Certified Advanced Compliant Air Bag Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS05027
2005 Lexus RX330
California
October 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 Certified Advanced 208-Compliant air bag system in a 2005 Lexus RX330 sport utility vehicle. 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. This two vehicle, hit-and-run crash occurred in October 2005 at 0334 hours in southern California. The crash occurred in the northbound lanes of a five-lane, divided interstate highway. The case vehicle was a 2005 Lexus RX330 sport utility vehicle that was being driven by a 37-year-old male. The other vehicle was an unknown year/make/model tractor trailer. The Lexus RX330 was traveling northbound in the second lane from the right. The other vehicle was traveling northbound in the third lane from the right and was ahead of the case vehicle. For unknown reasons, the tractor trailer abruptly changed lanes to the right and directly into the path of the Lexus. The driver of the Lexus saw the lane change. He braked but was unable to stop in time, and the front of the Lexus struck the rear of the tractor trailer. The driver's frontal air bag and the driver's knee air bag in the Lexus both deployed at this time. The Lexus came to rest in its original lane of travel. The tractor trailer did not stop.

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Dynamic Science, Inc.
Crash Investigation
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TABLE OF CONTENTS

BACKGROUND

Figure 1. Front view, 2005 Lexus RX330

This on-site investigation focused on the Certified Advanced 208-Compliant air bag system in a 2005 Lexus RX330 sport utility vehicle. 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. This two vehicle, hit-and-run crash occurred in October 2005 at 0334 hours in southern California. The crash occurred in the northbound lanes of a five-lane, divided interstate highway. The case vehicle was a 2005 Lexus RX330 sport utility vehicle that was being driven by a 37-year-old male. The other vehicle was an unknown year/make/model tractor trailer. The Lexus RX330 was traveling northbound in the second lane from the right. The other vehicle was traveling northbound in the third lane from the right and was ahead of the case vehicle. For unknown reasons, the tractor trailer abruptly changed lanes to the right and directly into the path of the Lexus. The driver of the Lexus saw the lane change. He braked but was unable to stop in time, and the front of the Lexus struck the rear of the tractor trailer. The driver's frontal air bag and the driver's knee air bag in the Lexus both deployed at this time. The Lexus came to rest in its original lane of travel. The tractor trailer did not stop.

This Certified Advanced Compliant Air Bag Investigation case was identified by SCI. DSI obtained permission to inspect the vehicle on November 28, 2005. The vehicle was inspected on November 30, 2005. The scene was inspected on December 8, 2005. Efforts to harvest the electronic data recorder were not successful.

SUMMARY

Crash Site

Figure 2. Overview of travel path (north)

The crash occurred in the northbound lanes of a five-lane, divided interstate highway. The asphalt roadway is straight and level. The roadway is bordered on the right by a solid white line and an asphalt shoulder. The roadway is separated from southbound traffic by a concrete New Jersey barrier. The weather was clear and the roadway was dark with no streetlights available. The speed limit is 105 km/h (65 mph).

Pre-Crash

The Lexus RX330 was traveling northbound in the second lane from the right at a driver reported travel speed of 105 km/h (65 mph). The other vehicle was traveling northbound in the third lane from the right and was ahead of the case vehicle. This vehicle was traveling at approximately 89 km/h (55 mph).

For unknown reasons, the tractor trailer abruptly changed lanes to the right and directly into the path of the Lexus. The driver of the Lexus saw the lane change.

Crash

The driver of the Lexus braked but was unable to stop in time, and the front of the Lexus struck the rear of the tractor trailer. The impact severity was moderate and resulted in the deployment of the driver's frontal air bag and the driver's knee air bag. The driver's seat belt pretensioner also actuated at this time.

The Lexus came to rest in its original lane of travel. The tractor trailer did not stop. The driver and vehicle were never identified.

Post-Crash

An ambulance was dispatched to the scene but the driver of the Lexus did not claim any injuries.

The case vehicle was towed from the scene and later declared a total loss.

VEHICLE DATA - 2005 Lexus RX330

The 2005 Lexus RX330 was identified by the Vehicle Identification Number (VIN): JTJGA31U050xxxxxx. The vehicle's odometer could not be read since there was no power. The 2005 Lexus RX330 was a five-door sport utility vehicle that was equipped with a 3.3 liter, six-cylinder engine, five-speed automatic transmission, front wheel drive, four-wheel disc brakes with ABS, electronic stability and traction control, power steering, and a tilt steering wheel. The RX330 was equipped with Goodyear Eagle RS P235/55R18 tires. The 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	200 kPa (29 psi)	6 mm (8/32 in)	No	None
LR	186 kPa (27 psi)	8 mm (10/32 in)	No	None
RR	179 kPa (26 psi)	8 mm (10/32 in)	No	None
RF	186 kPa (27 psi)	6 mm (8/32 in)	No	None

The seating in the 2005 Lexus RX330 was configured with front leather covered bucket seats with adjustable head restraints. The seats were electrically adjustable with height adjustments, track adjustments, and tilt adjustments. The driver's seat was adjusted to a distance of 38.0 cm (14.9 in) from the base of the A pillar (between mid and full back position). The front right passenger's seat was adjusted to a distance of 32.0 cm (12.6 in) from the base of the A pillar. At the time of the vehicle inspection, the driver's seat back was at a 69 degree angle, the seat bottom at a 10 degree angle. The front right passenger seat was a 64 degree angle, the seat bottom at a 10 degree angle. The second row was equipped with three asymmetrical 40/20/40 front facing reclining seats with fore/aft track adjustment. The seats were adjusted to the rearmost track position. The seat backs had a 71 degree angle, the seat bottoms had a 12 degree angle. The seats were configured with adjustable head restraints that were not damaged.

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 semi truck. The direct damage began at the left front corner and extended 107.0 cm (42.1 in) laterally to the right. The bumper fascia was knocked off and the bumper backing bar was rotated upward 90 degrees. The distance from the center of the bumper to the ground was 83.0 cm (32.7 in). The direct and induced damage extended across the entire front end and measured 176.0 cm (69.3 in). The hood was buckled and the windshield was fractured.	
CDC:	12FDEW2	
Delta V[1]:	Total	55.0 km/h (34.2 mph)
	Longitudinal	-55.0 km/h (-34.2 mph)
	Latitudinal	0 km/h (0 mph)
	Energy	291,134 joules (161,625 ft lbs)

Six crush measurements were documented at the bumper backing bar level: C1 = 30.0 cm (11.8 in), C2 = 31.0 cm (12.2 in), C3 = 34.0 cm (13.4 in), C4 = 34.0 cm (13.4 in), C5 = 28.0 cm (11.0 in), C6 = 23.0 cm (9.0 in).

Figure 3. Front left, 2005 Lexus RX330

[1]Computed using Barrier option. Barrier Equivalent Speed only coded into the EDS.

Interior Damage - 2005 Lexus RX330

The 2005 Lexus RX330 sustained minor interior damage. The windshield was cracked. There was no additional glazing damage. All four doors remained closed and operational. The rear lift gate also remained closed and operational. There was no intrusion. The driver's frontal air bag and knee air bag both deployed. The driver's knee bolster exhibited faint scuff marks on the left aspect that most likely were from the driver's left knee.

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 safety belts were equipped with retractor pretensioners and adjustable shoulder belt anchorages that were in the full down position. The driver's seat belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). At the time of the vehicle inspection, the driver's belt was extended in the used position as a result of the pretensioner actuation. The distance from the upper anchorage to the plastic stop button was 72.0 cm (28.3 in).

The remaining outboard safety belts were configured with sliding latch plates and switchable ELR/Automatic Locking Retractors (ALR). The second row center seat was equipped with an integral lap and shoulder belt that was equipped with a sliding latch plate and an ELR retractor.

Figure 4. Driver's seated position

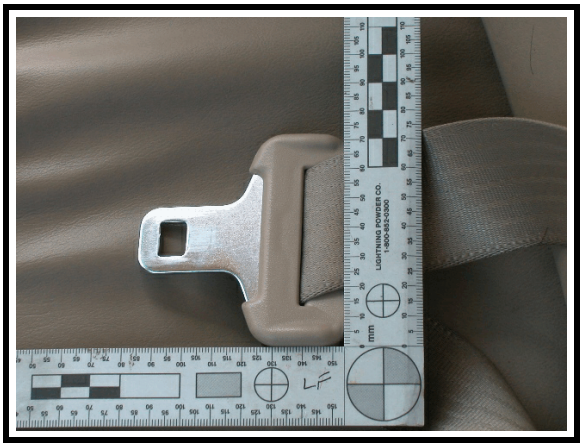

Figure 5. Driver's seat belt tang

Supplemental Restraint System - 2005 Lexus RX330

The 2005 Lexus RX330 was equipped with dual-stage frontal air bags, a driver's knee air bag, seat back mounted side air bags and front seat belt pretensioners. The driver's air bag, the driver's knee bag, and the driver's pretensioner deployed/actuated as a result of the longitudinal deceleration of the Lexus during the impact with the semi. The front right passenger air bag and the side air bags did not deploy.

Figure 6. Driver's air bag

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 measured 7.0 cm (2.8 in) wide at the top, 4.0 cm (1.6 in) wide at the bottom, and 6.0 cm (2.4 in) high. The deployed driver's air bag measured 58.0 cm (22.8 in) in diameter in its deflated state. The maximum deployed excursion was 33.0 cm (12.9 in). The distance from maximum excursion to the seat back was 30.0 cm (11.8 in). The air bag was tethered by a single internal tether. The tether was attached to a 21.0 cm (8.3 in) diameter circular stitch in the center of the air bag face. Two vertical vent ports were located at the 11 and 1 o'clock aspects of the rear of the air bag. The vent ports were 5.0 cm (1.9 in) high and were 16.0 cm (6.3 in) apart. There were faint specks across the bottom of the air bag face that may have been fabric transfers.

Figure 7. Driver's knee air bag (top)

The driver's knee air bag deployed from bottom mount H configuration cover flaps. The top module cover flap measured 24.0 cm (9.4 in) wide by 4.0 cm (1.6 in) high. The bottom flap measured 24.0 cm (9.4 in) wide by 6.0 cm (2.4 in) high. The deployed air bag measured 55.0 cm (21.6 in) wide by 30.0 cm (11.8 in) high. There was a dark scuff on the left upper aspect of the top of the air bag. Its origin is not known.

Figure 8. Driver's air bag (bottom)

VEHICLE DATA - Unknown year/make/model tractor trailer

Description:	Unknown year/make/model tractor trailer	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	Unknown	
Reported Defects:	Unknown	
Cargo:	Unknown	
Damage Description:	Unknown	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

OCCUPANT DEMOGRAPHICS - 2005 Lexus RX330

	Driver
Age/Sex:	37/Male
Seated Position:	Front left
Seat Type:	Leather covered bucket seat. Seat adjusted to between mid and full rear track position
Height:	163 cm (64 in)
Weight:	82 kg (180 lbs)
Occupation:	Book seller
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Normal, upright
Hand Position:	Unknown, actively steering
Foot Position:	Right foot on brake, left on floor.
Restraint Usage:	Lap and shoulder belt available, used
Air bag:	Steering wheel mounted front air bag, deployed. Lower instrument panel knee air bag, deployed.

OCCUPANT DEMOGRAPHICS - Unknown year/make/model tractor trailer

Age/Sex:	Unknown
Seated Position:	Front left
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	Unknown
Alcohol/Drug Involvement:	Unknown
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Unknown

OCCUPANT INJURIES -2005 Lexus RX330

Driver: Not injured

OCCUPANT KINEMATICS - 2005 Lexus RX330

The 37-year-old male driver was seated in an upright posture and restrained by the 3-point manual lap and shoulder belt. The leather covered bucket seat was positioned between the middle and full back position. Prior to impact, the driver began braking. At impact, the driver's frontal air bag and knee air bag deployed, and the driver's safety belt pretensioner actuated. The male driver initiated a forward trajectory. He loaded the safety belt and his left knee engaged both the knee air bag and the knee bolster. He did not report any injuries. He was able to exit the vehicle under his own power.

Attachment 1. Scene Diagram