

## **ACTIVE AND PASSIVE SAFETY FEATURES**

**Korolkov A.E.**

**Scientific supervisor - Associated Professor Gavrulina L.E.**

*Siberian Federal University*

### **Active Safety Features**

When buying an SUV, it's important to consider its safety features. These fall into two categories: active and passive. Active safety features help the driver avoid an accident, while passive safety features help protect occupants in the event of an accident.

The following active safety features are designed to help you avoid an accident.

#### **Anti-lock Brakes**

Most vehicles today are available with anti-lock brake systems (ABS). If anti-lock brakes do not come standard on the SUV you intend to buy, be sure to choose ABS as an option. While ABS does not generally help a vehicle stop quicker than conventional brakes do on dry pavement, it has two distinct advantages. First, and most importantly, ABS allows you to steer your vehicle under full braking power. This is because ABS pumps the brakes many times per second (much faster than a human can), preventing wheel lockup and helping to maintain steering control. That means when that car suddenly stops in front of you, you can brake hard and still steer over to the shoulder if you won't stop fast enough to avoid an accident. In these instances, ABS can be the difference between a fender-bender and a close call.

Second, ABS can help you stop quicker on slippery pavement. Porsche invited Consumer Guide® to Barber Motorsports Park in Birmingham, Alabama, for an SUV safety driving program. In simulated icy conditions at the Porsche program, an ABS-equipped vehicle stopped in a reasonable distance. With the ABS deactivated, our test Porsche Cayenne continued to skid for a distance that would have been at least twice as far as the ABS-equipped vehicle. In fact, it wasn't until the Cayenne left the simulated icy surface and got onto a wet asphalt surface that it had any grip at all. A well-trained driver may be able to pump the brakes and prevent a skid, thus stopping quicker. However, most drivers press the brake pedal in an emergency situation, making ABS the better choice.

#### **Anti-skid Systems**

Anti-skid systems, often referred to as electronic stability control (ESC), go by other names depending on the manufacturer. GM calls it StabiliTrac, Ford dubs it AdvanceTrac, and Chrysler calls it Electronic Stability Program (ESP). Other names include Vehicle Dynamics Control (Subaru), Dynamic Stability Control (Volvo), Vehicle Stability Assist (Honda) and Vehicle Stability Control (Toyota). For a complete list of anti-skid system names, check out the NHTSA's ESC-equipped vehicles list.

An anti-skid system uses several sensors to detect a loss of grip in your vehicle, then works with the anti-lock brake system to apply individual brakes to help keep the vehicle on its intended path. In some cases, an anti-skid system also reduces engine power.

So what does this mean to the driver? Well, if you approach a corner too rapidly and your vehicle begins to plow straight ahead, an anti-skid system will detect that the vehicle is not on its intended path and intervene by applying the inside brakes. This will rotate the vehicle through the turn and, hopefully, save you from going off the road. Anti-skid systems can't defy the laws of physics, so they won't help you take a 90-degree turn at 100 mph, but

they can be quite helpful in most driving. Anti-skid systems are available on most SUVs, but they are usually optional. Make sure to order your SUV with an anti-skid system.

#### Roll Stability Control

Roll stability control works very much like an anti-skid system, but uses additional sensors to detect an impending rollover. It then activates the anti-skid system. Roll stability control systems work on flat pavement; they can't prevent rollovers caused by hitting a curb or sliding into a ditch. Also, roll stability control should not be confused with what may be called rollover protection; these systems deploy curtain-side airbags when detecting an impending tip. Volvo, Ford, Mercury, Lincoln, Land Rover and Jeep have roll stability control systems, and Dodge plans to release one soon.

#### All-wheel Drive

All-wheel-drive and four-wheel-drive systems allow all four wheels to transfer power to the road. Though not generally considered a safety feature, AWD or 4WD can provide the additional traction you may need to accelerate out of harm's way.

#### Four-wheel Independent Suspension

Four-wheel independent suspension allows each wheel to react individually to bumps in the road. All SUVs have independent front suspension, but not all have independent rear suspension (IRS). Those without IRS have solid rear axles that cause both wheels to react to a bump in the road when either tire hits that bump. While four-wheel independent suspension is also not generally considered a safety feature, keeping at least one tire planted on the road could possibly make the difference in avoiding an accident, especially when taking bumpy corners at high rates of speed.

### Passive Safety Features

Not every accident can be avoided. Should you get into an accident, it's best to have the following safety features on your side.

#### Vehicle Body Structure

As part of the Porsche SUV safety driving program, Porsche claimed that SUVs with a unibody structure are safer than those with a trucklike body-on-frame design. A unibody vehicle uses the body panels and floorpan to form its structure, while a body-on-frame design uses a ladder-type frame as the main supporting structure. The body attaches to the frame and, while it does provide structural support, the body is not as significant to the structure as it is in a unibody vehicle.



In a body-on-frame vehicle, the vertical surfaces are simply bolted to the frame.

The handling advantages of a unibody design tend to support Porsche's claim. A unibody design allows for a lower center of gravity, which means a lesser chance of rollover and a better, more stable, car-like ride. This would afford the driver greater control and could make the difference between being involved in an accident and avoiding one. And it would certainly reduce the risk of rollovers.



Though a unibody vehicle may have frame rails, those rails are tied to the vertical surfaces of the body to increase strength. In some cases, vehicles are a combination of both construction techniques.

However, would unibody construction be safer in the event of a crash? When asked, Robert Shelton, former executive director of NHTSA, said no real-world studies had been done to prove that unibody SUVs are safer in a crash. But a deeper look at NHTSA's crash-test data for 2005 midsize and large SUVs tends to support Porsche's claim. As you can see in the chart below, in general, unibody SUVs are indeed safer than their body-on-frame counterparts. They score considerably better in front crash and rollover tests, and score only slightly lower in side impact tests. It should be noted, however, that many of the body-on-frame SUVs tested were older in design than most of the unibody SUVs. Perhaps with the application of newer technology, body-on-frame SUVs will be safer in the future.

	NHTSA Front-Impact Crash Test		NHTSA Side-Impact Crash Test		Rollover Rating	
	Driver	Passenger	Front	Rear	2WD	4WD
Body-on-Frame	3.792	4.083	5.000	5.000	2.909	3.545
Unibody	4.463	4.463	4.941	4.882	3.833	4.000
All	4.105	4.289	4.963	4.926	3.325	3.750

NHTSA Crash Test Scores

### Airbags

Since 1994, the government has required all cars sold in the United States to have a front driver-side airbag, and dual front airbags have been required since 1997. By the 2007 model year, all U.S. cars will be required to have advanced front airbags that inflate with greater or lesser power according to the needs of the occupant. Sensors that determine the occupant's size and position, whether a seatbelt is in use, and the severity of the crash all determine the force with which the airbag is deployed. These airbags, already in use in many vehicles, are safer for children and smaller occupants than the current single-stage airbags.

Studies show that front airbags aren't always enough, though. Side impact airbags are especially helpful in the event of a side collision. According to a 2003 study by the IIHS, head-protecting side airbags accounted for a 45 percent reduction in risk of death in side crashes. Torso-protecting side airbags reduced risk of death by 11 percent in the same study. Based on this data, safety-conscious buyers will obviously want to include head-protecting and/or torso side airbags on their SUV shopping lists.

### Seatbelt Pre-tensioners and Force Limiters

Seatbelt pre-tensioners, which take the slack out of seatbelts quickly and automatically under heavy braking or in a frontal crash, are standard in most vehicles. Pretensioners help ensure that occupants get the best possible protection from their seat belts. Check to make sure the vehicle you are buying has them.

When pretensioners work, they can make the belt quite taut, possibly leading to chest injuries in the event of a crash. That's where seatbelt force limiters come into play. Force limiters let a little bit of slack back out of the belt. They are designed to work with the airbag to help spread frontal crash forces across the occupant's body, thus reducing the risk of injury.