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A MILLION LIVES SAVED SINCE VOLVO INVENTED THE THREE-POINT SAFETY BELT

Under embargo until 13 August 2009

- More than a million people globally saved by the seatbelt - a Volvo invention
- 50th anniversary to be celebrated by Volvo this August
- Volvo the first company to fit the three-point safety belt as standard in its cars

SHORT STORY
More than a million people globally are estimated to have survived a car accident thanks to a 50-year-old invention designed by Volvo - the three-point safety belt.

The three-point seatbelt as we know it today was created by Volvo in 1959 and the manufacturer was so convinced of its safety potential that it made the patent available for other manufacturers, and motorists, to benefit from.

And although we may now take it for granted, modern technological developments, such as seat belt pre-tensioners, are designed to work in conjunction with the same basic design of the seatbelt, so it remains the single most important safety feature on all modern cars.

Volvo was also the first manufacturer to fit three-point safety belts as standard equipment in its cars, from 1963. Now required by law in modern cars, it continues to protect hundreds of thousands of people from death or serious injury in car accidents every year.

Peter Rask, Managing Director of Volvo Car UK, said: "For the majority of motorists, clicking the seatbelt into place is as much a part of the ritual to beginning a car journey as starting the engine.

"That makes it easy to forget its lifesaving potential. However other safety systems, such as airbags, are designed to work in conjunction with seatbelts, so it remains the most important safety device in any modern car."

Research published by the Department for Transport* indicates that annually about 565 people die in traffic accident not wearing a seatbelt and, in 2007, over 300 of these might have survived had they been belted in.
Seatbelt use in cars became mandatory for front seat occupants in the UK in 1983, with further legislation in 1989 making it a requirement for all children to wear one. In 1991 wearing a seatbelt in the back of a car became compulsory.

Notes to editors
*DfT publication Road Safety Compliance Consultation (para 4.6) published in November 2008.

HISTORY AND BACKGROUND
Driving a car during the 1920s and 30s was a risky business. There were an increasing number of cars on the roads which were getting ever faster, but there was no public debate on the issue of safety. The only car safety discussion in Swedish newspapers and trade publications related mostly to the dangerous habit of parking at night or on unlit streets and roads.

In the world of aviation, safety belts had been used almost from the very outset, mainly because
the pilots of the very first flying machines otherwise risked falling out of their open cockpits.

There are actually some very early patents for belts designed for motor cars. Probably the oldest of these is American and was issued in 1885, coinciding with the debut of the automobile. A few years into the 1900s, a French patent was issued for a safety system encompassing both a lap belt and a diagonal belt that stretched across the chest. At the same time, another belt received a patent in England, but it was in the USA that the first safety belts were used on a more widespread basis. In American racing during the 1910s and 20s, tough battles were fought with extremely fast, but not always very stable, cars and in 1922, a race car driver was the first to use a safety belt in the USA.

At this time it was already very clear to American doctors that the physical injuries resulting from car accidents were very serious. Many doctors therefore installed some form of homemade safety belt device in their own cars. During the 1930s, a few American doctors featured in a number of newspaper articles demanding that safety belts be fitted to all motor cars, but hardly anyone paid them any attention.

After the war, American car maker Nash made a commendable, but unsuccessful, attempt to improve safety. Customers were offered factory-fitted lap belts on 1949 models but interest turned out to be virtually non-existent and the trial was abandoned after just one year. The idea of increased safety for the world's motorists was kept alive, primarily by American medical organisations, but also by a few car manufacturers. In 1955 both Ford and Chrysler announced that lap belts would be available as options on 1956 models. General Motors and American Motors joined in somewhat later, but buyer interest was still minimal and all these initiatives fizzled out.

In Sweden, engineer Nils Bohlin had been working at SAAB's aviation division since the 1940s. In 1955 he was responsible for the development of the catapult seat and other safety equipment for pilots. It was Nils Bohlin who designed the catapult seat and its peripheral equipment for the Swedish fighter aircraft J35 Draken.

In 1958 Nils Bohlin was recruited to Volvo by then president Gunnar Engellau and appointed as the company's first safety engineer. Gunnar Engellau had realised the benefits of developing a profile of the company and it was obvious to emphasise safety, which by then had already become a significant part of Volvo's image.

For Bohlin this must have been a radical adjustment: at SAAB his job was to throw people out of a speeding vehicle but at Volvo, his job was to keep them in place.

By this time, the two-point diagonal belt was already available as an accessory for Volvo cars but its injury-preventive capability was not regarded as entirely satisfactory. There was a need for a physiologically correct multi-strap belt and it was on the basis of this that Nils Bohlin shaped his development programme. By 1959, this led to the installation of the three-point safety belt in Volvo's cars and later in cars the world over.

In 1952, a three-point belt had been designed and a patent was pending in the US but it was designed for aircraft. In this design, the diagonal belt was anchored behind the seat, almost directly behind the passenger. The diagonal belt and the lap belt met at the buckle that was positioned on the abdomen, with its anchoring points positioned such that the occupant could move in an impact, whereupon this unfortunately positioned buckle injured the body's softer organs instead of protecting them.

"I realised that both the upper torso and the lower part of the body had to held securely in place, with one belt across the chest and another across the hips. It also needed a non-moving attachment point for the buckle, placed far down beside the occupant's hip so that the belt is pulled taut across the body throughout the collision sequence. It was a matter of finding a solution that was both simple and efficient in use since it had to be able to be put on with one hand," explained Nils Bohlin at the time.

In 1958 Volvo's efforts in creating an effective safety solution resulted in a patent application for Nils Bohlin's three-point safety belt. His design had four important properties: 1) The system consisted of a lap belt and a diagonal belt, 2) the belts were anchored at a low attachment point beside the seat, 3) the belt geometry formed a V shape with the point directed toward the floor and 4) the belt stayed in position and did not move in an impact.

Bohlin's belt was in fact an effective demonstration of geometrical perfection rather than a cutting-
edge innovation. The solution and the benefits of the three-point design soon spread throughout the world as Volvo immediately made Bohlin's patent available to all car makers.

In 1959, the by now patented three-point belt was launched in the Volvo Amazon (120) and PV 544 on the Nordic markets. Volvo was thus the very first car maker in the world to equip its cars as standard with three-point safety belts. A major step forward in safety had now been taken, but the three-point belt still did not make an immediate breakthrough. Owing to the previous two-point belt's relatively poor protective ability and the fact that it was perceived as awkward, customers initially also resisted Volvo's three-point safety belt. Although it was easy to use and both comfortable and effective from a protection viewpoint, it was met with a certain degree of scepticism.

**Rolling over**

People did not know or properly understand how effective a safety belt protected occupants.

Volvo adopted a drastic method to convey the message by engaging Orvar Aspholm. Aspholm lived for speed. He had competed in speedway competitions and in the 1960s he participated in both Formula 3 and sportscar championships. He knew the risks. He also knew how to roll a PV 544.

He showed off that art to thousands of Swedes at car races and other well-attended events around the country. Sometimes the car was reinforced, but usually it was an ordinary standard car which he rolled over at speeds of up to 49 mph. Every time Orvar Aspholm rolled a car, he remained securely in his seat, held in place by the car's safety belt, and climbed out in one piece.

After Orvar Aspholm finished his active career rolling cars, a new career awaited him: he volunteered to serve as a living test-dummy in low-speed impacts that were conducted using a mobile collision sled. Here both Volvo and Orvar were able to demonstrate the importance of wearing a seatbelt even at low speeds. That was not something that the car-riding public took for granted back in the 1950s and 60s. In a sudden stop at just 3 mph, the human being's heavy head is subjected to a very unpleasant fore-and-aft movement - a movement that is highly dangerous to the cervical vertebra. Without a safety belt, the driver's face also hits the steering wheel during the forward part of this movement.

Thanks to the unlikely educational value of Aspholm's highly entertaining stunts, a large number of people learnt about the three-point safety belt's lifesaving properties.

**Introduction to other markets**

Ahead of the launch in other markets, Volvo conducted sled tests and crash tests with cars equipped with various types of safety belt. The results were clear: Volvo's three-point safety belt gave the best protection to the car’s occupants. Backed by these facts, in 1963, Volvo introduced the three-point safety belt in the USA and other markets where, for various reasons, it had not yet been adopted. All Volvos were now supplied with three-point safety belts for the front seats.

And still the American car-buying public was not convinced. For that reason, Nils Bohlin together with Bertil Aldman, doctor and then-head of the Swedish belt-testing and approval authority, went on a lecture tour of the USA. The two Swedes explained Volvo's safety philosophy and the benefits of the three-point safety belt to both a negative car industry and a sceptical general public. In a 1967 traffic safety conference in the US, Volvo presented its ground-breaking "28,000 Accident Report" based on all the collisions involving Volvo cars in Sweden over a period of one year. Only then did things begin to move. The Report showed clearly that the safety belt saved lives and that it also reduced injuries by about 50-60%.

**The belt in the rear seat**

Volvo soon realised the importance of ensuring that all the car’s occupants were held securely in their seats, and work on equipping the rear seat with belts was conducted in parallel with other safety-related developments. Volvo's cars were fitted with attachment points for rear seat belts as early as 1958, but it was not until 1967 that Volvo succeeded in convincing the car-buying public that the rear seat's occupants should also use the belts.

At that time, people held the peculiar belief that just sitting in the rear seat provided protection in a collision - after all, it was the front seat occupants who were in danger! The fact that the occupants of the rear seat are hurled forward with a force of 3000-5000 kg and thus risk seriously injuring both themselves and the occupants of the front seats were suppressed, or perhaps there was simply no awareness of this danger. Today the wearing of seat belts in the rear is required by
law and is simply a matter of course in most developed countries.

**Safety expert throughout his lifetime**
During his time at Volvo, Bohlin led the company's safety drive towards ever-safer occupant protection in Volvo cars. He was quick to realise the need for side-impact protection so in the 1970s he started working on various technical solutions that eventually resulted in what we now know as SIPS - Side Impact Protection System.

After retiring in 1985, Nils Bohlin was consulted by Volvo on a number of occasions regarding particularly complicated safety issues. In 2002, at the age of 82, Nils Bohlin succumbed to the after-effects of a stroke.

**One of the car industry's most important inventors**
Since the 1960s, Bohlin's three-point safety belt has saved many hundreds of thousands of lives and prevented or reduced the severity of injuries among many millions of others. This makes the three-point safety belt the single most important safety device in the car's 120-year history.

As confirmation of its effectiveness, Bohlin's invention has been identified by German patent registrars as one of the eight patents to have had the greatest human significance during the hundred years from 1885 to 1985. Bohlin shares this honour with patent-holders such as Benz, Edison and Diesel.

Nils Bohlin received many international honours for his work and his development of the three-point safety belt. Many people took the initiative to personally get in touch with Nils Bohlin to thank him when they realised their lives had been saved by his invention. Here is a summary of the awards that the three-point safety belt and Nils Bohlin received over the years:

**1956** Grant for continued studies in aviation medicine in the USA, The Swedish Union of Clerical and Technical Employees in Industry

**1965** Award for the best sales-enhancing attribute in 1964 (the Volvo seat), Volvo Dealership Association

**1975** Ralph H. Isbrandt award/medal for best technical report, SAE Society of Automotive Engineers Inc, USA

**1977** Diploma recognising Bohlin's pioneering work in car safety at Volvo, International Association of Accident and Traffic Medicine (6th Int. Conference)

**1979** Safety award for particularly excellent engineering work, NHTSA, USA (ESV conference in Paris)

**1985** Bohlin's safety belt patent listed as one of the eight patents of greatest significance to humanity in the past century (Benz, Edison, Diesel), Germany patent registry, West Germany

**1985** Award for special achievements, NHTSA, USA, (ESV conference in Oxford)

**1989** Nils Bohlin is inducted into the International Safety and Health Hall of Fame, USA

**1992** Safety award, Second World Traffic Safety Conference, New York, USA

**1995** Royal Swedish Academy of Engineering Sciences (IVA) gold medal

**1999** Nils Bohlin is inducted into the Automotive Hall of Fame

**2002** Nils Bohlin is inducted into the National Inventors Hall of Fame

**GLOBAL SAFETY INNOVATION**
Wearing a safety belt can increase the chance of surviving a collision by 50 percent.[1] This means that the three-point safety belt is, and will remain, the car's most vital safety aid and many more lives could be saved if belt usage increased across the world.

"What makes the three-point belt unique is that it improves safety for all types of occupants, in all types of accidents, in both the front and the rear seats. People often talk about the protective effect
in head-on collisions, but the belt also helps prevent the car’s occupants from being thrown out of
the car in a rollover” says Hans Nyth, head of the Volvo Cars Safety Centre.

It is the safety belt’s ability to keep the occupant in the seat that is of crucial importance. A
massive 75 percent of people thrown out of a car in an accident die in the process.[2] The belt
reduces the risk of fatalities and serious injuries from collisions by about 50 percent.[3]

**The most effective lifesaver**

It’s impossible to put an exact figure on the number of lives the three-point safety belt has saved
since 1959 - there are no globally coordinated traffic-safety statistics. Estimates put the figure at
just over a million lives. And many times that number have avoided serious injuries thanks to the
safety belt.[4]

In Europe, the safety belt is estimated to reduce road fatalities by 40 percent every year. Within the
EU in 2005, an estimated 11,700 drivers survived road accidents because they were wearing
safety belts. The figure for Germany alone was 2,000. Had these drivers not been using the belt, the
number of fatalities in Germany that year would have doubled.[5]

Corresponding estimates for the USA in 2004 show that safety belt use saved 15,200 lives and
resulted in society saving 50 billion dollars in costs.[6]

**Still considerable potential**

Safety belt use differs considerably in different parts of the world. In some parts, such as the
island of Sakhalin in Russia, safety belt use is as low as 3.8 percent. Highest usage rates are
found in countries with high average incomes such as France, Germany, Sweden, Australia and
Canada. In these countries on average 90-99 percent of front-seat passengers and 80-89 percent
of rear-seat passengers wear their safety belts.[7]

The USA has traditionally returned lower figures since that country’s legislation lags behind in this
area. However, the US reached a new record in 2008 with an average 83 percent front-seat
passengers using the safety belt.[8]

In 2004 there were 620 million cars registered throughout the world, of which about 270 million in
Europe and about 202 million in the USA[9]. At the end of 2008, this figure is expected to approach
800 million cars.[10] The number of traffic fatalities globally in 2008 is expected to reach an
unbelievable 1.2 million people.[11] Most of the increase in new cars and drivers is taking place
outside Europe and the USA.

"The big problem in many car-intensive countries is that far too many people still choose not to
use the safety belt. The belt represents by far the biggest lifesaving potential in modern traffic,”
adds Hans Nyth.

In the USA it is estimated that each percent increase in belt use would save 270 lives a year[12].
Studies in Europe show that another 7,000 lives could be saved if all EU countries had the same
belt usage level as the best member countries.[13]

There is still considerable life saving potential in the safety belt in industrialised countries that have
long been using the car and there is even greater potential in parts of Asia, South America and
Africa, where the number of cars is increasing very quickly.

If belt usage in these regions approached European levels, tens of thousands more lives would be
able to be saved. This, in turn, would put the total at far more than a hundred thousand lives
globally every year.

**Additional efforts are required**

Since the 1960s, Volvo Cars has worked hard to increase belt usage. For instance, Nils Bohlin
conducted a long presentation tour in the US introducing the three-point safety belt to convince the
widest possible audience of its benefits.

In recent years, Volvo has been involved in campaigns such as "Buckle up", while, at the same
time, has continuously made the belt more effective and convenient to use. Despite this, additional
efforts are still required from both public authorities and private companies to achieve high safety
belt usage throughout the world.
Ways of increasing safety belt usage

More convenient belts and the introduction of seat belt reminders have proven to be effective methods. Having said that, legislation, fines, campaigns and inspections are the main factors that increase safety belt usage. Compulsory belt usage is probably the most successful measure for saving lives on the road.

Legislation requiring all cars to be equipped with safety belts began to be introduced way back in the 1960s. However, it was not until 1971 that the first laws requiring belt usage were passed. That was in the state of Victoria in Australia, and traffic fatalities dropped by 18 percent that very first year.

Nonetheless, despite the excellent results it took another few years before the majority of European countries followed. There is still no legislation requiring rear safety belt use in many parts of the world, something that has a negative impact on both use of the belt and passenger protection.

Countries with low belt usage ratings can catch up quickly. In 2003-2004 Costa Rica very successfully coordinated legislation, public-awareness campaigns and inspections along the lines of the industrialised countries. Usage rose from 24 to 82 percent during the year of the campaign. In South Korea, safety-belt campaigns alloyed to a nationwide police crackdown and significantly raised fines led to a dramatic increase of belts - from 23 percent to 98 percent in less than one year.[14]

Myths about the belt live on

So, why doesn't everyone use the belt if the effects are so good? One reason is that perceptions and prejudices about the belt still live on: that it could be dangerous to wear a belt if you get stuck upside-down in a car, that it crushes your clothes, that it is uncomfortable, that the steering wheel or airbag will provide sufficient protection and so on. However, irrespective of these objections, the basic rule is that it is always better - for everyone and at all speeds - to wear a safety belt than to not do so.

The safety belt is vital in collisions at low speeds in city traffic - where most road accidents occur. The forces involved at low speeds are higher than perceived. Colliding at 31 mph corresponds to the force of hitting the floor having fallen from the third floor of a building. A person who is forewarned can brace himself for an impact of up to about 4 mph. That is why the safety belt should always be used. The airbag is an excellent supplement, but it is just that - a supplement. It can never replace the safety belt.[15]

How the belt should be positioned

For optimum safety, it is vital that the belt is positioned correctly. The diagonal strap should be positioned across the chest, as close to the neck as possible. This ensures the belt's correct angle so that the shoulder and chest are the areas of the body that absorb most of the force. The lower strap should be positioned across the hipbone down towards the thighs, not across the stomach. The belt should be pulled tight after being buckled. The closer it is to the body, the better the protection it offers. The belt should not be twisted or damaged.

Pregnant women should also wear the safety belt, even towards the end of their pregnancy. The belt should be placed tight against the shoulder with the diagonal section between the breasts and the side of the stomach. The hip section should lie flat against the side of the thigh and as low as possible below the stomach - it should never be allowed to slide up.

When a child is sitting on a booster cushion or child seat and using a three-point belt, the same belt geometry applies as for an adult. To place the belt under the child's arm causes considerable injury.

Notes to editors

1. European Transport Safety Council (ETSC), "Increasing seat belt use", 2007
3. European Transport Safety Council (ETSC), "Increasing seat belt use", 2007
4. Estimate by Volvo based on general and in-house statistics on accidents and belt use
5. European Transport Safety Council (ETSC), "Increasing seat belt use", 2007
7. Global Road Safety Partnership (GRSP)
9. Society of Motor Manufacturers and Traders, 2004
THE FUTURE OF THE SAFETY BELT

Although the belt's simple basic design is the same as it was back in 1959, in modern Volvos it now forms part of a high-tech safety system under constant development.

The most recent major change visible to the naked eye was the inertia-reel mechanism introduced in 1969, which made the belt more comfortable and flexible.

However, even if the changes are not visible, work on enhancing the safety belt has continued to keep pace with the rapid advances in safety technology.

"The safety belt is unique as it effectively catches and restrains the occupant in the seat. Other systems can complement and help the belt do its job even better. For instance by providing information about the forces in action and by interacting with the belt during the collision sequence to provide optimum protection," says Lennart Johansson, head of the Interior Safety department.

An example of this is the belt pre-tensioner. Upon receiving a signal from the crash sensor, it tightens the belt against the body of the seat occupant if a collision occurs. This reduces the gap between the belt and the body caused, for instance, by thick clothes. The safety belt pre-tensioner thus makes it easier for the belt to restrain the body as early as possible.

Seat occupants also benefit from the force limiters that are integrated into the belts of modern Volvo cars. Thanks to a sensor that monitors how quickly the belt is being reeled out, the force limiters can detect the dynamic mass - the seat occupant's moving body - as it is thrown forward.

This, in turn, means that it is possible to tailor the force with which the seat occupant's body is restrained and to optimise the absorption of the resulting dynamic mass. If the body is restrained by the belt with excessive force, the body may suffer injury. If, on the other hand, the force limiter is set too low, the body will be thrown forward too quickly against the airbag or instrument panel.

Force limitation can differ depending on the situation. For example, the force level in the belt may be higher at the start of the sequence, then switch to a lower level once the airbag takes over part of the task of energy absorption.

SENSORS DETERMINE HOW THE SYSTEMS INTERACT

The size of the occupant and the type of collision are the main parameters that determine when and how the seat belt pre-tensioners, airbags and force limiters will be deployed. In order to make the right decision, the car's on-board computer uses data obtained from thousands of pre-programmed collision scenarios and real-life accidents previously researched and analysed by Volvo.

Scenarios spanning from high-impact head-on collisions to crashes into trucks have been used in the system's development. The type of accident determines how quickly and at what level the various systems are activated. The information comes from sensors located all over the car. A main processor in the middle of the car collates the data and decides how the systems, including the safety belt, should interact.

SOLUTION TAILORED TO SUIT THE OCCUPANT

If the car is fitted with an integrated child booster cushion in the outside rear seat, the belt protection system is tailored to suit. Obviously, the rear safety belt must be able to protect a smaller, lighter person as effectively as possible.

WILL WE STILL BE USING THE SAFETY BELT IN 2020?

"At Volvo we are convinced that the belt will still be around in 2020 and way beyond that too. The belt may look somewhat different. It may have a four-point attachment instead of three. It will probably be designed so it is even easier to put on than it is today. Only when we have cars that automatically ensure that they are not involved in collisions can we do away with the belt. But that's a long way off yet, even though there is a lot of research going on in that area too," explains Lennart Johansson.
Belt development follows two parallel tracks: one is to make the belt and the system in which it operates as safe as possible, and the other is to adopt a variety of measures to make the belt even easier and convenient to use.

Four-point safety belt
The four-point safety belt has been discussed as a possible alternative by Volvo as well as other manufacturers and several solutions have been presented over the years. However, there is not yet a good technical solution that offers a suitable balance.

The four-point belt has its advantages. For instance, it restrains the occupant more effectively if the car rolls over (one reason why rally cars are fitted with four or five-point safety harnesses or belts). It also reduces the small risk of the seat occupant sliding out from under the three-point belt.

However, the four-point belt also has disadvantages. Volvo believes that it should be designed as a cross, forming an X pattern across the body. It is across the ribcage that the human body is strongest and has the best chance of absorbing incoming collision force. The challenge therefore is how best to effectively attach the upper point of the belt to the centre of the car where there is no natural attachment point in the bodywork.

Another challenge relates more to usage: for the past 50 years, people have become familiar with the three-point safety belt. How would a new solution be received? Is the possible benefit of better anchorage in the seat sufficient if, at the same time, usage actually drops? These are issues that are being studied by Volvo Cars, and the company is not excluding the possibility of future cars being fitted with four-point belts.

Motorised belt that responds to potential hazards
The motorised belt is an exciting new technology that tightens the seat belt and places the driver in the right position in potentially hazardous situations. For instance, the system could register if the car is being driven more actively, with more steering wheel input. In such a situation, there may be a benefit from having more support from the belt. The belt may also receive a signal from the car's collision warning system that an obstacle is approaching. Or that the car has noted that the driver is beginning to be drowsy or inattentive.

If so, the belt can provide a warning and alert the driver to the situation by pulling tight and positioning them in the seat.

Belts that are easier to use
Far too many drivers still do not use their safety belts. Solutions that make usage more natural and convenient are therefore constantly being discussed.

One alternative may be a belt buckle that rises from its place between the seats when someone sits down. This makes it easier, particularly in the rear seat, to find the buckle and use the belt. Other ideas involve showing the occupant where the belt is in the dark by sewing an illuminated strip into the belt.

Tests have also been conducted on fully automatic systems where the belt is placed across the seat occupant and then fastened. The challenge with this solution is not primarily technical in nature but rather the logic of how they should be used.

When exactly should the belt be put on? When the occupant sits in the seat? When the door is shut? When the ignition key is turned? And what will happen if one of the car’s occupants has just sat down and is holding something delicate? These are some of the challenges that the development engineers still have to solve.

Changes in the belts themselves
Today, Volvo and the other manufacturers use belts from a small number of manufacturers. There may be variations in the belts' stretching properties, but their structure and width are the same. One might imagine that a broader belt would offer better protection. However, since the force tends to gather in the middle of the belt, the additional width only offers marginal benefit. It is also more comfortable, particularly for women, to place a slimmer belt diagonally across the chest.

Making the belt inflatable and giving it some form of force limiter is another solution that has undergone limited testing by some manufacturers.
Allowing new technical solutions to interact with the belt can also improve its efficiency. In conjunction with the launch of the Volvo XC60 in 2008, Volvo Cars introduced the Pre-Prepared Restraints (PRS) function. PRS uses the same laser sensors as the collision-avoidance City Safety function. The laser sensor interacts with the airbags and force limiters so that the latter can be regulated more effectively in response to the severity of the collision.

**Volvo Cars’ work to ensure the very highest occupant protection**

Based on a relatively simple but highly-effective mechanical three-point safety belt, Volvo Cars has developed a high-tech safety system that provides the best possible protection for the car’s occupants. The examples in the list below show the journey - so far - from that groundbreaking innovation in 1959 onward:

- 1959 Three-point safety belt in the front, a Volvo innovation
- 1967 Safety belts fitted as standard, rear
- 1969 Three-point inertia-reel safety belts, front
- 1971 Safety belt reminders, front
- 1972 Three-point safety belts, rear
- 1986 Three-point safety belts, rear middle seat
- 1987 Mechanical belt pre-tensioner
- 1991 Automatic height adjustment for safety belts, front
- 1992 Pyrotechnical belt pre-tensioners, front
- 1993 Three-point inertia-reel safety belts in all seats
- 1996 Force limiters in safety belts, front
- 1999 Pyrotechnical belt pre-tensioners in all seats
- 1999 Force limiters in hip belts, front
- 2003 Safety belt reminders in all seats
- 2003 Pyrotechnical belt pre-tensioners for hip belts, front
- 2003 Adaptive force limiters, front
- 2007 2-level force limiters for children and adults respectively, rear
- 2008 Adaptive force limiters for low-speed impacts (PRS), front

**VOLVO SAFETY MILESTONES**

Volvo Cars builds many of the safest cars on the market. Ever since Volvo Cars was founded, safety has been a cornerstone of the company philosophy. The aim is to offer cars that are safe for all people in all imaginable traffic situations. The key to this success is to design safety systems that are smart and interact with one another. Volvo Cars bases its research on a variety of parameters, including data obtained from actual road accidents, with the future aim of ensuring there are no fatalities or serious injuries in or owing to a Volvo car.

**XC60 - Volvo's safest car ever**

2008 saw the launch of the XC60. This model has a safety level of absolute world class and includes City Safety, a function that helps the driver brake if he or she is about to drive into the car in front, as standard. City Safety has been developed to reduce the risk and consequences of a rear-end collision, something that is very common in urban traffic and when driving in slow-moving traffic. The system is active at speeds below 19 mph and is estimated to be able to reduce the occurrence of this type of accident by 50%.

**Vision 2020**

2008 was also the year when Volvo Cars clearly expressed its safety vision for the future - to design cars that should not crash. In the shorter perspective the aim is that by 2020 no-one should be killed or injured in a new Volvo car. The road there is challenging and part of the solution will be technology that involves cars and infrastructure communicating with one another.

**WHIPS turns 10**

Whiplash injuries are among the most common traffic injuries. It was back in 1998 that Volvo Cars introduced WHIPS, an effective system that protects the neck in a rear-end collision. The system, which halves the risk of long-term injuries, has now been around for ten years. WHIPS is fitted as standard in the front seats of all new Volvo car models.

**Avoiding accidents**

One effective way of reducing the number of injuries and fatalities in traffic is to help the driver avoid an accident in the first place. Surveys reveal that up to 90% of all accidents are caused by the driver being distracted and failing to concentrate fully on the road. Therefore, this is an area of top priority at Volvo Cars. For example, Volvo offers Driver Alert Control, which monitors...
attentiveness and alerts the driver if he or she shows signs of distraction or erratic driving. Collision warning and auto-braking are offered on several models as an option.

**If an accident occurs**
If an accident is unavoidable, Volvo's cars have been developed to help protect their occupants. Many different safety systems interact to provide effective protection: airbags, advanced grades of steel with energy-absorbing abilities, and safety belts with both belt pre-tensioners and force limiters.

**Unprotected road-users in focus**
Every year, thousands of pedestrians are injured and killed on roads and Volvo is working to reduce this figure. At the end of 2008, a unique new technology was unveiled that allows the car to detect pedestrians in the collision risk zone, alerting the driver in advance. If the driver does not respond to the warning, the car brakes itself and at low speeds the accident can even be entirely avoided. If a pedestrian is hit, the front of the Volvo is designed to absorb the impact energy and reduce the severity of personal injuries.

**Safe for the smallest passengers**
Volvo Cars offers a wide range of child-safety equipment for children of all ages. A young child's head is large and heavy in relation to the rest of its body and the child's weak neck cannot adequately support the head in a collision. That is why Volvo Cars strongly recommends that children should ride facing the rear for as long as possible, at least until the age of 3 or 4. For older children, from 4 to about 10 (140 cm) there are booster cushions. These help position the belt correctly across the shoulder and thighs and prevent the belt from sliding up across the more vulnerable abdomen.

In order to boost the use of child-safety equipment, there are also integrated booster cushions in Volvo's cars. They can be adjusted to two heights, making them useful over a long period of time as the child grows. Pregnant women should always use the safety belt, even during the final stages of pregnancy. The airbag should also remain activated.

**Safe and sound with personal security**
At the mere touch of a button in the Volvo Personal Car Communicator (PCC) you can determine whether the car is locked or not, wherever in the world you happen to be. It is also possible to see if anyone is inside the car and whether the alarm has been activated.

**Crash-test laboratory**
The heart of Volvo Cars' Safety Centre is the crash-test laboratory. It opened in 2000 and is one of the most advanced in the world. Here it is possible to recreate real-life accident scenarios and the researchers test the various car models in various collision situations.

**MILESTONES IN SAFETY**
1944 Safety cage
1944 Laminated windscreen
1959 Three-point safety belts in the front as standard
1960 Padded instrument panel
1964 Prototype of the first rear-facing child seat is tested in a Volvo
1966 Twin-circuit triangular (three-wheel) backup braking system
1966 Crumple zones
1967 Seat belts in the rear
1968 Head restraints front
1969 Three-point inertia-reel safety belts in the front
1972 Three-point safety belts in the rear
1972 Rear-facing child seat and child-proof door locks
1972 Volvo Experimental Safety Car (VESC)
1973 Energy-absorbing steering column
1974 Energy-absorbing bumpers
1974 Petrol tank relocated for enhanced safety
1978 Child booster cushion for children
1982 Under-run protection
1982 Door mirrors of wide-angle type
1984 ABS, anti-locking brakes
1986 Brake lights at eye level
1986 Three-point safety belt in the middle of the rear seat
1987 Safety belt pre-tensioner
1987 Driver's airbag
1990 Integrated booster cushion for children
1991 SIPS, side impact collision protection
1991 Automatic height adjustment of front safety belts
1993 Three-point inertia-reel safety belt in all seats
1994 SIPS, side-impact airbags
1997 ROPS, Roll-Over Protection System convertible (C70)
1998 WHIPS, protection against whiplash injuries
1998 IC, inflatable curtain,
1998 DSTC, Dynamic Stability and Traction Control
2000 Volvo Cars Safety Centre inaugurated in Göteborg on 29 March
2000 ISOFIX attachments for child seats
2000 Two-stage airbag
2000 Volvo On Call safety system
2001 Volvo Safety Concept Car (SCC)
2002 RSC, Roll Stability Control
2002 ROPS, Roll-Over Protection System SUV (XC90)
2002 Lower cross-member at the front - protection system for oncoming cars
2002 Development of virtual "pregnant" crash-test dummy
2003 PACOS - Passenger Airbag Cut-Off Switch
2003 IDIS, intelligent system for driver information
2003 Patented new structure at the front reduces collision forces
2003 Bangkok's Traffic Accident Research Centre (TARC) is inaugurated
2004 BLIS, system for information about the offset rear blind spot
2004 DMIC, door-mounted side airbag for convertibles
2005 Presentation of Volvo's co-driver system
2005 Multi Lock, combined alcolock and lock for the safety belt and key for speed restriction (research project)
2006 ACC, Adaptive Cruise Control
2006 Personal Car Communicator (PCC)
2006 Collision warning with brake support
2006 Active Bending Lights (ABL)
2007 Integrated two-stage child booster cushion
2007 CWAB, Collision Warning with Auto Brake
2007 Driver Alert Control
2007 Lane Departure Warning
2008 Alcoguard
2008 Pre-Prepared Restraints
2008 City Safety, low speed collision avoidance
2009 Adaptive Cruise control with queue assist
2009 Collision Warning with full auto-brake and pedestrian detection

Ends

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Descriptions and facts in this press material relate to Volvo Car UK's car range. Described features might be optional. All information is correct at time of going to press and may be altered without prior notification.

Related Images
Since the 1960s, Volvo Cars has worked hard to increase belt usage. For instance, Nils Bohlin, who invented the three-point safety belt, volunteered to serve as a living test-dummy in low-speed impacts that were conducted using a specially designed rigid sled. The results of these tests were widely publicized, and the company's efforts to increase belt usage were promoted in Sweden and other countries.

In 1959, the by now patented three-point belt was launched in the Volvo Amazon (120) and PV 544 standard with three-point safety belts. A major step forward in safety had now been taken, but the standards were not enough to prevent fatalities in collisions. Volvo soon realized the importance of ensuring that all the car's occupants were held securely in place.

The first airbag was introduced in 1972, and it was designed to supplement the three-point safety belt. The airbag system was later expanded to cover the passenger side as well. In 1998, Volvo Cars introduced the WHIPS (Whiplash Protection System) to prevent the head and neck from being jolted forward in a rear-end collision. The system has since been adopted by many other car manufacturers.

Safest belt system

The belt system that is still in use today is the three-point safety belt, which was first introduced in 1959. The belt is simple and easy to use, and it is designed to protect the wearer in the event of an accident. The belt system is also highly adaptable, and it can be used in a variety of positions to provide optimal protection for all occupants.

The three-point safety belt is a standard feature on all new Volvo car models, and it is regulated more effectively in response to the severity of the collision. The belt system is also used in conjunction with other safety features, such as airbags, to provide the best possible protection for all occupants.

The three-point safety belt is a standard in the front seats of all new Volvo car models. As the child grows, booster cushions are used to help position the belt correctly. A child's head is large and heavy in relation to the rest of its body, and the child's weak neck cannot withstand the impact. In the rear seats, three-point safety belts are used for the smallest passengers.

Whiplash protection

WHIPS is a system that is designed to protect the head and neck from being jolted forward in a rear-end collision. The system works by inflating a cushion that is placed on the headrest, which helps to absorb the impact and keep the neck in place. The system has been around for ten years and is fitted as standard in the front seats of all new Volvo car models.

The system is designed to work in conjunction with the three-point safety belt, and it halves the risk of long-term injuries. WHIPS is the result of extensive research and development, and it is a key feature of Volvo's research efforts to improve safety in cars.

The only car safety discussion in Swedish newspapers and trade publications related mostly to the dangerous habit of parking at night or on unlit streets and roads. The only place where the belt system is used is in Sweden, where car-owning people have a higher traffic mortality rate than in other countries. At the end of 2008, this figure is expected to approach or exceed one million people in Sweden.

In the USA it is estimated that each percent increase in belt use would save 270 lives a year.

Injury reduction

The belt system is the most important feature for reducing injuries in collisions. The Department for Transport* indicates that annually about 565 people die in traffic accidents, and the number of fatalities in Germany that year would have doubled if the belt had not been used.

A scenario from the 1970's

An accident scenario from 1970 is described as follows:

Jeff was traveling at 80 km/h in a Volvo Amazon (120) with a passenger. Both occupants were wearing three-point safety belts. The rear end of the car hit a tree, causing it to roll over. Jeff and the passenger were thrown forward and back, causing serious injuries.

In the case of the passenger, the belt system was not designed to handle the forces involved in such a collision. The belt could not withstand the impact, and the passenger's head and neck were jolted forward, resulting in serious injuries.

The scenario was used to illustrate the importance of developing a system that could handle the forces involved in such collisions. Volvo soon realized the importance of ensuring that all the car's occupants were held securely in place.

The airbag system

The airbag system was introduced in 1972 and was designed to supplement the three-point safety belt. The airbag system was later expanded to cover the passenger side as well. In 1998, Volvo Cars introduced the WHIPS (Whiplash Protection System) to prevent the head and neck from being jolted forward in a rear-end collision. The system has since been adopted by many other car manufacturers.