# INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
501 S. Madison Street, Suite 105
Bloomington, Indiana 47403-2452
(812) 855-3908 Fax: (812) 855-3537


# ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN08040
LOCATION - MISSOURI
VEHICLE - 2007 HONDA ACCORD LX
CRASH DATE - October 2008

Submitted:

June 23, 2009



Contract Number: DTNH22-07-C-00044


Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

# DISCLAIMERS

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be 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 systems.

**Technical Report Documentation Page**

| | | | |
|---|---|---|---|
| 1. *Report No.*<br>IN08040 | 2. *Government Accession No.* | 3. *Recipient's Catalog No.* | |
| 4. *Title and Subtitle*<br>On-Site Side Impact Inflatable Occupant Protection Investigation<br>Vehicle - 2008 Honda Accord LX<br>Location - Missouri | | 5. *Report Date:*<br>June 23, 2009<br>6. *Performing Organization Code* | |
| 7. *Author(s)*<br>Special Crash Investigations Team #2 | | 8. *Performing Organization Report No.* | |
| 9. *Performing Organization Name and Address*<br>Transportation Research Center<br>Indiana University<br>501 South Madison, Suite 105<br>Bloomington, Indiana 47403-2452 | | 10. *Work Unit No. (TRAIS)*<br>11. *Contract or Grant No.*<br>DTNH22-07-C-00044 | |
| 12. *Sponsoring Agency Name and Address*<br>U.S. Department of Transportation (NVS-411)<br>National Highway Traffic Safety Administration<br>National Center for Statistics and Analysis<br>Washington, D.C. 20590-0003 | | 13. *Type of Report and Period Covered*<br>Technical Report<br>Crash Date: October 2008<br>14. *Sponsoring Agency Code* | |
| 15. *Supplementary Notes*<br>On-site Side Impact Inflatable Occupant Protection Investigation involving a 2007 Honda Accord LX and 1974 Ford F100 pickup truck. | | | |
| 16. *Abstract*<br>This report covers an On-Site Side Impact Inflatable Occupant Protection Investigation that involved a 2007 Honda Accord LX and 1974 Ford F100 pickup truck, which were involved in an intersection related crash. The focus of this on-site investigation was the Honda's side impact air bag system. The Honda was occupied by a restrained 40-year-old female driver and a restrained 16-year-old female front row right passenger. The Honda was stopped for a stop sign at a 4-leg intersection. The driver proceeded to execute a left turn at the intersection and her vehicle was impacted in the left side plane by the front of the Ford. The impact was of sufficient force to trigger a deployment of the Honda's front left seat back mounted side impact air bag and left side curtain air bag. The Honda's driver was entrapped between the intruded left front door and center console. Rescue personnel cut the left front and left rear doors off the vehicle and extricated her through the left front door. She sustained minor injuries and was transported by ambulance to a hospital where she was treated and released. The front row right passenger also sustained minor injuries and was transported by private vehicle to a hospital where she was treated and released. | | | |
| 17. *Key Words*<br>Side Impact Air Bag<br>Air Bag Deployment<br>Motor Vehicle Traffic Crash<br>Injury Severity | | 18. *Distribution Statement*<br>General Public | |
| 19 *Security Classif. (of this report)*<br>Unclassified | 20. *Security Classif. (of this page)*<br>Unclassified | 21. *No. of Pages*<br>10 | 22. *Price* |

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

## TABLE OF CONTENTS

IN08040

Page No.

**Figure 1:** The damaged 2007 Honda Accord LX

The focus of this on-site investigation was the 2007 Honda Accord's side impact air bag system and the source of the driver's injuries. This crash was brought to the National Highway Traffic Safety Administration's (NHTSA) attention on October 17, 2008 by this contractor following an on-line search of Missouri State Highway Patrol crash report summaries. This on-site investigation was assigned on November 10, 2008. The crash involved a 2007 Honda Accord LX (**Figure 1**) and a 1974 Ford F100 pickup truck, which were involved in an intersection related crash. The crash occurred in October 2008, at 1505 hours, in Missouri and was investigated by the Missouri State Highway Patrol. This contractor inspected the Honda and the scene on November 12, 2008. The Honda's driver was interviewed on November 16, 2008. The Ford was driven from the scene and the driver refused to allow an inspection of the vehicle. This report is based on the police crash report, scene and vehicle inspections, an exemplar vehicle inspection, an interview with the Honda's driver, occupant kinematic principles, and this contractor's evaluation of the evidence.

## CRASH CIRCUMSTANCES

***Crash Environment:*** The trafficway on which the Honda was traveling was a 2-lane, undivided, state highway that traversed northeast and southwest and formed a 4-leg intersection with another state highway and a city street. The southwest travel lane was 3.1 m (10.2 ft) in width and the northeast travel lane was 3.4 m (11.2 ft) in width. The Honda was stopped at the intersection heading southwest. The roadway was straight at the intersection and was bordered by grass and bituminous shoulders 1.6 m (5.2 ft) in width. The intersection was controlled by a stop sign and the roadway pavement markings consisted of solid white edge lines, double yellow center line, and a solid white stop bar. The Honda's roadway had a negative 3% grade at the intersection and a negative 2.6% grade in the area of impact within the intersection. The trafficway on which the Ford was traveling was a 2-lane state highway that traversed northwest and southeast. Each travel lane was nominally 3.4 m (11.2 ft) in width and was bordered by grass shoulders 1.2 m (3.9 ft) in width. The roadway was level and the Ford's approach to the intersection was uncontrolled. The posted speed limit was 56 km\h (35 mph) for the Honda and 48 km\h (30 mph) for the Ford. At the time of the crash the light condition was daylight, the atmospheric condition was cloudy, and the roadway pavement was dry bituminous. The traffic density was light and the site of the crash was urban commercial. See the Crash Diagram on page 10 of this report.

***Pre-Crash:*** The Honda was occupied by a restrained 40-year-old female driver and a restrained 16-year-old female front row right passenger. The Honda was stopped at the stop sign (**Figure 2**) and the driver intended to turn left and proceed southeast. The Ford was occupied by a 16-year-old unrestrained driver and was traveling northwest approaching the intersection (**Figure 3**). The driver intended to continue through the intersection. The Honda's driver stated during the SCI interview that each leg of the intersection had previously been controlled by a stop sign. She

had not driven in the area for many months and was unaware that the intersecting state highway was no longer controlled by stop signs.

***Crash:*** After the Honda's driver stopped for the stop sign, a vehicle approaching from her right also stopped at the intersection. The driver saw the Ford approaching the intersection from her left and assumed it would also stop, so she proceeded into the mouth of the southwest roadway and began turning left. The Honda's driver realized that the Ford was not going to stop, so she applied the brakes. The Ford's driver told police that he swerved right and also applied the brakes. The front of the Ford impacted the left side of the Honda (**Figure 4**). The Honda's direction of force was within the 10 o'clock sector and the impact force was sufficient to trigger deployment of the driver's seat back-mounted side impact air bag and the left side curtain air bag. The impact redirected the Honda to the northwest and it came to rest. The Honda then immediately began to roll southwest across the intersection and came to final rest on the southeast lane heading southwest (**Figure 5**). The Ford came to final rest in the mouth of the intersection heading northwest.

***Post-Crash:*** The police were notified of the crash at 1511 hours and arrived on scene at 1519 hours. Emergency medical and rescue services also responded to the scene. The Honda's driver was entrapped within the vehicle between the intruded left front door and the center console. Rescue personnel cut the left front and left rear doors off the vehicle and extricated her through the left front door. The Honda's front row right passenger exited the vehicle without assistance through the right front door. The driver was transported to a hospital by ambulance. The front row right passenger was transported to a hospital by private vehicle. The Ford's driver was not injured and he drove his vehicle from the crash scene. The Honda was towed from the crash scene due to damage.


**Figure 2:** The Honda was stopped at the stop sign and the driver was intending to turn left; number on pavement shows distance in feet to area of impact (indicated by arrow)


**Figure 3:** Approach of the Ford southwest to the area of impact (indicated by arrow)

**Figure 4:** Damage to the Honda's left front and rear doors from the impact with the front of the Ford

The 2007 Honda Accord LX was a front wheel drive, 4-door sedan (VIN: 1HGCM56407A------) equipped with a 2.4L, 4-cylinder engine, automatic transmission, and 4-wheel anti-lock disc brakes. The front row was equipped with bucket seats, adjustable head restraints, lap-and-shoulder belts, a tilt and telescoping steering column, dual stage driver and front right passenger frontal air bags, seat back-mounted side impact air bags, and side curtain air bags that provided coverage for the front and second row outboard seating positions. The second row was equipped with a split bench seat with folding back (60/40), lap-and-shoulder belts, adjustable head restraints, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The vehicle's mileage was 62,998 kilometers (39,146 miles) and the specified wheelbase was 273 cm (107.5 in).

**Figure 5:** Yellow police T symbols show final rest position of the Honda

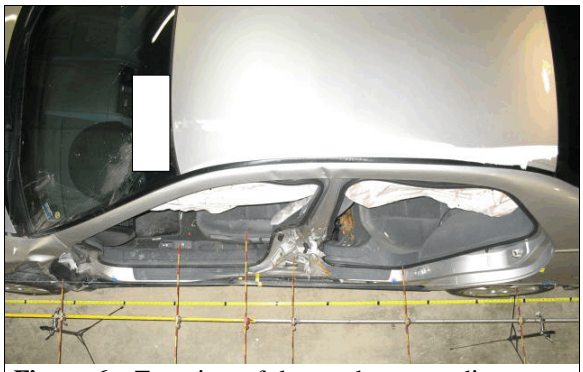


**Figure 6:** Top view of the crush gauge adjacent to the left side on the Honda showing the extrapolated crush profile

## CASE VEHICLE DAMAGE

***Exterior Damage***: The impact with the Ford involved the Honda's left side plane and the left front and rear doors were directly damaged. The direct damage began 58 cm (22.8 in) rear of the left front axle and extended 153 cm (60.2 in) rearward on the doors. Since the left front and rear doors had been cut off the vehicle and could not be adequately reattached to represent their crushed position, it was necessary to extrapolate the crush profile based on the damage to the B-pillar and from the doors. The crush profile was then represented against the door portals using the crush contour gauge (**Figure 6**). The residual maximum crush occurred on the left front door and was determined from this process to be 28 cm (11 in). It occurred 131 cm (51.6 in) rear of the left front axle and the height of the maximum door crush was 79 cm (31 in). The Door Sill Differential (DSD) was 25 cm (9.8 in). The table below shows the vehicle's right side crush profile.

| Units | Event | Direct Damage | | Field L | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Direct | Field L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Width CDC | Max Crush | | | | | | | | ±D | ±D |
| cm | 1 | 153 | 28 | 286 | 0 | 2 | 22 | 17 | 13 | 0 | 2 | 11 |
| in | | 60.2 | 11.0 | 112.6 | 0.0 | 0.8 | 8.7 | 6.7 | 5.1 | 0.0 | 0.8 | 4.3 |

The Honda's left side wheelbase was extended 1 cm (0.4 in) and the right side wheelbase was unchanged. The induced damage involved the left fender, B-pillar, roof side rail, roof, and left rear door.

***Damage Classification:*** The Honda's Collision Deformation Classification was **10-LPEW-3 (300** degrees) for the left side impact with the Ford. The Missing Vehicle algorithm of the WinSMASH program calculated the Honda's total Delta V as 20 km/h (12.4 mph). The longitudinal and lateral velocity changes were -10 km/h (-6.2 mph) and 17 km/h (10.6 mph), respectively. The results were based only on the Honda's crush profile and should be considered as a borderline reconstruction of the Honda's Delta V.

The vehicle manufacturer's recommended tire size was P205/65R15. The Honda was equipped with tires of the recommended size. The vehicle's tire data are shown in the table below.

| *Tire* | *Measured Pressure* | | *Vehicle Manufacturer's Recommended Cold Tire Pressure* | | *Tread Depth* | | *Damage* | *Restricted* | *Deflated* |
|---|---|---|---|---|---|---|---|---|---|
| | kPa | psi | kPa | psi | milli-meters | 32nd of an inch | | | |
| LF | 214 | 31 | 207 | 30 | 3 | 4 | None | No | No |
| LR | 207 | 30 | 207 | 30 | 6 | 7 | None | No | No |
| RR | 214 | 31 | 200 | 29 | 6 | 7 | None | No | No |
| RF | 214 | 31 | 200 | 29 | 3 | 4 | None | No | No |

***Vehicle Interior:*** The inspection of the Honda's interior revealed a light scuff mark on the left side curtain air bag, which probably resulted from contact by the left side of the driver's head. A light scuff mark 15 cm (5.9 in) in length was also found on the left front door arm rest, and another scuff 11 cm (4.3 in) in length was located on the forward lower quadrant of the left front door panel (**Figure 7**). The scuff on the arm rest was probably the result of loading by the driver's lower left arm while the scuff mark on the forward lower quadrant of the left front door panel was probably the result of loading by the driver's lower left leg. The left front and left rear doors were jammed shut and the right front and right rear doors remained closed and operational. All of the side door window glazing was closed and the second left and right rear window glazing was fixed. The left front door window glazing

**Figure 7:** Yellow tape shows probable occupant contact scuffs on the left front door

was disintegrated due to impact forces. The windshield glazing was cracked due to impact forces and the backlight was undamaged.

The vehicle sustained 7 passenger compartment intrusions. The most severe intrusions involved the driver's occupant space and all of the intrusions occurred on the lateral axis. The upper rear quadrant of the left front door intruded 16 cm (6.3 in) while the left B-pillar (**Figure 8**), roof side rail, and sill intruded 8 cm (3.1 in), 4 cm (1.6 in), and 3 cm (1.2 in), respectively.

**Figure 8:** View through windshield to left B-pillar intrusion

## AUTOMATIC RESTRAINT SYSTEM

The Honda was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that was certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The frontal air bag system consisted of dual stage driver and front right passenger air bags, driver seat position sensor, seat belt usage sensors, retractor mounted pretensioners, and a front right passenger weight sensor. Neither of the frontal air bags deployed in this crash.

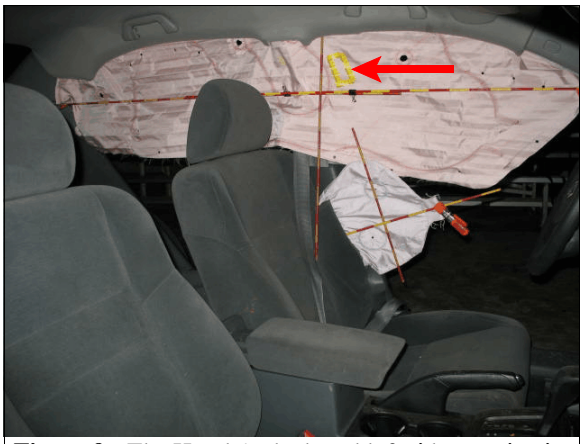


**Figure 9:** The Honda's deployed left side curtain air bag and seat-back-mounted side impact air bag; arrow shows location of a probable occupant contact scuff mark

The Honda's side impact air bag system consisted of front seat back-mounted side impact air bags and roof side rail-mounted side curtain air agbs. The vehicle's side impact sensors were located on each side of the vehicle within the lower door sill.

The left side curtain air bag was located along the left roof side rail (**Figure 9**) inside the headliner and extended from the A-pillar to the C-pillar. The fold creases on the air bag indicated that it had been folded accordion fashion within the headliner. The deployed side curtain air bag was 171 cm (67.3 in) in width and 38 cm (15 in) in height. There were no visible tethers. What appeared to be a 5 cm (2 in) wide vent port was located at the front of the air bag. Inspection of the air bag revealed a very light scuff mark located 62 cm (24.4 in) rear of the front of the air bag and 10 cm (4 in) below the roof side rail. The location of the scuff mark was consistent with contact by the left side of the driver's head during the crash. There were also numerous black smears on the front portion of the air bag, but these marks appeared to due to post-crash handling of the air bag.

The driver's seat back-mounted side impact air bag was located in the outboard side of the seat back and deployed through a tear seam. The deployed air bag (**Figure 9**) was oblong and had two circular tethers where both sides of the air bag were sewn together. Each sewn area was 5 cm (2 in) in width. There were no visible vent ports. The deployed air bag was 33 cm (13 in) in height and 25 cm (9.8 in) in width. Inspection of the air bag revealed no damage and no discernable evidence of occupant contact.

**Figure 10:** Area of stretching and wrinkling on driver's seat belt, outlined in white

## MANUAL RESTRAINT SYSTEM

The Honda was equipped with lap-and-shoulder belts for all front and second row seating positions. The driver's seat belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, and an adjustable upper anchor that was in the full down position. The front right seat belt was equipped with a switchable ELR/Automatic Locking Retractor (ALR), sliding latch plate, and adjustable upper anchor that was located in the full down position. The front row seat belts were equipped with retractor-mounted pretensioners that did not actuate in this crash consistent with the non-deployment of the frontal air bags. The second row seat belts consisted of continuous loop belt webbing, switchable ELR/ALRs, sliding latch plates and fixed upper anchors.

**Figure 11:** Driver's seat belt; arrow show location of load mark

The inspection of the driver's seat belt system revealed historical usage scratches on the latch plate and a area of slight stretching and wrinkling on the belt webbing (**Figure 10**) that was 12 cm (4.7 in) in length, beginning 7 cm (2.8 in) above the stop button. The retractor was also jammed as a result of damage on the left B-pillar and a length of belt webbing was extended out of the retractor consistent with usage in the crash (**Figure 11**). The length of belt was 111 cm (43.7 in) as measured from the stop button to the D-

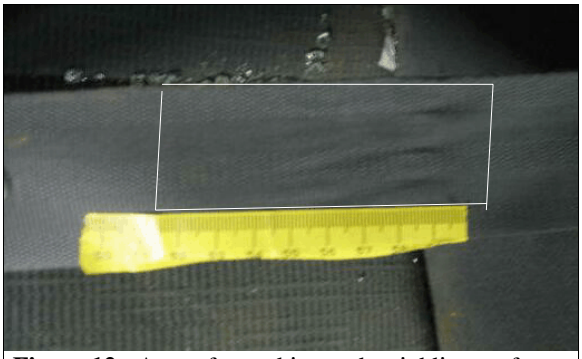


**Figure 12:** Area of stretching and wrinkling on front right passenger seat belt outlined in white

ring. The evidence indicated that the driver was restrained by the lap-and-shoulder belt and supported her statement that she was restrained in this crash.

The inspection of the front right passenger's seat belt system revealed historical usage scratches on the latch plate and a area of stretching and wrinkling on the belt webbing (**Figure 12**) that was 9 cm (3.5 in) in length, beginning 4 cm (1.6 in) above the stop button. The evidence indicated that the front right passenger was restrained by the lap-and-shoulder belt and supported the driver's statement that the passenger was restrained in this crash.

**CASE VEHICLE DRIVER KINEMATICS**

Based on the SCI interview, the Honda's driver [40-year-old, female; 168 cm (66 cm) and 76 kg (167 lbs)] was seated in an upright posture with both hands on the steering wheel at approximately the 10 and 2 clock positions and she was bracing for impact. She had her right foot on the brake pedal and left foot on the floor. The seat track was adjusted to the full rear position and the seat back was in the upright position. The adjustable head restraint was located in the full down position, and the distance from the top of the seat back to the top of the head restraint was 20 cm (7.8 in). The tilt steering column was located in the full up position and the telescoping adjustment was located between the middle and full forward position. The driver reported that she was wearing the seat belt over her left shoulder and snug and low across her hips. She was not wearing glasses at the time of the crash.

The Honda's left side impact with the front of the Ford displaced the driver to the left and slightly forward opposite the 10 o'clock direction of force and she loaded the seat belt. The left side of her head loaded the deployed left side curtain air bag causing a cervical and thoracic strain. Her left thigh and left lower leg loaded the intruding left front door, rear lower quadrant and forward lower quadrant causing a contusion on the left thigh and left lower leg that extended from the upper thigh to above her ankle. The driver also sustained contusions on her left shoulder, upper arm, and forearm due to loading the left B-pillar, seat back-mounted side impact air bag, and left front door arm rest, respectively. The intrusion of the left front door entrapped the driver between the door and the center console and stretched the seat belt so tightly that she could not unbuckle it until emergency responders cut off the left front door.

**CASE VEHICLE DRIVER INJURIES**

The driver was transported to a hospital by ambulance where she was treated in the emergency room and released. She has since had one follow-up visit to her private physician and lost 15 work days as a result of her injuries. The driver's injuries and injury sources are presented in the table below.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1 | Strain, acute, cervical, not further specified | minor 640278.1,6 | Air bag, driver's side inflatable curtain {Indirect injury} | Probable | Emergency room records |
| 2 | Strain, acute, thoracic, not further specified | minor 640478.1,7 | Air bag, driver's side inflatable curtain {Indirect injury} | Probable | Emergency room records |
| 3 | Contusion left shoulder, not further specified | minor 790402.1,2 | Left B-pillar | Probable | Emergency room records |
| 4 | Contusion left upper arm, not further specified | minor 790402.1,2 | Air bag, driver's side impact | Probable | Emergency room records |
| 5 | Contusion left forearm, not further specified | minor 790402.1,2 | Left front door, arm rest, rear upper quadrant | Probable | Interviewee (same person) |
| 6 | Contusion left lateral thigh, not further specified | minor 890402.1,2 | Left front door panel, rear lower quadrant | Probable | Interviewee (same person) |
| 7 | Contusion left lateral lower leg, not further specified | minor 890402.1,2 | Left front door panel, front lower quadrant | Certain | Interviewee (same person) |

## CASE VEHICLE FRONT ROW RIGHT PASSENGER KINEMATICS

Based on the SCI interview with the driver, the Honda's front right passenger [16-year-old, female; 163 cm and 79 kg (64 in, 175 lbs)] was seated in an upright posture with both feet on the floor. Her seat track was adjusted to the full rear position and the seat back was slightly reclined. The adjustable head restraint was located in the full down position, and the distance from the top of the seat back to the top of the head restraint was 20 cm (7.8 in). The driver stated during the interview that the passenger was wearing the seat belt over her right shoulder and snug and low across her hips. She was not wearing glasses at the time of the crash.

The Honda's left side impact with the front of the Ford displaced the front right passenger to the left and slightly forward opposite the 10 o'clock direction of force and she loaded the seat belt. While there was no discernable occupant contact evidence , her left knee probably loaded the center console, which caused a contusion on the knee. The passenger rebounded to the right and her right shoulder and upper arm probably loaded the right B-pillar and her right forearm probably loaded the rear upper quadrant of the right front door. The passenger sustained a contusion on the right shoulder, upper right arm and right forearm from these contacts. She also sustained a neck strain, which was probably due to the impact force, and a small laceration on her

left eyebrow due to flying glass from the disintegrated left front window glazing. She remained restrained in her seat throughout the crash.

**CASE VEHICLE FRONT ROW RIGHT PASSENGER INJURIES**

The front row right passenger was transported from the crash scene to a hospital by private vehicle. She was treated in the hospital emergency room and released. The passenger did not receive any follow visits to a medical facility and missed 4 days of school as a result of her injuries. The front right passenger's injuries and injury sources are presented in the table below.

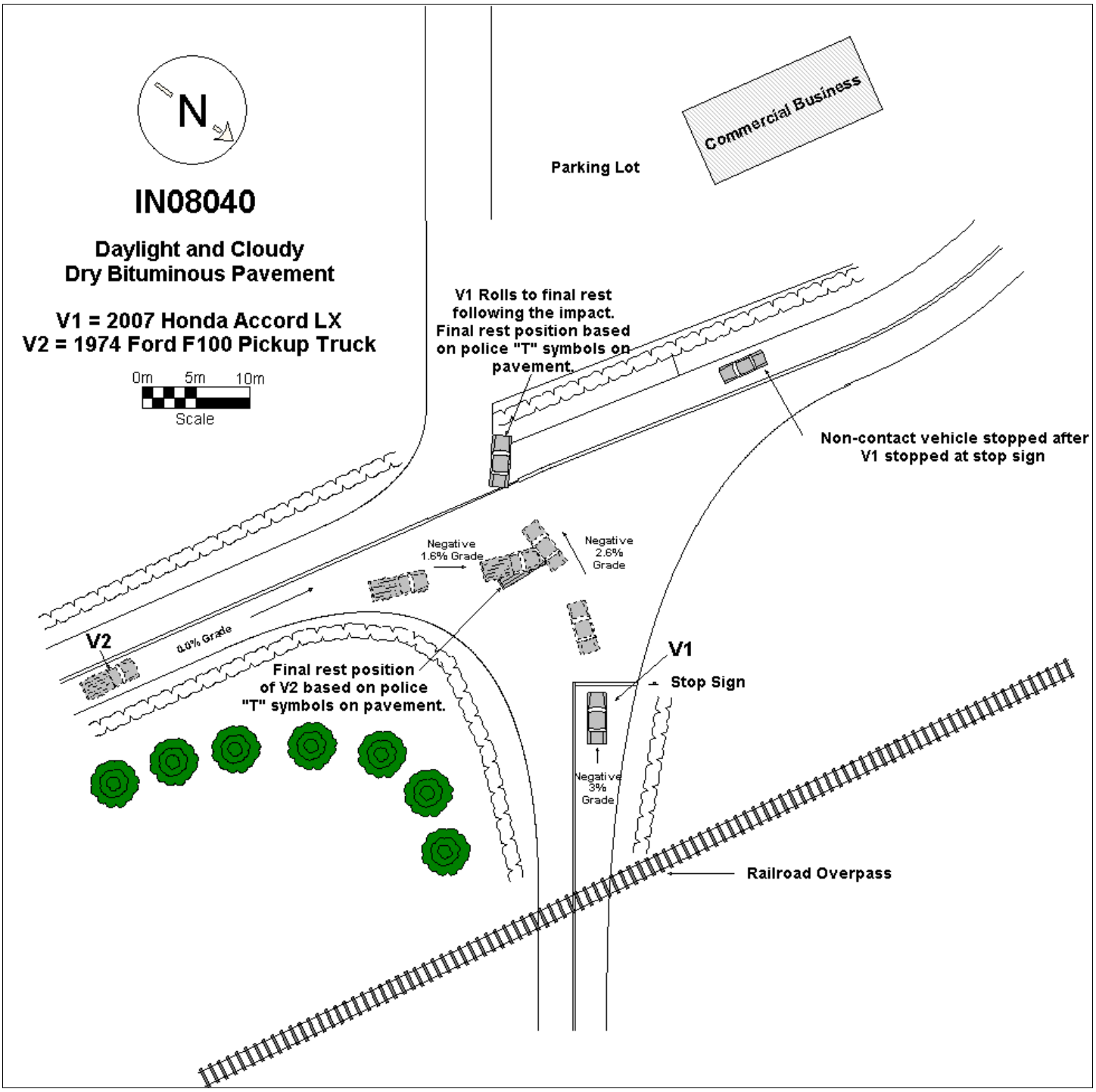
| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1 | Laceration, up to 1 cm (0.4 in), left face at border left eyebrow | minor 290602.1,2 | Noncontact injury: flying glass, left front glazing | Probable | Emergency room records |
| 2 | Strain {whiplash} cervical, not further specified | minor 640278.1,6 | Noncontact injury: impact forces | Probable | Interviewee (same person) |
| 3 | Contusion right shoulder, not further specified | minor 790402.1,1 | Right B-pillar | Probable | Emergency room records |
| 4 | Contusion right upper arm, not further specified | minor 790402.1,1 | Right B-pillar | Probable | Interviewee (same person) |
| 5 | Contusion right forearm, not further specified | minor 790402.1,1 | Right front door panel, rear upper quadrant | Probable | Interviewee (same person) |
| 6 | Contusion {ecchymosis} left knee, not further specified | minor 890402.1,2 | Floor, center console | Probable | Emergency room records |

**OTHER VEHILCE**

The 1974 Ford F100 was a rear-wheel drive, 2-door, conventional cab pickup truck (VIN: F10GL------) and was equipped with a 5.0L (302 $in^3$) V-8 engine. This vehicle was not inspected

***Damage Classification:*** The Missing Vehicle algorithm of the WinSMASH program calculated the Ford's total Delta V for the front impact with the Honda as 20 km/h (12.4 mph). The longitudinal and lateral velocity changes were -20 km/h (-12.4 mph) and -4 km/h (-2.5 mph), respectively. The results were based only on the Honda's crush profile and should be considered as a borderline reconstruction of the Ford's Delta V.

***Ford's Driver:*** The police crash report indicated that the Ford's driver (16-year-old, male) was not restrained and sustained no injury.


N
IN08040
Daylight and Cloudy
Dry Bituminous Pavement
V1 = 2007 Honda Accord LX
V2 = 1974 Ford F100 Pickup Truck
0m 5m 10m
Scale
Parking Lot
Commercial Business
V1 Rolls to final rest following the impact. Final rest position based on police "T" symbols on pavement.
Non-contact vehicle stopped after V1 stopped at stop sign
Negative 1.6% Grade
Negative 2.6% Grade
V2
0.0% Grade
Final rest position of V2 based on police "T" symbols on pavement.
V1
Stop Sign
Negative 3% Grade
Railroad Overpass