

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION**

CASE NO: CA09002

VEHICLE: 2008 HONDA PILOT

LOCATION: NEW YORK

CRASH DATE: JANUARY 2009

Contract No. DTNH22-07-C-00043

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety system.

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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION**
CASE NO: CA09002
VEHICLE: 2008 HONDA PILOT
LOCATION: NEW YORK
CRASH DATE: JANUARY 2009

BACKGROUND

This on-site investigation focused on the deployment of the frontal air bag system in this opposite direction crash of a 2008 Honda Pilot (**Figure 1**) and a 2006 Ford F150 pickup truck. The crash occurred when the northbound Ford F150 lost traction during a passing maneuver and rotated clockwise into the southbound lane where the full frontal area of the Honda impacted the left side of the Ford. The Honda Pilot was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system and an inflatable side impact protection system. The manufacturer of the Honda has certified that the vehicle is compliant to the advanced air bag requirements of Federal Motor Vehicle Safety Standard No. 208. The CAC system in the Honda was comprised of dual-stage frontal air bags with a front right occupant presence sensor, safety belt buckle switches, seat track positioning sensors, and retractor pretensioners. The inflatable side impact protection system consisted of front seatback-mounted side impact (thorax) air bags and roof side rail-mounted inflatable curtain (IC) air bags. The Honda's air bag control system was also equipped with a rollover sensor for the IC air bags. As a result of the crash, the driver's frontal and seat back-mounted air bags deployed. Both IC air bags also deployed. The Honda was driven by a 49-year-old restrained female that sustained police reported complaints of pain in her abdomen/pelvis area. She was transported by ground ambulance to a local hospital. The Ford's frontal air bags did not deploy. The Ford was driven by a 42-year-old restrained male who had police reported complaints of pain in his chest area and was transported by ground ambulance, to a local hospital. Both vehicles were towed from the crash scene due to disabling damage.



Figure 1: Left front oblique image of the 2008 Honda Pilot.

Notification of this crash was forwarded to the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) by the Calspan Special Crash Investigation team on January 15, 2009. The CID subsequently assigned this on-site investigation to the Calspan SCI team on January 16, 2009 due to its on-going interest in

traffic crashes involving late model year vehicles equipped with CAC frontal air bag systems. Calspan SCI obtained the police crash report and initiated a follow-up investigation to establish cooperation with the respective insurance agencies and to obtain permission to remove the Honda's Event Data Recorder (EDR) for imaging by Honda through NHTSA. The vehicle and scene inspections were conducted on January 22, 2009. The driver of the Honda did not respond to numerous requests for an interview and the treating hospital would not provide the medical records without a signed medical authorization.

SUMMARY

Crash Site

This crash occurred during the daylight morning hours of January 2009, on a 2-lane, 2-way north/south undivided roadway. At the time of the crash, the local area was experiencing snow showers and the bituminous road surface was snow covered. The roadway alignment was straight with a grade of 3.5 percent, positive to the south. The northbound travel lane measured 3.5 m (11.5 ft) in width while the southbound travel lane measured 3.9 m (12.8 ft) in width. Bituminous asphalt shoulders bordered both lanes. The west shoulder measured 0.7 m (2.3 ft) wide while the east side shoulder was 1 m (3.3 ft) wide. A W-beam guardrail bordered the east shoulder. The roadway was marked as a passing zone for the northbound travel direction with solid white edge lines. At the time of the SCI inspection, snow banks bordered the edges of the shoulders. The posted speed limit was 72 km/h (45 mph). The approximate point of impact was identified by a grouping of four gouge marks located in the southbound travel lane directly adjacent to a private driveway that was located on the west side of the roadway. **Figure 2** is a southbound view of the Honda Pilot's pre-crash path of travel. The Crash Schematic is included as **Figure 7** of this report.



Figure 2. Southbound trajectory view of the Honda's path of travel.

Vehicle Data

2008 Honda Pilot

The 2008 Honda Pilot was manufactured in 09/07 and was identified by the Vehicle Identification Number (VIN): 5FNYF18568B (production sequence deleted). The odometer reading at the time of the SCI inspection was unknown due to power issues which prevented the display of the electronic odometer. The power train consisted of 3.5-liter, V-6 engine linked to a 5-speed automatic transmission with all-wheel drive. The

Honda was equipped with 4-wheel power-assisted disc brakes with ABS and brake assist, electronic stability control, and traction control. The Honda was also equipped with Goodyear Integrity P235/70R16 (manufacturer recommended size) tires mounted on OEM 5-spoke alloy wheels. The vehicle manufacturer recommended front and rear cold tire pressure was 221 kPa (32 PSI). This vehicle was also equipped with a direct Tire Pressure Monitoring System (TPMS). The specific tire data at the time of the SCI inspection was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	193 kPa (28 PSI)	8 mm (10/32 in)	No	None
LR	186 kPa (27 PSI)	6 mm (8/32 in)	No	None
RF	193 kPa (28 PSI)	8 mm (10/32 in)	No	None
RR	193 kPa (28 PSI)	6 mm (8/32 in)	No	None

The manual restraint systems consisted of 3-point lap and shoulder belts in all eight seating positions. The front safety belts were equipped with retractor pretensioners. Additional safety systems included the CAC frontal air bags, front seat back-mounted side impact air bags and the IC air bags with rollover sensing.

2006 Ford F150

The 2006 Ford F150 pickup truck was identified by the VIN: 1FTRF04W76K (production sequence deleted). The vehicle was manufactured in August 2005. The digital odometer reading was unknown. This 4-door, 4-wheel drive pickup truck was powered by a 4.6-liter, V-8 engine linked to a 4-speed automatic transmission. The brakes were a power-assisted 4-wheel disc system with ABS. The front manual restraint systems consisted of 3-point lap and shoulder belts equipped with pretensioners in the two outboard positions and a lap belt located in the center seating position. The Ford was also equipped with CAC frontal air bags for the driver and front right passenger positions, but was not equipped with side impact air bags. The front axle tires were Cooper Discover P255/70R17 mounted on OEM 5-spoke alloy wheels. The Ford's rear axle separated from the vehicle during the crash and was missing at the time of the SCI inspection. The vehicle manufacturer recommended front and rear tire pressure was 241 kPa (35 PSI). The specific tire data at the time of the SCI inspection was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	241 kPa (35 PSI)	Unknown	No	None
LR	Unknown	Unknown	Unknown	Unknown
RF	Unknown	Unknown	No	None
RR	Unknown	Unknown	Unknown	Unknown

Crash Sequence

Pre-Crash

The Honda Pilot was traveling southbound, driven by the 49-year-old restrained female. The Ford F150 was traveling northbound, driven by the 42-year-old restrained male. The driver of the Ford lost directional control of the vehicle on the snow covered road surface as he attempted to pass a slower moving vehicle. The Ford initiated a counterclockwise yaw across the southbound travel lane, directly into the path of the southbound Honda.

Crash

The full frontal area of the Honda impacted the left rear aspect of the Ford (Event 1). The damage to the Ford began of the left B-pillar and extended to the rear corner of the cargo bed. The directions of force were within the 12 o'clock sector for the Honda and the 9 o'clock sector for the Ford. The point of impact was located entirely within the southbound travel lane and was evidenced by a series of four gouge marks (**Figure 3**) that measured 0.2 m (0.7 ft) to 1 m (3.3 ft) in length. The Damage Algorithm of the WinSMASH program was used to calculate the severity (delta-V) of the crash. The total delta-V of the Honda was 43.0 km/h (26.7 mph). The longitudinal and lateral delta-V components were -43 km/h (-26.7 mph) and 0 km/h, respectively. The Ford's total delta-V was 37 km/h (23.0 mph) with longitudinal and lateral components of -6.4 km/h (-4.0 mph) and 36.4 km/h (22.6 mph). The impact resulted in the actuation of the Honda driver's safety belt pretensioner and the deployment of the Honda's driver's frontal air bag, the left seat back-mounted air bag and both IC air bags. The frontal air bags in the Ford did not deploy. The impact force was rearward of the Ford's center of gravity; therefore it induced a counterclockwise (CCW) rotation of approximately 70 degrees as the vehicle traveled to final rest. The Honda's left front fender area remained engaged with the Ford as the vehicles separated and headed on their respective post crash trajectories. The Honda's forward momentum was



Figure 3: Four gouge marks in southbound lane

not altered laterally from impact forces. The Honda came to rest south of the initial point of impact, in an undocumented location on the snow covered roadway. The Ford came to final rest north of the initial point of impact, in an undocumented location.

Post-Crash

Local police and ambulance personnel responded to the crash site. The driver of the Honda complained of pain to her abdomen/pelvis area and was transported by ground ambulance to a local hospital where she was treated and released. The driver of the Ford complained of pain in his chest area and was transported by ground ambulance to a local hospital where he was admitted for treatment. The Honda and the Ford sustained disabling damage and were towed from the crash site. The vehicles were subsequently deemed total losses by their respective insurance companies and transferred to a regional vehicle salvage facility where they were inspected for this investigation.

Vehicle Damage

Exterior - 2008 Honda Pilot

The exterior of the Honda sustained severe frontal damage as a result of the crash sequence. The direct contact damage was distributed across the entire width of the front plane and included the bumper fascia, bumper beam, radiator, both headlight assemblies, hood and both front fenders. The bumper fascia separated from the vehicle during the engagement; therefore the direct contact damage was measured along the bumper beam and was 194 cm (76.4 in) in width. The crash displaced the engine and transmission rearward into the cowl and toe pan of the Honda. The crush profile was documented at the level of the bumper beam along a deformed width (Field L) of 90 cm (35.4 in). The crush profile (**Figure 4**) was measured at the bumper level and its results are as follows: C1 = 17 cm (6.7 in), C2 = 26 cm (10.2 in), C3 = 47 cm (18.5 in), C4 = 47 cm (18.5 in), C5 = 46 cm (18.1 in), C6 = 19 cm (7.5 in). The maximum crush was located at C4. The left wheelbase was reduced in length by 1 cm (0.4 in) while the right wheelbase was elongated by the same measurement when compared to original specifications. The Collision Deformation Classification was 12FDEW3. The windshield was fractured, but all other glazing was intact. The left front door was jammed closed and was removed during on-scene extrication efforts of the driver. All remaining doors were intact and operational at the time of the SCI inspection.



Figure 4: Front plane crush profile of the Honda.

Interior – 2008 Honda Pilot

The interior damage to the Honda consisted of the deployment of the vehicle's air bag systems, intrusion of the toe pan area and occupant contacts. The intrusion of the toe pan involved rearward displacement of 1 cm (0.4 in) on the left and 11 cm (4.3 in) in the front right position. The occupant contacts consisted of a fracture point to the knee bolster, a fracture to the center instrument panel and facial make-up transfers to the driver's air bag.

The driver's knee contacted the removable panel within the knee bolster that was centered under the steering column. The vertically oriented fracture line was 6 cm (2.4 in) in length, located 4 cm (1.6 in) left of the midline of the steering column. Another 6 cm (2.4 in) fracture was located on the top of the center instrument panel, located 43 cm (16.9 in) below the windshield header. A make-up transfer to the driver's air bag was located 3 cm (1.2 in) below the horizontal centerline and 0-6 cm (0-15.2 in) left of the vertical centerline. A distinct lipstick transfer was located on the lower left quadrant of the air bag and was 9 cm below the referenced centerline and 4-9 cm (1.6-3.5 in) left of the vertical centerline.

Exterior – 2007 Ford F150

The exterior of the Ford sustained left side damage as a result of the crash sequence with the Honda. The direct contact damage began on the aft aspect of the left rear door and extended 207 cm (81.5 in) rearward to the left taillight assembly and included the entire length of the cargo bed and the left rear wheel/axle. It should be noted that the flareside-style cargo bed utilized fiberglass/composite quarter panels. The impact resulted in lateral deformation of the left side of the cargo bed which resulted in shifting of the bed to the right. The lateral offset of the bed to cab was 46 cm (18.1 in). The rear axle was displaced and separated from the vehicle. It was not with the Ford at the time of the SCI inspection. The combined induced and direct contact damage began at the midpoint of the left rear door and extended 218 cm (85.8 in) to the left rear corner. The crush profile (**Figure 5**) was measured at the lower door level of the cargo bed and was as follows: C1 = 57 cm (22.4 in), C2 = 65 cm (25.6 in), C3 = 61 cm (24.0 in), C4 = 65 cm (25.6 in), C5 = 79 cm (31.0 in), C6 = 0 cm. The maximum crush was located at C5. The Collision Deformation Classification was 09LZEW4.

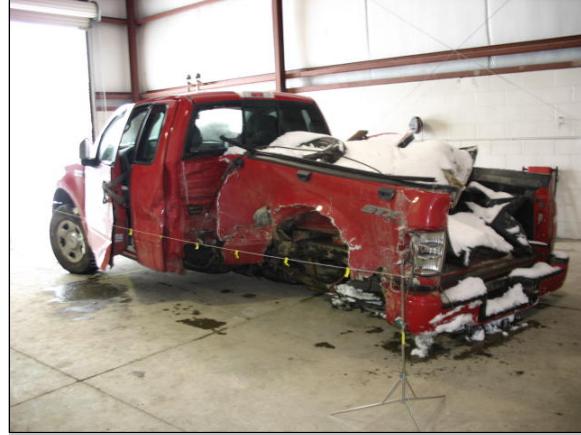


Figure 5: Left side crush profile of the Ford F150

Manual Restraint Systems – 2008 Honda Pilot

The driver's position was equipped with a 3-point lap and shoulder safety belt that consisted of continuous loop webbing, a sliding latch plate, an adjustable D-ring and an Emergency Locking Retractor (ELR). The D-ring was adjusted to the full-down position. The retractor was equipped with a pretensioner that actuated as a result of the crash. The actuated pretensioner locked the webbing in the used position. The latch plate revealed historical evidence of use and the friction surface exhibited abrading to its full width as a result of occupant loading. A 3 cm (1.2 in) abrasion to the webbing in the area of the buckled latch plate was located (84-87 cm (33.0-34.3 in) above the floor anchor. A secondary webbing abrasion was located on the lap belt 40-60 cm (15.7-23.6 in) above the lower anchor.

Frontal Air Bag System – 2008 Honda Pilot

The Honda was equipped with a CAC frontal air bag system that consisted of dual-stage air bags for the driver and front right passenger positions, seat track positioning sensors, safety belt switch sensors, a front right occupant presence sensor and a retractor pretensioners. The manufacturer of the Honda Pilot has certified that this vehicle is compliant to the advanced air bag requirements of Federal Motor Vehicle Safety Standard No. 208. The driver CAC frontal air bag deployed as a result of the crash from an H-configuration module located in the center of the steering wheel rim. The deployed air bag measured 52 cm (20.5 in) in diameter in its deflated state. The bag contained two tethers located at the 9 and 3 o'clock sectors and two vent ports located at the 11 and 1 o'clock sectors. The air bag's excursion from the module measured 27 cm (10.6 in). The horizontal distance from the center of the air bag module to the front left seat back was 57 cm (22.4 in). Make-up transfers were present of the face of the deployed air bag.

The front right passenger air bag was a top mount design located in the right aspect of the right instrument panel. The right front seat was unoccupied causing the CAC system to suppress the deployment of this air bag.

Side Impact Air Bags – 2008 Honda Pilot

The Honda was equipped with front seat back-mounted side impact air bags. The driver seat-mounted air bag deployed from a 40 cm (15.7) tear seam located on the outboard aspect of the seat back. The deployed air bag was oval-shaped and measured 38 cm (15 in) vertically and 27 cm (10.6 in) horizontally. The front right seat back-mounted air bag did not deploy.

Inflatable Curtain Air Bags – 2008 Honda Pilot

The Honda was also equipped with dual purpose rollover/side impact IC air bags (**Figure 6**) mounted within the roof side rails/headliner. Both IC air bags deployed as a result of the crash. The IC air bags measured 235 cm x 56 cm (92.5 in x 22 in) length x height in overall dimensions and provided coverage from the upper aspect of the A- to D-pillar

areas. A triangular shaped void in coverage was present at the forward third of the front door glazing. This area measured 51 cm x 36 cm (20.1 in x 14.2 in) length x height. A 24 cm (9.4 in) long tether extended from the A-pillars and was sewn to the forward aspect of the IC. The vertical coverage of the IC extended 11 cm (4.3 in) below the beltline in both the front and second row and 22cm (8.7 in) below the beltline in the third row. There was no contact evidence or damage to the deployed IC air bags.



Figure 6: Deployed driver IC airbag in Honda

Event Data Recorder – 2008 Honda Pilot

The Honda was equipped with an Air bag Control Module (ACM) that was located on the forward aspect of the center tunnel. The ACM module controlled the diagnostic, sensing and deployment command functions of the air bag system and also had limited Event Data Recording (EDR) capabilities. The ACM was removed from the Honda by the SCI investigator with permission from the insurance company. The EDR was forwarded to NHTSA and shipped to Honda for imaging. The EDR data was successfully imaged and was provided to the SCI team for summation in this report. The EDR output data were as follows:

The driver safety belt status indicated “Buckled” and the front right position was “Unbuckled” as this position was unoccupied. The driver pretensioner fire status indicated, “On” (actuated) and the front right position status was “Off”, not actuated. The first row right position seat weight sensor indicated “Empty” and the Occupant Position Detection System for the side impact air bag was recorded as “Empty”. The driver frontal air bag, side impact air bag and IC air bag deployment status indicated, “On” or deployed. The front right position was “Off”, “Off” and “On” respectively, indicating right IC deployment.

The EDR data recorded Safing Sensor on-times for the side (unspecified) of 17.92 milliseconds (MS) for the left side and 24.576 ms for the right side. The delta T On times were recorded at the same time frames. The front crash sensor On time was recorded at 1.024 ms for both sides and the SRS ECU On time (front) was recorded at 1.024 for the left side and Off for the right side. The output data also listed the driver’s seat track in a rear position.

Driver Demographics/Data – 2008 Honda Pilot

Age/Sex:	49-year-old/Female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Mid-to-rear, adjusted 8 cm (3.1 in) rearward of full-forward
Safety Belt Usage:	3-point lap and shoulder belt
Usage Source:	SCI vehicle inspection
Egress from Vehicle:	Assisted from vehicle by rescue personnel
Type of Medical Treatment:	Transported by ground ambulance to a local hospital where she was treated and released

Driver Injuries

Injury	Injury Severity AIS 09/Update 98	Injury Source
Complaint of pain to the abdomen/pelvis	Not codeable under AIS rules	Unknown

Source - Police Report

Driver Kinematics

The 49-year-old female driver of the Honda was seated in a mid-to-rear track position and was restrained with the manual 3-point lap and shoulder safety belt system. The seat track was adjusted 8 cm (3.1 in) forward of full-rear and the seat back was reclined 10 degrees aft of vertical. The horizontal distance from the seatback to the driver air bag module measured 57 cm (22.4 in). The 4-spoke tilt steering wheel was positioned 1 cm (0.4 in) from the full-up position at the time of the SCI inspection. At impact with the Ford, the safety belt ELR locked and the retractor pretensioner actuated. The driver's frontal CAC air bag deployed. Additionally, the driver seat back-mounted side impact air bag and both IC air bags deployed. The actuated pretensioner removed slack from the belt system and tightened the webbing around the driver as she responded to the frontal crash forces. Loading evidence on the belt system consisted of abrasions to the webbing and the frictional surface of the latch plate. The driver's knee(s) contacted the knee bolster which fractured the panel directly under the steering column. Her head moved forward and her face engaged the deployed frontal air bag as evidenced by make-up transfers on the air bag. There was no contact evidence of the side impact or IC air bags. The driver rebounded into the front left seat back where she came to rest. The driver complained on abdominal/pelvic pain and was extricated from the vehicle by rescue personnel prior to ground transport to a local hospital where she was treated and released. The combination of safety belt use and air bag deployment prevent the driver from potential serious injury.

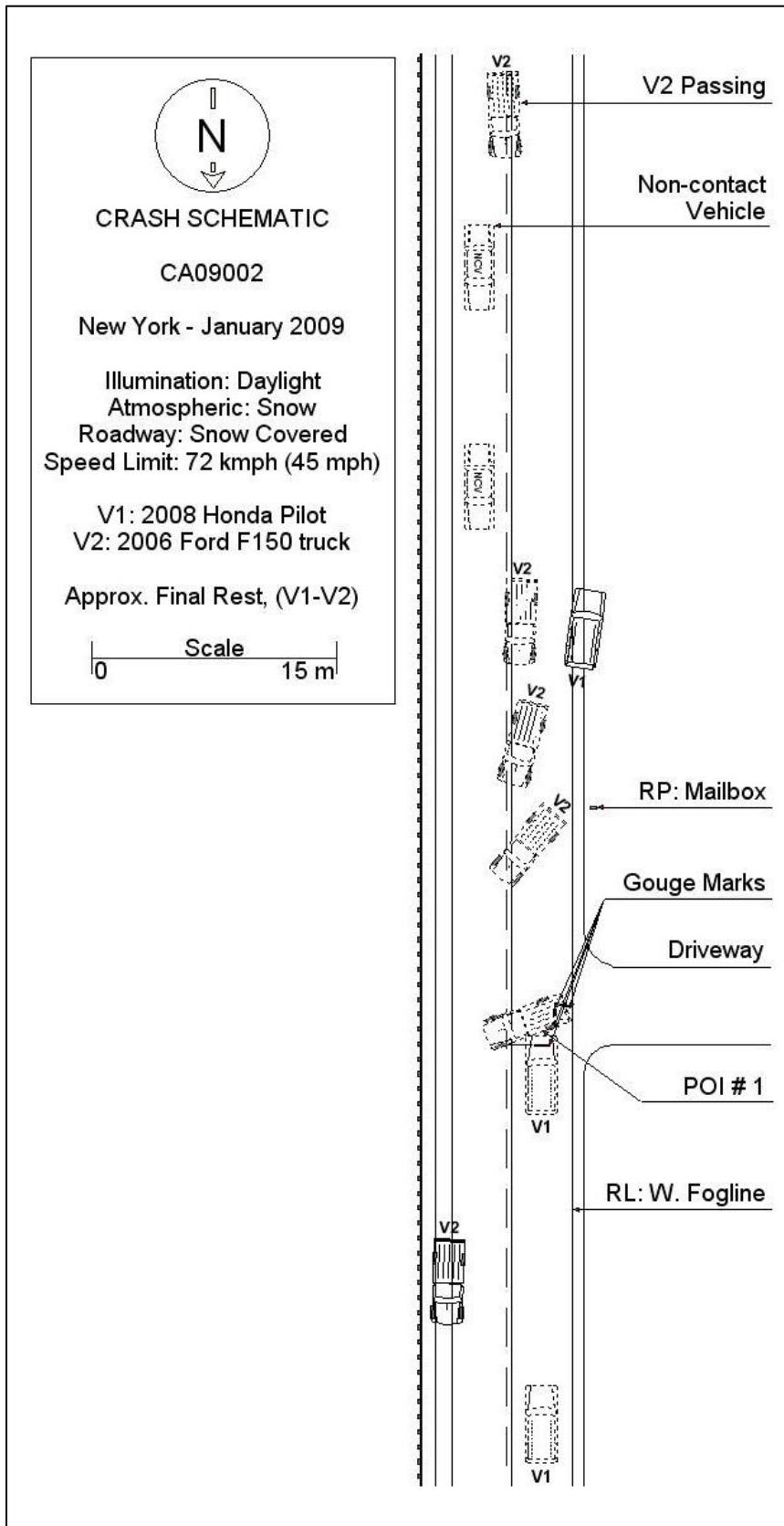


Figure 7. Crash Schematic