

# Rust affects car crash safety

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*Villaägarna (Swedish Homeowners' Association) and Folksam Insurance have completed the world's first official Euro NCAP crash test of used and rusty cars. The results show that serious rust on the crash beams impairs crash safety. Used and rusty Volkswagen Golf and Mazda 6 cars were used in the test.*

Both cars received reduced crash ratings according to the Euro NCAP model. In the frontal test, the Mazda 6 became deformed to the extent that the driver's seat twisted, and the crash test dummy hit its head on the B-pillar (the pillar between the doors). However, as head injuries may have been due to rebound from the steering wheel to the B-pillar, they are not included as part of the Euro NCAP model. This type of head injury is therefore not included in the Euro NCAP assessment.

We chose to perform the crash tests on the Volkswagen Golf and Mazda 6, two common family cars within different size classes, to establish if there was any correlation between rust and crash safety. The models tested, VW Golf generation V (2004-2008) and Mazda 6 generation I (2003-2008), are relatively susceptible to rust. They are, however, far from being the only cars susceptible to rust. So, if the tests had been performed on any other model of car with serious rust in the crash beams, then such tests may well have shown reduced crash worthiness due to corrosion damage. The most important factor is simply the degree of the rust and its location on the car in question, not the brand on the front of the car.

The cars were tested at Thatcham Research's crash laboratory in England, which is one of the crash laboratories that crash tests cars according to Euro NCAP's (European New Car Assessment Programme) standard.

"We asked Thatcham to test the cars in their crash laboratory in accordance with the same Euro NCAP standard used when these models of Volkswagen Golf and Mazda 6 were tested as new cars. So, they have not been assessed according to a newer or stricter standard," says Ulf Stenberg, Chief Legal officer at Villaägarnas Riksförbund.

## Crash results

The VW Golf rating lowered according to Euro NCAP's five-star rating scale, from a low five (33 points) when the car was new to a high four (32 points). But the difference in crash safety was marginal with only one point's difference. When it comes to the Mazda 6, the crash worthiness had worsened considerably. The crash rating was reduced from a low four (26 points) when the car was new, to a low three (18 points). For the Mazda 6 this equates to a 20 percent increased risk of being killed in a real accident, according to Folksam.

There is no guarantee that another used Mazda 6 with serious corrosion damage would have had the same outcome as in our test. Depending on where the rust is located though, other negative and uncontrollable crash impacts could occur, compared to when the car was new. As a result of rust the car does not deform as planned, and the ability to absorb shock from the force of impact deteriorates.

## Volkswagen Golf

New - 5 stars



Used and rusty - 4 stars



## Mazda 6

New - 4 stars



Used and rusty - 3 stars



**Euro NCAP's rating scale:**

5 stars - 33-37 points

4 stars - 25-32 points

3 stars - 17-24 points

2 stars - 9-16 points

1 star - 0-8 points

## The crash test dummy hits its head on the B-pillar

After hitting the steering wheel airbag, the driver crash test dummy rebounded and hit its head hard against the pillar between the car doors (B-pillar). However, the Euro NCAP assessment does not take this into account. When the Mazda 6 was new, this wasn't an issue as the crash test dummy's head hit the headrest on the rebound. But in the used car, the course of the crash develops very differently. As a result of considerable deformation, the driver's seat folds towards the side window and the B-pillar, and the crash test dummy hits its head.



*You can see here how the seat and the headrest are pressed toward the B-pillar.*

The car is usually the second largest household expense after accommodation. The cost of repairs for poor rust protection can be expensive and shorten the life of a vehicle. In 2015 and 2016, Villägarna examined the rust protection on new cars, which was when the question of the impact of rust on crash worthiness was raised.

“When crash tests are performed around the world, they use new cars. However, most people buy used cars, not new cars. So, this makes it interesting to know if crash worthiness can be impacted by rust,” says Ulf Stenberg.

## Articles related to our crash test

- [How the tests were performed](#)
- [Inflatable curtains can reduce risk of damage](#)
- [Crash tests don't tell us everything about how safe a car is](#)
- [Why your car gets rusty](#)
- [Do you dare to buy a rusty car?](#)

## Reports about Mazda 6 from the Thatcham crash test laboratory

- [Swedish version](#)
- [English version](#)

*The corresponding report for the Volkswagen Golf does not exist as the difference was small compared to the crash test of the new car.*

## How the tests were performed

The crash tests of the used and rusty VW Golf generation V (2004-08) and Mazda 6 generation I (2003-2008) were performed at Thatcham's laboratory in England. The assessment was carried out according to Euro NCAP's protocols from the time when the cars were new, and not according to current stricter protocols.

The crash tests are always performed in a predetermined/standardised way.

One of the crash tests that Euro NCAP uses is a full-frontal collision with a deformable barrier at 64 km/h in which 40 percent of the front of the car collides with the barrier. Similarly, a side impact crash in which a mobile barrier weighing 950 kg collides into the side of the car at a speed of 50km/h, as well as a sideways collision at 32 km/h with a stiff, thin pole.

In the crash test the crash test dummies are properly fastened with the seat belts. The angle of the back support, the headrest and the distance to the steering wheel, pedals and so on are appropriately adjusted.

View the films from the crash tests

Mazda 6



VW Golf



View the crash test from when cars were new

Mazda 6



VW Golf



In the summary rating from the test, the pole test has little impact. We therefore chose to use the Mazda 6 scores from the pole test done when the car was new.

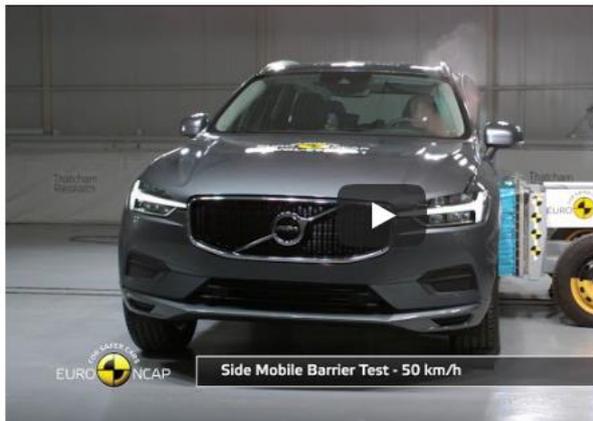
## Inflatable curtains can reduce the risk of damage

*In a frontal collision you are first flung forwards and then backwards, a so-called rebound. If you then hit something hard on the rebound, as was the case in our crash test of the rusty Mazda 6, there is a risk of injury. Curtain airbags that drop down from the ceiling to cover the car's side windows are only triggered in a side impact on most cars. However, with curtain airbags that are also triggered by a frontal impact, the risk of damage on rebound is reduced.*

Risks of injury due to rebound are significantly lower in some later generations of cars as, unlike the Mazda 6 generation I, they trigger the curtain airbags in frontal collisions and not only upon side impact.

So in frontal or diagonal collisions, this will reduce the risk of hitting the head on the B-pillar after a rebound from the steering wheel airbag.

**An example of how such a curtain airbag triggered by a frontal collision works in a frontal collision**



In the Volkswagen Golf the crash test dummy hit its head on the headrest both in the used and the new car test. So, there was no rebound into the B-Pillar.

# Crash tests don't tell us everything about how safe a car is

*It's almost impossible to see a car ad that doesn't show the stars from the Euro NCAP crash test. But do the tests tell you everything about the safety of a car? No, of course not. In reality, crashes happen in many other ways than the different model crashes used in the Euro NCAP model, such as other types of obstacles, other types of cars and at higher or lower speeds.*

“Euro NCAP provides good information on the crash worthiness of a car, but it does not say everything. A model only measures a limited part of reality,” says Ulf Stenberg, Chief Legal Officer at Villaägarnas Riksförbund (Swedish Homeowners' Association).

As an example, according to Euro NCAP no consideration is made for a rebound of the crash test dummies' heads when the dummies are first flung forward in a frontal collision, and thereafter flung backwards and hit the furnishings inside the car. In a real accident, a car's weight is of great importance to the safety of the car, but that's not fully apparent in the tests. Heavier cars are generally safer than lighter cars in real-life accidents. Further, Euro NCAP does not use sensors on the crash test dummies' feet and doesn't use female crash test dummies, apart from in one test, despite the fact that women are not impacted in the same way as men in a crash. But regardless of which crash test dummy is used, it will never behave in exactly the same way as a human being.

They do not measure the speed at which the passenger cabin collapses in a crash either, and instead use a predetermined speed. Two cars that crash according to the Euro NCAP template can both pass the standard test of frontal crash impact from a deformable barrier at 64 km/h. However, one of the cars may not even manage a speed of another 5 km/h before collapsing. Whilst the other car may be able to manage the crash at 70 or 75 km/h without any problem.

**The Insurance Institute for Highway Safety (IIHS) in the USA also performs crash tests on cars.**

Their tests are partially the same as the Euro NCAP ones. However, they also perform a more demanding frontal impact test with a 25% overlap of the front of the car against the barrier (small overlap) at the moment of impact. Unlike Euro NCAP, IIHS also performs a roof-strength test to ensure that the roof does not collapse if the car flips over, for example, after driving into a ditch. If the crash test dummy rebounds and hits the interior of the car, for example the B-pillar, after hitting the steering wheel airbag, this is taken into account in the IIHS tests, unlike the Euro NCAP tests.

Both the Euro NCAP and the IIHS performs side impact crash tests. The vehicles are subjected to a lateral impact from a side mobile barrier at 50 km/h. The IIHS crash test is much harder, however. Their side mobile barrier simulates a collision with an SUV, a more and more common type of car. This means that their side mobile barrier is higher than a normal passenger car and weighs 1,500 kg. Euro NCAP uses a lower side mobile barrier, weighing 950 kg, that corresponds to a small car. Furthermore, IIHS uses female crash test dummies in the side impact tests and Euro NCAP uses female crash test dummies in the full-frontal collision test.

## Why your car gets rusty

*If there's no visible rust on your car it is easy to believe that there is none. Unfortunately, this does not mean that there is no rust. New constructions have simply made the rust more difficult to spot.*

Today most cars are fitted with plastic shields under the car to reduce air resistance, which simultaneously increases the risk of rust. The plastic shields are fitted on the outside of the car's undercarriage and easily fill up with dirt, mud, gravel, road salt and moisture. When moisture remains over time the risk for rust increases.

Felt materials behind shields and rubber foam-like polymers in beams are not good as they tend to absorb water. Water drainage must also work well, so that no water remains anywhere inside the car.

It is preferable to have a boot made of plastic or aluminium rather than steel as steel is susceptible to corrosion. The galvanisation and the base paint of the chassis will deteriorate over time, but good wear-and-tear protection and wax in any cavities will help rust resistance. Any joins in the car need to be properly glued and sealed. Otherwise they easily become traps for rust.

The quality of rust protection differs between the various car models. However, many factors influence the process. Cars driven on roads that don't use road salt, such as in the north of Sweden and on Gotland, suffer less from rust.

## How to reduce the risk of rust

Take good care of your car and you will reduce the risk of it becoming rusty. If you own a car with plastic shields over the undercarriage, you need to keep the area between the shields and the undercarriage clean from road salt, mud, sand and gravel. This will remove moisture absorbed by the material. Repair any rusted areas before the rust gains a foothold and you will reduce the risk of further damage.

Rustproofing will reduce the risk of corrosion, especially if the car has poor rust protection or if the car has not been serviced in a long time. If you wash your car in winter in a car wash that reuses water, it means that you will be cleaning your car in salty water, which is not optimal if you want to prevent rust. If you want to find out more about your car's rust proofing, click on this [link](#) (in Swedish):

## Few owners know what their car looks like under the plastic shields.

The plastic shields under today's cars make it harder to detect corrosion. It can take from half an hour to two hours for a workshop to remove and replace the plastic shields. Which is not cheap. For a layman this will take longer and can feel laborious, to say the least. In addition, fasteners can be of poor quality and easily break when removing the plastic covers. That's why so few owners know what their car looks like under the plastic shields.

Additionally, it is difficult to detect internal rusting without an inspection camera. Rust does not appear suddenly but gradually, so on a new car you are unlikely to detect any rust.

You can read more about rustproofing cars in Villaägarnas Riksförbunds (Swedish Homeowners' Association's) reports from [2015](#) and [2016 \(in Swedish\)](#).

## Do you dare to buy a rusty car?

*Many people wonder how dangerous rust is on a car. To what extent is crash worthiness really affected? Is there a difference between dangerous and harmless rust? We try to answer some of the most common questions here.*

Rust on the door or the boot, for example, does not impact crash worthiness. Neither does superficial rust on the crash beams. However, deep-seated rust, rust holes and other serious corrosion on the crash beams will increase the risk of the crash beams being unable withstand the force of impact, unlike cars that are unaffected by corrosion.

The risk of rust increases with the age of the car, inadequate maintenance and inferior rust protection. It is however very difficult to predict if damage from corrosion on a car's crash beams will impact crash worthiness in an accident. It all depends on the location and degree of the corrosion damage as well as the severity of the crash. Regarding the rusty Mazda 6 generation I (2003-2008), that we subjected to a crash test, the corrosion damage meant a 20 percent increase in risk of fatal injury in a real accident, according to Folksam.

“As a layman it is difficult to know the difference between the crash beams and the sheet metal of a car. And it isn't easy to distinguish between superficial rust and deep-seated rust and other more severe types of corrosion. So, trying to identify dangerous versus harmless rust from a crash safety point of view is not easy,” says Ulf Stenberg, Chief Legal Officer at Villaägarna (Swedish Homeowners Association).

One problem is that the undercarriage of the car is often hidden under plastic shields. If you, as a car buyer, want to know if a car is rusty under the plastic shields, they have to be dismantled and the undercarriage cleaned, which is rarely done today.

### Inspection approval is no guarantee that there is no serious corrosion.

You might assume that an inspection approval (MOT) would mean that the car is free from rust. The cars we crash-tested were not banned from the road nor had they failed in their car inspection (MOT), but this proved to be no guarantee for unaffected crash worthiness. Many people would probably assume that a car that has passed its inspection equals no severe damage to the anti-intrusion beams. However, the problem could be that corrosion is hidden behind plastic shields under the car and isn't visible during the inspection.