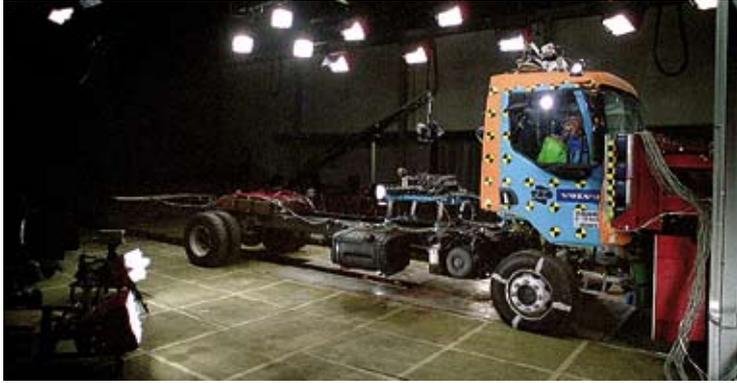


80 years of safety



VOLVO

Unwavering dedication to safety



Physical full-scale impact tests supplement the development engineers' collision simulations.



Comprehensive research for increased safety and security.

Volvo and safety belong together. That's the way I see it and that's also the way my predecessors have seen it all the way from day one of the company's operations back in 1927. I have a strong feeling that the entire Volvo Group is proud of the expertise and experience provided by 80 years of our work with safety. This has had a very definite effect on our way of developing products and services. It has led to us introducing many innovative solutions that have enhanced safety in and around our products.

The basis of our safety work consists of in-depth knowledge about accident scenarios, which our engineers analyse meticulously as they gather data about accidents involving our products. Over the years, this has resulted in thousands of in-depth studies of accidents – knowhow that has made it possible to develop new generations of heavy vehicles that are always safer than their predecessors.

Improved products have also had an effect. Accident statistics reveal that engineering solutions such as better safety belts, airbags and energy-absorbing cabs have made a strong contribution to halving the number of traffic fatalities in Europe over the past 30 years, even though transport volumes have doubled during the same period and the number of accidents has also increased.

We will continue to work with the aim of reducing the consequences of accidents. However, with the truly major improvements already behind us, we can see that the main potential lies in preventing accidents from occurring in the first place. This puts the spotlight on human behaviour.

Many years of research show that behaviour is behind the majority of accidents. Lack of attention in traffic is alone responsible for more than 50 percent of accidents. With the help of our experience, research into accident-preventive solutions and new technology, we are now equipping vehicles with a large number of functions that help the driver or operator to concentrate on doing the job at hand in a safe way. Some of these are described in this brochure.

As I said, we are proud of our know-how and we are convinced that we have helped give Sweden the safest traffic environment in the world and the confidence to set up a "zero vision" target for traffic fatalities. New technology opens up new possibilities and we will continue to do our utmost to help make traffic throughout the world even safer."

Leif Johansson
President and
CEO





Telematics is an important research area for enhanced safety.



Safe and simple operation in port with Volvo Penta IPS and a joystick.



Everyone in a coach needs both comfort and safety belts.



Safety policy

Volvo's products are characterised by SAFETY.

Volvo aims to supply its customers with products that meet the toughest demands on safety.

Volvo shall be perceived as a leading manufacturer of safe vehicles and transport products, machines and equipment.

Safety – an integrated part of our culture



The Volvo Group's impact test for truck cabs was introduced in 1960, before legislation required such tests.



Safety is largely about improving the interplay between the Volvo Group's products and other road users in a complex traffic environment.



The Volvo Group's development resources work with increasing sophisticated safety systems for both the users of the products and the people around them.

“The basic principle of all engineering is and must be safety.”

This statement from the Volvo Group's founders has served as a guiding star for the development of new products ever since the company started operating back in the 1920s, and it has made Volvo synonymous with safety the world over. Many unique safety solutions have seen the light of day in the intervening years.

One of the single most important inventions for reducing injuries to drivers and passengers is the three-point safety belt. Today seat belt use is a natural feature in most types of road vehicle and a legal requirement in most countries, but back in 1959 we created a sensation when we became the first car manufacturer in the world to fit three-point safety belts as standard in all our cars.

In 1960 the Volvo Group introduced safety testing of its truck cabs, a test that for a long time was way ahead of the legal requirements. Our Accident Investigation Team was born in 1969. Since then, the team has investigated thousands of accidents and analysed their causes. Our experiences from this process have been taken on board and been integrated into our product development over the decades.

In the 1970s, increasing numbers of unique safety details were introduced on our trucks and buses, for instance the impact-absorbing steering wheel and three-point seat belt with electronic locking.

One model after the other has been introduced, each safer than its predecessor, and the 1990s saw new safety features such as airbags in trucks as well as a variety of underrun protection systems.

Early developments in the area of safety focused on so-called passive safety – systems that are aimed at reducing occupant injuries in the event of an accident. From the 1980s onwards, the focus shifted more towards active safety systems, something that has been increasingly accentuated over the past few decades as the pace of IT development has speeded up. Ever more systems assist the driver in safer operation, while other systems are introduced that can step in and take over in emergency situations.

In the area of “interaction between man and machine”, the Volvo Group leads the world. Our development and research resources focus on the development of increasingly sophisticated safety systems for drivers, passengers and the people around Volvo's vehicles in an ever more complex traffic environment.

An increasingly troubled world means that the area of safety nowadays also encompasses concern for security. This aspect is all about properties and systems, which among other things reduce the risk of attacks or cargo theft. This too is an area in which our researchers and engineers work intensively



Safety on board a boat requires an engine that is highly reliable.



Good all-round visibility is important to safety.



Our goal is that all our engines should offer 100 percent reliability.



ESP (Electronic Stability Program) helps the driver handle the vehicle safely if it approaches a bend at excessive speed, for instance.



Airbags are an important safety feature in trucks.



FUPS – front underrun protection to reduce the consequences on a car of a collision with a coach.



Simple safety – a red safety belt that is easily visible when used.



For safer manoeuvring, a back-up camera is an excellent aid.



Driver training is an important part of safety promotion.

Own accident investigations for 40 years



Since its launch, the Volvo Trucks Accident Investigation Team has studied more than 1500 accidents on site, as well as several thousand accidents the world over through reports and medical records.

Every time the alarm sounds regarding an accident near Volvo in Göteborg involving a truck or bus bearing the company's badge, Volvo's accident investigation team is also alerted. This allows all the important factors relating to the accident and its causes to be studied in detail on site.

The team has carried out more than 1500 on-site investigations of accidents involving trucks or buses, examining them down to the tiniest detail. In addition, severe accidents are investigated after the event by checking the vehicle at the workshop and by examining reports from the police, emergency rescue services and hospitals. This may involve accidents anywhere in the world. The most recent report from the team relates to accidents between trucks and unprotected road users, that is to say pedestrians and riders of two-wheelers.

In parallel with investigations of real-life accidents, there are also constant physical tests on test tracks and at safety laboratories. The product development process makes considerable use of advanced virtual testing.

All this helps provide comprehensive experience.

Overall knowhow about how vehicles behave in various situations and what happens in different accident scenarios forms a valuable basis for further product development. This know-how also contributes towards a safer global traffic environment since it is applied every-

where. By organising safety seminars and participating in various joint projects, our researchers and engineers are given the opportunity to share their experiences and to learn from others.

The advanced new systems developed to help a driver avoid an accident really do come into their own in the constant fight against accident statistics. But accidents nonetheless occur and it is therefore vital that the vehicle is built in such a way that their effect is minimised, in the form of both human injuries and material damage.

As in product development, accident researchers work with different phases of the accident scenario on the basis of a timeline: Before – during – and after the accident.

What happened prior to the accident? With the help of tyre marks on the road surface, the tachograph and interviews, the experts may be able to ascertain



The Accident Investigation Team started investigating accidents involving trucks and buses way back in 1969.



By investigating accidents at the site, we obtain invaluable information that helps us in our work on new safety solutions.



Physical impact tests are an important part of the development of new products, as are collision simulations and accident investigations.

many important facts leading to the accident. Why did the various preventive safety systems not succeed in preventing the accident?

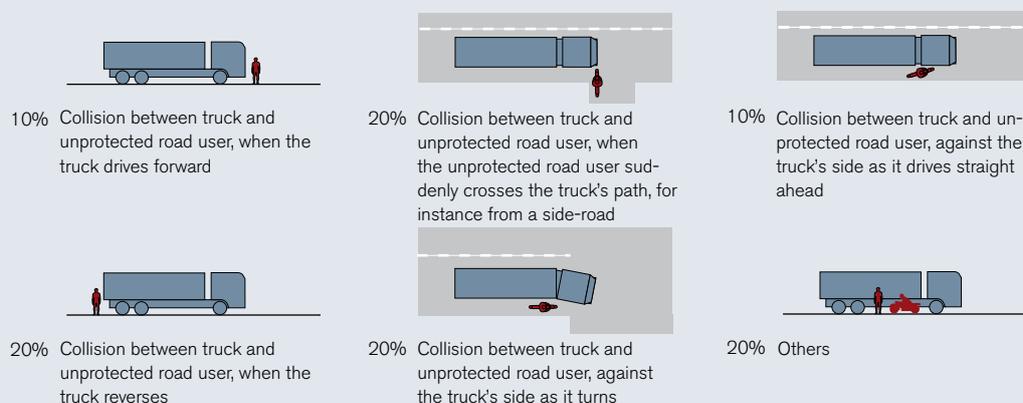
What happened during the accident itself? Which safety systems were activated, and what effect did they have? What injuries were suffered by the driver, passengers or other road-users?

What happened immediately after the accident? Did the built-in alarm system function as intended? Did the people involved receive essential assistance?

By examining many accidents in this way, it is possible to highlight the need for developing new systems that provide protection during different phases of an accident scenario.

35% of all severe injuries in accidents involving trucks in Europe are suffered by unprotected road users (pedestrians and riders of two-wheeled vehicles)

They are broken down between accident types as follows:



The Volvo Trucks Accident Investigation Team maintains a massive database of parameters such as accident types and the kinds of injuries suffered in accidents. In recent years, special attention has been paid to studying the relationship between trucks and unprotected road-users.

The experiences gained lead to the development of

The Volvo Group's various products are all characterised by a wide variety of built-in safety solutions. Through our research and our accident investigations, these products have been given properties and systems that make them safer. It's all about preventing the risk of accidents and about reducing injuries should an accident nonetheless occur.



Buses ▼

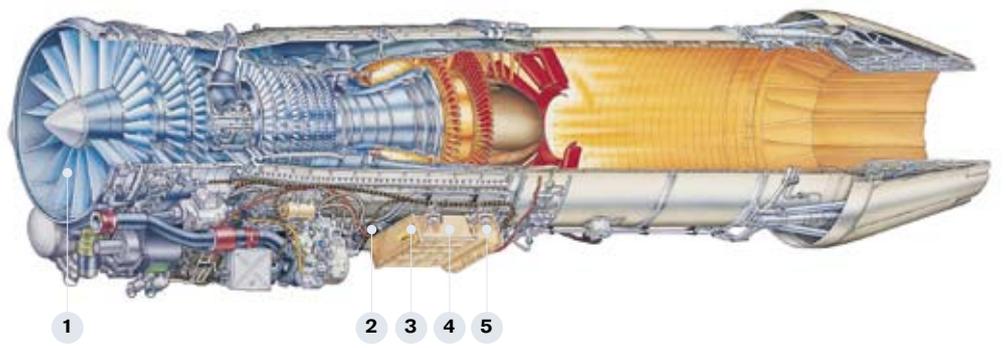
1. Electronically controlled disc brakes and ESP stability-enhancement system.
2. Rear-view mirrors with all-round visibility
3. Back-up camera
4. Cameras at doors to monitor safe disembarking for passengers
5. Safety doors
6. FIP (Front Impact Protection)
7. Soft, injury-reducing interior trim
8. Safety belts in all seats and booster cushions for children
9. Automatic fire extinguisher in the engine compartment
10. Protection system against driver knee injuries
11. FUPS (Front Underrun Protection System)

Construction machines ▲

1. "Volvo Care Cab" – safety cab, tested for rollover protection and protection against falling objects (ROPS/FOPS)
2. Good all-round visibility
3. "Contronic", machine monitoring system
4. Monitoring of electronic braking function
5. Dual-circuit braking system
6. Warning for brake wear
7. Anti-slip steps and well-placed grab-handles when entering and exiting the cab
8. Daily maintenance from the ground



safety solutions



Trucks ▼

1. Red safety belt, seat belt reminder, belt pre-tensioner and airbag
2. Underrun protection from all directions
3. Disc brakes, electronically controlled braking system, retarder and effective engine brake – all combined in the brake blending system
4. ESP (Electronic Stability Program)
5. HMI (Human-Machine Interaction) of world class for safer driving
6. Dynafleet, transport information system with a display that also shows the view from the back-up camera
7. Anti-theft protective system for added security
8. Intelligent ACC (Adaptive Cruise Control)
9. Starting assistance on uphill gradients
10. TPM (Tyre Pressure Monitoring)
11. The world's strongest truck cab and impact-resistant interior

Aircraft engines ▲

1. High resistance against bird strikes
2. Continuous monitoring of the engine's condition
3. Automatic switch to backup control system
4. Built-in automatic safety checks and safety reports before, during and after flight
5. Fault-tolerant control systems to maximise safety

Marine engines ▼

1. Delivery of complete drive systems to the boat-builder, and quality-guaranteed installation
2. Auxiliary systems for the driver – including well-developed controls and instruments, protection from gear changes at high speed, automatic and maximised powertrim and automatic engine synchronising
3. Low-speed function when entering ports (some engine installations)
4. EDC – automatic monitoring and diagnostics of the engine



Expert research for safety



The Volvo Group uses, among other things, driving simulators when developing new safety systems for its various products.

The Volvo Group's development and research resources gather together comprehensive expertise so as to continuously develop new systems for safety and security.

Our safety research is carried out by people within a wide range of scientific disciplines, from traditional development engineers and qualified telematics experts to behavioural scientists specialising in different areas.

Many of the Volvo Group's research and development resources are located in Göteborg, which offers an excellent environment for research into transport-related safety.

When considering the development of measures designed to enhance transport-related safety, it is useful to imagine an accident scenario following a time axis made up of five phases. Safety systems and properties are developed for everything from entirely normal driving to systems designed to reduce injuries and trigger an alert if an accident nonetheless takes place.

1. **“Preventive safety”**. The Volvo Group is a world leader in HMI (Human-Machine Interaction) research, which encompasses measures in the course of normal driving aimed at preventing the driver from entering into a critical situation in the first place.
2. **“Active safety”** is the phase when measures are taken to handle a critical situation that has already been initiated, for example through stabilisation of the vehicle by activating ESP (Electronic Stability Program).
3. **“Pre-crash”** is the phase when measures are taken to minimise the consequences once an accident becomes unavoidable, for example by braking the vehicle as hard as possible in order to minimise collision speed.
4. **“Crash”** is the phase during and immediately after the accident when the vehicle's passive safety systems try to minimise personal injury and damage to the passengers and to the cargo and surrounding area.

1. “Preventive safety”

2. “Active safety”

3. “Pre-crash”



Mobile laboratories are used, such as this Volvo Integrated Safety Truck.



In one of Volvo's research projects, the driver's head and eye movements are monitored to detect any signs of inattentiveness.



Full-scale collision tests are carried out, for instance rollover tests with buses.

5. "Post-crash" is the phase after the accident, when an action may for instance involve alerting the emergency rescue services and using the mobile phone network to transmit data about the collision to the alarm call centre.

Within Preventive Safety, the Volvo Group works among other things with a system whereby a camera is used to register the pattern of the driver's head and eye movements in order to detect whether he or she is inattentive, tired or distracted. Other systems such as adaptive cruise control and collision warning feature sensors that monitor what is happening in the vehicle's vicinity and ensure that the proper gap is maintained to the vehicle in front.

Another system registers whether the vehicle has unintentionally changed direction – a sign that the driver may have become distracted or fallen asleep at the wheel – and alerts him accordingly.

Many safety systems have already been implemented in the Volvo Group's products while other systems are being developed for the future and are being demonstrated, for instance, in full-scale vehicles such as the Volvo Integrated Safety Truck.



Volvo Integrated Safety Truck

The truck is equipped with sensors (marked 1-6 in the picture) of various kinds, such as cameras (1,2,3), radar sensors (4,5) and laser scanner (6), in order to detect human beings, animals and objects with which the vehicle may collide. The truck is a mobile laboratory with many functions designed for accident avoidance, such as:

- Warning for unintentional sideways movement of the vehicle
- Assistance for lane changes and active support for lane tracking
- Automatic brake boost for avoiding collisions
- The vehicle is prevented from being driven if anyone is in its path
- Warning in the event of excessive speed on approaching a bend
- Warning for obstacles outside the driver's field of vision
- Integrated and adjustable driver interface
- Night vision support

4. "Crash"

5. "Post-crash"

VOLVO

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80 years of safety



VOLVO