

MarketLine Case Study

Volvo

The safest car in the world

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OVERVIEW

Catalyst

Volvo conducts research to minimize dangerous situations on the road and improving their cars with modern safety features such as City Safety, the Pedestrian Detection. The Volvo V40 achieved the best score in the safety tests, overtaking other bigger models. Now the company is going a step further and is working on solutions that will reduce to zero serious injuries and fatalities from accidents involving Volvo cars. In 2012 Volvo management announced that from 2020 there will not be any fatalities or serious injuries in collisions involving Volvo cars. All these targets are a part of financial targets of Volvo that plans to improve performance and grow the business, with the target for annual global sales of 800,000 vehicles by 2020.

Summary

The history of Sweden's biggest car company dates back to the 1920s. The official debut date was 14th April 1927. The era of Volvo's safety dominance began in 1957, when the 120 Amazon model appeared on the roads of Sweden (and others countries). This was the first car that fitted three-point safety belt. Since then the company has worked to improve the active and passive safety features in its cars. The company has a long list of safety innovations implemented over the years to mass-produced cars reducing the number of accidents and injuries among Volvo cars' users.

In every stage of new car production, Volvo tries to maximize the safety of passengers by introducing new safety features to its new models.

Active safety systems installed in the new Volvo cars are the award winning technologies, contributing to Volvo cars being engaged in 27% fewer damage accidents and 51% fewer bodily injury accidents on average than other similar size cars. The active safety systems reduce the likelihood of being involved in accidents by further 19%.

Passive safety features help drivers and passengers stay alive and uninjured in a crash. Major passive feature like structural integrity, side impact support or pedestrian airbag decrease the chances of getting injured in case of accident. Volvo calculated that the combination of seat belts and air bags in Volvo cars is 75% effective in preventing serious head injuries and 66% effective in preventing serious chest injuries.

Volvo Corporation plans to introduce a few brand new safety features that are to be installed in their mass produced cars. Investing heavily in R&D, Volvo expects to eliminate fatal accidents involving its cars as of 2020 and reduce the cost of the production significantly.

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VOLVO HAS DEVELOPED SAFETY FEATURES SINCE ITS BEGINNING

Safety was highly important to Volvo from the very beginning of its existence. In 1924 the economist and businessman Assar Gabrielsson together with engineer and designer Gustaf Larsson combined their skills and established the new car marque. There were three major assumptions made while the design of the first vehicle was made - the Volvo should have a simple structure, its market success should be based on high quality rather than low price, it was to be based on their own, and not purchased, components. These values are kept alive even today, present cars are characterized by simple structure – the new engine range - VEA (Volvo Environmental Architecture) offers four-cylinder engines with higher performance than today's six-cylinder units and lower fuel consumption than the current four-cylinder generation and at the same time in VEA engine the number of unique parts is reduced by 60% increasing efficiency, quality assurance and efficiency by 35%. The all-new Volvo V40 and the V60 Plug-in Hybrid will be vital models to improve Volvo's sales in 2013. The major benefits of these models include very high scores in 2012 Euro NCAP safety tests, solid construction and high quality finishing features. Following on from the founders original version the majority of components used in the construction of the Volvo car are based on the projects designed by Volvo engineers. The quality demands of Volvo Car Corporation was confirmed in the latest J.D. Power study for the German market where Volvo Car Corporation comes first in the brand ranking for 2011. This result is proof of the high level of quality, dependability and service offered by Volvo.

Assar Gabrielsson claimed that "It's people who drive cars, that is why the main rule while designing our cars has to always be safety". After almost 100 years since the make was founded a deliberate commercial brand - identity strategy, focused on safety, resulted in customers associating Volvo with the safest cars in the world.

First Volvo car was produce in 1926 in Sweden

A prototype car named Jacob was firstly built in June 1926 and was marked with the Swedish symbol for the metal iron. Already back then the cars with the strange name "Volvo" (meaning "I roll" in Latin, conjugated from "volvere", in relation to ball bearings) were associated with strength and reliability. The car makers were paying close attention to quality and safety and slowly Volvo made its way to new international markets bringing fresh capital to the company allowing it to carry on with tests and new designs.

In 1928 first company's truck - Volvo LV1 – was a great success for the company. Equipped with 4-cylinder petrol engine, it had only 28 hp, and a maximum cargo weight was limited to 1,500 kg (half the mass of the vehicle). However, due to its robust and durable structure it was often used to carry loads with the weight up to two times exceeding the acceptable norm. Volvo also began assembling buses, which together with trucks, dominated the first decade of the company production records.

At the end of the 1920s Volvo started to experiment and research on future cars. It resulted with a concept car - Venus Bilo unusual prototype revealed by Volvo in 1933 - and the era of automobile production for the less wealthy customer - PV51, the first small Volvo.

Although not yet operating on a big scale, Volvo became popular among consumers due to the manufacturer's devotion to detail and wide range of tests every car needed to go through before being allowed for sale. By the end of that decade, Volvo started exporting their vehicles. The first country outside of Sweden to be offered Volvo vehicles was Finland, Sweden's neighbor.

Volvo commitment to safety paid off during the 1930s

Since its birth, Volvo has always prioritized the safety of their cars and in the 1930's, this strategy paid off. During the 1930s, Volvo's name became increasingly popular not only in Sweden but also on other parts of the European continent.

In early 1930s, Volvo sold 639 cars as compared to 280 in the first year, and the export of trucks to Europe started soon after. The Swedish label began to be recognized for its innovation - in 1935 it launched the Carioca (PV36) - the first car

in Volvo's streamlined body lines that accommodated six passengers (three in the front and three in the rear). The acquisition of Pentaverken Company, which from the beginning was the supplier of engines, allowed Volvo to control the development and production of quality engines for all its products. Currently, Volvo Penta is a world-renowned supplier of engines for boats and ships.

One of the most notable releases for the company in the 1930's was the introduction of a mass-produced bus. In 1934, Volvo manufactured the B1 bus, which received much praise from experts in the industry at the time. In 1936, the company released their omnibus models and that is when sales skyrocketed. From that time onward, the company became known as one of the leading producer of trucks in Sweden and neighboring countries as well.

In 1930, the Swedish automotive industry began to feel the effects of the worldwide economic crisis. Company's car sales fell in the domestic market as well as internationally. This was due to reduced income and high unemployment. Fortunately, by 1933, Volvo had begun to slowly come out of the crisis.

Initially all of Volvo's production policy based on cooperation with a large number of suppliers producing parts for their cars. However, the company gradually took over shares in smaller plants. For example in 1930, Volvo purchased a majority stake in Pentaverken in Skövde-company which produced engines for the company. In 1939 Volvo sold 2,468 cars of this brand, a great success for Volvo and reward for its rational policy in the crisis. The high sales allowed the company to focus on production of another model PV 51-52, built only with Swedish parts. The company's production between 1936-1938 was characterized by low, at that time fuel consumption, as it made 19 miles per gallon.

In the 1960s Volvo was recognized internationally

The 1960s was the time of largest expansion for Volvo Company. There were many plants opened outside Scandinavia, which significantly strengthened the position of Volvo in the world. The manufacturer also opened a new factory in Gothenburg, thereby increasing production capabilities. The company invested SEK 240 million (about \$35.5 million), planning to target production volume at about 100,000 cars per year. The entire production system used by Volvo was based on cooperation with a large number of suppliers and sub-contractors, which was the protection against workers strikes.

In 1966 Volvo released a new car Volvo 140 series, which in terms of technology was one of the most advanced vehicles in the world. The car was equipped, among others, with crumple zones, safety belts on all seats, disc brakes and exhaust emissions control device. Model 144 was hailed as the safest car in every market where it was introduced and was named car of the year in 1966 by Swedish magazine Teknikens Värld.

Over 1960's, Volvo started an extensive study on the impact of seat belts' use on reduction of injuries. The study included all Volvo cars incidents that occurred in 1966 in Sweden. The results showed that using seat belts decreased injuries by 50%. Volvo manufacturers realized that, the knowledge of what really is going on with the car and its passengers during an accident is a valuable and essential part of the process of technological development of the automotive industry. The seat belts were mounted in every produced Volvo car, increasing the safety feature of the car.

In 1963, the United States became the largest export market for Volvo. The company placed itself in fourth place among the best-selling imported cars. In the same year Volvo opened the first factory abroad in Halifax, Canada. In 1965, Volvo opened plants in the Belgian city of Ghent, in 1968, company started production of cars in Malaysia. Swedish cars sold well in the UK, Germany, the Netherlands and France, competing successfully with local brands.

Further expansion into international market in 1970s

In the 1970s Volvo was characterized by growth in European market share and technical development. The company worked to further expand the make's value: quality, safety and care for the environment, both in terms of the manufacturing process and vehicles and equipment produced by the company. In 1970 the road accidents research team was created, which operates to this day.

During the 1970s the production of the company exceeded two million cars. Since 1972 Volvo had been systematically buying Dutch DAF plants in order to fulfill the increase in demand of the European markets.

In 1972 Volvo Technical Center was founded, which carried out experiments and tested new vehicles. In the same year VESC (Volvo Experimental Safety Car) was introduced, the so-called "lab on wheels", equipped with systems such as antilock braking system during slip (ABS), airbags and telescopic bumpers. By 2012 Volvo traffic accident research team, which is a one of a kind, has collected accident data from more than 40,000 Volvo cars in Sweden over the past 40 years.

In 1974, 240 series had its debut, and a more luxurious 260. The Volvo 240 series was considered to be the safest car in the world by prestigious American Institute for Highway Safety. The employees of the independent institute calculated that there was one fatality for every 100,000 Volvo cars per year - less than half as many than the average for all cars. It was also proved that the average Volvo car guaranteed four times larger survival chances than any other car.

The production of about a million units of the Volvo 240 made the Swedish company a leading manufacturer of estate cars in Europe and in the world. 240 and 260 models also strengthened Volvo's position in the automotive market as a manufacturer of the safest cars in the world.

Volvo was associated so far as a manufacturer of high-end cars. In 1975, taking control over of the Dutch car manufacturer DAF created the opportunity to expand its range on smaller car models, such as the Volvo 340.

Introduction of new models full with safety features in 1980s

With purchase of the American truck manufacturer White Motor Corporation in 1981 and significant increase in sales in the Americas, Asian and Australian markets, the company became one of the leading world-scale producers of commercial vehicles, and also a major producer of passenger cars.

At the beginning of the 80's Volvo was still primarily a European company with a certain sales volumes also on other continents. The globalization of the company on a large scale started in this decade. Volvo entered the US, Asia and Australian markets. Volvo cars were very safe and its reputation was constantly on the rise and the market share became constant, Volvo launches new models, including the 760 and 440 - both far exceeded then-current standards for safety. As standard both car series offered airbags, ABS and traction control system. The Volvo 740 opened new chapter in the history of estate cars. This model diminished the differences between a comfortable family saloon and station wagon. The new "combo" was comfortable, safe and easy to drive and also spacious and practical.

Volvo welcomed the 1990s with major changes in concept of building its cars

The first half of the 1990s brought some serious changes in the concept of building Volvo cars. With the launch of a new model the Volvo 850, the company began the process of transforming the Volvo image. Since this point Volvo cars were supposed to still be very safe and comfortable, but at the same time sportier than previous models. New dynamic models were equipped with four technological novelties in the motoring world: transversely mounted 5-cylinder engines, a unique rear suspension system (Delta-link), side impact protection system (SIPS), and safety belts with a self-regulation mechanism. The level of safety, comfort, and above all the driving characteristics were similar to the performance of a sports car.

The 850 went down in history as the first estate and the first Volvo car involved in the British Touring Car Championship. At the end of 1995 Volvo launched new models, breaking with the existing "angular" style. The company altered markings of its models: S - for saloon type cars, V - for estate models and C - for coupes and convertibles.

New Volvo S80, stylistically different from the previous models, was a sensation. Although it had a different look to previous models, Volvo once again gained the reputation of the safest and most comfortable car in the world. In answer to the new fashion for sport utility vehicles (SUV) Volvo began production of the popular off-road XC70 Cross Country model in 1999.

In spring 1999, the Volvo Car Corporation was sold to Ford Motor Company. The theme of this transaction was the belief that the inclusion of Volvo Group in Ford, as one of the largest automotive companies in the world, would benefit from the Swedish carmaker's market position, as well as help to lower the cost of developing new products and extend the

distribution network. Today, Volvo Cars is part of the Premier Automotive Group, an existing company within the Ford Motor Company.

High-tech safety inventions in the new millennium

In 2000 Volvo opened its own Road Safety Centre. The new center represents the know-how accumulated during decades in the field of safety skills and knowledge of eminent engineers, working for safety in the automotive industry. The Road Safety Centre became the winner of international road safety award named after Prince Michael in the field for the driver and passengers. This prestigious award was presented to Volvo Car Corporation for the sixth time. The safety awards have they reflection in number of cars sold. Between 1927 and 31 December 2012 Volvo sold over 17.5 million cars.

In 2000 Volvo introduced the child protection system ISOFIX – child seat mounting system. ISOFIX is the name for the international standard for attachment points for child safety seats in passenger cars. In 2003 Volvo started to produce the world's first new patented front structure. The same year, Volvo launched the Intelligent Driver Information System (IDIS) which continuously monitors the car's preemptive systems such as steering wheel angle, pedal depressions, and overall factors that help the vehicle's computer to decide if the driver is busy or distracted, merging or turning, and will then accordingly delay certain data or alerts that are unimportant. Furthermore, the company introduced a fasten seatbelts indicator with audible signals. Next year Volvo came out with the idea of the blind spot BLIS system (Blind Spot Information System) in passengers' cars. In order to help increase visibility for drivers, Volvo started installing water-repellent glass in its cars.

Table 1: History of Volvo's main inventions

Year	Innovation
1927	Invention of automatic windscreen wipers
1944	Invention of steel security cage in passenger compartment
1944	Invention of laminated windscreens
1958	Invention of three point safety belts
1959	The use of three point safety belts in all Volvo models
1960	Invention of padded dashboard
1967	The use of three point safety belts in all Volvo models for rear seats
1970	Creation of a research team
1973	Installation Electric antifrost system for rear window as standard equipment on all Volvo models
1984	Installation of Anti-lock Braking System (ABS)
1987	The use of three point safety belts for rear center seats
1991	Invention of integrated elevated seats for children
1992	Invention of side impact protection system
1995	Installation of side airbags
2000	Invention of the protection against whiplash injuries (WHIPS) system
2003	Production of the first SUV vehicle with rollover protection system (ROPS) and roll stabilization system (RSC)
2003	Invention of design of the vehicle front
2003	Invention of New Front Structure called Volvo Intelligent Vehicle Architecture (VIVA, S40, V50)
2003	Installation of Rear seat belt reminders (in S40 and V50)
2003	Installation of IDIS Intelligent Driver Information System (in S40 and V50)
2003	Inauguration of Volvo's Traffic Accident Research Team in Bangkok
2004	Invention of BLIS Blind Spot Information System (in S40 and V50)
2005	Introduction of DMIC (Door Mounted Inflatable Curtain, new Volvo C70)
2006	Installation of PCC Personal Car Communicator (S80)

2006	Installation of CWBS Collision Warning with Brake Support (S80)
2007	Installation of PPB Power Park Brake (S80)
2007	Installation of DAC Driver Alert Control (V70, XC70)
2009	Installation of City Safety
2010	Installation of Pedestrian Detection with auto brake (New S60)
2012	Installation of Pedestrian airbag

SOURCE: Volvo's Webpage

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In 2007 Volvo opened a Crash Safety Laboratory in the Cars Safety Centre which is the technically most advanced in the world. It features one fixed and one movable test track, which can be combined to recreate collisions with different impacts, angles and speeds as well as it is equipped with a crash simulator that recreates different collisions without destroying the car body. More than 400 cars are tested in full-scale crash tests at Volvo Cars Safety Centre each year. Tests are designed to learn how the human body is affected in different types of collisions and to verify the calculations in the main computer which simulates crashes.

Starting from 2010 Volvo Car Group has been undergoing modernization. Completely new vehicle architecture – Scalable Product Architecture (SPA) – provides the foundation for products that delivers the Volvo brand's key components: safety, modern Scandinavian design, environmental care and driving dynamics. The new products are designed to present extra safety features and be environmentally safety. A new V40 model is the first model launched after the modernization, already available on the market, and was awarded the safest car award of the year 2012 by Euro NCAP. Volvo also plans to release a brand new XC90 SUV model in 2014 based on SPA. The new models, and safety features installed in new Volvo cars, are expected to be available to prospective customers in 2013 as due to the use of SPA in the designing process, the cost of production is estimated to decrease by approximately 10% which is estimated to have a direct impact on increased sales volume.

Figure 1: Volvo's sales figures, numbers of cars



SOURCE: Autoalliance

MARKETLINE

Increased sales figures in 2010 onwards

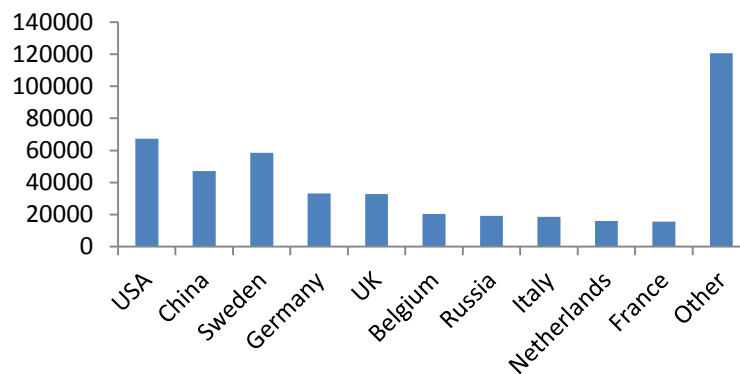
After Volvo was taken over by Geely in 2010, Volvo showed increasing numbers in sales around the world. In 2011, the company sold a total of 449 255 vehicles, an increase compared to the previous year by 20.3%. The sales growth of over 75,000 Volvo cars classifies Volvo as the one of the fastest growing prestige car manufacturer. Number of sold Volvo cars in China showed the greatest growth increase in 2011 - 54% compared to 2010. In North America, an increase compared to 2010 was 22.5%, in the Nordic countries 13.3%, Europe 13.1%. A market share in all regions has increased in comparison to the previous year. The basic strategy of Volvo Car Corporation is to further strengthen the presence in

mature markets such as Europe and America, while penetrating new emerging markets.

In 2011 In China, a completely new structure was created under the direction of Freeman Shen, senior vice president and president of Volvo Cars China Operations. New Volvo Car China headquarters set up in Shanghai. It includes the Technology Centre and all functions related to the purchase, design, sales, marketing, production and finance. The company plans to increase the production to 100,000 cars in 2013 and reach the target of 200,000 sold cars in China by 2015.

Currently the US remains the largest market for Volvo cars representing some 15% of the total company's sales volume, followed by Sweden (13%), China (10%), Germany and the UK (7% each).

Figure 2: Volvo's sales worldwide in 2011



SOURCE: www.volvocars.com

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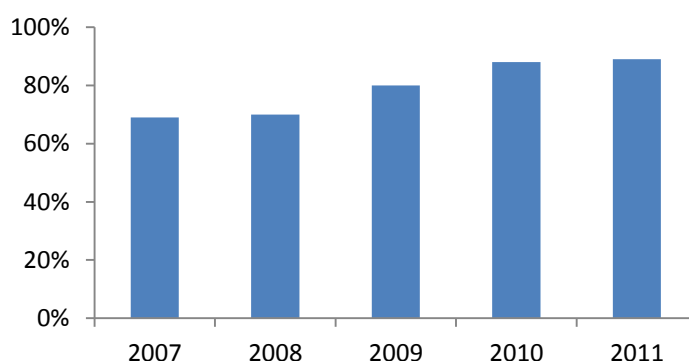
PASSIVE AND ACTIVE SAFETY FEATURES

Volvo is a leader in active and passive safety innovations with over 15 major solutions introduced to its cars during last decade. The company's leadership in car safety was confirmed in the US Insurance Institute for Highway Safety's (IIHS) 2012 by awarding five Volvo models with Top Safety Pick award. Safety is the major point in the organization's code of practice, taking extra care building Volvo cars to make them safer products. Volvo states that it is active and responsible in all areas of automotive safety, and its products "should be designed to meet and exceed applicable laws and regulations, but also to advance the state-of-art safety wherever applicable".

Generally, car manufacturers have made great strides towards protecting drivers, passengers, and pedestrians in the past. Passive safety systems such as crumple zones (called safety cages) or special shock absorber structures mitigate damage after a crash, while the latest active safety technologies are designed to prevent accidents before they happen. Active safety systems include all features installed in a car in order to reduce to a minimum the likelihood of a collision or accident. This group includes systems such as anti-lock brake systems (ABS), driver assistance during start-up and running or adaptive cruise control to name a few.

A 2011 report from the IIHS shows that the accident frequency involving new Volvo cars with installed City Safety technology decreased by 22%. At the same time, insurance claims for personal injuries decreased by 51% and workshop expenses dropped by more than 20%. Each year extensive independent safety testing is conducted and Volvo Cars is committed to be among the best in the class. In 2011, Volvo Cars received the highest rating in 81 of 91 tests carried out by car safety institutes like NCAP.

Figure 3: Share of independent tests where Volvo Cars received the highest rank (%)



SOURCE: www.volvocars.com

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Volvo active safety features

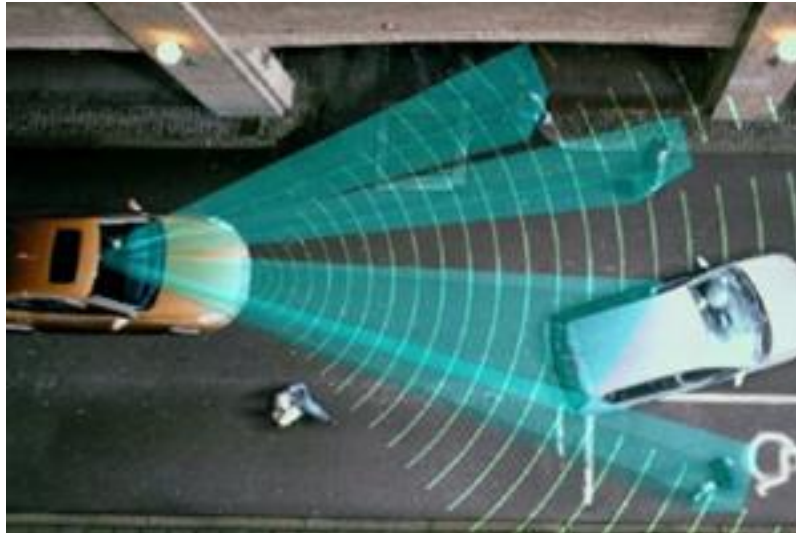
Active safety is about technical solutions that help the driver avoid an accident or significantly reduce the consequences of an accident. Some of the most recent innovations from Volvo Car Corporation include Pedestrian Detection with full auto brake, City Safety, Driver Alert Control, Cross Traffic Alert and Road Sign Information. A car with adaptive cruise control and collision warning cuts the risk of colliding with the vehicle in front on a motorway by up to 42% and according to Consumer Reports National Research Center's poll, 65% of Volvo customers pointed out that safety is the most important buying consideration.

City Safety

Both the National Highway Traffic Safety Institute and Insurance Institute for Highway Safety have stated that the automaker's City Safety technology helps reduce, and even prevent, low-speed collisions. In fact, the IIHS noted that users of City Safety wind up filing nearly 30% fewer at-fault claims.

Volvo City Safety is a technology designed to mitigate and, in certain circumstances, avoid low speed rear-end collisions with vehicles which are stationary or travelling in the same direction. Volvo City Safety is responsible for autonomous systems, responsible for emergency stop of the car. If the car travels at a speed of between 3.6 and 30 km/h, the unit uses a Lidar sensor (Light Detection and Ranging) mounted in the upper part of the windscreen to monitor 10m distances in front of the car. If a collision is imminent, City Safety will prepare the brakes so that if the driver starts braking, it is more efficient. However, if a driver does not respond, the system initiates full braking power. In cases where the speed difference between the obstacle and the Volvo is less than 15 km/h, the car will stop safely. With more speed difference when collision cannot be avoided, the system minimizes its effects.

Figure 4: Volvo City Safety



SOURCE: Autoalliance

MARKETLINE

If the driver tries to avoid a obstacles, or accelerates, the City Safety shuts off. It is also the world's only system that reduces the effects of the collision, which does not warn the driver without the drivers' knowledge. The system is designed to stop the car suddenly at the last possible moment. It is estimated that City Safety could provide a useful benefit (i.e. avert or mitigate the accident) in more than a half of all rear end collisions, and almost a fifth of all car to car collisions. In the US and Europe, several insurance companies have lowered premiums on cars with City Safety because the number of accidents has dropped sharply.

Pedestrian Detection with auto brake

Volvo believes that if every car was equipped with a Pedestrian Detection system, the number of pedestrians who are killed on the roads would be cut by 20% and in three cases out of ten collisions could be avoided completely.

As a result of more intense road traffic, accidents involving pedestrians are increasingly likely. In Europe, over 14% of all accident fatalities are pedestrians. Volvo has set itself the goal of reducing to zero collisions between its cars and pedestrians by 2020. For this purpose, the company has created a system of automatic pedestrian detection, warning of the possibility of finding a pedestrian on the road and in the absence of reaction of the driver to stop the vehicle.

The system was used for the first time at the beginning of the 2011. The pedestrian detection system with automatic braking includes radar (located on the grille), a camera placed and integrated with an internal rear-view mirror and a special controlling computer (central control unit system). The purpose of the radar is to detect and measure the distance of the approaching object. The camera determines the type of object, and the computer calculates the possibility of collision and reacts accordingly. The computer is capable of analyzing wide-angle radar that detects the presence of objects and monitors their speed and distance from the vehicle. An additional camera is mounted next to the rear view mirror. Using this information, the system identifies the object and decides whether it will be in the path of the vehicle.

If possible, the vehicle first sends a warning to the driver. If the driver does not start to brake quickly enough, the car does it for him. With speeds of up to 35 km/h the system will avoid hitting the pedestrian, at higher speeds the impact force is significantly reduced, and consequently there are fewer pedestrian injuries. The Pedestrian Detection System is connected to the ACC system (Adaptive Cruise Control), which maintains a specific distance from the car in front of them.

The Volvo Pedestrian Detection System is not the first to be able to detect pedestrians on the road and warn of possible danger. Similar systems have been already introduced by Mercedes-Benz and BMW, however, Volvo's system introduced the first automatic braking in dangerous situations.

Driver Alert Control (DAC)

Driver Alert Control (DAC) can monitor and verify driving deviations from the street lane the car is running along. In the event that the driver's behavior is distracted by e.g. falling asleep, the alarm is activated. Frequently it is connected with the crossing lane warning system (LWD), which signals leaving the lane without prior signaling (e.g. indicator). The DAC system assesses the impact that fatigue or distraction has on the car's movements through a camera, a number of sensors and a control unit. The camera, located between the windscreen and the interior rear view mirror, measures the distance between road lane markings and the car, while sensors monitor the car's movements. Once a risk is accessed, the system will make an audible signal and a coffee cup symbol will appear in the car's information display. The system is activated at 65 km/h and stays active as long as the speed exceeds 60 km/h.

Studies show that up to 90% of all traffic accidents are caused by drivers' distraction. Volvo reckons that this system can help prevent 30 to 40% of these accidents that are caused by single car road departures and head-on collisions.

IDIS Intelligent Driver Information System

IDIS constantly analyzes the situation on the road or in the event of emergency delays less relevant information for drivers from the various systems in the car, for example, signaling of incoming phone calls.

Intelligent Driver Information System's roots date back to technology used in military helicopters. Using this system leads to less distraction to the driver while driving. When the traffic situation requires full attention and concentration - for example when overtaking or braking - integral signals from mobile phone and some of the information from the on-board equipment are retained until the situation is calmer. The system constantly monitors the driver's steering movements and tracks the accelerator pedal, direction, braking, etc. This data is analyzed and if a set level of attention to driving is crossed, information that is not relevant for safety are delayed from being displayed to driver.

Under normal conditions, the driver can at any time pick up a phone call or text information as well as listen to the road service. IDIS system is standard in all versions of new Volvo cars, irrespective of whether the vehicle is equipped with an integrated telephone or not.

In the future IDIS is ready to cooperate with on-board information and communication devices. The more additional functions are installed in the car, the greater benefit of the IDIS system.

BLIS Blind Spot Information System

Traffic Accident Research at Volvo Car Corporation shows that when it comes to collision warning, 70% of the drivers feel that such a systems improve the level of safety significantly. Extra safety features seem to increase the volume of Volvo cars sold which has been especially visible since 2009. Introduction of more safety features had direct impact on sales volume which jumped by 34% between 2009 and 2011.

The company focused on improving blind spot vision becoming the first car maker to fit wide-angle door mirrors in 1979. Volvo's Blind Spot Information System (BLIS) uses small lamps placed beside the mirror to warn the driver of approaching vehicles located in the so-called "blind spot". BLIS uses cameras installed in the side mirrors. The system's software is programmed to identify cars as well as motorcycles, in daylight and at night. Since BLIS is camera-based, it does not function in conditions of poor visibility, for instance in fog or flying snow. If that happens, the driver receives a message that BLIS is not in action. BLIS is configured not to react to parked cars, road barriers, lampposts and other static objects. The system is activated when the driver exceeds the speed of 10 km/h.

The BLIS system was developed by Volvo and firstly used in the S80 passenger vehicle that was unveiled in 1998. The system works both at night and during the day. It captures cars passing by at a speed 20 km/h to 70 km/h higher than the moving vehicle. The system was introduced on 2005 S60, V70 and XC70s models as an option.

Volvo passive safety feature

Passive safety includes all factors that are designed to reduce to a minimum the consequences of an impact that has already occurred from the point of view of the vehicle occupants. The following features can be classified to this group: safety belts, airbags and pretensioners, body structure, body shape and adjustable head restraints to name the few.

Pedestrian airbag

According to data released by Transport Research Laboratory in May 2011 about 35% of road fatalities in the world are pedestrians and other persons who are not users of vehicles. Improving safety in this group now represents an important objective in both active and passive safety systems.

Figure 5: Pedestrian airbag on new Volvo



SOURCE: Volvo Webpage

MARKETLINE

Volvo constantly improves ways to reduce injuries to pedestrians. The pedestrian airbag system works in the speed range from 20 to 50 km/h. 75% of all accidents involving pedestrians take place at up to 40 km/h. The basis of the system of passer-by protection is the sensors located in the front bumper, recording contact between the car and the pedestrian. This unusual solution is based on the Pedestrian Detection system, which detects pedestrians in front of the car. When the risk of collision is detected, it automatically activates brakes. During the collision the tip of the bonnet is lifted and the airbag explodes. The air bag covers the area under the raised hood and covers a large part of the surface of the windshield and side bars. The safety cage consists of several kinds of metal alloys, which also reduces the effects of a collision. The front of the Volvo is being made from mild steel that absorbs some of the energy during an impact. Volvo's new Pedestrian Airbag goes some way to help further reduce the percentage of number of car crash fatalities involving pedestrians, currently 14% in Europe and 25% in China. Volvo claims that this system can reduce pedestrian fatalities by 5% and serious injuries by 14%.

Protection against whiplash injuries: WHIPS

Teams from the Volvo Accident Analysis Centre revealed that rear collisions were frequent occurrences, and often resulted in whiplash injuries. So Volvo engineers developed the Whiplash Protection System (WHIPS). Accident analysis showed that since the system was introduced in 2000, the number of injuries in Volvo cars fell by up to 50% as compared

to previous Volvo cars. The WHIPS installed in all Volvo cars' seats were awarded the 2009 Euro NCAP for the protection of the spine during accidents for passengers.

The WHIPS system was used for the first time in Volvo cars in 1998 but started to be installed in all Volvo cars in 2000. Its purpose is to reduce the burden on the neck and spine of vehicle passengers in a case of accident. The back of the seat is designed so that at the time of impact from the rear, seat backrests and head restraints conform to the movement of the body of the person sitting there, cushioning the impact in the same way as it does when catching a ball.

The WHIPS mechanism has been further enhanced improving its capabilities and provides better contact of the head and head restraint throughout the impact.

New, safer front structure called Volvo Intelligent Vehicle Architecture VIVA

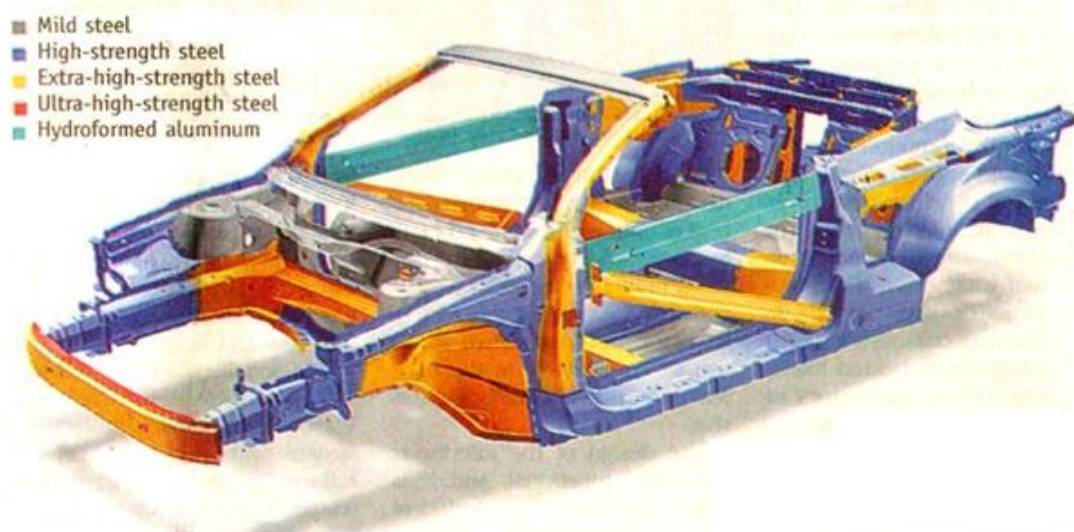
The new front structure is one of Volvo's many patented safety designs, and is an important part of Volvo's Intelligent Vehicle Architecture. A new approach to building a safety car integrates crashworthiness, dynamic styling and more accrue driving characteristics.

In the new front structure, four different grades of steel are used in an intelligent interplay to provide maximum safety for the car's occupants. Side impact protection is addressed by the use of extremely rigid cross members that form a three-way attachment between the leading edge of the A-pillar and the base of the B-pillar. The rear doors are also supported by a rigid structure. Such chassis construction allows for better energy absorption in event of a collision.

The VIVA systems were designed and developed in the Volvo Cars Safety Center. The company ran a series of tests to prove the structure's crashworthiness. About forty full-scale tests were performed, and numerous computer crash simulations, to help ensure that all the on-board components interact as required. The frontal body structure of a car is divided into several zones, each responsible for a different task in the deformation process. The outer zones are responsible for most of the deformation. The closer the collision forces get to the passenger compartment, the less the materials used deform. The intention is that the passenger compartment should remain intact in most collisions. During the design process, a series of computer simulated frontal crash tests were performed prior to engine installation. The engines were then designed to fit within the empty space that remained after the simulated crash test.

Different grades of steel are used in different areas of the chassis in order to gain the relevant properties. In addition to conventional bodywork steel, three different grades of high-strength steel are employed: High Strength Steel, Extra High Strength Steel and Ultra High Strength Steel.

Figure 6: Volvo VIVA structure



SOURCE: Volvo Webpage

MARKETLINE

Low-speed deformation zone: in cases of low speed collision, the most exposed part of the chassis–bumper is supposed to be the only part engaged. In Volvo cars the front bumper incorporates an extremely rigid cross-member of boron steel. Such a design helps to absorb the forces generated by a low-speed collision without damage to the rest of the body structure. The damaged bumper can be replaced easily at reasonable cost.

High-speed Deformation Zone: high strength steel is used for producing the straight sections of the side members, tested for optimized high-energy absorption. This zone accounts for most of the deformation in a collision. In addition, Volvo has opted to include upper side cross-members since they provide essential protection if the vehicle should collide, for example, with a truck platform or a loading pier.

Back-up Zone: the section of cross-member that turns outward toward the A-pillar is designed to act as a barrier protecting the cabin space and as a back-up against deformation. Such a design also helps minimize the possibility of the front wheel from penetrating into passenger compartment instead it helps to absorb the collision forces. This section is extremely rigid and is made of extra high-strength steel.

FUTURE SAFETY TECHNOLOGIES

Volvo plans to invest about \$11 million in the next three years for future developments. Almost half of this sum will be spent in Sweden in the form of infrastructure for the new vehicle architecture and engine family. The big investment figure goes in line with the planned increased of the sales figures up to 2015. Håkan Samuelsson, President and CEO of Volvo Car Group claims that "this is a proof of Volvo Car Group's determination to strengthen the company's position as a Swedish car maker with a unique attractiveness on the global market".

Fully automated driving while in traffic

Volvo is working on fully automated driving while in traffic, reducing collisions at intersections and reducing to zero collisions involving animals which are the latest projects in the field of safety that Volvo is working on. The company plans to implement all these solutions in mass production in the next few years, reducing the rate of accidents and injuries by another 20%.

With the automatic support driving in traffic (Autonomous Driving Support) drivers will soon not have to focus on driving and will be able to devote their attention to other activities. Through the use of data from cameras and radar, the vehicle can follow a moving vehicle in front. Acceleration, braking and steering takes place automatically. If the vehicle in front is forced to make rapid maneuvers because of the obstacles, the driver is assisted by the control system, which makes the car turn in the same direction. If the driver chooses to take control back themselves, it can do so by touching the brake or the gas pedal or moving the steering wheel. The system is not design to limit the driver, but supports the driver in driving, minimizing the risk of collision with other cars or objects on the road.

Intersection Support System

In the US alone about 21.5% of road deaths occurred at intersections, and in the 16 countries of the European Union (excluding Sweden), this percentage exceeded 20%. To reduce the number of collisions, Volvo started work on a support system to overcome accidents at intersections (called Intersection Support). Automatic braking at Intersections system brakes when at the time of leaving the junction there is another car in front of the turning vehicle.

Animal Detection System

Volvo is working on a new system to minimize the risk of collisions involving animals (called Animal Detection). The system can stop the car in case of intrusion of an animal on the road. The system consists of two parts - a radar sensor and infrared cameras that register the situations before and the sides of the car. Currently, the system detects large animals such as elk, deer, cattle, and horses. However, in the future the system will operate also in the event the smaller animal appears on a road. Importantly, the system works well at night. All solutions are still in the testing phase and it will take several years before they are introduced into mass-produced Volvo cars.

New Scalable Product Architecture

The company wants to increase the make's competitiveness and benefit from economies of scale by introducing SPA (Scalable Product Architecture) - a flexible, scalable product architecture which means that most Volvo models can be built on the same production line irrespective of vehicle size and complexity. SPA is planned to covers most of Volvo's future car models. Peter Mertens, Senior Vice President Research and Development in Volvo claims that SPA will make Volvo cars technologically independent. The new architecture covers about two-thirds of total sales volume and with about 40% of all components shared by all car models irrespective of size. The company will be able to reduce the price of the car by reducing the cost of development and parts design.

CONCLUSIONS

The safest cars in the world

Despite strong developing competition, Volvo continues to lead in the car safety technologies. Continued work on the improvement of quality and reliability, and above all the safety of users makes the Volvo company more and more noticeable in the global market and increase the sale volume from year to year. Volvo brand is known on all continents.

Long list of safety feature innovation

Volvo is widely known for its invention of security systems (like three points safety belts) and placing them in mass-produced vehicles through its history. This feature was from the beginning of the brand an indisputable advantage of Volvo. As a result of its constant pursuit of car safety the latest Swedish vehicle, Volvo V40, has been recognized as the safest car in the world in 2012. The car received the best result in the history of Euro NCAP tests. In the category of supporting safety systems Volvo V40 received the maximum number of points - 100%. Adult Occupant safety is 98%, and pedestrian protection - up to 100%. The recent sales volume increase in last three years (over 1.2 million over 2010-2012) proves that more customers focus on safety features while choosing new car. This market trend bodes well for the company which plans to increase the annual sale volume worldwide to 800,000 cars in 2016.

Active and passive safety features massively reduces chances of injuries

In addition to standard security systems, Volvo, as first company in the world, introduced active systems such as City Safety, Pedestrian Detection with auto brake, Intelligent Driver Information System with Driver Alert Control or BLIS. Generally they help to avoid collisions and are expected to collectively reduce the volume of injury by 30-40%.

Volvo statistics show that both active and passive safety features have reduced the number of severe injuries by approximately 50% since the 1960's. The new safety system projects are designed to make Volvo cars even safer and place its cars in the leading position where safety is concerned. By 2020 Volvo plans to reduce the number of amount of road accidents involving Volvo cars to zero.

Volvo plans to install new safety features and reduce the cost of production

In order to reduce further the number of accidents and casualties the company has already started the trials with new safety features that are to be fitted to cars, like Autonomous Driving Support, Intersection Support or Animal Detection systems. All of them are designed to reduce the risk of injuries and at the same time Volvo is spending around \$11 million on Scalable Product Architecture which is claimed to help reduce the time and cost of production lowering the price of the cars and making them more affordable and competitive. The safety features coupled with new, safer and cheaper cars are to drive the company to the long term sales target of 800,000 cars annually.

APPENDIX

Definitions

Euro NCAP - The European New Car Assessment Programme (Euro NCAP) is a European car safety performance assessment program based in Brussels, Belgium and founded in 1997 by the Transport Research Laboratory,

ISOFIX - name for the international standard for attachment points for child safety seats in passenger cars,

ComSense - an alert delay feature that reduces the risk of distraction by briefly postponing lower priority alerts when the brakes or indicators are activated,

A-pillar - is the first pillar of the passenger compartment, usually surrounding the windscreen.

B-pillar - the pillar which is present in between the rear & the front door.

Sources

www.euroncap.com

www.volvocars.com

www.volvo.com

www.volvoclub.org.uk

www.euroncap.com

www.autoalliance.org

Further Reading

Sweden – New Cars - Industry Profile published by MarketLine on 05 December 2012

Ask the analyst

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