

# Lexus Safety Feature Summary

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## PASSIVE SAFETY

### **Supplemental Restraint Systems (SRS)**

Lexus engineers its vehicles with advanced passive safety technology, founded in a body structure equipped with front and rear crumple zones. Lexus models are equipped with pretensioners and force limiters on the front seatbelts, and most models feature them on the rear outboard seatbelts, as well.

Lexus models are equipped with advanced deployment front airbags, front seat-mounted side airbags and side curtain airbags for all seating rows. The advanced dual-stage front airbags are designed to deploy at one of two speeds, according to impact force. The driver's front airbag also includes an extra low stage designed to deploy based, in part, on the seat's position on its track. Lexus luxury utility vehicles are equipped with roll-sensing side curtain airbags.

## DRIVING DYNAMICS

### **Advanced Braking Systems**

All Lexus models come equipped with four-channel, four-sensor anti-lock brakes (ABS) with Electronic Brake-force Distribution (EBD). ABS can help maintain steering control during emergency braking maneuvers. In the LX 570 and GX 460 luxury utility vehicles, ABS operates even in low-range four-wheel drive. Sensors monitor road conditions according to changes in wheel speed. Such responsiveness helps the driver maintain control while traversing hilly, unpaved terrain.

All Lexus models are equipped with EBD, which helps to optimize brake pressure at each wheel, especially during braking while cornering. Brake Assist, also standard on all Lexus models, is designed to determine if the driver is attempting emergency braking and, if the driver has not stepped firmly enough on the brake pedal to engage the ABS, Brake Assist (BA) applies increased braking pressure until the brake pedal is released.

### **Vehicle Dynamics Integrated Management (VDIM)**

For 2011, Lexus models equipped with the advanced Vehicle Dynamics Integrated Management (VDIM) system are all LS models, the GS 460 and GS 450h models, the IS 350, IS F and RX 450h. Vehicle Stability Control (VSC), which also incorporates Traction Control (TRAC), is a part of the VDIM system and is used on the ES 350, GS 350, RX 350, GX 460 and LX 570 models. VSC helps the driver keep the vehicle going on its intended course. It detects front- and rear-wheel slide and attempts to control either condition using throttle intervention and/or by braking individual wheels.

VDIM integrates and manages a host of handling technologies more quickly than other dynamic handling technologies. A component of VDIM is the Electronically Controlled Brakes (ECB), a "brake-by-wire" system (except in IS 250, IS 350, IS F and GS 350). ECB translates brake pedal pressure into electric signals that, via computer control, help provide precise and optimized braking in virtually any traction condition. Electronic control provides quick brake response when needed, helping the VDIM system to anticipate and help correct slides before they might occur. The ECB system is backed by conventional hydraulic brake control in case of the unlikely event of electronic failure.

VDIM integration strategy provides precise control for the ECB, Electric Power Steering (EPS), VSC, BA, EBD and engine torque via the electronically controlled throttle. On the LS 460 L, LS 600h L, GS 460 and GS 450h models, VDIM also influences Variable Gear Ratio Steering (VGRS) to affect minor steering corrections when needed.

In the IS F model, VDIM is specially calibrated to account for the demands of high-performance track driving. Using a dashboard switch, the driver can select Normal, Sport or Snow driving modes. In Sport mode, VDIM allows higher dynamic thresholds before intervening and alters steering assist to increase steering feel. Sport mode enables optimal vehicle control on a track in areas where the skills of even top-level drivers are challenged. Also in the IS F models, VDIM provides an electronically controlled brake-based limited-slip differential effect on the rear wheels. During cornering, VDIM suppresses any tendency for the inside wheel to spin, transmitting more power to the outside wheel to maintain traction and momentum. The experienced driver can disengage VSC/TRAC by pressing and holding the TRAC-off button for more than three seconds.

### **Seeing into Curves**

The Adaptive Front-lighting System (AFS), which helps illuminate a turn or curve as the driver steers into it, is standard on the LS, GS 460 and GS 450h and LX 570 models. It is available as an option on HS 250h, GS 350, ES 350, GX 460 and RX models.

The ES 350, LX 570 and LS models feature a dual-swivel version of AFS. In this version of AFS, a medium-to-high speed mode allows the right and left front headlamp bulbs to both swivel toward the direction of the turn at the same time, enhancing system effectiveness. In the first-generation AFS system, only the bulb on the side of the turn direction swivels toward the turn.

On the first-generation AFS, a central controller calculates the optimum lighting direction based on input from vehicle speed and steering angle and swivels the right and left headlights independently. The left beam can rotate from zero to 15 degrees in a left turn while the right beam remains in the center position. The right beam can rotate from zero to five degrees in a right turn while the left beam remains in a center position.

The AFS headlamps have a self-leveling feature, similar to HID headlights. An AFS on/off switch allows the driver to disengage the system at any time.

For the dual-swivel AFS, in a left turn the left beam can rotate from zero to 15 degrees (nine for the LX 570 and 20 for the LS 460), while the right beam rotates from zero to 7.5 degrees (LS models and ES 350) or zero to nine degrees (LX 570). In a right turn, the right beam can rotate from zero to 10 degrees (four for the LX 570), while the left beam rotates from zero to five degrees (four for the LX 570).

### **Dynamic Radar Cruise Control and Pre-Collision System**

All Lexus sedans (except IS sedan) and luxury utility vehicles offer the Pre-Collision System (PCS), which integrates the Dynamic Radar Cruise Control system. A millimeter-wave radar sensor helps detect obstacles in front of the car, while vehicle speed, steering angle and yaw-rate inputs help to determine whether a collision is unavoidable.

In such a situation, PCS preemptively retracts front seat belts and pre-initializes Brake Assist so that increased braking will be applied the instant the driver depresses the pedal. The active braking feature will automatically apply the brakes up to a deceleration rate of 0.3 g if the driver fails to react to system warnings. On models equipped with Adaptive Variable air Suspension (AVS), the AVS system adjusts to firmer settings for optimal chassis response when PCS is activated.

The Dynamic Radar Cruise Control sensors use radar technology to help maintain a pre-set following distance from the car traveling in front. If the vehicle gets too close, the throttle is automatically reduced and brakes are applied. Once the road clears, the vehicle returns to its pre-set speed.

The HS 250h optional Pre-Collision System (PCS) also integrates a Driver Attention Monitor System. When this system detects the driver's face is not facing forward and there is an object ahead, it will alert the driver first with a warning beep and if necessary, lightly taps the brakes to get the driver's attention. When it deems a collision is imminent, it can automatically retract seat belt and prime the brakes to help reduce crash energy.

LS models offer the Advanced Pre-Collision System (APCS) which is designed to help detect pedestrians in the vehicle's path. Using two small cameras mounted at the front of the car that work in conjunction with millimeter-wave radar, APCS is sensitive enough to detect certain nonmetallic objects.

The APCS option also integrates a Driver Attention Monitor System. A camera mounted on the steering column monitors the orientation of the driver's face. If the camera detects that the driver is not looking directly ahead for a few seconds or more, and if an obstacle is detected ahead, the system alerts the driver first with a warning beep and a flashing light. As the car closes on the obstacle, if the driver does not react, APCS can begin to gently apply the vehicle's brakes.

To assist the driver in maneuvering around the obstacle, APCS adjusts the steering ratio to quicken the degree and speed of steering response. Simultaneously, in anticipation of a potential impact, the system automatically retracts the front seatbelts and prepares the brake assist system to respond with full power when the driver applies the brake pedal.

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