Electronic Stability Control and Knee Air Bag Investigation/Vehicle to Vehicle
Dynamic Science, Inc./Case Number: DS06005
2005 Lexus RX330
California
December 2005

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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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16. Abstract

This on-site investigation focused on the Electronic Stability Control feature and driver knee air bag in a 2005 Lexus RX330. This two vehicle crash occurred in December 2005 at 1220 hours in an urban area of California. The crash occurred on a divided state freeway with four eastbound travel lanes. The case vehicle is a 2005 Lexus RX330 being driven by an unrestrained 50-year-old female. According to the police report, there were seven additional passengers in the Lexus.. The Lexus RX330 was traveling east in lane one of four. The other vehicle was a 1998 Dodge Ram pickup being driven by a 37-year-old female. The Dodge Ram was traveling east in the right lane, ahead of the case vehicle. According to the police report, the driver of the Lexus had missed her freeway exit and was distracted while she tried to figure out where she was. When she refocused her attention on traffic ahead of her, she realized that traffic had slowed and she was only one to two car lengths behind the Dodge Ram. The driver of the Lexus braked but the front of the case vehicle struck the back of the Dodge Ram. The impact resulted in the deployment of the driver's front and knee air bags. During this impact, the case vehicle underrode the Dodge Ram and as the Lexus continued moving forward, the Dodge Ram rotated clockwise. The right front door hinge area of the Lexus snagged on the Dodge Ram's left rear bumper corner. When the case vehicle snagged, it began to rotate counterclockwise, traveled off the freeway lanes and onto the south shoulder. The back left of the Lexus impacted the guardrail before it came to final rest on the south shoulder, facing an unknown direction. The Dodge Ram came to final rest still on the freeway, facing southeast. According to the police report, the only injury in the case vehicle was a complaint of "pain in (the) face" by the 7-year-old male passenger. Medical aid was declined.

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BACKGROUND

Description

This on-site investigation focused on the Electronic Stability Control feature and driver knee air bag in a 2005 Lexus RX330.

Figure 1. Front right, 2005 Lexus RX330

This crash was identified within a group of potential cases provided by DSI personnel to the NHTSA on January 30, 2006. On February 2, 2006, NHTSA requested that this vehicle be inspected but only if the Electronic Data Recorder (EDR) could be removed. On February 6, 2006, DSI secured permission to inspect the vehicle and remove the EDR. A police report was obtained on February 8, 2006. The vehicle was inspected on February 14, 2006 and the EDR was successfully harvested. NHTSA was notified of the EDR retrieval and assigned the case to DSI on February 15, 2006. Field work was completed on February 15, 2006. On February 17, 2006, the EDR was shipped to the NHTSA so that is could be sent to the vehicle manufacturer for download. A prototype readout tool report was received on October 6, 2006 and is included as Attachment 2 to this report.

This two vehicle crash occurred in December 2005 at 1220 hours in an urban area of California. The crash occurred on a divided state freeway with four eastbound travel lanes. The case vehicle is a 2005 Lexus RX330 being driven by an unrestrained 50-year-old female. According to the police report, there were seven additional passengers in the Lexus. The vehicle is configured to safely carry a total of five occupants.

The Lexus RX330 was traveling east in lane one of four. The other vehicle was a 1998 Dodge Ram pickup being driven by a 37-year-old female. There were no other occupants in the pickup. The Dodge Ram was traveling east in the right lane, ahead of the case vehicle.

According to the police report, the driver of the Lexus had missed her freeway exit and was distracted while she tried to figure out where she was. When she refocused her attention on traffic ahead of her, she realized that traffic had slowed and she was only one to two car lengths behind the Dodge Ram.

The driver of the Lexus braked but the front of the case vehicle struck the back of the Dodge Ram. The impact resulted in the deployment of the driver's front and knee air bags. During this impact, the case vehicle underrode the Dodge Ram and as the Lexus continued moving forward, the Dodge Ram rotated clockwise. The right front door hinge area of the Lexus snagged on the Dodge Ram's left rear bumper corner. When the case vehicle snagged, it began to rotate

counterclockwise, traveled off the freeway lanes and onto the south shoulder. The back left of the Lexus impacted the guardrail before it came to final rest on the south shoulder, facing an unknown direction. The Dodge Ram came to final rest still on the freeway, facing southeast.

According to the police report, the only injury in the case vehicle was a complaint of "pain in (the) face" by the 7-year-old male passenger. Medical aid was declined.

SUMMARY

Crash Site

This crash occurred on a divided state freeway with four eastbound travel lanes. There are concrete shoulders on both sides of the eastbound lanes, with a concrete traffic barrier adjacent to the north shoulder. Adjacent to the south shoulder, there is a guardrail which leads to a brick wall with a concrete base. Just east of the impact location, the freeway ends and the two right eastbound lanes split from the two left eastbound lanes. In the area where the crash occurred, vehicles in the right lane must exit to the right.

It was daylight and the concrete travel lanes were dry and level. There were no visual obstructions present that would have played a factor in this collision. The posted speed limit on this section of freeway is 105 km/h (65 mph).

Pre-Crash

The case vehicle is a 2005 Lexus RX330 being driven by an unrestrained 50-year-old female. According to the police report, there were seven additional occupants in the Lexus. The vehicle is configured to safely carry a total of five passengers. Per the police report, there was a 12-year-old male in the front row center position, but there is no seat available in this location. Also per the police report, there was a 32-year-old male in the front right seat, a 19-year-old male in the second row left seat, a 7-year-old male and a 2-year-old male in the second row center seat, and a 26-year-old male and a 5-year-old male in the second row right seat. Per the information contained on the police report, all of the occupants except for the 7 and 5-year-old male passengers were restrained with lap and shoulder belts.

Figure 2. Approach of both vehicles to crash location - east

The Lexus RX330 was traveling east in lane one of four at an EDR reported speed 88.0 km/h (54.7 mph) approximately 5 seconds prior to impact. The other vehicle was a 1998 Dodge Ram pickup being driven by a 37-year-old female. The pickup was traveling east in the right lane, ahead of the case vehicle. According to the police report, the driver of the Lexus had missed her freeway exit and was "looking at signs trying to determine where she was". When she refocused her attention on traffic ahead of her, she realized that traffic had slowed and she was only one to two car lengths behind the Dodge Ram.

Crash

The driver of the case vehicle braked but could not stop in time and the front of the Lexus (12FZAE6) struck the back of the Dodge Ram. The series of the Dodge Ram is unknown and a Winsmash missing vehicle routine could not be run. The barrier equivalent routine of the WinSmash program computed a total delta V of 51.0 km/h (31.6 mph).

Based on the damage to the case vehicle, it is likely that the driver steered to her left in an attempt to avoid striking the pickup. The impact severity was moderate and resulted in the deployment of the driver's front and knee air bags. The EDR reported longitudinal delta V was 34.7 km/h (21.6 mph), 150 milliseconds into the crash. During this impact, the case vehicle underrode the Dodge Ram and as the Lexus continued moving forward, the Dodge Ram rotated clockwise. The right front door hinge area of the Lexus snagged on the Dodge Ram's left rear bumper corner. When the case vehicle snagged, it began to rotate counterclockwise, traveled off the freeway lanes and onto the south shoulder. The back left of the Lexus impacted the guardrail (05BLEE2), causing light damage. The barrier equivalent routine of the WinSmash program computed a total delta V of 8.0 km/h (5.0 mph).

The Lexus came to final rest on the south shoulder, facing an unknown direction. The Dodge Ram came to final rest still on the freeway, facing southeast.

Figure 3. Guardrail struck by case vehicle - 2nd event (east)

Post-Crash

According to the police report, the only injury in the case vehicle was a complaint of "pain in (the) face" by the 7-year-old male passenger. Medical aid was declined.

Both vehicles were towed from the scene. The Lexus RX330 was later declared a total loss.

Vehicle Data - 2005 Lexus RX330

The 2005 Lexus RX330 was identified by the Vehicle Identification Number (VIN): JTJHA31U750xxxxxx. The Lexus RX330 is a four-door hatchback, all wheel drive, sport utility vehicle with seating for five. It was equipped with a 3.3 liter 6-cylinder engine, 5 speed automatic transmission with a "Snow Mode" switch, Vehicle Stability Control (VSC), an anti-lock brake system with Electronic Brakeforce Distribution and Brake Assist, front and rear disc brakes, tilt/telescoping steering wheel, and the optional Navigation System Package. The Navigation System comes with Bluetooth/voice-activation/compass and a rear back-up camera. The vehicle mileage could not be obtained from the digital odometer because the vehicle had no power.

The Lexus was equipped with advanced occupant protection systems including dual stage Certified Advanced 208-Compliant driver and front right passenger air bags with a front passenger occupant classification system and driver and front right passenger seat belt buckle switches. The front passenger occupant classification system is explained in more detail in the Supplemental Restraints section of this report. The vehicle was also equipped with a driver knee air bag, front row driver and passenger seat mounted side air bags, and dual front seat belt pretensioners with load limiters. The Lexus also comes equipped with front and rear side curtains that are designed to deploy during a rollover event or a "severe" side impact.

The 2005 Lexus RX330 was equipped with Michelin Energy MXV4 P235/55R18 tires. This vehicle comes equipped with a tire pressure monitoring system that alerts the driver when the tire pressure is "critically low" (not defined). A warning light on the left instrument panel illuminates when this condition occurs. The manufacturer's recommended cold tire pressure for the front and rear tires was 207 kPa (30 psi). The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	200 kPa (29 psi)	6 mm (8/32 in)	No	None
LR	193 kPa (28 psi)	6 mm (8/32 in)	No	None
RR	179 kPa (26 psi)	6 mm (8/32 in)	No	None
RF	186 kPa (27 psi)	6 mm (8/32 in)	Yes	None

The front row seating in the Lexus RX330 was configured with dual leather bucket seats. The seats were equipped with adjustable head restraints that were not damaged. The second row was

configured as a leather 40/20/40 split bench seat with folding backs. All three second row seating positions were equipped with adjustable head restraints that were not damaged.

Vehicle Damage

Exterior Damage - 2005 Lexus RX330

The 2005 Lexus RX330 sustained moderate front end damage as a result of the impact with the Dodge Ram. The case vehicle sustained 38.0 cm (15.0 in) of direct damage along the front bumper beginning 24.0 cm (9.4 in) right of the precrash center point of the vehicle, extending to the right. The direct damage extended down the right side of the vehicle to the right front door panel. The right front fender was peeled back and the right front door was damaged near the hinges. The hinges showed slight signs of stress but there was no hinge failure and the right front door remained closed and operational. There was direct damage to the right A pillar, above the belt line. There were additional direct damage scrapes on the right rear wheel lip that may be attributed to this crash event. The case vehicle underrode the Dodge Ram's rear bumper and it appeared that there was greater than 13.0 cm (5.1 in) of above bumper crush differential in the C4, C5 and C6 locations. Accurate above bumper measurements were not able to be obtained due to the damage. The plastic bumper cover was no longer with the vehicle. In order to calculate and report the correct amount of bumper crush, an exemplar vehicle was measured for freespace. Six crush measurements were documented along the front bumper as follows: C1=0.0 cm (0.0 in), C2=0.0 cm (0.0 in), C3= 0.0 cm (0.0 in), C4=1.0 cm (0.4 in), C5=1.0 cm (0.4 in), C6=5.0 cm (2.0 in). The location of maximum crush was C6, the right front bumper corner.

The Lexus sustained light back end damage as a result of the impact with the guardrail. The vehicle sustained 25.0 cm (9.8 in) of direct damage along the back bumper, beginning 60.0 cm (23.6 in) left of the precrash center point of the vehicle, extending to the left. There was minimal crush but the direct damage from this event extended 51.0 cm (20.1 in) forward of the rear stringline. Six crush measurements were documented along the back bumper as follows: C1=8.0 cm (3.1 in), C2=4.0 cm (1.6 in), C3=1.0 cm (0.4 in), C4=0.0 cm (0.0 in), C5=0.0 cm (0.0 in), C6=0.0 cm (0.0 in). The location of maximum crush was C1, the left rear bumper corner.

Figure 4. Front - 2005 Lexus RX330

Figure 5. Damage to right front - 2005 Lexus RX330

CDC (Impact 1): (Impact 2):	12FZAE6 05BLEE2	
Delta V (Impact 1)[1]:	Barrier Equivalent speed	51.0 km/h (31.6 mph
Delta V (Impact 2):	Total	8.0 km/h (5.0 mph)
	Longitudinal	7.5 km/h (4.7 mph)
	Latitudinal	-2.7 km/h (-1.7 mph)
	Barrier Equivalent Speed	7.7 km/h (4.8 mph)
	Energy	10,932 joules (8,063 ft lbs)

Figure 6. Back left damage - 2005 Lexus RX330

[1]Provided for informational purposes only. Insufficient information available on struck vehicle to compute a missing vehicle result.

Interior Damage - 2005 Lexus RX330

The 2005 Lexus RX330 sustained minor interior damage due to intrusion, occupant contacts and normal air bag deployment related damage.

Although the driver was unrestrained, the driver's retractor pretensioner actuated during the crash and was locked in place post-impact. There were lipstick and foundation make-up transfers found on the front of the driver air bag. There were small tears in the instrument panel cover, on the lower left side. There was a scuff on the lower right A pillar and the upper left C pillar. There was a slight oil transfer to the back of the driver's headrest. There were deep scuffs to the upper right B pillar and a scuff to the right C pillar. A red mark and a blue transfer were found on the back of the right front seat back. All of the above were likely due to occupant contact.

There was integrity loss to the left and right front side glazing; both disintegrated during the crash. The side doors and hatch all remained closed and operational.

The only intrusion was in the front right seating area. There was lateral intrusion of the A pillar and A pillar cover, lateral intrusion of the side panel (forward of the A pillar) and longitudinal windshield intrusion. The specific passenger compartment intrusions were documented as follows:

Row/Position	Intruded Component	Magnitude of Intrusion	Direction
1R	Windshield	17.0 cm (6.7 in)	Longitudinal
1R	Side panel forward of the A pillar	6.0 cm (2.4 in)	Lateral
1R	A pillar cover	5.0 cm (2.0 in)	Lateral
1R	A Pillar	1.0 cm (0.4 in)	Lateral

Figure 7. Intrusion of A pillar and A pillar cover

Manual Restraint Systems - 2005 Lexus RX330

The 2005 Lexus RX330 was configured with manual 3-point lap and shoulder belts for each of the five seating positions. Both front seat belts were equipped with B-pillar pretensioners with load limiters and seat belt height adjusters. The driver's pretensioner actuated during the crash, although the belt was not being worn at the time of the crash. The right front pretensioner did not actuate. The driver's seat belt height adjuster was in the full down position and the right front passenger's was full up. The driver's safety belt was configured with a sliding latch plate and an emergency locking retractor (ELR). The right front safety belt had a sliding latch plate and a switchable ELR/Automatic Locking Retractor. The second row seating positions were not equipped with seat belt anchorage adjustments. All three safety belts had sliding latch plates and switchable retractors.

The second row outboard seating positions were equipped with the lower anchor points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. All three seating positions were also equipped with child safety seat top tether anchor points, located on the second row seat backs.

Supplemental Restraint System - 2005 Lexus RX330

The case vehicle was equipped with advanced occupant protection systems. The systems consist of dual stage Certified Advanced 208-Compliant (CAC) driver and front right passenger air bags with a front passenger occupant classification system and driver and front right passenger seat belt buckle switches. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The front passenger occupant classification system detects conditions present in the front right seat and based on those conditions, activates or deactivates the air bags. This system monitors the weight and load on the front right seat and the passenger seat belt buckle switch in order to determine the conditions. The conditions detected by the system are as follows:

1. Adult
2. Child or child restraint system
3. Unoccupied
4. System malfunction.

There is a passenger "Airbag On" and "Airbag Off" indicator light located in the center instrument panel. Approximately two seconds after the vehicle is started, the passenger occupant classification system will begin operating and judges whether or not to turn the indicator light on or off.

The vehicle was also equipped with a driver knee air bag, front row driver and passenger seat mounted side air bags, and dual front seat belt B pillar pretensioners with load limiters. The Lexus RX330 also comes equipped with front and rear side curtains that are designed to deploy during a rollover event or a "severe" side impact. Information on these systems and how they function during a crash event is collected by the vehicle's Electronic Data Recorder (EDR). The case vehicle's EDR was removed from the vehicle with permission and shipped to the manufacturer to be downloaded. A prototype readout tool report was received on October 6, 2006 and is included as Attachment 2 to this report.

The prototype readout tool report indicated that:

- Deployment time = 24 ms
- Deployment stage driver = Hi
- Deployment stage passenger = Not fired
- Belt switch status driver = Belted
- Belt switch status passenger = Un Belted
- Occupant detection passenger = No level
- Event counter = 1 count
- Writing flag = Finished writing
- Vehicle speed was 88.0 km/h (54.7 mph) five seconds before impact and decelerated to 84.0 km/h (52.2 mph) at 0.4 seconds before impact.
- The brake switch status was OFF from 5 through 0.4 seconds before impact.

Figure 8. Driver's front air bag

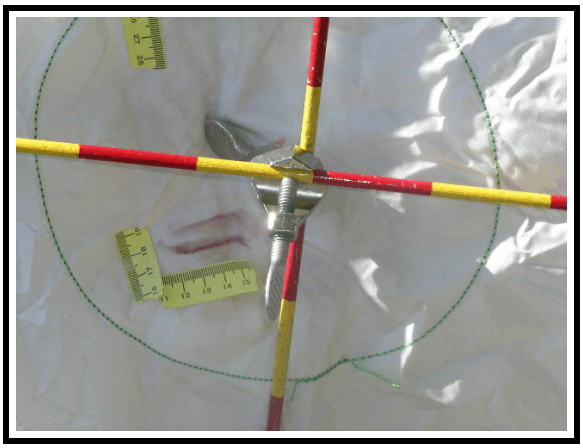


Figure 9. Lipstick and foundation transfers to driver air bag

As a result of the longitudinal deceleration that occurred during the collision with the Dodge Ram, the driver's front and knee air bags deployed and the seat belt pretensioner actuated. The front right passenger's front air bag did not deploy and the seat belt pretensioner did not actuate .

The driver's air bag was mounted in the center of the steering wheel hub. The air bag module had a Y configuration. The lower left and right cover flap measurements were as follows: the outer flap edge heights were 5.0 cm (2.0 in), the inner flap edge heights were 6.0 cm (2.4 in), the upper flap edges were 7.0 cm (2.8 in) and the lower flap edges were 5.0 (2.0 in). The top cover flap was fairly rectangular in shape and measured 9.0 cm (3.5 in) along the upper edge, 13.0 cm (5.1 in) along the lower edge and 7.0 cm (2.8 in) along both sides. The air bag was circular in shape and measured 60.0 cm (23.6 in) high/wide in its deflated state. The maximum excursion measured 33.0 cm (13.0 in) from the module face. The longitudinal distance between the module face and the front left seat back was 60.0 cm (23.6 in). The air bag had one internal tether and two vent ports on the back of the bag at the 10 and 2 o'clock positions. The vent ports consisted of narrow slits in the air bag material. Driver contact evidence was found on the front of the deployed air bag. Lipstick and tan makeup foundation transfers were found near the left center of the air bag. There were very small purplish dots scattered on the top left section; the source of these discolorations are unknown. Black cover flap streaks were located on the lower left side of the bag. The back of the deployed air bag had a few cover flap streaks, but was not damaged and showed no sign of occupant contact.

The driver's knee air bag was mounted below the steering column. The air bag module had an H configuration. The top and bottom flaps were 26.0 cm (10.2 in) wide. The height of the top flap was 4.0 cm (1.6 in) and the height of the bottom flap was 5.0 cm (2.0 in). The air bag was semicircular in shape and measured 63.0 cm (24.8 in) wide by 34.0 cm (13.4 in) high (in the center). There was a piece of fabric made of the same material as the air bag that was sewn onto the lower right section of the bag and measured 19.0 cm (7.5 in) wide by 31.0 cm (12.2 in) high. The knee air bag did not have tethers or vent ports. There was no damage and no visible occupant contact evidence found on the knee air bag and cover flaps, but there were coffee splatter stains all over the deployed bag.

The front right passenger air bag was a mid instrument mount. The air bag did not deploy.

The case vehicle was also equipped with dual front row side air bags and side curtains for both seating rows. Neither the side air bags nor the side curtains deployed during the crash events.

Figure 10. Driver's knee air bag

Vehicle Data - 1998 Dodge Ram pickup

Description:	1998 Dodge Ram pickup (series unknown)	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	Unknown	
Reported Defects:	None	
Cargo:	Unknown	
Damage Description:	“Moderate” back left damage per the police report	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Occupant Demographics - 2005 Lexus RX330

	Driver	Occupant 2	Occupant 3	Occupant 4
Age/Sex:	50/Female	32/Male	12/Male	19/Male
Seated Position:	Front left	Front right	Front right - believed to be sitting on the lap of Occupant 2	Second left
Seat Type:	Leather covered bucket seat	Leather covered bucket seat	Leather covered bucket seat	Leather covered 40/20/40 split bench with folding backs
Height:	155 cm (61 in)	Unknown	Unknown	Unknown
Weight:	45 kg (100 lb)	Unknown	Unknown	Unknown
Occupation:	Unknown	Not Applicable	Not Applicable	Not Applicable
Pre-existing Medical Condition:	None noted	None noted	None noted	None noted
Alcohol/Drug Involvement:	None	Not Applicable	Not Applicable	Not Applicable
Driving Experience:	Unknown	Not Applicable	Not Applicable	Not Applicable
Body Posture:	Presumed to be upright, forward facing	Unknown	Unknown	Unknown
Hand Position:	Presumed to be on the steering wheel, actively steering	Unknown	Unknown	Unknown
Foot Position:	Presumed to on the foot controls and/or floorboards	Unknown	Unknown	Unknown
Restraint Usage:	None	None	None	None

Air bag:	Front air bag available - deployed. Knee air bag available - deployed. Seat back mounted side air bag available - nondeployed. Side curtain available - nondeployed.	Front air bag available - nondeployed. Seat back mounted side air bag available - nondeployed. Side curtain available - nondeployed.	Front air bag available - nondeployed. Seat back mounted side air bag available - nondeployed. Side curtain available - nondeployed.	Side curtain available - nondeployed.

	Occupant 5	Occupant 6	Occupant 7	Occupant 8
Age/Sex:	7/Male	2/Male	26/Male	5/Male
Seated Position:	Second row center	Second row center - believed to be sitting on the lap of Occupant 5	Second row right	Second row right - believed to be sitting on the lap of Occupant 7
Seat Type:	Leather covered 40/20/40 split bench with folding backs	Leather covered 40/20/40 split bench with folding backs	Leather covered 40/20/40 split bench with folding backs	Leather covered 40/20/40 split bench with folding backs
Height:	Unknown	Unknown	Unknown	Unknown
Weight:	Unknown	Unknown	Unknown	Unknown
Occupation:	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Pre-existing Medical Condition:	None noted	None noted	None noted	None noted
Alcohol/Drug Involvement:	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Driving Experience:	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Body Posture:	Unknown	Unknown	Unknown	Unknown
Hand Position:	Unknown	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown	Unknown
Restraint Usage:	None	None	None	None
Air bag:	None	None	Side curtain available - nondeployed.	Side curtain available - nondeployed.

Occupant Demographics - 1998 Dodge Ram

	Driver
Age/Sex:	37/Female
Seated Position:	Front left
Seat Type:	Unknown
Height:	152 cm (60 in)
Weight:	73 kg (160 lb)
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Presumed to be upright, forward facing
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt used per the police report

Occupant Injuries - 2005 Lexus RX330

Driver: Not injured per the police report.

Front Right Occupant: Not injured per the police report.

Other Front Right Occupant: Not injured per the police report.

Second Row Left Occupant: Not injured per the police report.

Second Row Center Occupant: Per the police report, this occupant complained of “pain in face”. Medical aid was declined.

Other Second Row Center Occupant: Not injured per the police report.

Second Row Right Occupant: Not injured per the police report.

Other Second Row Right Occupant: Not injured per the police report.

Occupant Injuries - 1998 Dodge Ram

Driver: Not injured per the police report.

Occupant Kinematics - 2005 Lexus RX330

Driver Kinematics

The 50-year-old female driver appears to have been seated in an upright posture in the leather covered bucket seat and was not restrained by the available 3-point manual lap and shoulder belt. The shoulder belt anchorage was in the full down position. The seat was adjusted to between the center and forward most track position. The seat back was reclined at a 100 degree angle and the seat bottom had a 9 degree angle. During the initial impact, the driver's front and knee air bags deployed and the left front seat belt pretensioner actuated, although the belt was not being worn during the crash. The female driver initiated a forward trajectory towards the 12 o'clock direction of force. She engaged the deployed front air bag with her face, leaving make-up transfers on the front of the bag. Her right hand may have been forced off the steering wheel due to the deploying air bag and may have contacted the rearview mirror, moving it out of position. Her knees and lower legs likely contacted the deployed knee air bag, but no evidence of occupant contact was found. It is possible that the driver's left knee may have also impacted the lower left instrument panel, damaging a small section of the material covering the panel.

The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing the driver to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing the driver to move rearward and slightly lateral towards the 5 o'clock direction of force. According to the police report, the driver was not injured in the collision.

Figure 11. Possible occupant contact points - lower left instrument panel

Front Right Occupant Kinematics

The 32-year-old front right male passenger was seated forward facing in the leather covered bucket seat and was not wearing the available 3-point manual lap and shoulder belt. The shoulder belt anchorage adjustment was in the full down position. The seat was adjusted between the center and forward most track position. The seat back was reclined at a 112 degree angle and the seat bottom had an 11 degree angle. It is believed that there was a 12-year-old male sitting on this occupant's lap.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force. The right front passenger air bag did not deploy. This vehicle is equipped with a front passenger occupant classification system which may have turned off the passenger air bag. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the case vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant was not injured in the collision.

There was a slight scuff to the base of the A pillar that may have been due to contact from this occupant or possibly the occupant seated on his lap.

Figure 12. Scuff to right A pillar - possible occupant contact

Other Front Row Right Occupant

According to the police report, this 12-year-old male passenger was seated in the front center position. The vehicle has a center console in this location, but no actual seat or seat belt. It is possible that this passenger was sitting on the console, but due to the extremely short distance between the console and instrument panel, it is highly likely that he would have had to sit sideways, facing the right side of the vehicle. It is possible that this occupant was seated forward facing on the lap of the right front 32-year-old passenger. This occupant was not restrained. The front right seat was adjusted between the center and forward most track position. The seat back was reclined at a 112 degree angle and the seat bottom had an 11 degree angle.

At impact, the 12-year-old passenger initiated a forward trajectory towards the 12 o'clock direction of force. The front passenger air bag did not deploy. This vehicle is equipped with a front passenger occupant classification system which may have turned off the passenger air bag. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward.

The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant was not injured in the collision.

There was a slight scuff to the base of the A pillar that may have been due to contact from this occupant or possibly from the 32-year-old occupant who's lap he may have been sitting on.

Second Row Left Occupant Kinematics

The 19-year-old second row left male passenger was seated forward facing in the leather covered split bench seat with folding backs and was not restrained by the available 3-point manual lap and shoulder belt. The seat was adjusted to the rearmost track position. The seat back was reclined at a 106 degree angle and the seat bottom had a 10 degree angle.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant was not injured in the collision.

There were two possible occupant contact points found in this passenger's general seating area, but it is not known who caused one of the contacts. It is likely that the scuff found on the left C pillar was from this occupant. There may have been a passenger seated on the lap of the second row center occupant who may have caused the oil transfer to the back of the driver's head restraint by touching the head restraint with his hand. It is also possible that the second row left occupant contacted the seat back with his face or hand.

Figure 13. Oil transfer to back of driver head restraint - possible occupant contact

Figure 14. Scuff to left C pillar - possible occupant contact

Second Row Center Occupant Kinematics

The 7-year-old second row center male passenger was seated forward facing in the leather covered split bench seat with folding backs and was not restrained by the available 3-point manual lap and shoulder belt. The seat was adjusted to the rearmost track position. The seat back was reclined at a 106 degree angle and the seat bottom had a 10 degree angle. It is believed that there was a 2-year-old male either seated on the lap of this occupant, or next to this occupant, sharing the seat.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant complained of "pain in face" but declined medical treatment. If the 2-year-old male was sitting on this occupant's lap, it is possible that the facial pain was a result of this occupant's face hitting the back of the 2-year-old's head.

Other Second Row Center Occupant Kinematics

The 2-year-old second row center male passenger was seated forward facing and was not restrained. It is believed that this 2-year-old was either seated on the lap of the 7-year-old center occupant, or was seated next to the 7-year-old, sharing the seat with him. The seat was adjusted to the rearmost track position. The seat back was reclined at a 106 degree angle and the seat bottom had a 10 degree angle.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant was not injured in the collision.

Second Row Right Occupant Kinematics

The 26-year-old second row right side male passenger was seated forward facing in the leather covered bucket seat and was not wearing the available 3-point manual lap and shoulder belt. The seat was adjusted to the rearmost track position. The seat back was reclined at a 106 degree angle and the seat bottom had a 10 degree angle. It is believed that there was a 5-year-old male child sitting on this occupant's lap.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force, likely contacting the back of the right front seatback with one or both knees, resulting in a blue and a red transfer. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the freeway and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. It is possible that this occupant contacted the right C pillar during this second impact, resulting in a scuff. Per the police report, this occupant was not injured in the collision.

Figure 15. Scuff to right C pillar - possible occupant contact

Other Second Row Right Occupant Kinematics

The 5-year-old second row right side male passenger was seated forward facing and was not restrained. It is believed that this occupant was sitting on the lap of the 26-year-old right rear passenger.

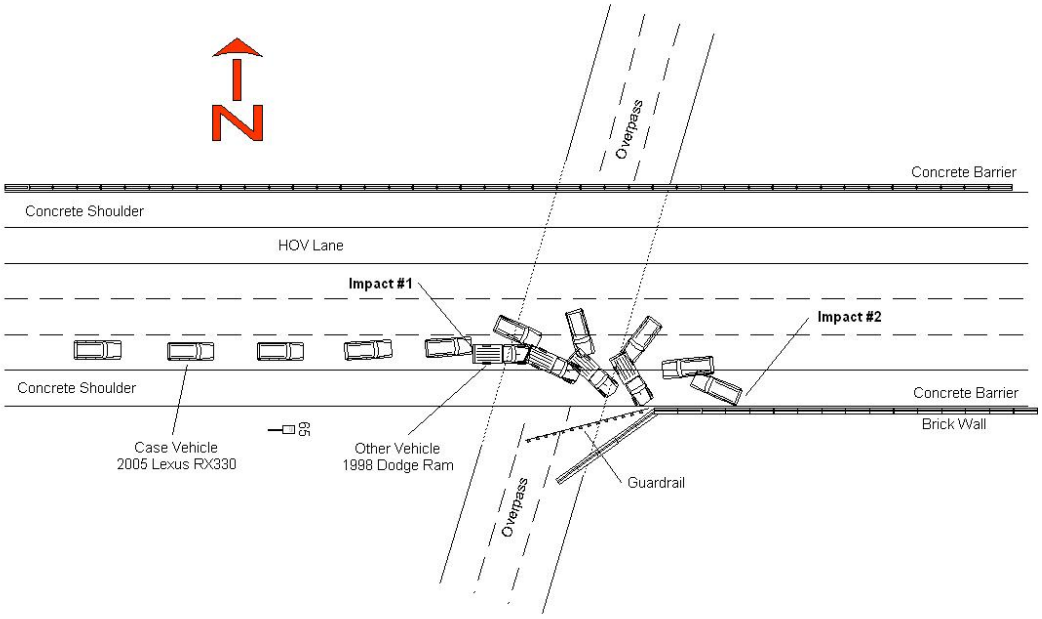
The seat was adjusted to the rearmost track position. The seat back was reclined at a 106 degree angle and the seat bottom had a 10 degree angle.

At impact, this passenger initiated a forward trajectory towards the 12 o'clock direction of force, likely contacting the left B pillar. There were deep scuffs found on the upper left B pillar, possibly a result of the 5-year-old holding onto the pillar for support during the crash. The case vehicle underrode the back bumper of the Dodge Ram and continued traveling forward. The right front door hinge area snagged on the left rear bumper of the Dodge Ram and the vehicle began a sharp counterclockwise rotation, causing this occupant to pitch left. The Lexus traveled off the free way and onto the south shoulder. The back left bumper corner impacted a guardrail, likely causing this occupant to move rearward and slightly lateral towards the 5 o'clock direction of force. Per the police report, this occupant was not injured in the collision.

Figure 16. Scuffs to right B pillar - possible occupant contact

Figure 17. Transfers to right front seat back - probable occupant contacts

Attachment 1. Scene Diagram



Attachment 2. Prototype Readout Tool Report

PROTOTYPE READOUT TOOL REPORT DS06-005

Event Data

INVESTIGATION DATE	07/13/2006
INVESTIGATOR	
ACCIDENT DATE	
VEHICLE	
MODEL YEAR	
VIN NUMBER	

Data Table

Data Name	Data
ECU Maker	DENSO
ECU Number	89170-48210
R/O Deployment Time	0.0 ms
R/O RA MAX Value within 2sec. from trigger	0.0 (deg)
R/O CSA-Manual Cut OFF(N/A)	(N/A)
NewPage	0 Page
Freeze Signal	Freeze
Deployment Time	24 ms
Deployment Stage Driver	Hi
Deployment Stage Passenger	Not Fired

PROTOTYPE READOUT TOOL REPORT

Event Data

INVESTIGATION DATE	07/13/2006
INVESTIGATOR	
ACCIDENT DATE	
VEHICLE	
MODEL YEAR	
VIN NUMBER	

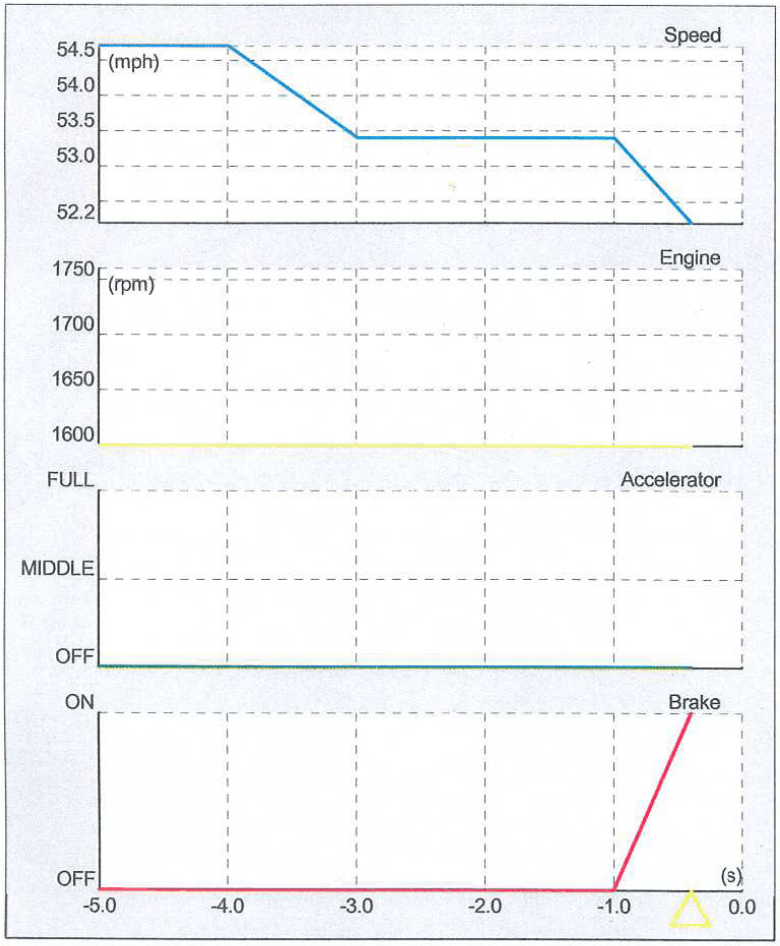
Graph Data

Latest/Frozen	BANK0
Freeze Signal	Freeze

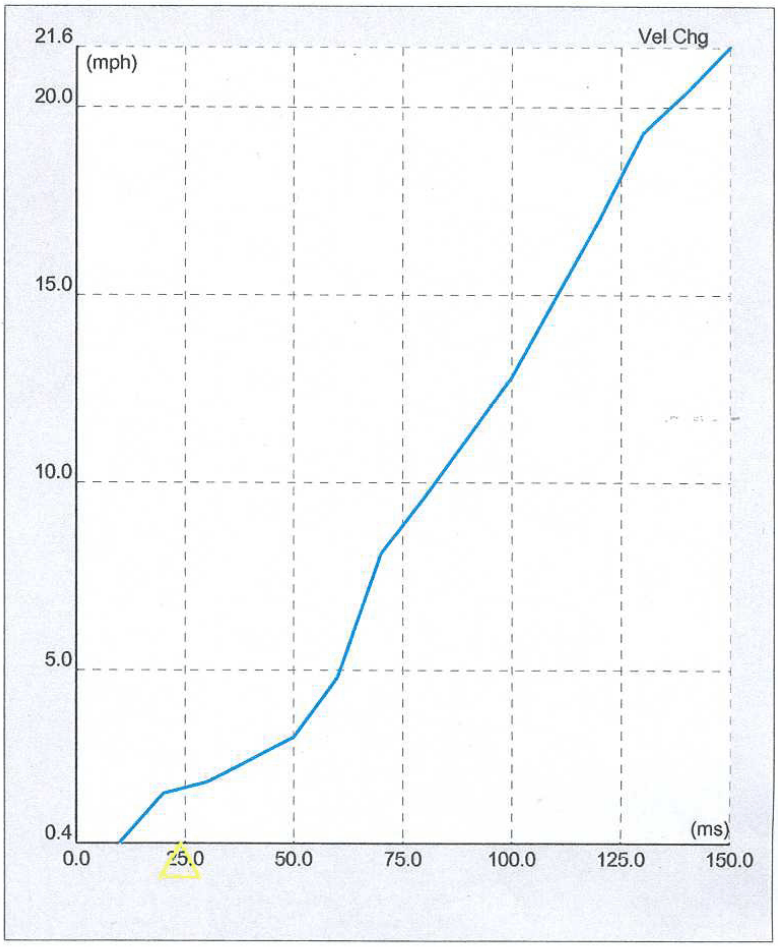
Individual Data

Data Name	Data
Time From Previous Event	5000 ms
Time From Last PreCrash Data	600 ms
Pre-Crash Data Flag	OFF OFF OFF OFF OFF OFF
Shift Position	Other
Seat Position Driver	RW
Belt Switch Status Driver	Belted
Belt Switch Status Passenger	UnBelted
Occupant Detection Passenger	No Level
PAB-Manual Cut OFF(N/A)	(N/A)
Ignition Cycles	0 times
Lamp On Term	0 minutes
Daig Code	0 0 0 0 0 0 0 0 0 0 0 0
Event counter	1 Count
Writing Flag	Finished Writing

Pre-Crash Data



Post-Crash Data



Pre-Crash Data

s	Speed	Engine	Accelerator	Brake
-5.0	54.7	1600	OFF	OFF
-4.0	54.7	1600	OFF	OFF
-3.0	53.4	1600	OFF	OFF
-2.0	53.4	1600	OFF	OFF
-1.0	53.4	1600	OFF	OFF
-0.4	52.2	1600	OFF	ON

Post-Crash Data

ms	Vel Chg	ms	Vel Chg	ms	Vel Chg
10.0	0.4	70.0	8.1	130.0	19.3
20.0	1.7	80.0	9.6	140.0	20.4
30.0	2.0	90.0	11.2	150.0	21.6
40.0	2.6	100.0	12.8		
50.0	3.2	110.0	14.9		
60.0	4.8	120.0	17.0		