

## PRESS INFORMATION

# The all-new Volvo S40

- **Developed and tested in the world's most advanced safety centre**
- **New, patented frontal structure with several crumple zones**
- **Four steel grades interact for optimal deformation**
- **The same side-impact protection system as in larger Volvo models**
- **Frontal design with integrated protection for other road users**
- **68% greater torsional rigidity compared to the current Volvo S40**
- **Unique intelligent driver information system – IDIS**
- **High level of theft protection**

The all-new Volvo S40 is a compact car with extremely high safety levels – both protective and preventive. Volvo's objective has been reached: the same high safety level in the new S40 as in the current S80 model.

This is possible thanks to several interacting units, including a very stiff body, a new frontal structure and a world-first intelligent system for driver information.

The safety systems have been developed and tested in The Volvo Cars Safety Centre, the most advanced facility of its kind in the world. About forty full-scale tests have been performed to help ensure that all the on-board components interact.

## PROTECTIVE SAFETY

## **Crumple zones that employ different grades of steel**

During the development of the all-new Volvo S40, the designers started off by using the crash safety levels of the Volvo S80 as a model – with the aim of reaching the same high level with the new compact body.

“While we cannot change the laws of physics, our aim of building cars that are the safest in their class applies to all models, irrespective of size,” says Ingrid Skogsmo, head of the Volvo Cars Safety Centre.

In a compact car body, the preconditions for efficient deformation are different to those of a large body. Since the necessary deformation is absorbed within a shorter total distance, the various materials’ properties must be exploited to the maximum so as to absorb as much of the incoming energy as possible.

“A tough challenge, one that we approached in an entirely new way,” confirms Ingrid Skogsmo.

The frontal body structure of the Volvo S40 was divided into several zones, each with 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 objective is that the passenger compartment should remain intact in most collisions.

In order to give each zone the relevant properties, different grades of steel are used in different areas. Four different steel grades are used. 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.

The zonal system enables the collision forces to be absorbed in a highly ingenious and effective manner:

### **Low-speed deformation zone**

The front bumper incorporates an extremely rigid crossmember of Boron steel. The attachments to the longitudinal members of the body are designed in the form of ‘crash boxes’, which absorb the forces generated by a low-speed collision without damage to the rest of the body structure. The crash boxes can be replaced easily at reasonable cost.

### **High-speed deformation zone**

The straight sections of the side members are made of high strength steel, a very ductile grade of material, which is optimised for high energy absorption. This is the zone that accounts for most of the deformation in a collision.

In addition, Volvo has opted to include upper side members also in the compact Volvo S40 since they provide significant occupant protection if the vehicle should collide, for example, with a truck platform or a loading pier.

### **Back-up zone**

The section of member that turns outward toward the A-post is designed to act as a barrier for the cabin space and as a back-up reducing deformation. The design also helps minimize the risk of the front wheel penetrating the interior. The wheel instead helps absorb the collision forces. This section is extremely rigid and is made of extra high-strength steel.

### **Three-way attachment**

A rigid cross-member connects the A-posts and lower side members. On each side they form an extremely rigid three-way attachment, which very strongly helps to maintain the the cabin space in a severe crash.

The new front structure is one of Volvo's many patented safety designs.

### **Compact engines contribute to crash safety**

Owing to efficient packaging, the engines in the all-new Volvo S40 have been able to be made 200 mm slimmer. Since the engines are installed transversely, the reduced width creates greater space between engine and passenger compartment. In a collision, the engine can be pushed no less than 150 mm rearwards before the crankshaft comes into contact with the cross-member near the bulkhead.

The all-new Volvo S40 also shares the same type of interior safety systems as found on the S60 and S80 models.

The steering column can be deformed up to 140 mm. When deformed, the steering column moves horizontally, to provide the optimal airbag position for this vehicle.

In cars for the North American market the collapse function adapts to the use of the seat belt.

More safety features in common with the S60 and S80 models:

- Collapsible pedals
- Dual-stage airbags
- Seat belt pretensioners for the front seats and rear outboard seats
- Force limiter for the front seat belts
- Belt reminder for the front seats (for European markets also in the rear)

## **Side Impact Protection System**

The all-new Volvo S40 is 50 mm wider than its predecessor. This creates added space for deformation in a collision. In other respects, the Volvo S40 has the same type of side impact protection as found on the S60 and S80 Volvo models, with SIPS (Side Impact Protection System), side-impact airbags and inflatable curtains. These curtains are designed to provide enhanced occupant protection in rollover accidents, by deflating more slowly (approximately 3 seconds) than the front airbags.

The side airbags are larger than in the previous S40 model so as to help provide more effective protection at hip and chest height.

Several features contribute to the stiffer body and help reduce side intrusion:

- The reinforced, transversely installed tubular beam between the A-pillars
- The diagonally installed beams of Ultra High Strength Steel in the doors
- The B-pillars, which have been significantly reinforced and are dimensioned to help provide enhanced protection

The Volvo S40 has been designed to help provide the highest level of occupant protection in a rear-end collision too.

Volvo's system for avoiding neck injuries – WHIPS (Whiplash Protection System) – is one of the most effective on the market. In the event of a severe impact from the rear, the seat backrest and head restraint accompany the movements of the seat occupant's body.

The seats and backrests are of a particularly robust design. They are dimensioned to withstand high loads from items such as unsecured luggage, while at the same time they are designed to yield in severe crashes where a balance of strength and flexibility is important for occupant safety.

“Our seats are far sturdier than those usually found in the compact segment,” says Ingrid Skogsmo.

## **Protection for other road users**

The design of the all-new Volvo S40 has a front characterised by clean, smooth surfaces and rounded corners. The curves and panels are shaped to help reduce the risk of injury to pedestrians and cyclists in the event of an accident. Furthermore, the front has an energy-absorbing structure ahead of the bumper so as to help reduce the risk of leg injuries.

The bonnet and front wings are designed to absorb collision energy. This helps reduce the risk of head injuries. In addition, the compact new petrol engines leave a generous 70 mm of free space between the cylinder head and bonnet.

### **Built for children too**

Just like the rest of the Volvo range, the all-new Volvo S40 is developed with a keen focus on children. The body's safety structure and interior safety systems are designed and dimensioned to help protect the youngest occupants too.

Both rear outer seats can be fitted with integrated child booster cushions for children above three years of age.

The front passenger airbag can be switched off and disabled with a key (available from spring 2004) (not in the US or Canada).

The front passenger seat is factory-prepared for fitting a rearward-facing child seat. It has special anchorage loops for attachment using the seat belt.

## **PREVENTIVE SAFETY**

### **Stable driving properties**

The body of the all-new Volvo S40 is 68 percent stiffer than that of its predecessor, thanks to advanced body design. This torsional rigidity contributes to stable, predictable and consistent behaviour on the road. The car's chassis design, with its broad track and long wheelbase, also has a positive effect on stability.

- The front track is 1535 mm (63 mm wider than the previous S40 model).
- The rear track is 1531 mm (57 mm wider)
- The wheelbase is 2640 mm (78 mm longer)

The suspension is independent all round, with spring struts at the front and a multilink system at the rear. The rear suspension provides a certain degree of passive steering to counteract any tendency to skid.

The all-new Volvo S40 can be specified with:

- STC (Stability and Traction Control) anti-spin system.
- DSTC (Dynamic Stability and Traction Control), which corrects the car's progress and poise if there is any sign of starting to skid.

In 2004 the Volvo S40 T5 will become available in combination with All Wheel Drive. Volvo's electronically controlled AWD system distributes the torque automatically to match the road and driving style and providing stable, consistent driving characteristics.

### **Excellent braking**

The all-new Volvo S40 has extremely powerful ABS brakes – with electronic brake-force distribution to the rear wheels and automatic panic-braking assistance – EBA (Emergency

Brake Assistance). The front wheels feature ventilated discs. The disc size is adapted to engine power (diameter up to 16.5”).

### **Projector-type headlamps**

The headlamps feature projector-type low beams. The concentrated beam of light is surrounded by a “halo” which helps oncoming drivers judge the distance to the car.

Bi-Xenon gas discharge lamps (GDL) for high and low beam are available as an option.

Additional side-mounted turn indicators in the door mirrors and integrated side-marker lights in the front and rear lamps make the Volvo S40 easy to see from the side too.

### **Ergonomic driver's environment**

An ergonomically designed seating position with all the instruments and controls in just the right position makes for safer progress. In this respect, the Volvo S40 continues a renowned Volvo tradition. It has a comfortable and conveniently operated driver's seat, an adjustable steering wheel and a logically laid out instrument panel.

Steering wheel-mounted controls for the audio system, cruise control, telephone and RTI (Road and Traffic Information) navigation system add further to driving safety.

### **Intelligent Driver Information System**

The all-new Volvo S40 introduces IDIS – the Intelligent Driver Information System.

IDIS is a car industry world novelty, influenced by fighter aircraft technology. The system helps the driver avoid being distracted while driving.

When the traffic requires the driver's full attention and concentration, for example when overtaking or braking, signals from the integrated GSM telephone and certain peripheral information are delayed until the situation is calmer.

The IDIS function continuously registers the driver's activity by monitoring steering wheel movements, the accelerator pedal, turn signal function, braking and so on. This information is processed and at a given activity level, information that is not essential to safety is held back.

In normal conditions, the driver can at any time answer phone calls and text messages and receive traffic information.

IDIS is standard in all versions of the all-new Volvo S40, irrespective of whether or not the car is fitted with an integrated phone.

IDIS is factory-prepared for forthcoming on-board systems for information and communication. The more such functions the car has, the greater the benefit of IDIS.

## **Security**

Volvo's holistic view of safety encompasses not just Protective and Preventive safety, but also Personal Security. The Volvo S40 is designed to provide effective protection for the car's occupants and their property, both while on the move and when the car is parked.

The level of theft protection is very high, as a result of close co-operation with Thatcham, the world-leading automotive research and technology centre. The Volvo S40 is equipped with a number of protective functions, such as:

- Electronic immobiliser
- Electronic anti-theft "marking"
- Uniquely identified control modules
- Audio system as an integral part of the on-board electrical system

The all-new Volvo S40 can also be equipped with laminated door windows, an unusual feature in a compact car. Laminated glass is extremely difficult to smash and provides enhanced protection against break-ins.

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