Certified Advanced 208 Compliant Vehicle Investigation / Vehicle to vehicle
Dynamic Science, Inc. / Case Number: DS05021
2005 Lexus RX330
California
September 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 performance of the air bag system in a Certified Advanced 208-Compliant (CAC) vehicle (2005 Lexus RX330). The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirement of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Lexus RX330 sport utility vehicle was being driven by a 19-year-old female. The Lexus was struck on the left front by a 1992 Honda Accord in an intersection crash. The impact resulted in sufficient longitudinal deceleration of the Lexus to command the deployment of the frontal air bag system, including the driver's knee air bag. The Lexus was redirected to the right and struck a concrete curb with its front right tire. There were no reported injuries. Both vehicles were towed from the scene due to damage.

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Dynamic Science, Inc.
Crash Investigation
Case Number: DS05021

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BACKGROUND:

Description

This on site investigation focused on the air bag system in a Certified Advanced 208-Compliant (CAC) vehicle (2005 Lexus RX330). The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirement of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Lexus RX330 sport utility vehicle was being driven by a 19-year-old female. The Lexus was struck on the left front by a 1992 Honda Accord in an intersection crash. The impact resulted in sufficient longitudinal deceleration of the Lexus to command the deployment of the frontal air bag system, including the driver's knee air bag. The Lexus was redirected to the right and struck a concrete curb with its front right tire. There were no reported injuries. Both vehicles were towed from the scene due to damage.

Figure 1. Front left, 2005 Lexus RX330

This CAC/Knee Air Bag case was found during a NHTSA review of salvaged vehicles. A group of potential cases was provided to DSI on October 21, 2005. DSI obtained permission to inspect the vehicle and located the police crash report on October 25, 2005. The case was assigned to DSI on the same day. The case vehicle was inspected on October 25, 2005. Efforts to obtain permission to harvest the EDR were not successful.

SUMMARY

Crash Site

This two-vehicle crash occurred within the confines of a four-leg intersection. The crash occurred in September 2005. At the time of the crash, there were no adverse weather conditions and the mixed asphalt/concrete roadway was dry. The eastern leg of the intersection was comprised of two westbound travel lanes, a left turn lane and two eastbound travel lanes. The western leg of the intersection was comprised of two eastbound travel lanes, a turn lane and two westbound travel lanes. The turn lanes are separated from the through lanes on the

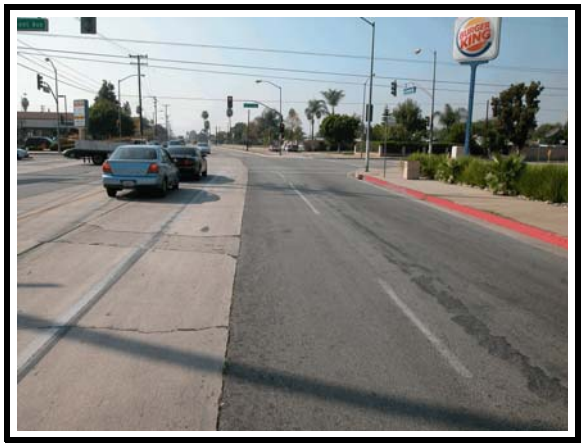

Figure 2. Lexus approach to area of impact (west)

right by a solid white line and from the through lanes on the left by double yellow lines. Traffic flow through the intersection was controlled by three-phase traffic signals. The speed limit for both east and westbound traffic was 64 km/h (40 mph).

Pre-Crash

The 2005 Lexus RX330 was traveling westbound in the second lane from the right approaching the intersection. There were at least two occupants in the Lexus–a 19-year-old female driver and an unknown age/sex front right seat occupant. The 1992 Honda Accord was being driven by a 49-year-old male. The Accord was initially traveling eastbound in the left turn lane. According to witnesses, the Accord had traveled to the middle of the intersection and had stopped for traffic to clear before attempting a left turn. While in the intersection, the light changed to red. The driver of the Accord began to make the left hand turn. The driver of the Lexus failed to stop at the intersection and continued into the intersection through the red light.

Crash

The left front of the Lexus struck the center front of the Accord. The impact severity was moderate and resulted in the deployment of the frontal air bag system in the Lexus. The missing vehicle routine of the WinSmash program computed a total delta V of 12.0 km/h (7.5 mph), based on the Lexus' front crush profile. The longitudinal and lateral components were -11.8 km/h (-7.3 mph) and 2.1 km/h (1.3 mph), respectively. The Lexus was redirected to the right and struck a raised concrete curb on the northwest corner of the intersection with its front right tire. The Accord rotated in a counterclockwise direction and came to rest in the intersection.

Figure 3. Impact 2, curb impact

Post-Crash

There were no injuries in this crash. Both drivers were able to exit their respective vehicles under their own power. Both vehicles were towed form the scene due to damage. The Lexus was later declared a total loss by the insurance company.

VEHICLE DATA - 2005 Lexus RX330

The 2005 Lexus RX330 was identified by the Vehicle Identification Number (VIN): 2T2HA31U15Cxxxxxx. The vehicle's odometer could not be read because there was no power to the instrument panel. The Lexus RX330 was a four-door sport utility vehicle that was equipped with a 3.3 liter six-cylinder engine, five-speed automatic transmission, front wheel drive, disc brakes with ABS, power steering, and a tilt steering wheel. The Lexus was configured with Michelin Energy MXV4 P235/55R18 tires. The vehicle manufacturer's recommended cold tire pressure was 207 kPa (30 psi). The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	9 mm (11/32 in)	Yes	Cut/holed
LR	221 kPa (32 psi)	9 mm (11/32 in)	No	None
RR	186 kPa (27 psi)	8 m (10/32 in)	No	None
RF	Flat	7 mm (9/32 in)	No	None

The seating in the 2005 Lexus RX330 was configured with leather covered front bucket seats with adjustable head restraints and a leather covered rear bench seat with a folding back. The driver's seat was located at the rear most track position with the front of the seat cushion 38.0 cm (14.9 in) rearward from the base of the A pillar. The front right passenger's seat was located in the mid track position with the front of the seat cushion 30.0 cm (11.8 in) rearward from the base of the A pillar. Both front seats had a seat back angle of 70 degrees and a seat cushion angle of 14 degrees.

VEHICLE DAMAGE

Exterior Damage - 2005 Lexus RX330

Damage Description:	The 2005 Lexus RX330 sustained moderate front end damage as a result of the impact with the Honda Accord. The direct damage began 28.0 cm (11.0 in) left of the vehicle centerline and extended 43.0 cm (16.9 in) to the left bumper corner. The hood, bumper and left fender were damaged. The left front tire was restricted and flattened. The tire had come off the rim. The left wheelbase was shortened by 21.5 cm (8.5 in). All the doors remained closed and operational. The driver's door would open but with some difficulty. Six crush measurements were documented at the bumper level (at the width of the backing bar) as follows: C1 = 6.0 cm (2.4 in), C2 = 5.0 cm (2.0 in), C3 = 3.0 cm (1.2 in), C4 = 1.0 cm (0.4 in), C5 = 0 cm (0 in), C6 = 0 m (0 in).	
CDC:	Impact 1: 12FYLW1 Impact 2: 12FLWN3	
Delta V (Impact 1):	Total	12.0 km/h (7.5 mph)
	Longitudinal	-11.8 km/h (-7.3 mph)
	Latitudinal	2.1 km/h (1.3 mph)
	Energy	8,500 joules (6,269 ft lbs)

Figure 4. Left side, 2005 Lexus

Interior Damage - 2005 Lexus RX330

The 2005 Lexus RX330 sustained minor interior damage as a result of occupant contacts. Left knee scuffing was observed on the glove box and center console. The scuffing measured 15.0 cm (5.9 in) high by 13.0 cm (5.1 in) wide on the center console and 8.0 cm (3.1 in) wide by 7.0 cm (2.8 in) high on the glove box. Scuffs were observed on the bottom of the steering column. Food was spilled along the right side of the driver's seat. A white scuff was found on the right side of the front passenger's seat back.

Figure 5. Scuff from left knee of front right occupant

Manual Restraint Systems - 2005 Lexus RX330

The 2005 Lexus RX330 was configured with manual 3-point lap and shoulder belts for each seating position. Both front seat safety belts were equipped with retractor pretensioners and adjustable D rings that were in the mid position for the driver and full up position for the front right passenger. The driver's safety belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). At the time of the vehicle inspection, the driver's seat belt was restricted in the used position as a result of pretensioner actuation. The length of webbing from the anchor point to the stop button was 107.0 cm (42.1 in). The front right passenger's seat belt was configured with a sliding latch plate. The retractor type was not known. At the time of the vehicle inspection, the front right passenger's seat belt was restricted in the used position as a result of pretensioner actuation. The length of webbing from the anchor point to the stop button was 104.0 cm (40.9 in). The remaining safety belts were configured with sliding latch plates and switchable ELR/Automatic Locking Retractors (ALR).

Figure 6. Frontal air bags

Supplemental Restraint System - 2005 Lexus RX330

The Lexus RX330 was a Certified Advanced 208-Compliant (CAC) vehicle. The 2005 Lexus RX330 was equipped with dual-stage frontal air bags and safety belt retractor pretensioners for the driver and front right passenger positions, seat back mounted side air bags and a knee air bag for the driver's position. The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirement of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. Both front seat positions were configured with occupancy sensors. The frontal air bags and

safety belt pretensioners deployed as a result of the longitudinal deceleration of the Lexus during the impact with the Accord.

The driver's air bag deployed from the center of the steering wheel hub through Y-configuration module cover flaps. The top flap measured 13.0 cm (5.1 in) wide by 8.0 cm (3.1 in) high. The bottom flaps were symmetrical and measured 5.0 cm (2.0 in)/6.5 cm (2.6 in) high by 7.0 cm (2.8 in) wide. The deployed driver's air bag measured 64.0 cm (25.2 in) in diameter in its deflated state. The air bag was configured with a single internal tether that was attached to a 13.0 cm (5.1 in) diameter circular panel in the center of the air bag face. Two rectangular vent ports were located near the 12 o'clock aspect on the rear of the air bag.

Figure 7. Front right passenger's air bag

The front right passenger's air bag deployed from a top mount module with symmetrical H configuration module cover flaps. The module flaps measured 10.0 cm (3.9 in) wide by 8.0 cm (3.1 in) high. The deployed front right passenger's air bag measured 58.0 cm (22.8 in) seam to seam and 65.0 cm (25.6 in) high. The maximum deflated excursion measured 69.0 cm (27.1 in). Two circular vent ports were located at the 3 and 9 o'clock aspects of each side panel of the air bag.

The driver's knee air bag deployed from a bottom mount module with symmetrical H configuration module cover flaps. The module flaps measured 24.0 cm (9.4 in) wide by 8.0 cm (3.1 in) high. The deployed driver's knee air bag was rectangular and measured 58.0 cm (22.8 in) wide and 33.0 cm (12.9 in) deep. Faint blue scuffing that measured 6.0 cm (2.4) by 7.0 cm (2.8 in) was located at the bottom left corner of the top of the air bag.

Figure 8. Driver's knee air bag

VEHICLE DATA - 1992 Honda Accord

Description:	1992 Honda Accord	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	Unknown	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Front	
CDC:	Unknown	
Delta V:	Total	15.0 km/h (9.3 mph)
	Longitudinal	-13.0 km/h (-8.1 mph)
	Latitudinal	-7.5 km/h (-4.7 mph)
	Energy	23,584 joules (17,395 ft lbs)

OCCUPANT DEMOGRAPHICS - 2005 Lexus RX330

	Driver	Occupant 2
Age/Sex:	19/Female	Unknown
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	NA
Driving Experience:	Unknown	NA
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt available, used	Lap and shoulder belt available, used
Air bag:	Steering wheel mounted front air bag, deployed. Knee air bag, deployed	Top instrument panel mounted air bag, deployed

OCCUPANT INJURIES -2005 Lexus RX330

Driver: Not injured

Front right occupant: Not injured

OCCUPANT KINEMATICS - 2005 Lexus RX330

The 19-year-old driver of the Lexus was likely seated in an upright position in the leather covered bucket seat. The driver's seat was located at the rear most track position–38.0 cm (14.9 in) from the base of the A pillar. The seat back was at a 70 degree angle and the seat bottom was at a 14 degree angle. She was wearing the manual lap and shoulder belt. At impact, the frontal air bags deployed and the safety belt pretensioners actuated. The female driver initiated a forward and slight left trajectory. She loaded the safety belt and likely engaged the deployed air bag with her face. There were no reported injuries. The driver was able to exit the vehicle on her own.

There was no information about the right front occupant in the police report and an interview was not obtained because this occupant could not be located. The front right occupant was likely seated in a forward facing fashion on the leather covered bucket seat and was using the manual lap and shoulder belt (the belt was found in the used/pretensioned position). The front right passenger's seat was located in the mid track position–30.0 cm (11.8 in) from the base of the A pillar. The seat back was at a 70 degree angle and the seat bottom was at a 14 degree angle. At impact, the frontal air bags deployed and the safety belt pretensioners actuated. This occupant initiated a forward and slight left trajectory and struck the lower instrument panel with the left knee. There were no reported injuries.

Attachment 1. Scene Diagram