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ON-SITE ROLLOVER INVESTIGATION

CASE NUMBER - IN09032
LOCATION - ILLINOIS
VEHICLE - 2008 HONDA CR-V EX
CRASH DATE - July 2009

Submitted:

February 11, 2010

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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 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

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15. *Supplementary Notes* On-site rollover investigation involving a 2008 Honda CR-V EX.			
16. *Abstract* This on-site investigation focused on the rollover of a 2008 Honda CR-V EX and the sources of the injuries for the driver and front row passenger. The Honda was occupied by a restrained 17-year-old female driver and a restrained 17-year-old female front passenger. The driver was traveling northwest in the center lane of an urban interstate highway when the Honda was impacted on the left rear corner by an unidentified automobile (event 1). The impact caused the Honda to rotate counterclockwise and the front plane impacted a concrete median barrier (event 2), which caused the frontal air bags to deploy. The Honda continued to rotate and the back plane impacted the barrier (event 3). The vehicle rolled over left side leading (event 4) 8 quarter turns. During the rollover the back plane of the vehicle impacted the median barrier (event 5). During the rollover, the rollover inflatable curtain (IC) air bags and front seat-mounted side impact air bags deployed. Following the crash, the driver and front right passenger exited the vehicle without assistance and were transported by ambulance to a hospital. They were treated in the emergency room for minor injuries and released.			
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IN09032

This on-site investigation focused on the rollover of a 2008 Honda CR-V EX (**Figure 1**) and the sources of the injuries for the driver and front row passenger. This crash was brought to our attention by the National Highway Traffic Safety Administration (NHTSA) on August 31, 2009, through the sampling activities of the National Automotive Sampling System-General Estimates System (NASS-GES). This investigation was assigned on September 18, 2009. The crash involved the Honda, which departed the roadway and rolled over following two impacts with a concrete median barrier. The crash occurred in July, 2009, at 0515 hours, in Illinois and was investigated by the Illinois State Police. The crash scene and Honda were inspected on September 22-23, 2009. An interview with the mother of the driver was completed on October 3, 2009. The investigating police officer was interviewed on October 13, 2009. This report is based on the police crash report, an interview with the investigating police officer, vehicle inspection, photographs of the crash scene, exemplar vehicle inspection, an interview with the driver's mother, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2008 Honda CR-V EX

CRASH CIRCUMSTANCES

Crash Environment: The trafficway that the Honda was traveling on was a 6-lane, divided interstate highway that traversed in a northwest-southeast direction. The crash occurred within an interchange area. The trafficway had three travel lanes in each direction and was separated by a concrete median barrier. The Honda's roadway was straight and level and was bordered by a concrete median shoulder and bituminous outside shoulder. Each travel lane was approximately 3.7 m (12 ft) in width. The roadway pavement markings consisted of solid white outside edge lines, broken white lane lines, and solid yellow median lines. An inspection of the crash scene was not possible due to heavy traffic conditions. At the time of the crash, the light condition was daylight, the atmospheric condition was clear, and the roadway was dry bituminous. The speed limit was 89 km/h (55 mph). The traffic density was moderate and the site of the crash was urban commercial. The Crash Diagram is on page 13 of this report.

Pre-Crash: The Honda was occupied by a restrained 17-year-old female driver and restrained 17-year-old female front passenger. The driver was traveling northwest in the center lane (**Figure 2**) and intended to continue straight ahead. An unidentified automobile was traveling in the inside lane approaching the Honda. The crash sequence was initiated when the unidentified automobile entered the Honda's travel lane.

Crash: The left corner of the Honda's back bumper (**Figure 3**) was impacted by either the front or right side plane of the unidentified automobile (event 1). The impact caused the Honda to rotate

counterclockwise and travel toward the concrete median barrier. The Honda departed the roadway and its front plane (**Figure 1**) impacted the concrete median barrier (event 2). The direction of force was within the 1 o'clock sector and the impact force was sufficient to trigger deployment of the frontal air bags. The vehicle continued to rotate counterclockwise and the back plane (**Figure 4**) impacted the median barrier (event 3). The vehicle rotated off the median barrier and rolled over (event 4, **Figure 5**) left side leading an estimated 8 quarter turns. During the rollover, the vehicle's rollover inflatable curtain (IC) air bags and front seat-mounted side impact air bags deployed. Also during the rollover, the back plane of the vehicle impacted the median barrier (event 5, **Figure 6**). The Honda came to final rest on its wheels heading northeast.

Figure 2: Area of crash

Figure 3: Damage on back bumper fascia from impact with an unidentified automobile

Figure 4: Arrow show damage to back plane from impact with the concrete median barrier (event 3)

Figure 5: Damage to top plane due to the rollover

Post-Crash: The police were notified of the crash as well as emergency medical and rescue personnel. The police crash report did not indicate a time of notification or arrival at the crash scene. The driver and front passenger both exited the vehicle without assistance. They were both transported by ambulance to a hospital.

The Honda's rollover mitigation features consisted of rollover sensing and Electronic Stability Control (ESC). The vehicle has been given a four star rollover rating on a five star scale by NHTSA and a Static Stability Factor of 1.26[1]. A four star rating indicates that the vehicle has a 10%-20% chance of a rollover when involved in a single vehicle crash. The specific chance of rollover for this vehicle model was given as 15%. The Static Stability Factor (SSF) is a calculation based on the vehicle's track width and height of its center of gravity. The result of the calculation is a measure of a vehicle's resistance to rollover. A higher SSF indicates a more stable vehicle. The majority of passenger vehicles have an SSF of 1.30 to 1.50[2]. The test vehicle also did not tip-up during the dynamic steering maneuver test in which the test vehicle was put through a fish-hook shaped steering maneuver (i.e., hard left and hard right steer) at between 56 km/h-80km/h (35-50 mph).

Figure 6: Arrows shows the damage to the tailgate from impact with the median barrier during the rollover (event 5)

Figure 7: Damage scratches on the right fender, right A-pillar, and right front door overlap in two directions

The rollover of the Honda (event 4) occurred following the back plane impact with the concrete median barrier (event 3). As the vehicle rotated counterclockwise off the median barrier, the friction between the left side tires and the pavement caused the vehicle to rollover left side leading. Overlapping scratches formed in two directions on the right fender, right A-pillar, right front door (**Figure 7**), and the left A-pillar indicated that it probably rolled over 8 quarter turns. The vehicle came to final rest on its wheels heading northeast. Due to traffic conditions, it was not possible to inspect the crash scene. The specific location of rollover initiation and the distance traveled during the rollover could not be determined.

CASE VEHICLE

The 2008 Honda CR-V EX was a 4-wheel drive, 4-door, sport utility vehicle (VIN: 5J6RE48588L------) that was manufactured in June 2008. It was equipped with a 2.4-liter, 4-cylinder engine, 5-speed automatic transmission, 4-wheel anti-lock disc brakes with electronic

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[1] www.safercar.gov, 10/8/09

[2] "Trends in the Static Stability Factor of Passenger Cars, Light Trucks, and Vans", NHTSA Technical Report, DOT HS 809 868, June 2005

brake force distribution, traction control, electronic stability control, and rollover sensing. The front row was equipped with bucket seats, active head restraints, lap-and-shoulder safety belts with pretensioners, dual stage driver and front passenger frontal air bags, seat-mounted side impact air bags, and rollover/side impact IC air bags that provided protection for the front and second rows. The second row was equipped with a split bench (40/60) with split folding backs, adjustable head restraints, lap-and-shoulder safety belts, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The vehicle's specified wheelbase was 262 cm (103.1 in).

CASE VEHICLE DAMAGE

Exterior Damage: The impact with the unidentified automobile (event 1) involved the left side plane of the Honda. The direct damage involved the left rear corner of the back bumper and consisted of scratches on the bumper fascia. The direct damage began 92 cm (36 in) rear of the left rear axle and extended 8 cm (3.1 in) along the side of the back bumper fascia. There was no residual crush as a result of this impact.

The Honda's first impact with the concrete median barrier (event 2) involved the front plane (**Figure 8**). The front bumper, bumper fascia, grille, hood, and the right headlamp/turn signal assembly were directly damaged. The direct damage began at the front right bumper corner and extended 80 cm (31.5 in) across the front bumper. The front bumper was torn off the vehicle, so two crush measurements were taken,one on each frame member. The maximum residual crush was 12 cm (4.7 in) occurring on the right frame member (C_2). The table below shows the front crush profile.

Figure 8: Front plane damage on the Honda from impact with the median barrier

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	2	80	12	84	3	12	N/A	N/A	N/A	N/A	49	0
in		31.5	4.7	33.1	1.2	4.7	N/A	N/A	N/A	N/A	19.3	0.0

The Honda's second impact with the median barrier (event 3) involved the back plane. The back bumper, right lower portion of the tailgate, and right taillight assembly were directly damaged (**Figure 9**). The direct damage began on the back right bumper corner and extended 125 cm (49.2 in) along the bumper. The crush measurements were taken on the back bumper and the maximum residual crush was 7 cm (2.8 in) occurring at C_6 (**Figure 10**). The induced damage involved the right quarter panel. The table below shows the back 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	3	125	7	161	0	0	0	1	3	7	12	0
in		49.2	2.8	63.4	0.0	0.0	0.0	0.4	1.2	2.8	4.7	0.0

Figure 9: Damage on the Honda's back bumper from the impact with median barrier; arrow shows the damage on the tailgate that occurred during the rollover

Figure 10: Right side view of the back bumper crush

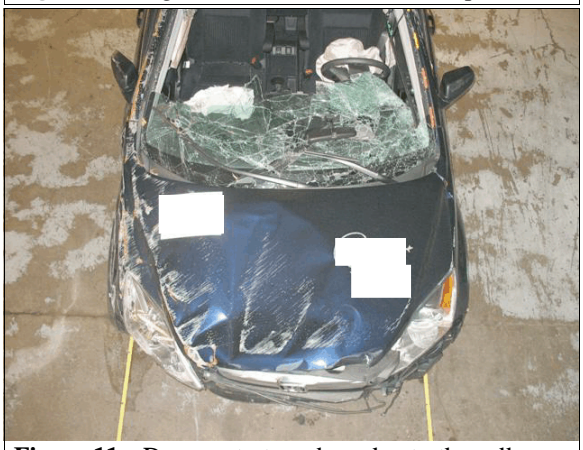


Figure 11: Damage to top plane due to the rollover

The rollover (event 4) involved Honda's top and both side planes. The direct damage on the top plane began at the front of the hood (**Figure 11**) and extended to 4 cm (1.6 in) rear of the left rear axle, and involved the full width of the roof, 103 cm (40.6 in). The direct damage on the left side plane was limited to the fender, left A-pillar, and roof side rail. It began 8 cm (3.1 in) forward of the left front axle and extended 17 cm (6.7 in) rearward on the fender. The direct damage on the left A-pillar began 76 cm (29.9 in) rear of the left front axle and extended rearward on the pillar and along the left roof side rail to the C-pillar. The direct damage on the right side plane began at the front of the fender and extended intermittently along the full length of the vehicle. It involved the fender, roof side rail, both doors and the quarter panel. The maximum residual lateral crush was 4 cm (1.6 in) and occurred at the top of the right A-pillar. The maximum vertical crush (**Figure 12**) was 5 cm (2 in) and occurred at the right corner of the windshield header. Both crush points were located 102 cm (40.2 in) rear of the right front axle.

The impact with the median barrier that occurred during the rollover (event 5) involved the back plane. The tailgate was directly damaged. The direct damage was located between the bottom of the backlight and the bottom of the tailgate and involved approximately the right half of the tailgate (**Figure 9**).

Figure 12: The location of the maximum vertical and lateral crush on the Honda

Damage Classification: The Honda's Collision Deformation Classifications were **09-LBLS-1** (**260** degrees) for the left side plane impact with the unidentified vehicle (event 1), **01-FZEW-1** (**20** degrees) for the front plane impact with the concrete median barrier (event 2), **05-BDEW-1** (**160** degrees) for the back plane impact (event 3) with the median barrier, **00-TDDO-2** for the rollover (event 4), and **00-BZMW-2** for the back plane impact with the median barrier during the rollover (event 5). The Barrier algorithm of the WinSMASH program calculated the Honda's total Delta-V for the front plane impact as 20 km/h (12.4 mph). The longitudinal and lateral velocity changes were -18.8 km/h (-11.7 mph) and -6.8 km/h (-4.2 mph), respectively. The Barrier algorithm was also used for the back plane impact and the total Delta-V was calculated as 12 km/h (7.5 mph). The longitudinal and lateral velocity changes were 11.3 km/h (-7.0 mph) and -4.1 km/h (-2.5 mph), respectively. The results for both runs appeared reasonable based on the vehicle's damage. The WinSMASH program could not be used on the rollover since rollovers are out of scope for the program. Based on the extent of the roof crush, the severity of the rollover damage was minor. The severity of the damage for the back plane impact with the barrier that occurred during the rollover was also minor.

The vehicle manufacturer's recommended tire size was P225/65R17. 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'sRecommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	159	23	207	30	6	7	None	No	No
LR	255	37	207	30	5	6	None	No	No
RR	255	37	207	30	6	8	None	No	No
RF	255	37	207	30	6	8	None	No	No

Vehicle Interior: The inspection of the Honda's interior (**Figures 13** and **14**) revealed evidence of probable occupant contacts on the right instrument panel above the glove box from the front passenger's knees. There was a possible occupant contact on the center instrument panel adjacent to the top left corner of the glove box door possibly from the passenger's left knee. No discernable occupant contact evidence associated with the driver was observed.

Figure 13: The driver's seat, left front door, and left instrument panel of the Honda

Figure 14: The center and right instrument panel; possible knee contact marks from front passenger highlighted

All the vehicle's doors remained closed and operational. The pre-crash status of the left front window glazing was partially open and the remainder of the window glazings were either fixed or closed. The windshield was in place and cracked from impact forces, but it had collapsed from weathering since the crash. The right front window and roof glazings were disintegrated from impact forces.

The vehicle's passenger compartment sustained three intrusions due to the rollover. The intrusions occurred in the front passenger seating area and involved the windshield header, roof and right A-pillar. The windshield header and roof intruded vertically 5 cm (2 in) and 3 cm (1.2 in), respectively. The right A-pillar intruded laterally 4 cm (1.6 in).

AUTOMATIC RESTRAINT SYSTEM

The Honda was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front passenger air bags, driver seat position sensor, safety belt usage sensors, retractor and safety belt buckle-mounted pretensioners and a front passenger weight sensor. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the frontal air bag impact sensors were located on the left and right inner fenders. The manufacturer has certified that the vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. Both frontal air bags deployed in this crash.

The Honda was also equipped with rollover/side impact IC air bags and front seat-mounted side impact air bags. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the side impact sensors were located within the lower B- and C-pillars. The inflators for the IC air bags were located under the roof panel forward of the hatchback opening. Both IC air bags and both seat-mounted side impact air bags deployed in this crash.

The driver's frontal air bag was located in the steering wheel hub and the module cover was a three-flap configuration constructed of pliable vinyl. The top flap was 13 cm (5.1 in) in width and 11 cm (4.3 in) in height at the Honda emblem. Each bottom flap was triangular-shaped and

was 8 cm (3.1 in) in width as measured along the tear seams. An inspection of the air bag module cover flaps revealed that they opened at the designated tear points and were undamaged. The deployed air bag (**Figure 15**) was round with a diameter of 60 cm (23.6 in). It was designed with two 4 cm (1.6 in) diameter vent ports located on the back of the air bag at the 11 and 1 o'clock positions. Inspection of the air bag revealed no damage. Two blood transfers were present within the upper left quadrant. The blood transfers appeared to be related to blood spatter and not direct occupant contact.

Figure 15: The Honda driver's frontal air bag

The passenger's frontal air bag was located in the top of the instrument panel and the module cover was a horizontal two-flap configuration constructed of medium gauge vinyl. Both the top and bottom flaps were 24.5 cm (9.6 in) in width and 6 cm (2.4 in) in height. An inspection of the air bag module cover flaps revealed that they opened at the designated tear points and were undamaged. The deployed air bag (**Figure 16**) was rectangular with a width of 44 cm (17.3 in) and a height of 60 cm (23.6). The air bag was not designed with vent ports. Inspection of the air bag revealed no damage. Several small blood transfers were located on the upper right and lower left quadrants, but these appeared to be related to blood spatter.

Figure 16: The front passenger's frontal air bag

The IC air bags (**Figures 17** and **18**) were located along the roof side rails inside the headliner and extended from the top of the A-pillar to slightly behind the C-pillar. They were designed with inflation chambers adjacent to the outboard seat positions. The deployed IC air bags were 177 cm (69.7 in) in width and 42 cm (16.5 inches) in height. They were attached at the lower A-pillars by a 33 cm (13 in) rope tether. The IC air bags extended 11 cm (4.3 in) below the beltline. The gap between the bottom of IC air bags and the and the front of the window frame at the beltline was 27 cm (10.6 in). There was no visible tether at the C-pillar. Inspection of the ICs revealed no discernable evidence of occupant contact, and they sustained no damage.

The driver's and front passenger's seat-mounted side impact air bags were located in the outboard side of the respective seat backs and deployed from behind a triangular-shaped plastic trim panel. The deployed air bags (**Figures 17** and **18**) were 36 cm (14.2 inches) in height and

23 cm (9.1 in) in width at the top. Each air bag had an oval-shaped area in the approximate center of the air bag where both sides were sewn together. There were two vent ports on the leading edge of each air bag (**Figure 19**). Inspection of the deployed air bags revealed no damage and no discernable evidence of occupant contact. A yellow mark and small black mark were present on the inboard surface of the driver's air bag, which did not appear to be related to occupant contact. A yellow mark was also located on the front passenger's air bag in the same location.

Figure 17: The Honda's left IC air bag and driver's seat-mounted side impact air bags

Figure 18: Right IC air bag and passenger seat-mounted side impact air bags

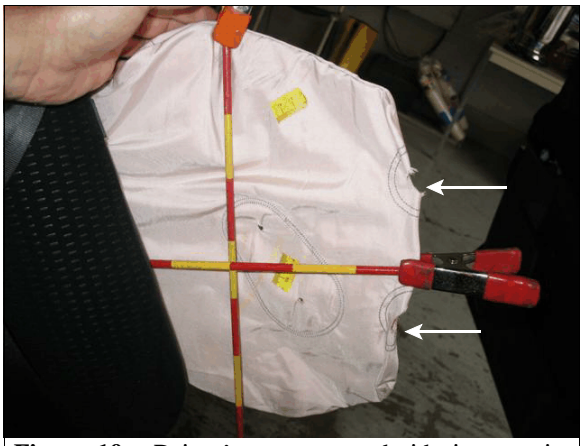


Figure 19: Driver's seat-mounted side impact air bag; arrows show vent ports

MANUAL RESTRAINT SYSTEM

The Honda was equipped with lap-and-shoulder safety belts for the driver and front passenger seating positions. The driver's safety 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 passenger safety belt consisted of continuous loop belt webbing, an ELR/Automatic Locking Retractor (ALR), sliding latch plate, and an adjustable upper anchor that was located in the full-down position. The driver and front right passenger safety belts were equipped with retractor-mounted and buckle-mounted pretensioners. The second row lap-and-shoulder safety belts were similar to the front passenger safety belt but had fixed upper anchors and were not equipped with pretensioners.

Inspection of the driver's safety belt assembly revealed that both the retractor-mounted and buckle-mounted pretensioners actuated in the crash. The retractor was jammed and a length of belt webbing was extended out of the retractor consistent with usage. The length of the belt webbing was 89 cm (35 in) from the stop button to the D-ring. The length of the buckle stalk was reduced 3 cm (1.2 in) due to actuation of the pretensioner. The latch plate showed historical usage scratches and slight load abrasions were present on the latch plate belt guide. There were minor abrasions on the belt webbing near the D-

ring. This evidence indicated that the driver was restrained by the lap-and-shoulder belt at the time of the crash.

Inspection of the front passenger's safety belt assembly revealed that both the retractor-mounted and buckle-mounted pretensioners actuated in the crash. The retractor was jammed and a length of belt webbing was extended out of the retractor consistent with usage. The length of the belt webbing was 94 cm (37 in) from the stop button to the D-ring. The length of the buckle stalk was reduced 5 cm (2 in) due to actuation of the pretensioner. The latch plate showed historical usage scratches and load abrasions were present on the latch plate belt guide. There were minor abrasions on the belt webbing near the D-ring. This evidence indicated that the front passenger was restrained by the lap-and-shoulder belt at the time of the crash. The remaining seat positions were unoccupied.

CASE VEHICLE DRIVER KINEMATICS

The driver of the Honda [17-year-old, female; 163 cm (64 in) and 59 kg (130 lb)] was seated in an unknown posture. At the time of the inspection, the seat track was adjusted 8 cm (3.1 in) rear of the forward position, which placed the seat track adjustment between the forward and middle positions. The seat back was slightly reclined and the head restraint was adjusted to the full-down position. The distance from the top of the seat back to the top of head restraint was 20 cm (7.9 in). The tilt steering column was located in the center position and the telescoping steering column was located between the middle and full-forward positions. The driver was not wearing glasses or contact lenses.

The initial impact to the Honda's left rear corner by the unidentified automobile was minor and probably had little affect on the driver. Occupant kinematic principles suggest the following scenario for the driver during the remainder of the crash sequence: As the vehicle rotated counterclockwise prior to the concrete median barrier impact, the driver was displaced to the right to some degree within the safety belt due to the vehicle's deceleration as it rotated. The front impact with the concrete median barrier displaced the driver forward and to the right opposite the 1 o'clock direction of force and she loaded the safety belt. While there was no discernable evidence of occupant contact on the driver's frontal air bag, it is probable that her face and chest loaded the air bag. The driver was redirected rearward into the seat back when the vehicle's back plane impacted the median barrier as it continued rotating counterclockwise. As the vehicle rolled over left side leading, the driver was displaced to the left and toward the roof and loaded the safety belt. While there was no discernable occupant contact evidence on the left IC air bag and seat-mounted side impact air bag, the driver probably loaded these air bags during the rollover. There was no discernable evidence to suggest that the driver contacted her head on the roof during the rollover. The driver remained restrained in her seat throughout the crash sequence and was able to exit the vehicle through the left front door following the crash.

CASE VEHICLE DRIVER INJURIES

The driver was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released. The driver received no follow-up treatment and

missed no work days due to the crash. The table below presents the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Abrasion, superficial, left lateral foot	minor 890202.1,2	Noncontact injury: flying glass, unknown source	Probable	Emergency room records
2	Contusions, small, not further specified	minor 990400.1,9	Unknown injury source	Unknown	Interviewee (relative)

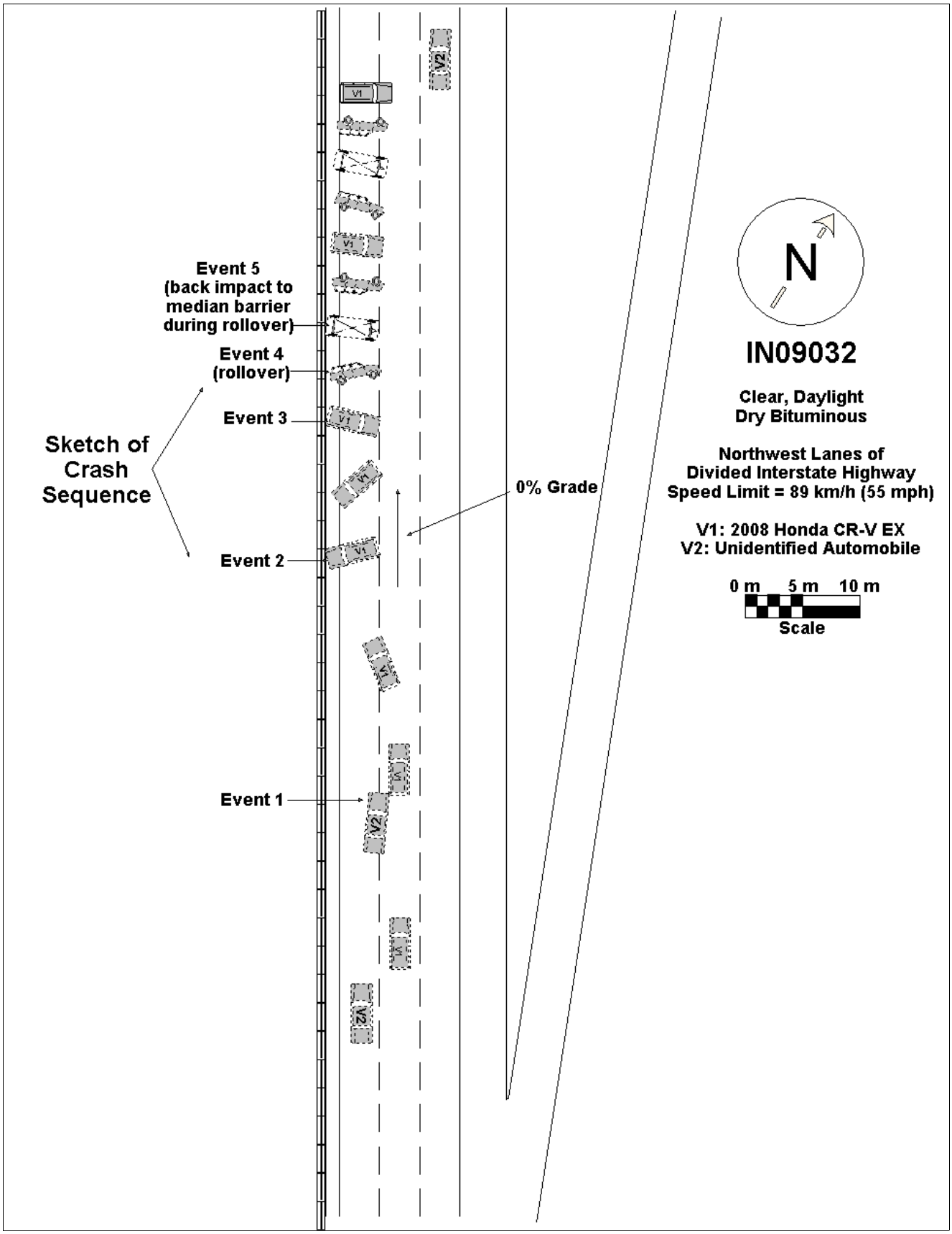
CASE VEHICLE FRONT ROW PASSENGER KINEMATICS

The Honda's front row passenger [17-year-old, female 163 cm (64 in) and 50 kg (110 lb)] was seated in an unknown posture. At the time of inspection, the seat track was adjusted to 16.5 cm (6.5 in) rear of the forward position, which placed the seat track adjustment between the middle and rear positions. The seat back was slightly reclined and the head restraint was adjusted to 2 cm (0.8 in) above the full-down position. The distance from the top of the seat back to the top of head restraint was 22 cm (8.7 in). The passenger was not wearing glasses or contact lenses.

The initial impact to the Honda's left rear corner by the unidentified automobile was minor and probably had little affect on the passenger. As the vehicle rotated counterclockwise prior to the concrete median barrier impact, the passenger was displaced to the right within the safety belt. It is possible that the right side of her body was displaced against the right front door due to the vehicle's deceleration as it rotated. The front impact with the concrete median barrier displaced the passenger forward and to the right opposite the 1 o'clock direction of force and she loaded the safety belt. While there was no discernable evidence of occupant contact on the passenger's frontal air bag, it is probable that her face and chest loaded the air bag. The occupant contact evidence located on the right instrument panel above the glove box suggests that the passenger's knees contacted this component during this impact. The passenger was redirected rearward into the seatback when the vehicle's back plane impacted the median barrier as it continued rotating counterclockwise. The passenger sustained a contusion and abrasions on the back, which was probably due to contact with the seat back. As the vehicle rolled over, left side leading, the passenger was displaced to the left and toward the roof and loaded the safety belt. While there was no discernable occupant contact evidence on the right IC air bag and seat-mounted side impact air bag, the passenger probably loaded these air bags during the rollover. The passenger sustained abrasions on the right shoulder and a laceration on the right elbow, which were probably due to flying glass particles. The passenger also sustained a contusion on the lateral right thigh, which was probably from contact to the right front door arm rest. There was no discernable evidence to suggest that the passenger contacted her head on the roof or right roof side rail during the rollover. The passenger remained restrained in her seat throughout the crash sequence and was able to exit the vehicle through the right front door following the crash.

The front passenger was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released. The passenger received no follow-up treatment and missed no work days due to the crash. The table below presents the passenger's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Abrasions, superficial, linear, upper central back	minor 690202.1,7	Seat back, front passenger's	Probable	Emergency room records
2	Contusion middle of back, not further specified	minor 690402.1,4	Seat back, front passenger's	Probable	Interviewee (friend)
3	Abrasions, significant, right shoulder, just below right pedicle distally; posterior shoulder (circular pattern); right posterior proximal humerus area	minor 790202.1,1	Noncontact injury: flying glass, unknown source	Probable	Emergency room records
4	Laceration right elbow not further specified	minor 790602.1,1	Noncontact injury: flying glass, unknown source	Probable	Interviewee (friend)
5	Contusion mid lateral right thigh with tenderness, not further specified	minor 890402.1,1	Right front door arm rest, forward upper quadrant	Probable	Emergency room records


Event 5
(back impact to
median barrier
during rollover)
Event 4
(rollover)
Event 3
Sketch of
Crash
Sequence
Event 2
Event 1
0% Grade
N
IN09032
Clear, Daylight
Dry Bituminous
Northwest Lanes of
Divided Interstate Highway
Speed Limit = 89 km/h (55 mph)
V1: 2008 Honda CR-V EX
V2: Unidentified Automobile
0 m 5 m 10 m
Scale