

**CRASH DATA RESEARCH CENTER**

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**CALSPAN ON-SITE ADVANCED OCCUPANT PROTECTION SYSTEM  
CRASH INVESTIGATION**

**CASE NO: CA04-007**

**VEHICLE: 2004 LEXUS LS430**

**LOCATION: NEW YORK**

**CRASH DATE: FEBRUARY 2004**

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation  
National Highway Traffic Safety Administration  
Washington, D.C. 20590

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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.

## TECHNICAL REPORT STANDARD TITLE PAGE

<p>1. <i>Report No.</i> CA03-040</p>	<p>2. <i>Government Accession No.</i></p>	<p>3. <i>Recipient's Catalog No.</i></p>	
<p>4. <i>Title and Subtitle</i> Calspan On-Site Advanced Occupant Protection System Investigation Vehicle: 2004 Lexus LS430 Location: State of New York</p>		<p>5. <i>Report Date:</i> October 2005</p>	
		<p>6. <i>Performing Organization Code</i></p>	
<p>7. <i>Author(s)</i> Crash Data Research Center</p>		<p>8. <i>Performing Organization Report No.</i></p>	
<p>9. <i>Performing Organization Name and Address</i> Transportation Sciences Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225</p>		<p>10. <i>Work Unit No.</i> C00410.0000.0148</p>	
		<p>11. <i>Contract or Grant No.</i> DTNH22-01-C-17002</p>	
<p>12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590</p>		<p>13. <i>Type of Report and Period Covered</i> Technical Report Crash Date: February 2004</p>	
		<p>14. <i>Sponsoring Agency Code</i></p>	
<p>15. <i>Supplementary Note</i> This on-site investigative effort focused on the performance of the Advanced Occupant Protection System (AOPS) that was present in a 2004 Lexus LS430.</p>			
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<p>17. <i>Key Words</i> Advanced Occupant Protection System Driver and Passenger Frontal and Knee Bolster Bag Deployment</p>		<p>18. <i>Distribution Statement</i> General Public</p>	
<p>19. <i>Security Classif. (of this report)</i> Unclassified</p>	<p>20. <i>Security Classif. (of this page)</i> Unclassified</p>	<p>21. <i>No. of Pages</i> 13</p>	<p>22. <i>Price</i></p>

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**CALSPAN ON-SITE ADVANCED OCCUPANT PROTECTION SYSTEM  
INVESTIGATION**

**CALSPAN CASE NO.: CA04-007  
LOCATION: STATE OF NEW YORK  
VEHICLE: 2004 LEXUS LS430  
CRASH DATE: FEBRUARY 2004**

***BACKGROUND***

This on-site investigative effort focused on the performance of the Advanced Occupant Protection System (AOPS) that was present in a 2004 Lexus LS430 (**Figure 1**). The AOPS consisted of dual-stage frontal air bags, frontal knee air bags, and front and rear outboard safety belt pretensioners. The Lexus was also equipped with a Pre-Collision System (PCS) and OnStar. The vehicle was occupied by a restrained 34-year-old male driver, a 34-year-old female restrained front right passenger, and a 15-year-old female unrestrained rear-right passenger. The male driver of the Lexus LS430 was operating the vehicle northbound on an undivided two-lane state roadway during daylight hours. At the time of the crash, there were no adverse



**Figure 1. Damaged 2004 Lexus LS430**

weather conditions. The driver fell asleep and relinquished control of the vehicle as the Lexus approached a left curve. The vehicle continued on a straight-line straight trajectory and departed the right roadside in a tracking mode. The front right corner area struck a utility pole that was located approximately 1 m (3') from the right road edge and approximately 20 m (65') north of the point of roadside departure. The impact fractured the utility pole, resulting in moderate damage to the front of the vehicle, which was sufficient to deploy the dual-stage frontal air bag system, the driver's and front right passenger's knee air bags, and fire the front and rear outboard safety belt retractor pretensioners. The On-Star system was also activated as a result of the crash. The Lexus continued through the fractured pole, struck a cluster of three roadside mailboxes, and came to rest on the right shoulder 29 m (95') north of the struck pole. The occupants did not sustain injury and refused medical treatment at the scene.

This crash was identified by the Calspan SCI team. The notification was forwarded to the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) on March 1, 2004 due to the deployment of the knee air bags and the presence of the AOPS. An on-site investigation was assigned on March 5, 2003. The vehicle was inspected at a local body shop two days after the crash. At the time of the vehicle inspection, cooperation had been established with the owner of the vehicle to retrieve the Event Data Recorder (EDR) and forward it to NHTSA for download by Toyota. Due to the location of the module, it could not be removed from the vehicle without removing the entire instrument panel area. After consultation with NHTSA, it was determined to have qualified repair personnel remove the EDR when and if the vehicle was to be repaired. The owner was reluctant to allow removal of the EDR. He subsequently declined as he negotiated repair and potential sale of the vehicle through his insurance company.

### ***VEHICLE DATA – 2004 LEXUS LS430***

The 2004 Lexus LS430 was identified by the Vehicle Identification Number (VIN): JTHBN36F740 (production sequence omitted). The vehicle was a four-door sedan equipped with a 4.3 liter, V-8, engine, and the Ultra Luxury Selection trim, which the Pre-Collision System (PCS). The vehicle was equipped with a six-speed automatic transmission with sequential shift that allowed the driver to manually shift gears. The LS430 was configured with four-channel, four sensor Anti-lock Brakes and the Brake Assist system. The Brake Assist system was designed to determine if a driver was attempting emergency braking and, if the driver had not applied sufficient braking force to activate the anti-lock brake system, it applied maximum braking pressure until pedal pressure was released. An Electronic Brakeforce Distribution (EBD) feature optimized braking pressure at each wheel to maintain stability during hard braking and cornering. The Lexus was also equipped with Vehicle Stability Control (VSC), which detected and helped to correct loss of lateral traction during cornering. The system automatically reduced the throttle and applied the brakes in response to traction loss. The VSC system integrated traction control (TRAC) to help limit rear wheel spin on slippery road surfaces. The Lexus was also configured with Adaptive Variable Air Suspension system and height control, which offered 'Normal' and 'Sport' settings for a more luxurious ride or higher handling precision. According to Lexus, the system, "reads the road and smoothes out the ride accordingly." At the time of the vehicle inspection, an indicator on the instrument panel read, "Height Hi." Dynamic Radar Cruise Control was also present on the vehicle, which is designed to detect a vehicle ahead and automatically reduce speed and/or apply the brakes to maintain the pre-set following distance. The LS430 was also configured with an Adaptive Front Lighting System, which automatically rotated the head lamps outward up to 15 degrees in response to a turn, based on vehicle speed and steering angle. An indirect tire pressure monitoring system was present on the LS430, which alerted the driver via an indicated light on the instrument panel to a tire inflation issue. The side windows were configured with Lamisafe AS AH1 laminated glass.

The PCS system uses a millimeter-wave radar sensor to detect obstacles in front of the car and a Pre-Collision System computer with vehicle speed, steering angle and yaw rate inputs that help to determine in advance whether a collision is unavoidable. If the system determines that a collision is not avoidable, it can preemptively activate the Pre-Collision seatbelt to retract the driver's and front passenger's seatbelts. PCS also prepares the Brake Assist which, after the driver applies the brakes, automatically applies increased braking force to help reduce pre-collision speed. The LS430 was also equipped with OnStar which activated as a result of the crash.

The Lexus LS430 was equipped with Dunlop SP Winter Sport M3 225/55R17 winter tires. The manufacturer's recommended tire pressure was 220 kPa (32 PSI).

The specific tire information at the time of the SCI inspection was as follows:

<b>Position</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	244.8 kPa (35.5 PSI)	8.7 mm (11/32")	No	None
LR	241.3 kPa (35.0 PSI)	7.1 mm (9/32")	No	None
RF	234.4 kPa (34.0 PSI)	7.9 mm (10/32")	No	None
RR	244.8 kPa (35.5 PSI)	7.1 mm (9/32")	No	None

The seating in the Lexus LS430 was configured with leather-trimmed bucket seats for the driver and front right passenger positions. The driver's seat was configured with a three-position, 24-function memory system, heat controls, and an adjustable power head restraint. In addition to the driver's seat, the memory system controlled the outside mirrors, driver's adjustable D-ring height, and steering wheel telescoping and tilt functions. At the time of the vehicle inspection, the driver's head restraint was positioned 6.4 cm (2.5") above the seat back, the seat back was reclined 30 degrees, the forward edge of the seat cushion was vertically located 30.5 cm (12.0") above the floor and the rearward seat cushion angle was 20 degrees from horizontal. The driver's seat was positioned 16.5 cm (6.5") rear of the full-forward track position and 7.6 cm (3.0") forward of the full-rear track position. The steering wheel was adjusted to the full-down position and the telescoping adjustment was positioned 0.6 cm (0.3") forward of full-rear and 4.0 cm (1.6") rear of full-forward.

The front right passenger's seat was configured with a power, headed seat with an adjustable power head restraint. The front right passenger's head restraint was positioned 7.6 cm (3.0") above the top of the seat back, the seat back was reclined 20 degrees, the forward edge of the seat cushion was vertically located 27.9 cm (11.0") above the floor and the rearward seat cushion angle was 15 degrees from horizontal. The front right passenger's seat was located 17.8 cm (7.0") rear of the full-forward track position and 6.4 cm (2.5") forward of the full-rear track position.

The rear seating positions were configured with a leather-trimmed bench seat with adjustable outboard track and recline positions. Each rear outboard seat was configured with power adjustable head restraints, and the center position was configured with a manual head restraint. The rear left and rear center were in the full-down positions, and the rear right was positioned 3.8 cm (1.5") above the seat back at the time of the vehicle inspection. Both rear seats were in the full-rear track position at the time of the inspection, and the seatbacks were not reclined. The total track travel for the outboard rear seats measured 7.6 cm (3.0"). Each outboard seat was also configured with a heating and cooling system and massagers.

### **CRASH SITE**

This single-vehicle crash occurred during the daylight hours of February 2004 in the state of New York. At the time of the crash, there were no adverse weather conditions and the asphalt roadway surface was dry. The crash occurred on a curved section of a two-lane, north/south state roadway. The roadway was configured with one travel lane in each direction, separated by a double-yellow centerline and bordered by asphalt shoulders that measured 2.6 m (8.5') in width. The roadway was level and exhibited a northbound left curve with a radius of curvature of 2.02 degrees. The rural roadway environment consisted of fields and houses. Utility poles were present on both sides of the roadway. A private asphalt driveway was present on the east side of the roadway 13.4 m (44.0') north of the struck utility pole (**Figure 2**). Private mailboxes were present on the north aspect of the driveway at the road edge. The posted speed limit for the roadway was 89 km/h (55 mph). The scene schematic is included as **Figure 14** of this narrative report.



**Figure 2. View of utility pole (replaced), driveway, and mailboxes (replaced)**

### **CRASH SEQUENCE**

#### **Pre-Crash**

The 34-year-old driver of the Lexus LS430 was operating the vehicle in a northbound direction on the state roadway. The driver stated in a brief interview that he mistakenly ingested a sleeping pill earlier in the day and was feeling fatigued prior to the crash. The front right passenger and rear right passengers were both sleeping prior to the crash. The driver fell asleep and relinquished control of the vehicle prior to the left curve. As the Lexus reached the left curve in the roadway, the vehicle continued its straight trajectory and departed the northbound travel lane. The Lexus continued onto the right asphalt shoulder and subsequently onto the right roadside in a tracking mode. It was not known if the Pre-Collision System activated as the Lexus approached the utility pole.



**Figure 3. Northbound approach for the 2004 Lexus LS430**

#### **Crash**

The front right corner of the Lexus struck a utility pole that measured 30.5 cm (12.0") in diameter, located 1.7 m (5.6') outboard of the right roadside. The impact resulted in moderate damage to the LS430 and was sufficient to fire the safety belt pretensioners and deploy the frontal air bags and knee air bags. The damage algorithm of the WinSMASH program computed a delta-V of 17.0 km/h (10.6 mph) for the impact with the pole. The wood pole fractured at ground level as a result of the impact, which resulted in the top half of the pole to become suspended by the attached wires. The Lexus continued in a northbound direction through the



pole, and due to the yielding nature of the pole, the forward trajectory of Lexus was not altered. The driver woke up after the pole impact and attempted to bring the vehicle to a controlled stop by applying the brakes. The Lexus crossed a private driveway on the roadside and struck an in-line cluster of three mailboxes located on the north aspect of the driveway, 20.9 m (68.6') north of the pole. The front right aspect of the Lexus struck the mailboxes, 7.6 cm (3.0") inboard of the pole impact. The driver brought the vehicle to a controlled stop on the right roadside, 30.5 m (100') north of the pole and 8.8 m (28.9') north of the mailboxes.

### **Post-Crash**

The occupants of the Lexus exited the vehicle under their own power. They did not sustain injury and refused medical treatment at the scene. It is not known if OnStar had contacted the occupants of the vehicle immediately following the crash. As rescue personnel were securing the vehicle approximately 15 minutes after the crash, a firefighter acknowledged noise in the vehicle. As he entered the Lexus, an OnStar representative inquired if there was anyone in the vehicle that could respond to them. The firefighter identified himself; the OnStar representative asked if the vehicle had been involved in a crash. The firefighter stated that the vehicle had been involved in a crash, and that rescue personnel were on location. The OnStar representative inquired if there was anyone they could contact at that time, and the firefighter stated that the scene was under control, rescue personnel were on location, and no additional resources were needed.

### **VEHICLE DAMAGE**

#### **Exterior Damage – 2004 Lexus LS430**

The 2004 Lexus LS430 sustained moderate frontal damage as a result of the impact with the utility pole. The direct contact damage from the utility pole began 38.1 cm (15.0") right of the centerline and extended 43.2 cm (17.0") laterally to the front right corner. The front right headlamp assembly was crushed. The front right aspect of the hood was scuffed, deformed, and crushed longitudinally. Scuff marks from contact with the fractured pole extended longitudinally and laterally to the left to the rear center aspect of the hood (**Figure 4**).



**Figure 4. Overhead view of frontal damage and hood contact**

The bumper fascia was separated and fractured at the right corner. The front aspect of the right fender was crushed rearward. The combined direct and induced damage from the pole impact involved the entire frontal width of the vehicle. The bumper beam was crushed rearward about the left corner, the right aspect exhibiting the most severe longitudinal displacement. The entire hood was buckled rearward, and the right front fender was buckled outward. Six crush measurements were documented along the front bumper beam, which measured 121.9 cm (48.0") in width and were as follows: C1 = 0.0 cm. C2 = 2.9 cm (1.1"), C3 = 6.6 cm (2.6"), C4 = 12.7 cm (5.0"), C5 = 19.1 cm (7.5"), C6 = 24.8 cm (9.8"). The Collision Deformation Classification for the impact with the utility pole was 12-FREW-1.

The secondary impact with the mailboxes resulted in minor frontal damage to the bumper fascia and the hood. A narrow area of deformation from contact with a mailbox post was located on the leading edge of the hood 30.5 cm (12.0") right of the centerline and measured 5.1 cm (2.0") in width (**Figure 5**). Minor crush was present on the leading edge of the hood from the engagement with the post. Scuff marks on the bumper fascia were present in line with the hood contact, although there was no fracture or deformation to the bumper fascia from the mailbox post contact. A lateral crease that measured 25.4 cm (10.0") in width was present on the hood from contact with the bottom aspect of the mailbox. The crease was located 3.8 cm (1.5") aft of the leading edge of the hood and 22.9 cm (9.0") right of the centerline. Abrasions to the hood were present aft of the crease from contact with the mailbox as the Lexus continued forward. The CDC for the mailbox impact was 12-FREN-1.



**Figure 5. Close up of front right damage from the mailbox post**

#### **Interior Damage – 2004 Lexus LS430**

The 2004 Lexus LS430 sustained minor interior damage that was associated solely with the air bag deployment. There were no intrusions of the passenger compartment and no occupant contacts. The windshield was fractured above the front right passenger's air bag from contact with the air bag cover flap. The plastic panel under the glove box door was partially separated.

#### **MANUAL RESTRAINT SYSTEMS – 2004 LEXUS LS430**

The Lexus LS430 was equipped with 3-point lap and shoulder belts with sliding latch plates for each seating position. The front seat restraints were configured with motorized adjustable D-rings that exhibited 10.2 cm (4.0") of vertical travel. The controls for the motorized D-rings were on the interior door panel, forward of the release handle. The driver's D-ring was located 1.3 cm (0.5") below the full-up position and the front right passenger's D-ring was positioned in the full-up position. The driver's safety belt was configured with an Emergency Locking Retractor (ELR). The driver's safety belt was restricted in the stowed position at the time of the vehicle inspection (**Figure 6**), however, slack was present in the webbing. Since the webbing was not taut, it suggested the safety belt was spooled back into the retractor post-crash, and due to the pretensioner actuation, the retractor would not extend the webbing. The driver's plastic-covered latch plate exhibited heavy abrasions from occupant loading, and moderate abrasions were present on the driver's D-ring. Load-induced rippling was present on the webbing that began 52.1 cm (20.5") above the lower anchor and extended through the D-ring behind the B-pillar trim.



**Figure 6. View of restricted driver's safety belt**

The front right passenger's safety belt was configured with a switchable ELR/Automatic Locking Retractor (ALR) and was restricted in the used position. A portion of the webbing had been spooled back into the retractor post-crash, which did not allow enough webbing to engage the buckle during the inspection (**Figure 8**). The total exposed webbing measured 111.8 cm (44.0") in length. Heavy abrasions were present on the plastic-covered latch plate from occupant loading and faint abrasions were present on the D-ring. Corrugation from occupant loading began 50.8 cm (20.0") above the anchor and extended 33.7 cm (13.3") up the webbing.



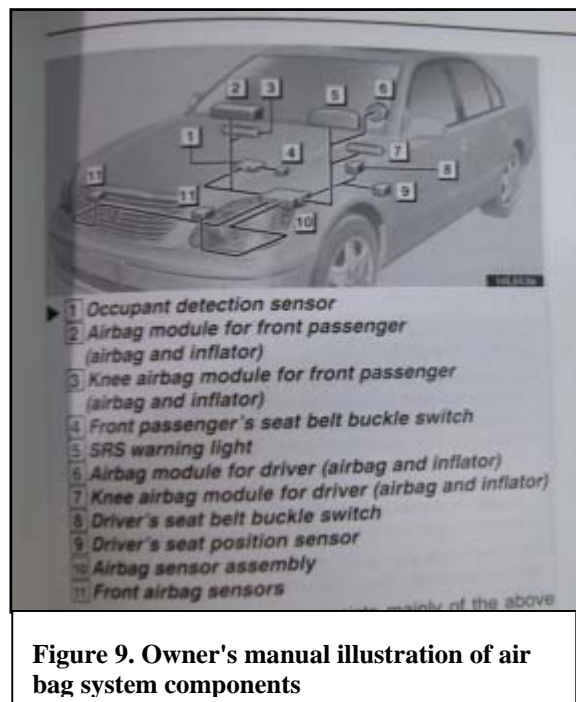
**Figure 8. View of front right passenger's safety belt**

The rear safety belts were configured with switchable ELR/ALR retractors. The outboard safety belts were found taut against the seat back, restricted in the stowed position at the time of the inspection, due to pretensioner actuation. Pretensioner actuation also resulted in the separation of the plastic stop buttons on both safety belts as the webbing was pulled through the latch plates. The post-crash status of the right rear safety belt supports lack of restraint usage by the right rear female occupant. The rear center safety belt was not restricted.

### ***ADVANCED OCCUPANT PROTECTION SYSTEM – 2004 LEXUS LS430***

#### **Frontal Air Bag System**

The dual-stage frontal air bag system deployed as a result of the utility pole impact. During the vehicle inspection, the ignition switch was activated and the air bag light on the instrument panel was constantly illuminated. **Figure 9**, from the vehicle's owner's manual, illustrates the air bag system components. Two air bag sensors were located on the outboard aspects of the upper radiator support area. Additional system components included a driver's seat track position sensor, a front right occupant detection sensor, driver's and front right passenger's buckle switches, and the safety belt pretensioner assemblies.



**Figure 9. Owner's manual illustration of air bag system components**

**Figure 10** shows the deployed frontal air bags and deployed knee air bags in the 2004 Lexus LS430. The driver's air bag deployed from the center of the steering wheel hub through H-configuration module cover flaps. The top flap measured 10.2 cm (4.0") in height and the bottom flap measured 7.6 cm (3.0") in height. The lateral tear seam measured 14.6 cm (5.8") in width. The air bag measured 66.0 cm (26.0") in diameter in its deflated state. It was tethered by two internal straps that measured 6.4 cm (2.5") in width and were located at the 3 and 9 o'clock positions. The tether stitching on the center of the air bag face measured 7.6 cm (3.0") in diameter. The air bag was vented by two flap-like rectangular ports that were located 6.4 cm (2.5") inboard of the peripheral seam and 8.9 cm (3.5") laterally from the centerline. The ports measured 1.3 cm (0.5") in width and 4.1 cm (1.6") in length. There was no occupant contact evidence present on the air bag.



**Figure 10. View of deployed frontal air bags and deployed knee air bags**

The front right passenger's air bag deployed from a top-mount module located on the right instrument panel with a single cover flap design. The rectangular cover flap measured 12.7 cm (5.0") in height and 31.1 cm (12.3") in width. The rigid plastic cover flap struck the windshield during the deployment of the air bag which resulted in a windshield fracture. The cover flap was restricted in the deployed position at the time of the inspection and the vertical displacement of the leading edge measured 7.6 cm (3.0"). The front right passenger's air bag measured 40.6 cm (16.0") in width and 50.8 cm (20.0") in height in its deflated state. The air bag was not tethered. It was vented by two circular ports located at the 3 and 9 o'clock positions on the side panels. The ports measured 6.4 cm (2.5") in diameter and were located 14.0 cm (5.5") below the top panel and 8.9 cm (3.5") rear of the outboard seams on the face of the air bag. There was no occupant contact evidence on the front right passenger's air bag.

The front and rear outboard safety belts were equipped with retractor pretensioners that fired in conjunction with the frontal air bag system in response to the frontal impact. The retractor pretensioners were separate from the Pre-Collision System safety belt tensioners. The front seat safety belts were restricted, although the slack in the driver's belt and extension of the front right passenger's safety belt webbing supported both front seat occupants as restrained. According to the owner's manual for the Lexus, an occupant presence sensor in the front right seat would suppress the pretensioner if the seat was unoccupied, and indicated that the safety belt pretensioners and frontal air bags may not operate together in all collisions. The firing of the rear seat pretensioners restricted the safety belt webbing in the stowed position for the outboard positions. Both outboard safety belts were taut against the seat back, as they were not in use at the time of the crash. The owner's manual for the LS430 stated the rear seat pretensioners would fire regardless of seat occupancy, and that all safety belt retractors would remain locked after the pretensioners fired.



### Frontal Knee Air Bags

The frontal knee air bags deployed in conjunction with the frontal air bags. Both knee air bags deployed from the left and right lower instrument panels. The knee air bag modules measured 26.0 cm (10.3") in width and 10.2 cm (4.0") in height and were flush with the lower instrument panel faces. Each module exhibited H-configuration cover flaps. Each top flap measured 5.1 cm (2.0) in height and each bottom flap measured 3.8 cm (1.5") in height. The flaps measured 25.4 cm (10.0") in width. The driver's knee air bag module (**Figure 11**) was located 17.1 cm (6.8") inboard of the left aspect of the lower instrument panel and 4.4 cm (1.8") below the steering column. The module tear seam was located 30.5 cm (12.0") above the floor. The front right passenger's knee air bag module was centered under the glove box door. The lateral tear seam was located 30.5 cm (12.0") above the floor.



**Figure 11. Driver's knee air bag module**

The knee air bags deployed outward and upward (**Figure 12**). Each knee air bag measured 35.6 cm (14.0") in height and 61.0 cm (24.0") in width in their deflated state (**Figure 13**). The knee air bags were tethered by a single internal strap that measured 38.7 cm (15.3") in width that was laterally centered. The tether was located 17.8 cm (7.0") from the leading edge of the knee air bag, and the maximum inflated thickness of the air bag measured 10.2 cm (4.0").



**Figure 12. Deployed front right passenger's knee air bag in deployed position**



**Figure 13. Rear aspect (against instrument panel) of deployed front right passenger's knee air bag**

The leading edge of the deflated driver's knee air bag extended upward to the lower aspect of the steering column along the lower instrument panel. In its deflated state, the longitudinal distance between the driver's knee air bag and the leading edge of the driver's seat measured 21.6 cm (8.5"). The leading edge of the front right passenger's knee air bag extended upward and was located 12.7 cm (5.0") below the top of the glove box door. In its deflated state, the longitudinal distance between the front right passenger's knee air bag and the leading edge of the front right passenger's seat measured 22.9 cm (9.0").

### **Side Impact Air Bags/Inflatable Curtains**

The 2004 Lexus LS430 was equipped with side impact air bags for each front seating position. The side air bags were located in the outboard aspects of the front seat backs and provide torso protection. The side air bags did not deploy in this crash.

The 2004 Lexus LS430 was also equipped with side impact Inflatable Curtains (IC's). The IC's deploy downward from the roof side rails between the A- and C-pillars and provide head protection for the front and rear seat occupants. The IC's did not deploy in this crash.

### ***OCCUPANT DEMOGRAPHICS – 2004 LEXUS LS430***

#### **Driver**

Age/Sex:	34-year-old male
Height:	Unknown
Weight:	Unknown
Seat Track Position:	16.5 cm (6.5”) rear of the full-forward track position and 7.6 cm (3.0”) forward of the full-rear track position
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Unknown
Type of Medical Treatment:	Did not sustain injury and refused medical treatment at the scene

#### **Driver Kinematics**

The 34-year-old male driver was seated in a semi-reclined posture with the seat track adjusted 16.5 cm (6.5”) rear of the full-forward track position and 7.6 cm (3.0”) forward of the full-rear track position and the seat back reclined 30 degrees. He was restrained by the manual 3-point lap and shoulder belt. Given that the driver was asleep prior to the crash, his head was most likely against the head restraint and he probably did not have an opportunity to brace. It was not known if the Pre-Collision System activated prior to the impact. At impact with the utility pole, the safety belt pretensioners fired, and the frontal air bags and frontal knee air bags deployed. The driver woke up and initiated a forward trajectory and loaded the safety belt. The loading to the safety belt was sufficient to produce heavy abrasions on the plastic-covered latch plate. His lower legs contacted the deployed driver's knee air bag, which mitigated contact with the knee bolster. His face contacted the deployed driver's air bag, which prevented contact with the steering wheel. He rebounded rearward into the seat back and applied the brakes. The secondary impact with the mailboxes was not sufficient to cause displacement of the driver. He remained in his rebounded driving position as he brought the vehicle to a controlled stop on the roadside. The driver did not sustain injury and exited the vehicle under his own power. He refused medical treatment at the scene.

### **Front Right Passenger**

Age/Sex: 34-year-old female  
Height: Unknown  
Weight: Unknown  
Seat Track Position: 17.8 cm (7.0”) rear of the full-forward track position and 6.4 cm (2.5”) forward of the full-rear track position  
Manual Restraint Use: Manual 3-point lap and shoulder belt  
Usage Source: Vehicle inspection  
Eyewear: Unknown  
Type of Medical Treatment: Did not sustain injury and refused medical treatment at the scene

### **Front Right Passenger Kinematics**

The 34-year-old female front right passenger was seated in a reclined posture with the seat track adjusted 17.8 cm (7.0”) rear of the full-forward track position and 6.4 cm (2.5”) forward of the full-rear track position. She was restrained by the manual 3-point lap and shoulder belt. The specific pre-crash recline angle was unknown, but the driver stated that the seat was reclined significantly as the front right passenger was sleeping. The seat back recline had been adjusted from its pre-crash position prior to the vehicle inspection. It was not known if the Pre-Collision System activated prior to the impact. At impact with the utility pole, the front right passenger’s safety belt pretensioner fired, and the frontal air bag and knee air bag deployed. Since the front right passenger was asleep, she probably did not have an opportunity to brace. She initiated a forward trajectory and loaded the safety belt, evidenced by heavy abrasions on the plastic-covered latch plate. Her lower legs contacted the deployed knee air bag, which prevented contact with the lower instrument panel, and her face contacted the deployed front right passenger’s air bag which mitigated contact with the upper instrument panel. She rebounded rearward and came to rest in the seat. The secondary impact with the mailboxes was not sufficient to cause displacement of the front right passenger. She did not sustain injury and exited the vehicle under her own power. She refused medical treatment at the scene.

### **Rear Right Passenger**

Age/Sex: 15-year-old female  
Height: Unknown  
Weight: Unknown  
Seat Track Position: Full-rear  
Manual Restraint Use: Unrestrained  
Usage Source: Vehicle inspection  
Eyewear: Unknown  
Type of Medical Treatment: Did not sustain injury and refused medical treatment at the scene

### **Rear Right Passenger Kinematics**

The 15-year-old female rear right passenger was seated in the rear right position and was unrestrained, evidenced by the taut, restricted safety belt. She was asleep prior to the collision. At impact with the utility pole, the rear right safety belt pretensioner fired and restricted the safety belt in the stowed position. The unrestrained passenger initiated a forward trajectory and loaded the rear aspect of the front right seat back, although there was no occupant contact evidence on the seat back. She rebounded rearward and came to rest in the right rear seat. She

did not sustain injury and exited the vehicle under her own power. She refused medical treatment at the scene.



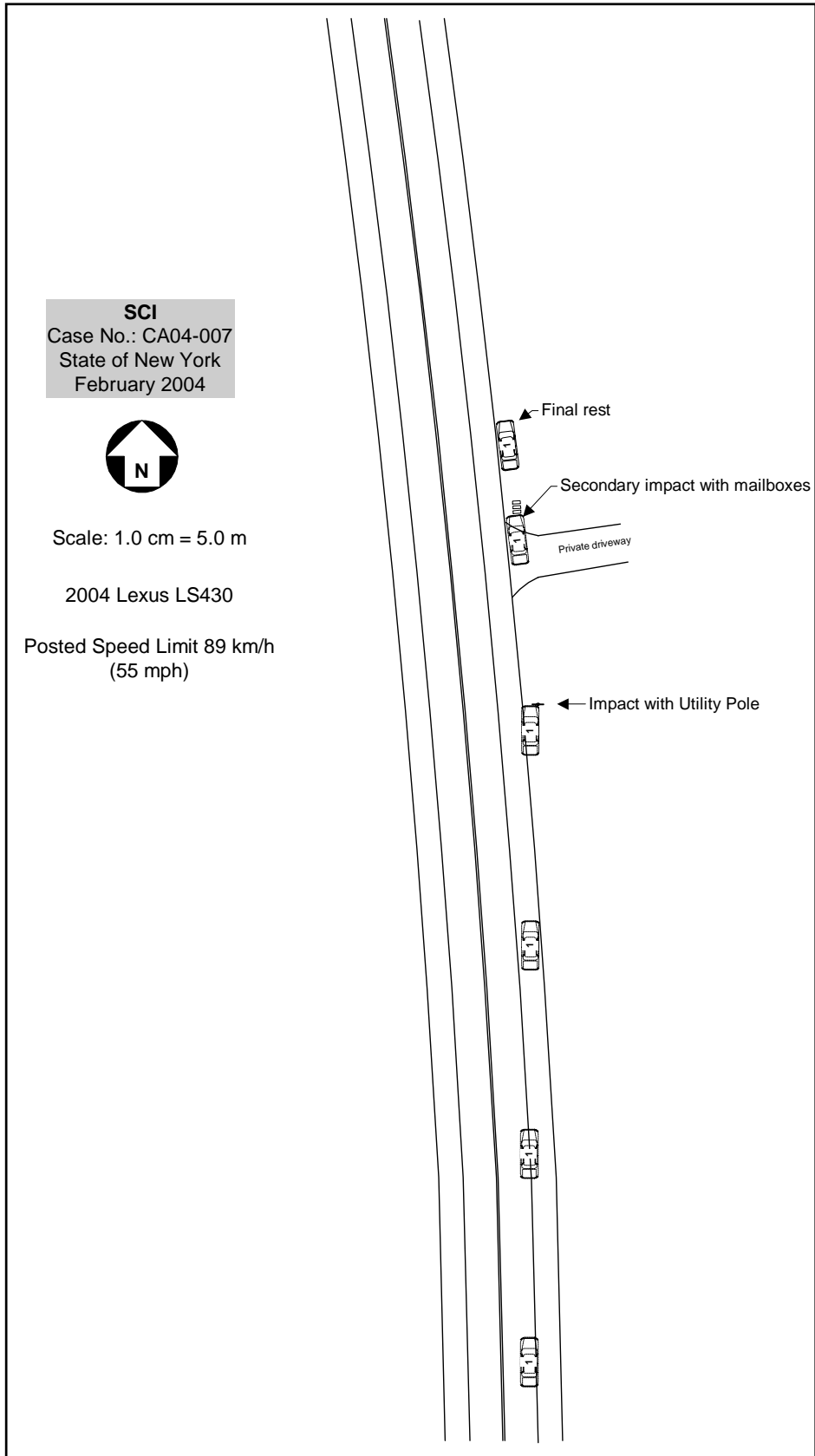


Figure 14. Scene schematic.