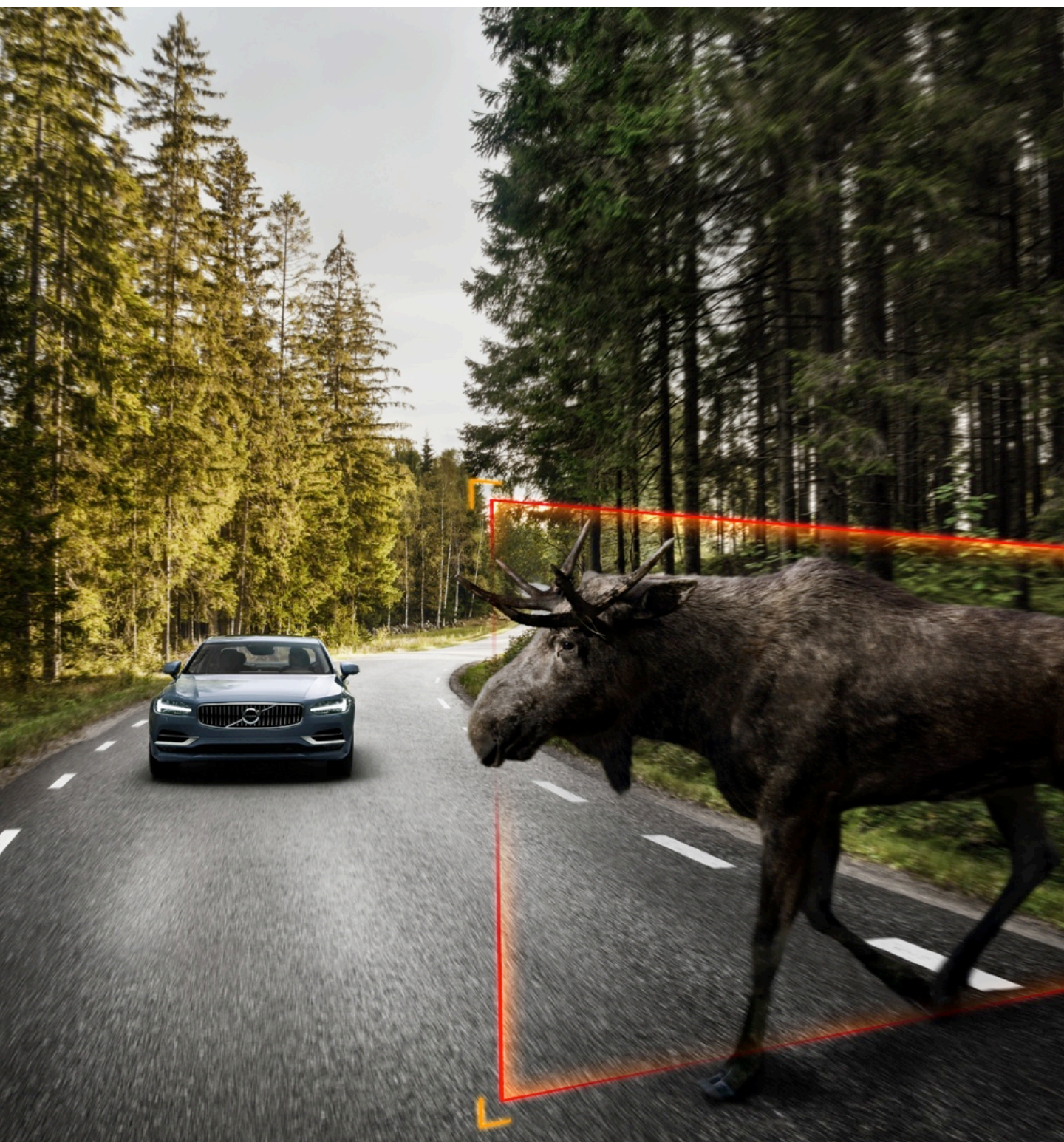




# INTELLISAFE

A fact sheet on the Safety Technology in Volvo's 90 Series cars





## 90 Series

Support, Prevent, Protect



### Standard (a selection)

- **IntelliSafe Assist:**
  - Adaptive Cruise Control
  - Pilot Assist
  - Distance Alert
- **Lane Keeping Aid**
- **Lane Departure Warning**
- **Driver Alert Control**
- **Road Sign Information**
- **Speed Limiter**
  - with road sign limiter
- **Run-off Road Mitigation**
- **Run-off Road Protection** incl. occupant safe positioning, energy-absorbing front seat structure reducing the vertical forces
- **Safety cage** The hot-formed steel amounts to about a third of the total body weight (XC90: 40%, S90: 35%, V90: 35% and V90 Cross Country: 35%)
- **Advanced Seat belts and Airbags**

### City Safety:

works day and night detecting:

- **Vehicle**
- **Pedestrian**
- **Cyclist**
- **Large animal**

warning: light, sound and brake pulse

preparing: front seat belts

braking: driver brake support, automatic braking incl. intersection scenario.

### Options (a selection)

- **IntelliSafe Surround:**
  - Blind Spot Information (BLIS)
  - Rear Collision Warning (with braking at stand still)
  - Cross Traffic Alert
- **360° Camera**
- **Park Assist Pilot**
- **Two integrated two-stage booster cushions (S90, V90, V90 Cross Country)**
- **One integrated booster cushion (XC90)**

# City Safety Technology

City Safety is our umbrella term for our standard collision avoidance functionalities. All City Safety functionalities are standard in our 90 Series cars 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 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**

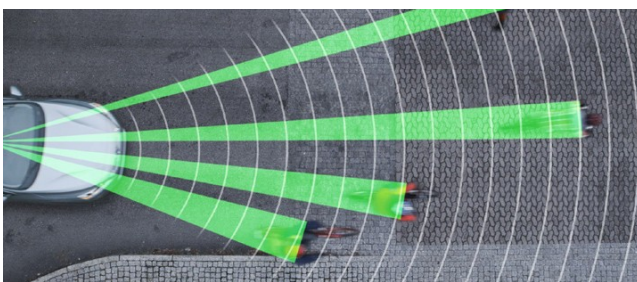
If the driver turns in front of an oncoming vehicle City Safety can assist by braking automatically, if the driver does not. This functionality was a World-First in the new Volvo XC90.



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.





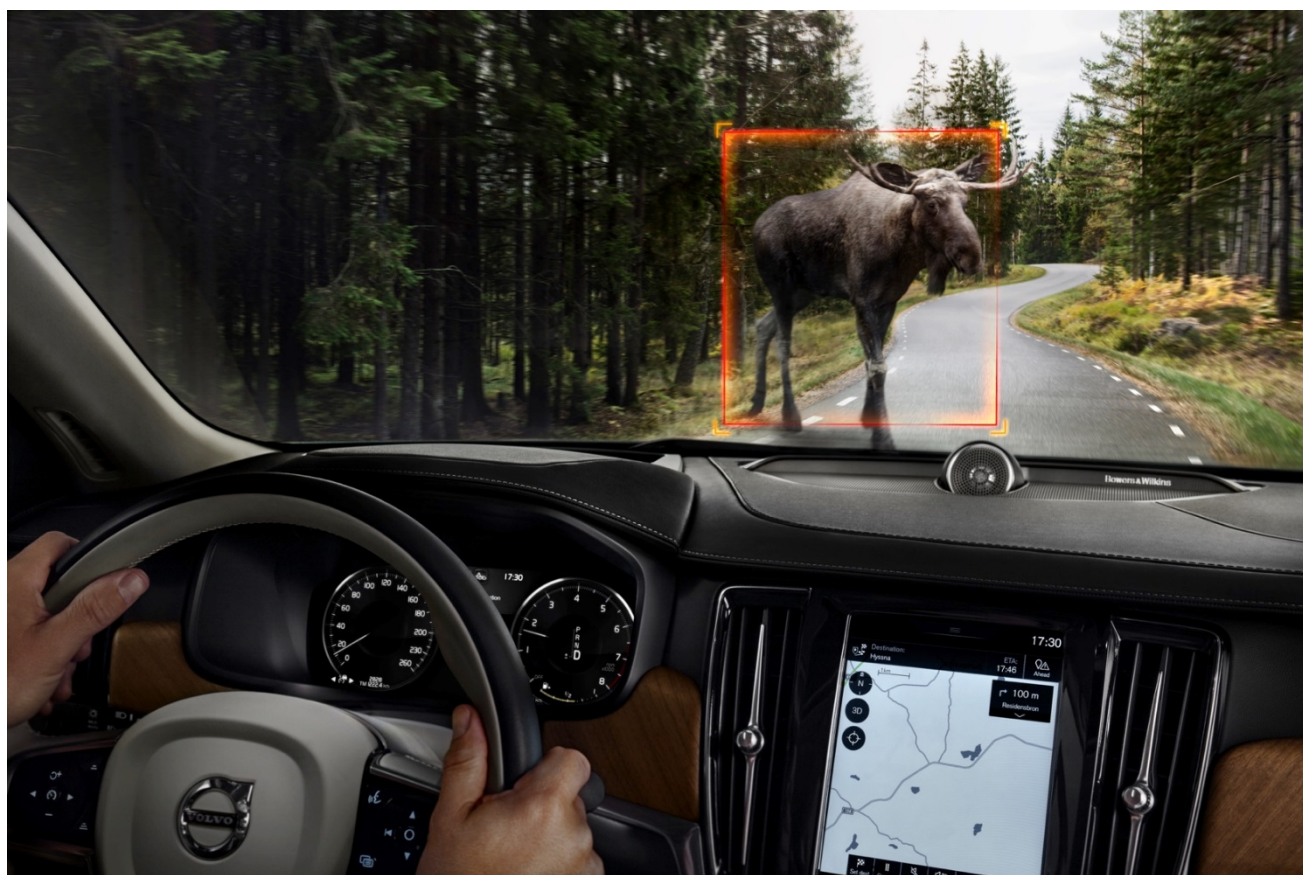
# INTELLISAFE

Standard equipment



## City Safety Technology

### Large Animal Detection



### Avoiding or mitigating collisions with large animals

The 90 Series cars come with a comprehensive standard collision avoidance package, City Safety, also includes detection of large animals, like moose, elks and horses.

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 system 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.

# Pilot Assist

## Semi-autonomous drive

Pilot Assist assists the driver with steering support, distance and speed control in situations ranging from slow moving traffic jams to free flowing long distance driving on motorways in speeds up to 130 km/h. The system is standard in Volvo's 90 Series cars.

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.

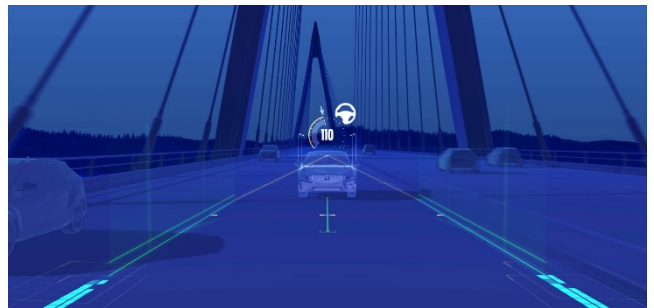
When the semi-autonomous Pilot Assist system is activated, acceleration, braking and steering are assisted in order to help the driver comfortably follow the traffic flow within the current lane.

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 the centre of the 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 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.



# 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 within its 90 Series cars, 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.

The system works by using evasive steering manoeuvres and if needed, 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 can be applied to the steering to support the driver along with braking action. 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. It is now standard on all 90 Series cars.

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.



# Connected Safety

Making the most of available technology



Volvo Cars has always approached product development from a human-centric perspective, utilising the best available technologies to deliver meaningful and useful features and services in the car. With arrival of in-car connectivity, Volvo Cars believes that this can deliver not just added services – but added safety and peace of mind. Connected Safety information is presented to the driver via pop-up icons in the driver display. For Connected Safety to function the car must have a connection to the Internet and the cloud. We are developing a number of systems designed to make driving safer and more enjoyable. Here are two examples of what Connected Safety will offer in coming Volvo cars:

## **Slippery Road Alert\***

The purpose of Slippery Road Alert is to increase the driver's awareness of both current road conditions and those on the road ahead.

Road friction is measured during steering, braking and/or acceleration. If the friction is below a certain level, the driver receives a slippery road alert in the driver display. All friction measurements above a certain level are sent to the cloud.

The cloud sends slippery road alerts to connected Volvo cars approaching a low friction zone.

## **Hazard Light Alert\***

The purpose of Hazard Light Alert is to alert the driver about vehicles on the road ahead that have their hazard lights activated.

Awareness of vehicles along the road ahead makes it possible for the driver to prepare and adapt his/her driving style to safely handle the situation.

\*Slippery Road Alert and Hazard Light Alert are available in the 90 Series cars in Sweden and Norway.

# Child Safety

Protecting what is important to you

At Volvo Cars we look at child safety with both the car and child seat in mind, making them work together in the best way to ensure children have a safe journey. In 1978 we invented the worlds first booster cushion for children. This is one example of our long tradition of work with child safety at Volvo Cars. Today, we have a wide range of standard and optional features designed with your child in mind. Here are a few of them:

## Rearward facing Child seats

The safest way of travelling in a car is rearwards. Therefore, babies and young children should travel facing the rear of the car for as long as possible.

Our new, infant and rearward-facing, child seats are pure rearward facing. The child seat can accommodate a child up to 6 years (25 kg). The child seats are easy to install, adjust and remove thanks to its compact design. The seats are upholstered in the new Volvo material, Wooltextile, which is a combination of 80% wool and 20% polyester.



## Integrated Booster Cushions

A number of models have their own integrated booster cushions available as an option – a very user-friendly form of child restraint.

## Accessory boosters: Booster seat and Booster cushion and backrest

Our new booster seat and the latest incarnation of our classic booster cushion are also upholstered in the new Volvo material, Wooltextile. They are designed for children between 4–10 years (15–36 kg).

## ISO-FIX Mountings

Internationally standardized ISO-FIX child seat mountings are standard-fitted on the two outer second-row seats.

## Child Safety Locks

Manual rear door child safety locks are standard. They are operated individually for each of the rear doors by opening the door and activating a mechanical locking device in the door end. In locked position, the door cannot be opened from inside.

## Power child safety locks

Power-operated child safety locks are available as an option. They are controlled for both of the rear doors with a button on the driver's door. As with the standard-fitted manual child safety locks (which they replace), they lock the interior door handles so the doors cannot be opened from inside.





# INTELLISAFE

Standard equipment



## Swedish Steel







The Safety Cage



To help keep the occupant space inside intact in a crash, Volvo's new 90 Series cars have 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.

Safety cage with patented front structure: The hot-formed steel amounts to about a third of the total body weight (XC90: 40%, S90: 35%, V90: 35% and V90 Cross Country: 35%).

	<b>Mild steel</b>
	<b>High strength steel</b>
	<b>Very high strength steel</b>
	<b>Extra high strength steel</b>
	<b>Ultra high strength steel</b>
	<b>Aluminium</b>

*INTELLISAFE*

**V O L V O**