

## Communiqués

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# The all-new Volvo S40: Compact car safety the Volvo S40 way

**Occupant protection for the compact S40 on a par with the Volvo S80 thanks to:**

**New, patented front architecture**

**Four different grades of steel**

**Clever engine compartment packing**

**Re-engineered collapsible steering column**

“When we designed the all-new Volvo S40, we needed to answer two questions,” says Volvo Cars’ safety engineer Ragnar Crona:

How do we handle the high impact forces from larger vehicles?

Where do we find the crumple zone necessary to provide a “soft” stop for the occupants in the Volvo S40?

The dilemma is that the front structure should deform under high impact force. However, this force must be lower than the maximum that the safety cage surrounding the occupants can handle. This means that collision performance is highly dependent on just how strong the safety cage can be made.

In a traditional front structure, incoming impact forces are transferred from the side members down to the sill and the floor. During this transfer of the impact force, large bending moments are created. These bending moments limit the maximum force that the side member can be designed to withstand. Therefore, in order not to crush the back-up structure, the force in the side members has to be kept relatively low.

The energy that the side member can absorb is a function of how long it is and the force level it can handle.

Low force capability gives a long side member – creating an additional challenge when designing a smaller car.

**New, patented front architecture**

The all-new Volvo S40 has a new front architecture for which Volvo has the patent.

In the Volvo S40, the forces from the deforming side members are transferred into a web of longitudinal and lateral members that form the front part of the safety cage.

This web can be compared to an old-fashioned railroad bridge where zigzag members absorb all forces in the optimum way.

With this architecture, we can allow the side members to deform at a higher load. This means that the same amount of energy can be absorbed with shorter side members. The complete front end can therefore be made shorter.

We have used High-Strength Steel in the body area that absorbs the collision energy. This grade

of steel is optimal for deformation at a very high load.

In the areas surrounding the occupants, where we want very little or no deformation at all, we have used Extra-High-Strength Steel. This steel grade is very strong but still ductile enough to make sure that the safety cage deforms in a controlled manner.

#### **Each part knows where to go in a crash**

The Volvo S40 is thus designed to absorb incoming collision energy and to take the front-end deformation in a controlled way. The only problem is that we have a five-cylinder engine in the way.

“Normally when you design an engine, you make sure that it fits into the car. When we designed the engine for the Volvo S40, we made sure it would be slim enough to fit into the engine compartment even after a collision,” says Ragnar Crona.

The five-cylinder engine installed the Volvo S40 is new and it is made extremely slim to allow the biggest possible crumple zone. Therefore, the new Volvo S40 engine gives the occupants more of a survival zone compared to previous Volvo engines.

Everything you find under the bonnet of the Volvo S40 has a predetermined position after a frontal impact, piling up in an organised way ahead of the safety cage.

#### **More space inside**

We have also increased the space inside the car during impact. In a crash, the re-engineered steering column will collapse more than in previous models. This allows the driver to move further forward inside the car during the crash without compromising safety. As a result, the belt and airbag are better able to help limit the forces imposed on the driver, thus bringing his or her body to a “softer” stop.

#### **Compact car safety**

Altogether, the patented front structure, the engine bay packaging, the combination of different-grade steel and the re-engineered collapsible steering column give the Volvo S40 a remarkably good front crumple zone. In fact, in terms of frontal collision protection, this clever engineering puts the new compact Volvo S40 on a par with the current Volvo S80, recognised worldwide as one of the safest cars on the market. It is not possible to change the laws of physics, but new technologies can certainly be harnessed to make smaller cars even safer.

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#### **Mots clés:**

S40, Press Releases, Product News, 1995

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