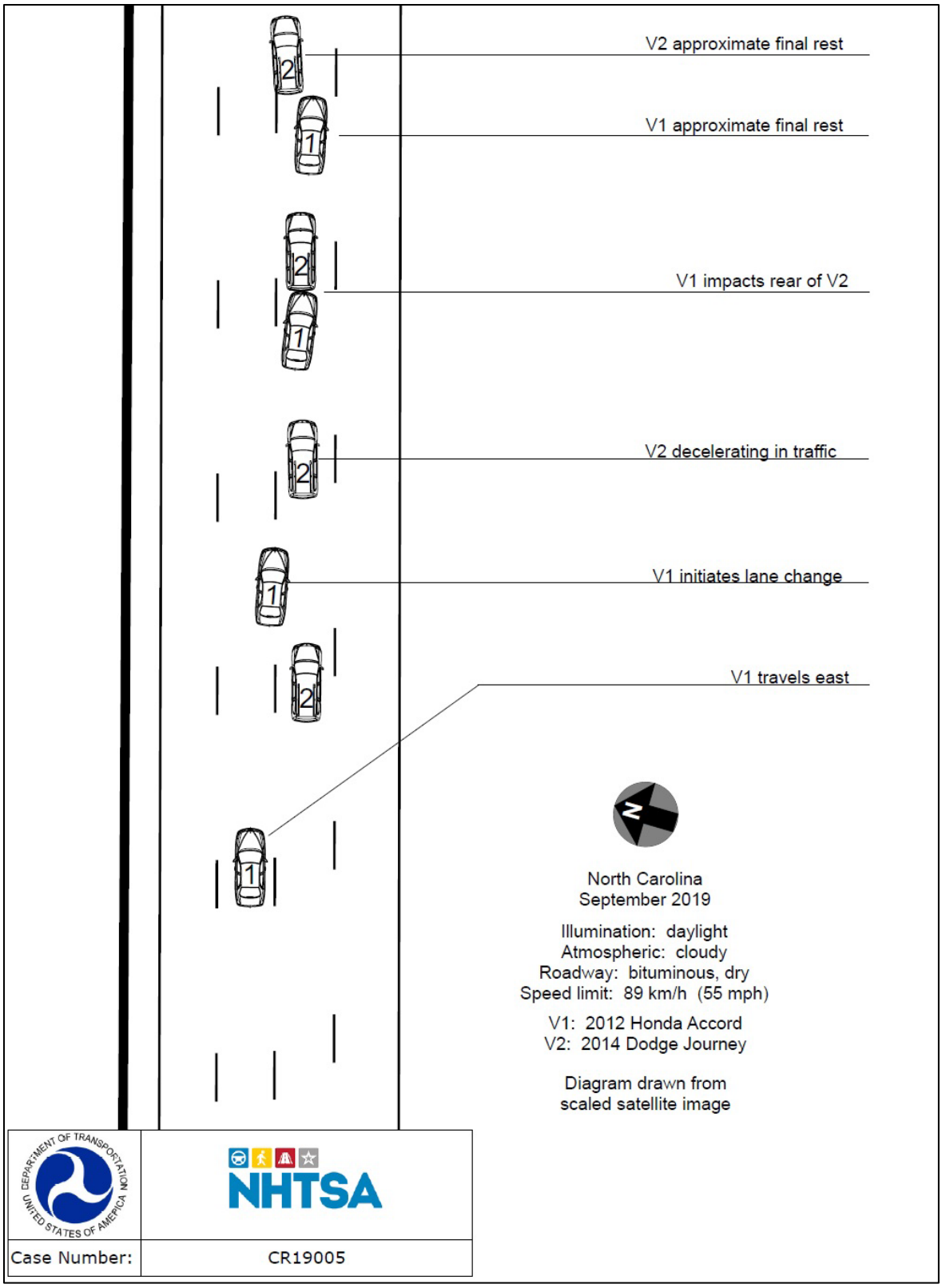
Description

The 2014 Dodge Journey was identified by the VIN 3C4PDCDGXETxxxxxx. It had been repaired prior to SCI case assignment and could not be located for inspection. According to a commercially available vehicle history report, the Dodge's last reported odometer reading was 72,559 km (45,086 mi). No further information concerning the Dodge was available.

Occupant Data

The Dodge was driven by a belted 40-year-old female with a belted 47-year-old male front-right passenger. According to law enforcement documentation of the crash, neither occupant of the Dodge sustained injury as a result of the crash or was medically transported from the crash scene.

Crash Diagram



Appendix A: 2012 Honda Accord Manufacturer-Decoded Event Data[1]

[1] The data contained in this technical report were imaged by the vehicle's manufacturer using a proprietary tool and software. The information contained in the associated Crash Viewer application may differ relative to this report.

Decoding result of SRS data below.

VIN: 1HGCP2F38CAxxxxxx

SUMMARY OF INTERPRETATION

Coverage	Status

FAULT DETECTION HISTORY	Past: No Present: No

SIDE	Left		Right	
SEATBELT	Belted		Unbelted	
SPS	Far position		N/A	
OPDS	N/A		Prohibited / Empty seat	
SWS	N/A		Prohibited / Level 0	
SENSOR	Front	Side	Front	Side
G TRIGGER	ON	ON	ON	ON
THRESHOLD	ON	OFF	ON	OFF
FRONT A/B	OFF	N/A	Auto stop	N/A
S/A (Side airbag)	N/A	OFF	N/A	OFF
C/A (Curtain airbag)	OFF	OFF	OFF	OFF
P/T	ON (Lo TTF)	OFF	CUT OFF	OFF

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