

**TRANSPORTATION SCIENCES
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**GENERAL DYNAMICS REMOTE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION**

SCI TECHNICAL SUMMARY REPORT

NASS/SCI COMBO CASE NO. 03-43-285H

VEHICLE – 2004 LEXUS RX330

LOCATION - STATE OF NORTH CAROLINA

CRASH DATE – DECEMBER 2003

Contract No. DTNH22-01-C-17002

Prepared for:

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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 are 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 remote investigation focused on the performance of the Certified Advanced 208-Compliant (CA208-C) safety system in a 2004 Lexus RX330. The manufacturer of this vehicle has certified that this 2004 Lexus RX330 meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included multi-stage frontal air bags, seat track position sensors for the front seats, an occupant presence sensor for the front right seat, and retractor mounted pretensioners for the front safety belts. In addition, the Lexus was equipped with seatback mounted side impact air bags, left and right side Roll-Sensing Curtain Air Bags (RSCA), and a driver's knee bolster air bag. Furthermore, the Lexus contained an air bag control module that had event data recording capabilities. The air bag control module was removed by the NASS researcher and was forwarded to NHTSA for download by Toyota. The Lexus was involved in an intersection crash with a 1991 Ford Taurus. A restrained 31-year-old pregnant female driver occupied the Lexus. The 1991 Ford Taurus was occupied by a 37-year-old-male driver, 53-year-old male front right occupant, and a 39-year-old male rear right passenger. The Lexus was traveling northbound on a three-lane north/south roadway approaching an intersection. The Ford was traveling eastbound on a similar roadway approaching the same intersection. The Ford failed to yield to the approaching Lexus and the front left aspect of the Lexus impacted the right front of the Ford. The Lexus subsequently departed the east quadrant of the intersection and impacted a fire hydrant and a tree with its frontal plane. As a result of the impact with the Ford, the driver's frontal air bag, knee bolster air bag, and left side curtain air bag deployed. Additionally, the driver's safety belt pretensioner actuated as a result of the impact with the Ford. The driver of the Lexus sustained three soft tissue (AIS-1) injuries as result of the crash. The driver of the Lexus declined treatment at the scene. She arranged for transport to her obstetrician's office for evaluation. The driver was referred to a local hospital where she was admitted overnight for observation of her pregnancy. The Lexus and the Ford sustained severe damage and were towed from the crash site.		13. Type of Report and Period Covered Technical Report Crash Date: December 2003	
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**GENERAL DYNAMICS REMOTE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION
SCI SUMMARY TECHNICAL REPORT
NASS/SCI COMBO CASE NO. 03-43-285H
SUBJECT VEHICLE – 2004 LEXUS RX330
LOCATION - STATE OF NORTH CAROLINA
CRASH DATE - DECEMBER 2003**

BACKGROUND

This remote investigation focused on the performance of the Certified Advanced 208-Compliant (CA208-C) safety system (**Figure 1**) in a 2004 Lexus RX330. The manufacturer of this vehicle has certified that this 2004 Lexus RX330 meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included multi-stage frontal air bags, seat track position sensors for the front seats, an occupant presence sensor for the front right seat, and retractor mounted pretensioners for the front safety belts. In addition, the Lexus was



Figure 1. Subject 2004 Lexus RX330.

equipped with seatback mounted side impact air bags, left and right side Roll-Sensing Curtain Air Bags (RSCA), and a driver's knee bolster air bag. Furthermore, the Lexus contained an air bag control module that had event data recording capabilities. The air bag control module was removed by the NASS researcher and was forwarded to NHTSA for download by Toyota. The Lexus was involved in an intersection crash with a 1991 Ford Taurus. A restrained 31-year-old pregnant female driver occupied the Lexus. The 1991 Ford Taurus was occupied by a 37-year-old-male driver, 53-year-old male front right occupant, and a 39-year-old male rear right passenger. The Lexus was traveling northbound on a three-lane north/south roadway approaching an intersection. The Ford was traveling eastbound on a similar roadway approaching the same intersection. The Ford failed to yield to the approaching Lexus and the front left aspect of the Lexus impacted the right front of the Ford. The Lexus subsequently departed the east quadrant of the intersection and impacted a fire hydrant and a tree with its frontal plane. As a result of the impact with the Ford, the driver's frontal air bag, knee bolster air bag, and left side curtain air bag deployed. Additionally, the driver's safety belt pretensioner actuated as a result of the impact with the Ford. The driver of the Lexus sustained three soft tissue (AIS-1) injuries as result of the crash. The driver of the Lexus declined treatment at the scene. She arranged for transport to her obstetrician's office for evaluation. The driver was referred to a local hospital where she was admitted overnight for observation of her pregnancy. The Lexus and the Ford sustained severe damage and were towed from the crash site.

This crash was identified by the National Automotive Sampling System (NASS) during the weekly sampling of Police Accident Reports (PARs). The NASS PSU performed the

vehicle and scene inspections, and the driver interview. Due to the presence of the Certified Advanced 208-Compliant safety system in the 2004 Lexus RX330, NHTSA assigned the tasks of case review and report preparation to the General Dynamics SCI team.

SUMMARY

Crash Site

This multiple event crash occurred during the morning hours of December 2003 in the state of North Carolina. At the time of the crash, there were no adverse weather conditions and the asphalt road surface was dry. The crash events occurred within the four-leg intersection and off-road of the northeast quadrant of the intersection. The north/southbound roadway consisted of one travel lane in each direction and was delineated by a center two-way left turn lane median. The northbound travel lane curved right approaching the intersection. The north/southbound lanes were not controlled by a traffic signal. The posted speed limit for this roadway was 56 km/h (35 mph). The northeast roadside consisted of a curb ramp, fire hydrant, and several trees. The east/westbound roadway was configured with one travel lane in each direction and was not delineated. Traffic flow through the intersection was controlled by a stop sign for this roadway. The posted speed limit was 56 km/h (35 mph) for the east/west travel lanes. **Figure 2** is a southwest view of the crash site. The NASS scene schematic is included as **Figure 16** of this report. It should be noted that the Lexus' approach to the roadside impacts and final rest are incorrectly positioned in the NASS scene schematic as it shows the roadside impacts to the front left aspect of the vehicle. The roadside impact occurred right of the centerline of the Lexus.



Figure 2. Southwest view of the crash site.

Vehicle Data

2004 Lexus RX330

The 2004 Lexus RX330 was identified by the Vehicle Identification Number (VIN): JTJHA31U34 (production sequence omitted). The odometer reading was 9,656 kilometers (6,000 miles) at the time of the NASS inspection. The vehicle was a four-door sport utility vehicle that was equipped with a 3.3-liter, six-cylinder engine linked to a five speed automatic transmission, four-wheel drive, four-wheel disc brakes with ABS, electronic brakeforce distribution, and brake assist, tire pressure monitoring system, traction control, vehicle stability control, and daytime running lights. The tires on the Lexus were Michelin Energy LX4, size P225/65R17. The maximum pressure for these tires was 241 kpa (35 psi). The manufacturer recommended front and rear tire pressure was 207 kpa (30 psi). The specific tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	0 kpa	7 mm (9/32)	Yes	Punctured Tread
LR	193 kpa (28 psi)	7 mm (9/32)	No	None
RF	269 kpa (39 psi)	7 mm (9/32)	No	None
RR	234 kpa (34 psi)	7 mm (9/32)	No	None

The Lexus was configured with leather upholstered front bucket seats with height adjustable head restraints that were adjusted between the mid to full-down position at the time of the NASS inspection. The second row was configured with a leather upholstered three-passenger bench seat with height adjustable head restraints for the three seating positions. The rear outboard head restraints were adjusted to the full-down position and the center was adjusted between the mid to full-down position at the time of the inspection.

1991 Ford Taurus

The 1991 Ford Taurus was identified by the VIN: 1FACP52UXM (production sequence omitted). The odometer reading was 216,975 kilometers (134,825 miles) at the time of the inspection. The vehicle was a four-door sedan that was equipped with a 3.0-liter, six-cylinder engine, four-speed automatic transmission, and front-wheel drive. The left front tire on the Ford was a BF Goodrich Control T/A size P205/70R14. The maximum pressure for this tire was 241 kpa (35 psi). The remainder of the tires were Michelin Radial Plus size P205/70R14. The manufacturer recommended tire pressure was unknown. The maximum pressure for these tires was 241 kpa (35 psi). The specific tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	207 kpa (30 psi)	2 mm (3/32)	No	None
LR	207 kpa (30 psi)	7 mm (9/32)	No	None
RF	0 kpa	3 mm (4/32)	Yes	De-beaded
RR	0 kpa	7 mm (9/32)	No	De-beaded

Crash Sequence

Pre-Crash

The restrained 31-year-old pregnant female driver of the Lexus was operating the vehicle northbound, negotiating the right curve on approach to the intersection (**Figure 3**). The 37-year-old male driver of the Ford was operating the vehicle eastbound approaching the same intersection. The driver of the Ford stated to the



Figure 3. Lexus northbound travel to the intersection.

NASS researcher that he stopped at the intersection for the stop sign. He did not see the approaching Lexus and entered the intersection to continue his eastbound travel.

Crash

The front left aspect of the Lexus impacted the front right aspect of the Ford in the intersection. The NASS researchers' derived resultant directions of force were within the 11 o'clock sector (340 degrees) for the Lexus and 2 o'clock sector (70 degrees) for the Ford, which was used to calculate a delta V. Based on the SCI evaluation of the vehicle damage, the directions of force were revised to 11 o'clock (320 degrees) for the Lexus and 2 o'clock (50 degrees) for the Ford. This change warranted the delta V to be recalculated. The delta V was calculated using the missing vehicle algorithm of the WINSMASH program due to the Lexus



Figure 4. Northbound view of the initial point of impact.

sustaining multiple overlapping impacts to the front. The total computed delta for the Lexus was 17.0 km/h (10.6 mph). The longitudinal and lateral components were -13.0 km/h (-8.1 mph) and 10.9 km/h (6.8 mph), respectively. The total computed delta V for the Ford was 19.0 km/h (11.8 mph). The longitudinal and lateral components were -12.2 km/h (-7.6 mph) and -14.6 km/h (-9.1 mph), respectively. Due to the missing vehicle algorithm and multiple impacts the WINSMASH program underestimated the delta V for this impact. The Lexus's air bag control module had event data recording capabilities. The downloaded data indicated that the delta V for this impact was 31.2 km/h (19.4 mph) at 150 milliseconds. This delta V was consistent with the resultant damage to the Lexus. This impact resulted in the deployment of the driver's frontal air, knee bolster air bag, and the actuating to of the driver's safety belt pretensioner.

As a result of the angled impact configuration, the Lexus began a clockwise rotation and the Ford initiated a counter clockwise rotation. Both vehicles began to travel in a northeast trajectory and the left rear of the Lexus impacted the right rear of the Ford. The resultant directions of force were within the 9 o'clock sector for the Lexus and 3 o'clock sector for the Ford. The damage algorithm of the WINSMASH program was used to calculate and delta V for this impact. The total delta V for the Lexus was 13.0 km/h (8.1 mph). The longitudinal and lateral components were 0.0 km/h and 13.0 km/h (8.1 mph), respectively. The total delta V for the Ford was 14.0 km/h (8.7 mph). The longitudinal and lateral were -2.4 km/h (-1.5 mph) and -13.8 km/h (-8.6 mph), respectively. This impact resulted in the deployment of the left side RSCA.

The Lexus continued the northeast trajectory as a result of the initial impact. The front left tire was damaged and restricted. The restricted front left tire resulted in a 5.9-meter (19.4 feet) tire mark that began at the point of impact and extended to the northeast corner of the intersection. In addition, the NASS researcher documented 1.4 meters (4.6 feet) of post-impact front right tire mark from the Ford in the intersection and 4.8 meters

(15.7 feet) of front right tire mark on the northeast roadside from the Ford's trajectory to final rest.

The Lexus continued its northeast trajectory and departed the northeast quadrant of the intersection at the location of the curb ramp for the sidewalk. The Lexus traveled off-road and impacted a fire hydrant with its frontal aspect (**Figure 5**). The resultant direction of force was within the 12 o'clock sector. The damage for this impact could not be located on the Lexus due to a subsequent frontal impact to a tree; therefore, a delta V could not be calculated.

The Lexus traveled an additional 2.8 meters (9.2 feet) and impacted a 30.0 cm (11.2") diameter tree with its front (**Figure 5**). The resultant direction of force for this impact was within the 12 o'clock sector. The WINSMASH barrier equivalent algorithm was used to calculate a delta V for this impact. The barrier equivalent delta V was 26.0 km/h (16.2 mph). It should be noted that this damage pattern was a result of the fire hydrant and tree impact damage. The Lexus came to rest against the tree facing in a northeast direction.



Figure 5. Area of impact with the fire hydrant and the tree.

Post-Crash

The restrained 31-year-old pregnant female driver of the Lexus sustained three soft tissue (AIS-1) injuries. The driver of the Lexus declined treatment at the scene. She arranged for transport to her obstetrician's office for evaluation. The driver was referred to a local hospital where she was admitted overnight for observation of her pregnancy. The Lexus and the Ford sustained severe damage and were towed from the crash site.

Vehicle Damage

Exterior – 2004 Lexus RX330

The 2004 Lexus RX330 sustained severe damage as a result of the multiple event crash. The damage from the initial impact with the Ford consisted of longitudinal and lateral displacement of the frontal components (**Figure 6**). Due to the multiple overlapping impacts to the frontal aspect, a crush profile was not documented for this impact. The NASS researcher documented a Collision Deformation Classification (CDC) for this impact of 11-FL99-9 (9's represent unknown values). Based on the SCI evaluation of the damage the CDC was revised for this report as follows: 12-FLEW-1.



Figure 6. Frontal damage from the initial impact with the Ford.

The Lexus sustained minor severity damage as a result of the secondary sideslap impact with the Ford (**Figure 7**). The damage consisted of lateral displacement of the left rear door and left rear quarter panel. The direct contact damage measured 203.0 cm (79.9”), which began at the left rear bumper corner and extended forward. The maximum crush measured 13.0 cm (5.1”) and was located at the mid point of the left rear quarter panel. Six equidistant crush measurements were documented along the mid-door level using a combined direct and induced damage width of 203.0 cm (79.9”) and were as follows: C1 = 3.0 cm (1.2”), C2 = 13.0 cm (5.1”), C3 = 12.0 cm (4.7”), C4 = 0.0 cm, C5 = 2.0 cm (0.8”), C6 = 0.0 cm. The CDC for this impact was 09-LZEW-1.



Figure 7. Left side damage from the secondary impact with the Ford.

The Lexus sustained minor severity damage as result of the impact with the fire hydrant. The damage for this impact could not be located due to the multiple overlapping frontal impacts. The NASS researcher assigned a CDC for this impact of 99-F999-9. The SCI revised CDC was 12-F999-9.

The Lexus sustained moderate severity damage as a result of the impact with the 30.0 cm (11.8”) diameter tree (**Figure 8**). The damage from this impact resulted in the longitudinal displacement of the frontal structure of the Lexus. The direct contact damage measured 30.0 cm (11.8”). This impact yielded a maximum crush depth of 35.0 cm (13.8”) which was located 55.0 cm (21.7”) inboard of the front left bumper support corner. Six crush measurements were documented along the bumper support using a combined direct and induced damage width of 100.0 cm (39.3”) and were as follows: C1 = 0.0 cm, C2 = 16.0 cm (6.3”), C3 = 29.0 cm (11.4”), C4 = 27.0 cm (10.6”), C5 = 8.0 cm (3.1”), C6 = 0.0 cm. The NASS researcher documented CDC for this impact was 12-FLEN-2. Based on the SCI evaluation of the damage, the CDC was revised for this report as follows: 12-FZEN-1.



Figure 8. Damage from the impact with the tree.

Interior – 2004 Lexus RX330

The 2004 Lexus RX330 sustained minor interior damage (**Figure 9**) as a result of occupant contacts. There were no intrusions into the passenger compartment. The NASS researcher documented a scuff to the lap portion of the safety belt webbing from the driver's abdomen. The NASS researcher also documented two scuffs to the knee bolster air bag from contact by the driver's knees.



Figure 9. Overall view of the driver's area.

Exterior – 1991 Ford Taurus

The 1991 Ford Taurus sustained moderate right side damage as a result of the initial impact with the Lexus (**Figure 10**). The direct damage measured 49.0 cm (19.3") and began at the front right corner and extended rearward. The maximum crush was 57.0 cm (22.4") and was located at forward edge of the front right fender. The damage involved lateral displacement of the right side and frontal components. Six crush measurements were documented at the mid-door level using a combined direct and induced damage width of 113.0 cm (44.5"), and were as follows: C1 = 0.0 cm, C2 = 10.0 cm (3.9"), C3 = 24.0 cm (9.5"), C4 = 37.0 cm (14.6"), C5= 37.0 cm (14.6"), C6= 57.0 cm (22.4"). The CDC for this impact was 02-RFEW-4.



Figure 10. Right side damage from the initial impact with the Lexus.

The secondary sideslap impact with the Lexus resulted in moderate damage to the right rear aspect of the Ford (**Figure 11**). The direct contact damage began at the right rear corner and extended forward 214.0 cm (84.3"). The resultant damage consisted of lateral displacement of the right rear door, right rear quarter panel, and disintegrated right rear door, right rear, and rear glazing. Six crush measurements were documented at the mid-door level using a combined direct and induced damage width of 214.0 cm (84.3") and were as follows: C1 = 5.0 cm (2.0"), C2 = 24.0 cm (9.5"), C3 = 22.0 cm (8.7"), C4 = 11.0 cm (4.3"), C5 = 12.0 cm (4.7"), C6 = 1.0 cm (0.4"). The CDC for this impact was 03-RZEW-2.



Figure 11. Right side damage from the secondary impact with the Lexus.

Certified Advanced 208-Compliant Safety System – 2004 Lexus RX330

The 2004 Lexus RX330 was equipped with a Certified Advanced 208-Compliant safety system. The manufacturer of this vehicle has certified that this 2004 Lexus RX330 meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included multi-stage frontal air bags, seat track position sensors for the front seats, an occupant presence sensor for the front right seat, and retractor mounted pretensioners for the front safety belts. The system was monitored and controlled by an air bag control module. The air bag control module deploys the appropriate safety system dependant on crash severity, occupant presence, safety belt buckle status, and seat track position. In the subject crash, the air bag control module warranted the deployment of the driver’s frontal air bag, knee bolster air bag, left side RSCA, and the actuating of the driver’s safety belt pretensioner.

The driver’s frontal air bag deployed from the center of the steering wheel hub (**Figure 12**). The air bag was configured with a triangular cover flap design. The top flap measured 8.0 cm (3.1”) in height and 12.0 cm (4.7”) in width. The lower flaps measured 8.0 cm (3.1”) in height and 7.0 cm (2.8”) in width. The air bag measured 66.0 cm (26.0”) in diameter in its deflated state. The air bag contained two tethers and two vent ports. The vent ports were located at the 11 and 1 o’clock positions on the rear aspect. No occupant contacts were noted to the air bag.



Figure 12. Deployed driver's frontal air bag.

The driver’s knee bolster air bag deployed from the left side knee bolster (**Figure 13**). The air bag was configured with H-configuration cover flaps. The top flap measured 3.0 cm (1.2”) in height and 25.0 cm (9.8”) in width. The lower flap measured 5.0 cm (2.0”) in height and 25.0 cm (9.8”) in width. The knee bolster air bag measured 38.0 cm (15.0”) in height and 56.0 cm (22.0”) in width in its deflated state and contained two tethers and no vent ports. The NASS researcher documented two occupant contacts to the face of the knee bolster air bag. The occupant contacts consisted of two scuffmarks on the left and right aspects from the driver’s knees. The NASS researcher also noted that the upper section of the plastic knee bolster panel was displaced from the deploying knee bolster air bag. The section of the knee bolster was mounted below the



Figure 13. Deployed driver's knee bolster air bag.

steering column and measured 12.0 cm in (4.7”) height and 36.0 cm (14.2”) in width. No occupant contact points were noted to the displaced panel.

The front right air bag was a mid-mount design on the instrument panel. The front right seat was not occupied; therefore, the air bag control module did not deploy the front right air bag.

Air Bag Control Module – 2004 Lexus RX330

The 2004 Lexus RX330 was equipped with an air bag control module that had event data recording capabilities. The air bag control module was removed by the NASS researcher and was forwarded to NHTSA for download by Toyota. The air bag control module data does not address the side impact air bags and RSCA’s. The following tables represent the data that was recorded by the air bag control module’s Event Data Recorder (EDR):

Table 1

Deployment Time	26 ms
Deployment Stage Driver	High
Deployment Stage Passenger	Not Fired

Table 2

Time From Previous Event	5100 ms
Time From Last Pre-Crash Data	700 ms
Pre-Crash Data Flag	Off
Shift Position	Other
Seat Position Driver	RW
Belt Switch Status Driver	Belted
Belt Switch Status Passenger	Unbelted
Occupant Detection Passenger	No Level
Passenger Air Bag Manual Cut Off	N/A
Ignition Cycles	0 Times
Lamp On Term	0 Minutes
Daig Code	0
Previous Event Counter	1 Count

Table 3

Seconds	Speed	Engine	Accelerator	Brake
-5.0	76.0 km/h (47.2 mph)	1200	Off	On
-4.0	76.0 km/h (47.2 mph)	1200	Off	On
-3.0	76.0 km/h (47.2 mph)	1200	Off	On
-2.0	76.0 km/h (47.2 mph)	1200	Off	Off
-1.0	78.1 km/h (48.5 mph)	1200	Off	Off
-0.3	78.1 km/h (48.5 mph)	1200	Off	On

Table 4

Milliseconds	Velocity Change
10.0	0.6 km/h (0.4 mph)
20.0	2.3 km/h (1.4 mph)
30.0	4.2 km/h (2.6 mph)
40.0	5.8 km/h (3.6 mph)
50.0	11.3 km/h (7.0 mph)
60.0	16.3 km/h (10.1 mph)
70.0	21.1 km/h (13.1 mph)
80.0	24.1 km/h (15.0 mph)
90.0	26.1 km/h (16.2 mph)
100.0	27.7 km/h (17.2 mph)
110.0	28.6 km/h (17.8 mph)
120.0	29.6 km/h (18.4 mph)
130.0	30.6 km/h (19.0 mph)
140.0	31.1 km/h (19.3 mph)
150.0	31.2 km/h (19.4 mph)

Roll-Sensing Curtain Air Bags – 2004 Lexus RX330

The 2004 Lexus RX330 was equipped inflatable curtain air bags for the outboard seating positions. The inflatable curtains are Roll-Sensing Curtain Air Bags (RSCA) and are designed to deploy at a severe tilt degree, roll or lateral G-force from side impacts. In the subject crash, the left side RSCA deployed (**Figures 14 and 15**). The air bag measured 38.0 cm (15.0”) in height and 167.0 cm (65.7”) in width. The RSCA contained two tethers and no vent ports. No occupant contacts were noted to the RSCA. The right RSCA did not deploy in this crash.



Figure 14. Deployed left side RSCA.



Figure 15. Deployed left side RSCA

Side Impact Air Bags – 2004 Lexus RX330

The 2004 Lexus RX330 was equipped with seatback mounted side impact air bags for the front seating positions. In this crash, the side impact air bags did not deploy. It was probable that the side impact threshold was not achieved during this crash sequence.

Manual Restraint Systems – 2004 Lexus RX330

The 2004 Lexus RX330 was equipped with integrated manual 3-point lap and shoulder safety belts for the five seating positions. The driver's safety belt was configured with a sliding latch plate, Emergency Locking Retractor (ELR), and a retractor mounted pretensioner. The driver utilized her safety belt in the crash, which was evidenced by the occupant loading on the lap portion of the safety belt. Furthermore, the safety belt was found restricted in the used position as a result of the actuated status of the retractor pretensioner. The front right safety belt was configured with a sliding latch plate, switchable Emergency Locking Retractor/Automatic Locking Retractor (ELR/ALR), and a retractor mounted pretensioner. The front right safety belt was not used; therefore the pretensioner did not actuate. The rear safety belts were configured with sliding latch plates, and switchable ELR/ALR.

Occupant Demographics – 2004 Lexus RX330

Driver

Age/Sex: 31-year-old female (7-months pregnant)
Height: 160.0 cm (63.0")
Weight: 77 kgs (170 lbs)
Seat Track Position: Mid-track
Manual Restraint Use: Manual 3-point lap and shoulder belt
Usage Source: Vehicle inspection
Eyewear: Contact Lenses
Type of Medical Treatment: Transported to a local hospital where she was hospitalized for one day.

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Chest contusion	Minor (490402.1,4)	Frontal air bag
Right lower leg contusion	Minor (890402.1,1)	Knee bolster air bag
Left dorsal hand abrasion at 3 rd metacarpal joint	Minor (790202.1,2)	Left side RSCA

Source- Post-emergency room records

Driver Kinematics

The 31-year-old pregnant female driver of the 2004 Lexus RX330 was seated in an upright driving posture and was restrained by the manual 3-point lap and shoulder belt. The seat was adjusted to a mid-track position. The initial impact with the Ford resulted in the driver's frontal air bag and knee bolster air bag deployment and the actuating of the safety belt pretensioner. The driver initiated a forward and left trajectory in response to the 11 o'clock direction of force and loaded the lap portion of the safety belt. It's unknown how the shoulder belt was positioned on the driver. The driver's chest contacted the frontal air bag which resulted in the chest contusion. Her right leg contacted the knee bolster air bag which resulted in the right lower leg contusion. The secondary impact with the Ford involved the left rear aspect of the Lexus impacting the right rear of the Ford. This resulted in the left side RSCA deployment. The driver initiated a lateral left trajectory in response to the 9 o'clock impact force and her left hand contacted the left side RSCA which resulted in the left dorsal hand abrasion at 3rd metacarpal joint.

Driver – Medical Treatment

The driver of the Lexus declined treatment at the scene. She arranged for transport to her obstetrician's office for evaluation. The driver was referred to a local hospital where she was admitted overnight for observation of her pregnancy. The unborn child was not injured a result of the crash.

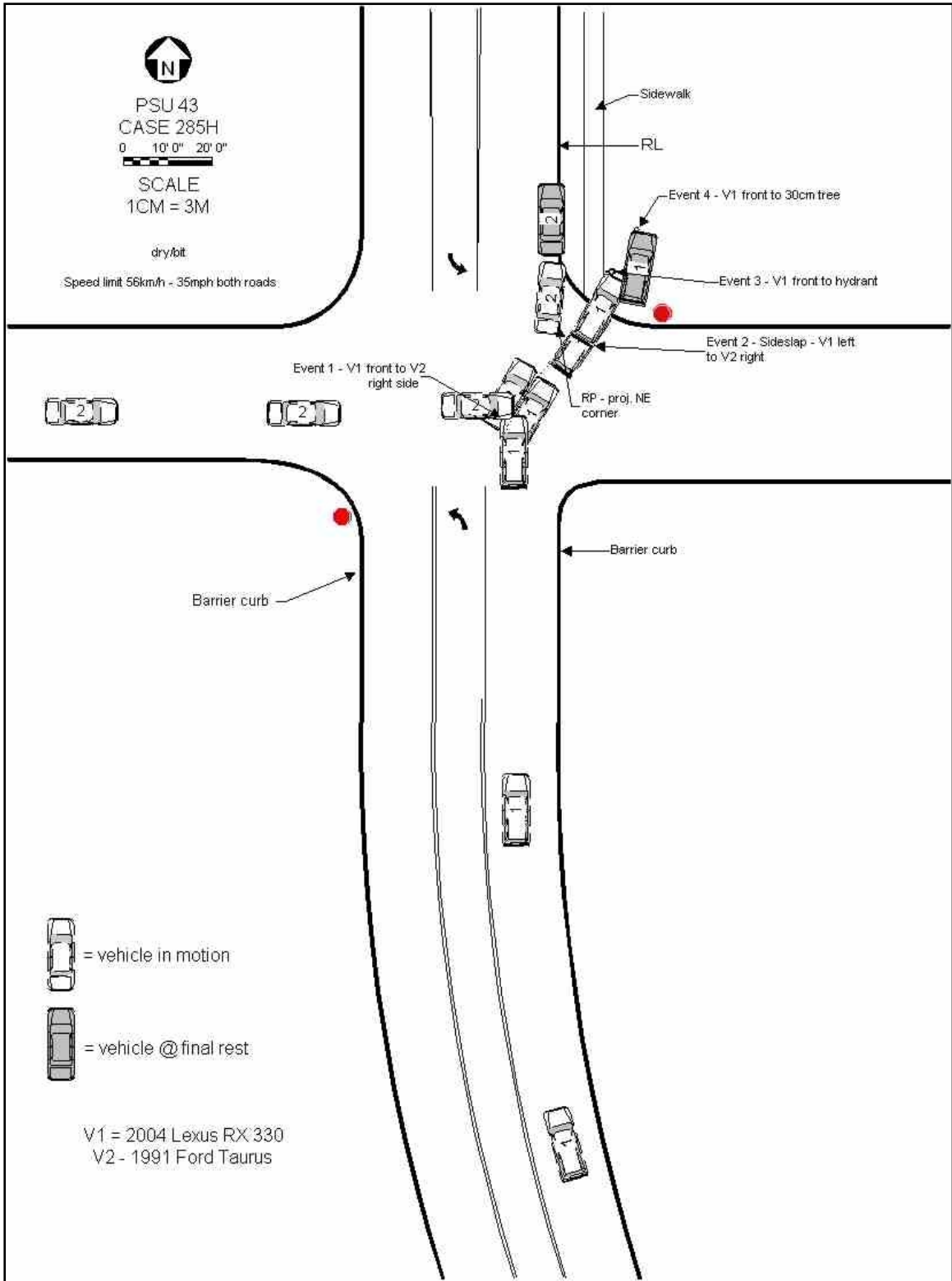


Figure 16. NASS Scene Schematic