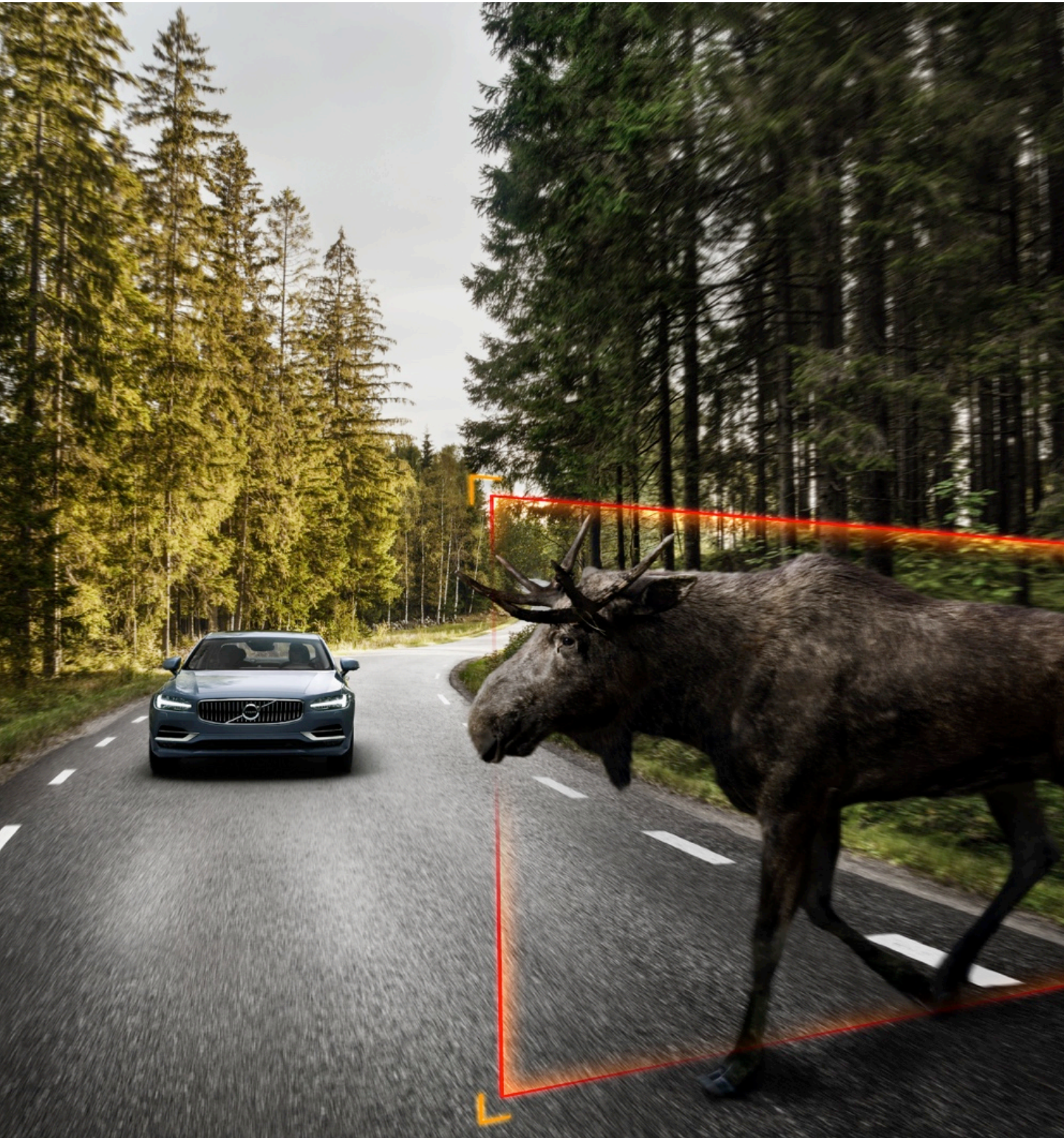




# INTELLISAFE

A factsheet on Volvo Cars' safety technology in the new Volvo S90



## S90 Safety

### System overview



### Package

#### **IntelliSafe Pro**

- IntelliSafe Surround
- IntelliSafe Assist

### Options

#### **IntelliSafe Surround:**

- Blind Spot Information
- Rear Collision Warning
- Cross Traffic Alert

#### **IntelliSafe Assist:**

- Adaptive Cruise Control
- Pilot Assist <130Km/h
- Distance Alert

#### **• 360 Camera**

- **Park Assist Pilot**
- **Integrated two-stage booster cushions**

### Standard (a selection)

- **Lane Keeping Aid**
- **Driver Alert Control**
- **Road Sign Information**
- **Speed Limiter**
  - with road sign limiter
- **Run-off Road Mitigation**
- **Run-off Road Protection** incl. occupant safe positioning, front seat structure energy-absorbing, reducing the vertical forces
- **Safety cage** ~35% of total body weight is hot formed steel
- **Airbags**

#### **City Safety**

works day and night detecting: vehicle, pedestrian, cyclist, large animal, warning: light, sound and brake pulse preparing: breaks and front seat belt braking: automatic braking incl. intersection braking.

## Run-off Road

Run-off road accidents are amongst the largest cause of single vehicle accidents. To combat this, Volvo Cars has developed two systems aimed at helping to avoid a run-off road accident from taking place, or protecting the car's occupants in the case of an unavoidable road departure.



### Run-off Road Mitigation

Volvo introduces a new function Run-off Road Mitigation with the S90 designed to prevent unintentional road departure at vehicle speeds between 65-140 km/h. This is a world-first.

Run-off Road accidents are amongst the most common type of single-vehicle accidents.

Reasons for such accidents include driver inattentiveness, fatigue or poor weather conditions.

Half of all traffic fatalities in the United States are unintentional road departure crashes, while in Sweden, single-vehicle accidents account for one-third of all fatal and severe injury crashes with passenger cars.

The system works by using evasive steering manoeuvres and braking to support the driver in keeping the car on the road in situations where accidental road departure is detected as imminent.

When a potential run off road situation arises torque is applied to the steering to support the driver along with braking action if needed. The system can always be overridden by the active intervention of the driver.



### Run-off Road Protection

In 2014 Volvo launched Run-off Road Protection in the XC90. It is a world first solution focusing on accidental road departure.

Using input from the car's advanced sensor system, the technology is able to detect a run off road scenario.

When an unavoidable run off road situation arises the front safety belts are electrically tightened as much as possible to keep the occupants in position.

To prevent spine injuries Volvo has designed an energy-absorbing functionality between the seat and seat frame which deforms mechanically to cushion the vertical forces that can arise when the car encounters a hard landing in the terrain.

Based on real-life data, Volvo Cars has developed three complete vehicle crash test track methods, called Ditch, Airborne and Rough terrain, for evaluating the consequences of various Run-off Road protection scenarios.

## Pilot Assist

### Semi-autonomous drive

Pilot Assist is a stepping-stone technology on the way to fully autonomous cars. The second generation of Pilot Assist, launched now in the S90, extends the scope of this semi-autonomous function to not only include low speed traffic jam situations but also include general driving situations on motorways with proper road markings.

Pilot Assist Makes driving safer and more relaxed in monotonous stop-and-go traffic by adding steering assistance to the highly popular Adaptive Cruise Control functionality.

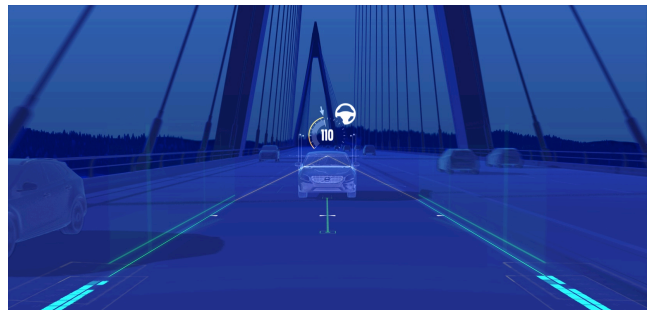
When the semi-autonomous Pilot Assist system is activated, acceleration, braking and steering are assisted in order to help the driver comfortably follow the traffic flow within the current lane.

This has the effect of reducing driver strain in tedious driving situations and increasing safety margins. The system also delivers enhanced speed and distance keeping and a more consistent and precise position in lane.

With generation two of Pilot Assist the system now offers steering assistance functionality up to 130 km/h and no longer needs a lead car. This means that Pilot Assist will be increasingly useful on long motorway trips where the road markings are clearly visible.

However the driver is expected to actively participate in the driving and remains responsible for monitoring, supervision, and over all operation of the vehicle. It is also important to emphasize that semi-autonomous systems are restricted in how much acceleration, braking and steering force they can apply.

The driver is always legally responsible for driving the vehicle (driver in the loop: hands on the wheel, eyes on the road, mind on driving).



The driver can override the system at any time by using either the brake pedal, accelerator pedal or steering wheel. The turn indicator can be used to temporarily abort the steering support if the driver wants to change lane.

Pilot Assist is automatically switched off if the driver does not keep a hand on the steering wheel.

#### Interface

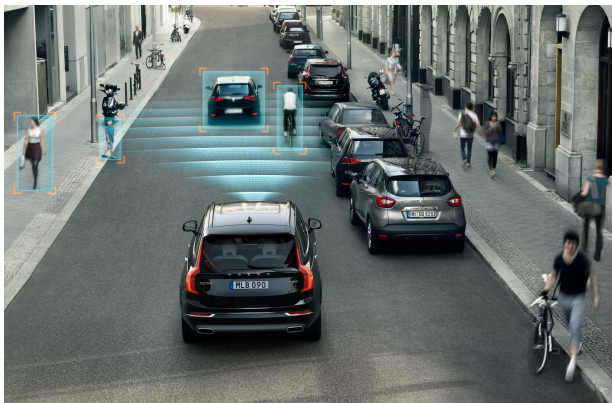
Pilot Assist is selected and activated by the driver using the steering wheel buttons on the left side of the steering wheel. Adaptive Cruise Control settings like time gap and set speed are available and the driver display shows necessary status information, i.e. steering support on/off. If the system for some reason must be turned off, the driver receives a warning.



# City Safety Technology

## Standard on all new Volvo cars

City Safety is our umbrella term for our standard collision avoidance functionalities. All City Safety functionalities are standard in the Volvo S90 and are always active above 4 km/h.



### Avoiding or mitigating collisions with other vehicles

City Safety first warns the driver and then brakes automatically if the driver does not brake or steer to avoid vehicles (cars, motorcycles, trucks, buses) that are in front of the car, moving slower in the same direction, braking or not moving. At speed differences up to 50 km/h between the car and the vehicle in front, a collision can be avoided if the driver does not react.

At higher speed differences, the collision is mitigated. The driver can take control and brake and/or steer away at any time. If a collision is imminent, at speeds above 30 km/h, the front safety belts are tightened to secure the driver's and front seat passenger's position. US studies indicate that 50 per cent of drivers involved in collisions have not tried to avoid the collision.

### Avoiding or mitigating collisions with cyclists

If a cyclist swerves into, or crosses the path of the car, or is stationary in the path of the car, the City Safety warns the driver and brakes automatically if the driver does not. The car's speed can be reduced by up to 50 km/h and thereby avoid a collision.

### Avoiding or mitigating collisions with oncoming vehicles in intersections

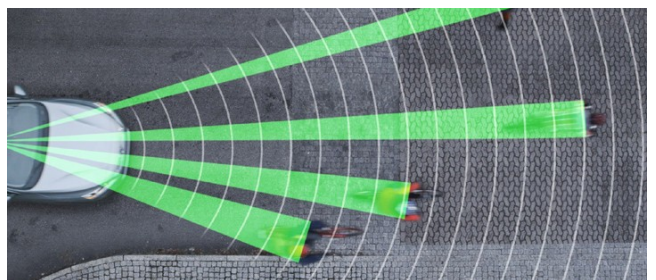
If the driver turns in front of an oncoming vehicle City Safety can assist by braking automatically, if the driver does not. This functionality was a World-First in the all-new Volvo XC90.



If a collision is imminent, at speeds above 10 km/h, the front safety belts are tightened to secure the driver's and front seat passengers' position.

### Avoiding or mitigating collisions with pedestrians

If a pedestrian moves into, or crosses the path of the car, or is stationary in the path of the car, City Safety warns the driver and brakes automatically if the driver does not, at speeds up to 70 km/h. A collision with a pedestrian can be avoided at speeds up to 45 km/h. For speeds between 45 and 70 km/h, the collision is mitigated.



## City Safety Technology

### Large Animal Detection



### Avoiding or mitigating collisions with large animals

In the Volvo S90 our comprehensive standard collision avoidance package, City Safety, also includes detection of large animals, like moose/elk and deer - another world first from Volvo Cars.

The standard-fitted radar/camera unit can detect large animals standing on the road or slowly moving across it with the side towards the car. If a large animal is detected, the Volvo S90 warns the driver.

When the driver brakes, additional brake pressure is provided to support avoidance if needed. If the driver does not react the car applies the brakes to mitigate the possible effects of an impending collision. In this way collisions with large animals can be avoided or mitigated. The car's speed can be reduced by up to 15 km/h.

If a collision is imminent, at speeds above 30 km/h, the front safety belts are tightened to secure the driver's and front seat passenger's position.

# Swedish Steel

## The S90 Safety Cage



- Mild steel
- High strength steel
- Very high strength steel
- Extra high strength steel
- Ultra high strength steel
- Aluminium

To help keep the occupant space inside intact in a crash, the all-new S90 has literally been made stronger in every sense. This is achieved by more extensive use of hot-formed boron steel, which is the strongest type of steel presently used in the car body industry.

The complete safety cage around the occupants is made from hot-formed boron steel and is designed for maximum occupant protection in all types of crash scenarios. The hot-formed steel amounts to about 35 per cent of the total body weight.

# *INTELLISAFE*

**V O L V O**