Office of Defects Seat Belt Investigation / Single Vehicle Rollover
Dynamic Science, Inc. / Case Number: DS02-001
2000 Honda CR-V LX 5-door
Louisiana
November, 2001

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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.

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15. Supplemental Notes

This single vehicle, rollover type crash, occurred in November, 2001 at 0045 hours on a two lane highway. The case vehicle, a 2000 Honda CR-V LX 5-door SUV that was driven by a driver reported restrained 34-year-old female, was traveling eastbound at a driver reported 97 km/h (60 mph). The front right seat of the case vehicle was occupied by a driver reported restrained 15-year-old male. The driver reported that a deer ran out onto the highway directly in front of the case vehicle. The driver indicated that she steered the vehicle to the right in order to avoid striking the deer. The vehicle entered the right shoulder area. She felt the rear wheels leaving the roadway and she steered back to the left. The vehicle went into a counterclockwise yaw leading with the right side. The vehicle began to rollover about its longitudinal axis four quarter turns and came to final rest on all four wheel on the westbound shoulder of the highway heading southeast. The vehicle was towed from the scene and declared a total loss by the insurance company. The driver indicated that during the rollover both frontal seat belts disengaged. She was thrown into the second seat area where she landed on her right shoulder on the second seat right floorboard area. The driver of the case vehicle stated that the front right occupant felt the seat belt release, and he fell forward striking the dashboard. The front right occupant helped pull out the driver. The driver of the case vehicle reported injuries consisting of a fractured right clavicle and ligament damage to her right shoulder. The driver was transported to a local hospital for treatment and then released. The front right occupant sustained lacerations to his hands from glass (post impact), and he complained of a sore neck. The front right occupant did not seek any medical treatment.

16. Abstract

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Seat belt buckle malfunction, injury, passenger,	

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Dynamic Science, Inc.
Accident Investigation
Case Number: DS02-001

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BACKGROUND:

Description:	This case was reported to the NHTSA by the driver of the case vehicle through the DOT Auto Safety Hotline. The Office of Defect Investigation (ODI) assigned the case to SCI. A Vehicle Owner's Questionnaire was received in December, 2001 and the driver of the case vehicle reported that both front seat belts disengaged during the rollover collision. DSI was assigned the case on January 4, 2002 and an on-site investigation was conducted and the field work was completed on January 16, 2002
Investigation Type:	On-scene
Crash Location:	Louisiana
Crash Date:	November, 2001
Notification Date:	January 04, 2002
Field Work Completed:	January 16, 2002

SUMMARY:

This single vehicle, rollover type crash, occurred in November, 2001 at 0045 hours on a two lane US highway in Louisiana. At the approximate area of impact, the highway is an undivided, two lane, two way, asphalt roadway with a rolling hills type grade. There were asphalt shoulders at both roadway edges, with dirt and wooded areas beyond the shoulder's edge. The roadway was dry and free of defects. It was dark and the roadway was not lighted. There were no traffic controls present and the speed limit is 89 km/h (55 mph).

Figure 1. Direction of travel (east) by case vehicle.

The case vehicle, a 2000 Honda CR-V LX 5-door SUV that was driven by a driver reported restrained 34-year-old female (165 cm/65 in, 63 kg/138 lbs), was traveling eastbound at a driver reported 97 km/h (60 mph). The front right seat of the case vehicle was occupied by a driver reported restrained 15-year-old male (163 cm/64 in, 75 kg/165 lbs).

The driver stated that a deer ran out onto the highway directly in front of the case vehicle; the police report only indicated that the driver had lost control of the vehicle. The driver indicated that she steered the vehicle to the right in order to avoid striking the deer. The vehicle entered the right shoulder area. She felt the rear wheels leaving the roadway and she counter steered back to the left. The vehicle went into a counterclockwise (CCW) yaw leading with the right side. At this point she recalled that the tires may have blown and the vehicle began to rollover on the

highway. The vehicle began to overturn (00TDDO2) about its longitudinal axis four quarter turns and came to final rest on its wheel on the westbound shoulder of the highway heading southeast. The police report indicates that the case vehicle laid down approximately 14.3 meters (47 ft.) of centrifugal type skidmarks with all four wheels after the vehicle rolled over and headed towards final rest.

The driver indicated that during the rollover both frontal seat belts disengaged. She was thrown into the second seat area where she landed on her right shoulder on the second seat right floorboard area. The driver of the case vehicle stated that the front right occupant felt the seat belt release, and he fell forward striking the dashboard. The front right occupant was then able to hold himself in place by pushing with both of his hands against the dashboard. The front right occupant assisted the driver from the vehicle.

Figure 2. Exterior damage to case vehicle-right side.

The case vehicle sustained rollover (00TDDO2) type damage about the entire vehicle. There was scratching on the top of the vehicle that extended from the hood to the rear of the vehicle. There was scratching to the left and right top rails and along both sides. The rear right, left rear side windows and backlight disintegrated. Both front right and rear right tires had deflated and there was scratching to the rims. The windshield and the roof header intruded into the driver's compartment area. The vehicle was towed from the scene and declared a total loss by the insurance company. The rollover collision was beyond the scope of the WinSmash reconstruction algorithm to produce delta V results.

The driver of the case vehicle reported injuries consisting of a fractured right clavicle and ligament damage to her right shoulder. The driver was transported to a local hospital for treatment and then released. The front right occupant sustained lacerations to his hands from glass (post impact), and he complained of a sore neck. The front right occupant did not seek any medical treatment.

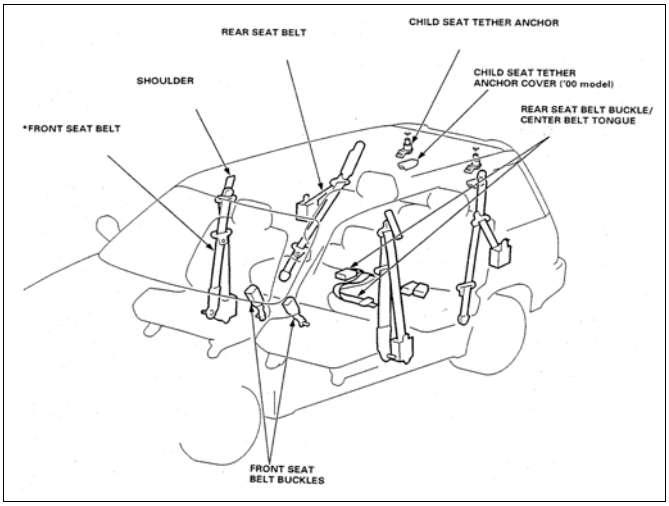

Figure 3. Seat belt and buckle locations.

Both outboard front seating positions of the case vehicle were equipped with 3-point continuous loop manual seat belts with Automatic Tensioning System (tensioners) within the retractors mounted on the lower B pillars. The vehicle was also equipped with redesigned driver's and front right passenger's airbags. The airbags were located in the steering hub and the top aspect of the front right

instrument panel, respectively. According to Honda, the Automatic Tensioning System (tensioners) within the front seat belts are integrated with the deployment of the front airbags. The Automatic Tensioning System (tensioners) will deploy only when the front airbags deploy. The airbags in this crash did not deploy. The Automatic Tensioning System (tensioner) did not deploy in either front seat position.

The metal tongue portion of the sliding latch belt assembly for both the driver and front right occupant had scratching from normal use. There was evidence of historical use on both the driver and front right seat belt latches, but there was no evidence of loading. The seat belts pass through slots on the latches and both the driver and front right occupant latches were slightly abraded from normal use. The front right occupant's latch had a "nick" on the top right corner. Evidence of seat belt loading as a result of rollover type forces in this crash was not expected, nor found. The driver's retractor was an Emergency Locking Retractor (ELR) and the front right occupant's was a switchable type retractor from ELR to ALR mode. The driver and front right occupant buckle assembly was mounted on the inboard sides of both front seats. There were no visual indications of failure to either seat belt buckle. The metal tongues were latched and locked into both of the seat buckles. Both belts were pulled forcefully and both remained latched and locked.

It is not known what caused both of the front buckles to unlock and release the metal seat belt latch. Visually, there did not appear to be anything abnormal about the seat belt latches or buckles, and there was no indications of failure.

The driver's and front right occupant's lap and shoulder belts were removed from the vehicle, as were both front seat belt buckles. They were shipped to ODI shortly after the inspection of the case vehicle.

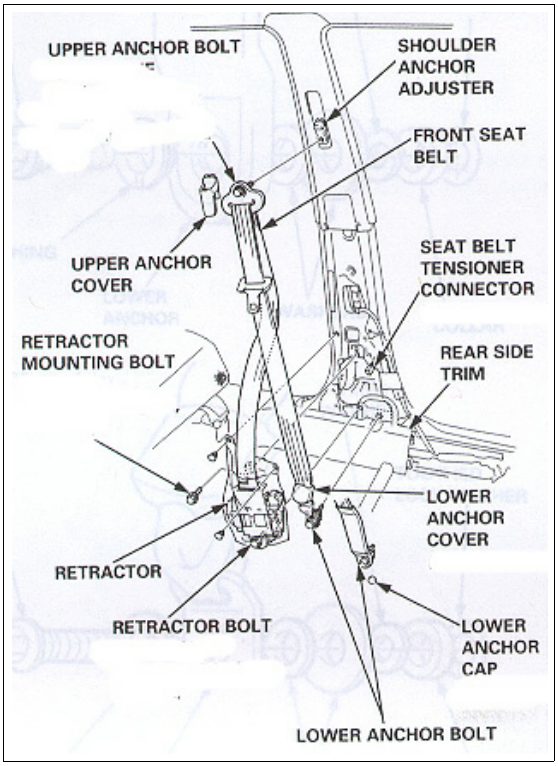

Figure 4. Front seat belt components.

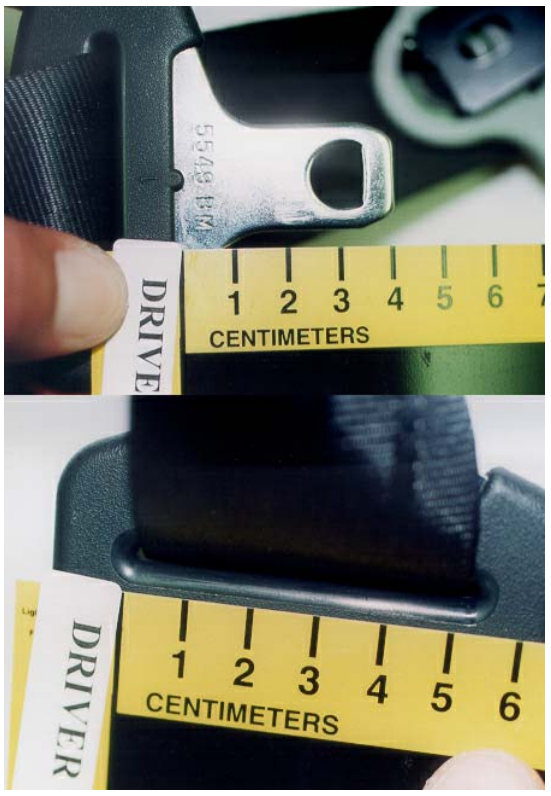

Figure 5. Driver's seat belt latch.

Figure 6. Front right seat belt latch.

Figure 7. Front right occupant's seat belt latch.

SCENE DIAGRAM

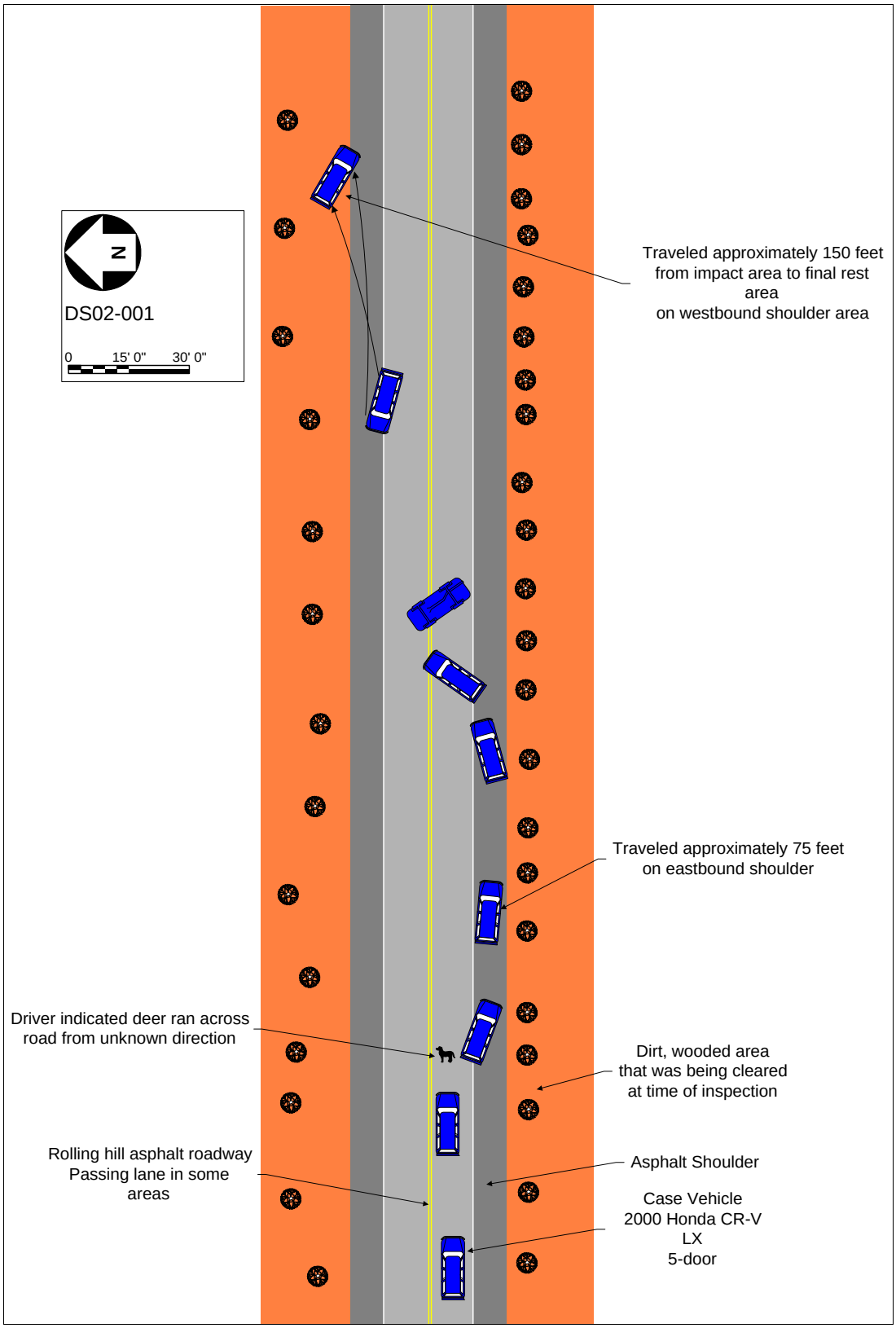

Figure 8. Scene diagram

DETAILED INFORMATION

Vehicles

Case vehicle

Description:	2000 Honda CR-V LX 5-door SUV	
VIN:	JHLRD2849YCXXXXXX	
Odometer:	41,658 km (25,885 miles)	
Engine:	2.0 L V4	
Reported Defects:	Driver's and front right occupant's seat belt buckles released seat belt latches	
Cargo:	None	
Damage Description:	Moderate sheet metal damage extended from the hood rearward to the back of the vehicle. Both rear side windows and backlight disintegrated. The roof and left windshield header corner intruded into the driver's compartment area. Rollover scratching was present on both top side rails and both sides. Vehicle towed due to damage. Declared a total loss by insurance company.	
CDC:	00TDDO2	
Delta V:	Total	N/A
	Longitudinal	N/A
	Latitudinal	N/A
	Energy	Unknown

Figure 9. Exterior damage to case vehicle-left side.

Occupants

Case vehicle	Occupant 1	Occupant 2
Age/Sex:	34/Female	15/Male
Seated Position:	Front left	Front Right
Seat Type:	Fabric covered bucket seat, seat adjusted to the middle track position. Seat back slightly reclined.	Fabric covered bucket seat, seat adjusted to between the middle and rear most track position. Seat back reclined.
Height:	165 cm (65 in.)	163 cm (64 in.)
Weight:	63 kg (138 lbs)	75 kg (165 lbs)
Occupation:	Unknown	N/A
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	None
Driving Experience:	Presumed ≈15 years	N/A
Body Posture:	Normal, upright	Normal, upright
Hand Position:	Both hands on steering wheel at 10 and 2 o'clock positions	Unknown
Foot Position:	Right foot on accelerator, left on floor	Unknown
Restraint Usage:	3-point continuous loop lap and shoulder belt with sliding latch, used in crash	3-point continuous loop lap and shoulder belt with sliding latch, used in crash
Air bag:	Steering hub mounted air bag, did not deploy	Top mounted in instrument panel, did not deploy

Injuries and Injury Mechanisms

Case vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Fractured right clavicle	752200.2, 1	810.00	Second right seat floor
	Ligament injury to right shoulder	715099.7, 1	959.2	Second right seat floor
Front right occupant:	Lacerations to his hands, post impact. Complained of sore neck. **Non-codeable** injuries.			

Occupant Kinematics

The 34-year-old driver of the case vehicle was seated in a normal, upright fashion with both of her hands on the steering wheel. The driver indicated that she was wearing the available 3-point continuous loop manual lap and shoulder belt. The shoulder belt upper anchorage adjustment was in the full up position. The front left fabric covered bucket seat was adjusted to the middle track position, and the seatback was slightly reclined rearward. The driver's head restraint was found on the front right occupant's seat cushion. It is not known what caused the head restraint to come out of the seatback. There is no direct evidence to refute or substantiate that the driver was wearing the seat belt. There is evidence of historical use on both the driver and front right seat belt latches, but there is no evidence of loading. One possible scenario is that the driver was not wearing the lap and shoulder belt. The front right occupant was wearing the lap and shoulder belt. As the case vehicle began to rollover to the right about its longitudinal axis, the driver was displaced laterally to the right and loaded the seat belt. It is at this point that if the seat belt was latched, the inertial forces released the metal latch from seat belt buckle. The driver kept moving laterally to the right, came out of her seat and struck the left side of the front right seatback. The swing down arm rest on the left side of the front right seatback was torn away. It is possible that some part of the driver struck the front right occupant's seat belt buckle and released the seatbelt latch. The case vehicle continued rolling over onto its top and then onto its four wheels. The driver was thrown rearward. Her legs struck the left instrument panel deforming it. Her legs probably struck the left sunvisor and the rear view mirror knocking both off. She also struck the the center instrument panel. She came to final rest on the floor of the 2nd rear bench seat between the driver's and front right occupant's seats. She sustained a fractured right clavicle and an unknown ligament injury to her right shoulder. She was transported to a hospital, received medical treatment and was released.

Figure 10. Front right seat, note front right seat arm rest.

Figure 11. Driver's sunvisor and the rear view mirror knocked off.

Figure 12. Damaged left and center instrument panel.

The 15-year-old front right occupant was seated in a normal, upright position with both of his feet resting on the floor. The driver indicated that he was wearing 3-point continuous loop manual lap and shoulder belt. The shoulder belt upper anchorage adjustment was in the up

position. The front right fabric covered bucket seat was adjusted to between the middle and rear most track position. The seatback was reclined rearward. There is no direct evidence to refute or substantiate that the front right occupant was wearing the seat belt. The case vehicle began to rollover onto its right side about its longitudinal axis. The swing down arm rest in the left side of the front right seatback was torn away by driver loading. As indicated earlier, it is possible that some part of the driver struck the front right occupant's seat belt buckle and caused the seatbelt latch to release the seat belt buckle. As the case vehicle rolled over four quarter turns and back onto its four wheels, the front right occupant was able to hold himself in the front right seat in a seated position. At final rest, he assisted the driver out of the vehicle and sustained lacerations (post impact) from broken glass inside the vehicle. He did not seek medical treatment.