

# **CRASHWORTHINESS TESTING AND RATING FROM THE CONSUMER PERSPECTIVE, AND IN RELATION TO THE VISION OF ZERO DEATHS IN ROAD TRAFFIC**

**Claes Tingvall**

Swedish National Road Administration,  
Chalmers University of Technology

**Anders Lie**

**Peter Larsson**  
SNRA

## **ABSTRACT**

The potential of increased occupant protection in cars is large with a possible reduction of deaths and disabilities of more than 50%. Increased protection is also a strategic area for the gradual implementation of the Swedish 0-goal, that is the goal of zero fatalities in the road transport system.

The possibilities to manage a further development of crashworthiness by simply a legislative process is limited, especially in Europe, and it can be estimated that the distance between the levels in vehicle regulations and best practice is 20 years. This is mainly because the technical development is driven by market forces, while the legislative process is not.

Such a process must be fed by adequate information about important differences between products, as well as possible solutions.

In this presentation, it is claimed that such information, partly derived from crash tests, must be dynamic in the sense that criterias and test methods must be changed gradually.

The Swedish approach to consumer information is presented, like Swedish NCAP, as well as the EURO-NCAP activities.

## **Background**

The difference between individual car models in crash protection is large. From real life accidents it has been found, that the magnitude of these differences is in the region of 1:10 regarding life threatening and disabling injuries. These differences are partly attributable to weight of the vehicle, but for cars of the same weight, differences of up to 1:5 can be found. Among cars introduced in the 80-ties and the 90-ties, the safety level has improved, and especially for cars newly introduced, the risk of fatal and severe injuries has decreased dramatically, or in the order of 30%. The passive safety of cars is therefore one of the major instruments to eliminate health losses in road transport.

The reduction of injury risk in cars has been achieved by many factors that have encouraged technical development, but the main explanations are safety

regulations and public demand for more crashworthy cars.

In order to strengthen the demand for safer cars, and to encourage the car industry to compete in the safety area, crashworthiness rating has been commonly used. There is a variety of methods and ways to use the results. In this paper the ideas behind rating and the methods used are described and discussed.

## **Passive safety and the vision about zero health losses in road traffic.**

Recently, a new approach to traffic safety has been introduced in Sweden. In order to make it clear that road accident health losses are not acceptable, a vision about zero serious health losses has been formulated. In this vision, no possible accident is allowed to generate a higher accident severity than the biomechanical tolerance for a fatality or an impairment of the human. This approach has a major impact on the passive safety of vehicles. The increased passive safety of vehicles is a possibility for the industry to increase the attractiveness of the road transport system. If the car industry does not develop the safety of the vehicles, speed limits and other restricting measures will be sharpened. This is an overall market driven process, where there is a link between the passive safety of vehicles, and the way that they are used. The overall ability of the car industry to produce safer cars is directly linked to the future design of the road transport system and it will become clearer to the industry what is expected.

## **The role of crashworthiness rating**

Crashworthiness rating is important from different aspects. Basically, it is worthwhile to encourage rating if:

- There is a distance between the level of safety stipulated in regulation and the current best practice, and there are important differences between different car models on the market.
- There is a possibility to develop the passive safety level beyond best practice.
- There is a need for detecting failures in the passive safety.

It is clear that all three aspects have been found realistic. There is, especially in Europe, a large distance between current safety regulations and the safety of vehicles sold today, but to a different degree for individual car models. There are also areas where technical solutions are possible, but have not yet been introduced.

Published failures has also been a major concern for the industry, where even major recall programs have been generated by findings in rating.

There are also other aspects on crashworthiness rating such as for whom, and for what purpose the rating is conducted.

Normally, crashworthiness rating is an instrument to help the consumer to choose a safer car. This is a way to encourage passive safety as an area for competition for the car industry, thus driving the process of increased safety further.

Rating the passive safety can also be an instrument from the society perspective, creating the best possible population of vehicles from the total safety point of view. This is quite different from the single consumer perspective, where the safety for the individual is focused, even if a possible collision partner can be at a higher risk. This problem arises when the consumer is guided towards heavier cars, that because of the mass relations in a two car collision, is favoured and the opponent is at higher risk. From the society perspective, it is, however, quite different, in that it is the sum of all injuries that should be minimized, and in a situation where i e economic incentives is to be used, the best possible situation might be slightly lighter cars for all, and not as many heavy cars as possible.

From a more general perspective, it should, however, be clear that the consumer rating is a strategic instrument for creating a process. While regulations are more and more complicated to enforce, as they are normally subject to a variety of aspects and are not enforced until a reasonable level of agreement has been reached, market forces will act much faster, and with only parts of the market and consumers demanding better protection. Treating the consumer rating as a complement to regulations, where regulations stipulate the minimum level of protection and rating as the tool for targeting the maximum level of protection, much attention should be paid to methods and ways to firmly direct the process.

One other question that must be dealt with is how tests and test results are performed and presented according to how sensitive and specific they are. Consumer testing is by definition for the benefit of the consumer. Of course tests and presentations should be as serious and clear as possible, but it is more unfair to have a situation where the "predicted" result is good, while the vehicle in fact was poor, than vice versa. To be "unfair" to the industry is to the consumer of low interest compared to

be "unfair" to the consumer. Furthermore, reading instructions must be clear in the sense, that one negative outcome from a test is enough to guide the customer to choose a certain car, while a positive result is not a guarantee for a car performing well overall.

### **Different types of rating systems**

**Retrospective rating** - Retrospective rating is based on accident statistics and can, if desired, be generalized to the whole accident population. This type of rating is sensitive to if the problem of exposure is solved in an adequate way. The fact that different cars are driven by different populations must be handled in a way that the safety of the car is measured, and not the users population. One method used is the paired comparison, where two car accidents are used.

The main drawback with the retrospective rating is the time lag between the introduction of a new car and accidents occurring to a sufficient number allowing statistically sound figures.

**Predictive rating** - Predictive rating is by definition not based on real life accidents. Crash tests are often said to be predictive rating, but it must be questioned if this is possible on the basis of one or few tests. The possibility to generalize single crash tests to the whole population is very small, unless the test results can be said to give the overall safety level of a vehicle.

There are however other methods that can be said to be predictive rating. One such method is technical inspections where different technical solutions are given weights that are supposed to be chosen in a way to give correct predictions in real life accidents.

### **Rating aiming at driving the process against safer cars**

- Crash tests are more adequate in this category, where the aim of the rating is to focus on a certain area to compare different car models in a certain aspect, such as frontal or side collisions. The test method is not necessarily a "representative" test ( In fact, it is not possible to construct such a test), but instead a test that will focus on an area where cars are known to produce results that varies substantially, and is important for consumers. Therefore, such tests can direct towards special areas, such as luggage retention, CRS, rear seat occupants in mid rear etc, that is, areas that are important under special circumstances. Other such ratings can be lists of features.

### **Areas of development for consumer testing**

The methods for driving the process further by testing and rating cars have mainly focused on frontal impacts to barriers. Some efforts has also been done in the

area of lateral impacts. There are also some examples of special areas, such as luggage retention. The variety of accident configurations and occupant populations asks for development of more and varied areas of rating. This becomes increasingly important as the consumers and the industry reacts on new safety aspects. If the consumer rating shall play an important role for really improving real life safety, reliable test methods must be prepared in order to have the possibility to meet new demands. One area of special interest is neck injuries in rear end impacts. Such injuries are often life lasting and therefore severe. The knowledge on injury criterias is limited, but it is well known that it is not the presence of a head restraint, or the height of it, that is important. New rating methods must be developed soon to help the consumer and to guide the industry in the right direction. Other areas are rear seat occupant protection, luggage retention, CRS, rollover protection, compatibility etc.

### **The "Swedish" approach**

The "Swedish" approach to rating is that it is a meaningful and important tool to create a market for safer cars. The rating approach in Sweden is to publish both retrospective rating as well as predictive and crash tests. The method of "self-declaration" made by the industry will also be used, where the single car importer will be given the opportunity to declare if the car passes some well defined crash tests. Such a method is a cost/effective way of gaining information on a large number of cars.

The information to the consumers will be passed on by the media and by special reports made official. Other ways to implement rating results is to inform fleet buyers about the benefit of choosing safe cars. Customers of these cars, i e rental cars, will also be informed to choose safer cars. The possibility to integrate taxes on cars with safety will be further analyzed.

During 1996, a number of mid sized cars will be tested according to the forthcoming EU directives on crash protection in frontal and side impacts as well as pedestrian protection. The frontal tests will be performed in a higher velocity than the proposed directive (64 kmh instead of 56kmh) while the other tests will be driven according to the directives. The program is known under the name EURO-NCAP, where Sweden will take part.

Regarding the future, the intention will be to test cars according to the "0 goal", where it will be specified a number of situations where the car is supposed to meet the road furniture in a number of situations, and also other vehicles. In the "0-vision", a possible accident is not supposed to give a higher injury than the level of a serious health loss", means that if an accident can happen at a certain velocity and other circumstances, the crash protection must be designed in a way that a specified level

of injury criterias is met. The target car can be defined, and the available cars on the market can be rated according to this target car. A Swedish NCAP might in the short run be a car to car impact where one car model collides with itself.

In the long run, the total ability of the car industry to market more crashworthy cars will be the limiting factor for the rest of the road transport system. If the industry fails in this part, the road user will have to take the burden for creating a road transport system with no serious health losses.

### **SUMMARY**

The market process has been the key factor for the rapid improvement of the crash protection of cars during the 90-ties in Europe. Such a process is fed by adequate information about the performance of different products, and the possibility to improve the safety. During the 90-ties, the consumers have increasingly asked for better safety, giving incentives for a competition between car manufactures, that have in most areas been positive for the consumer. Such a process must continue as long as there are meaningful improvements to gain.

The idea about constructing an "overall" best test for predicting the passive safety of a car must be questioned in that it may hurt the general idea about rating.

The Swedish strategy is to give the consumer a number of possibilities to judge the car, but it is important to have an ongoing process in changing rating methods into areas where new challenges for the industry can be found. Otherwise, an objective to compare "over time" and have identical methods can be overrun by technical improvements and that new areas for protection are not covered. Very soon, methods for compatibility, neck injuries in rear end impacts, CRS, roll over etc must be found and used for rating and consumer information.

The idea about "zero-vision" must cover also the passive safety of cars, where "zero health loss cars" are defined and tested according to such a concept. In a sense, the "zero-vision" is also a market driven process, where it is up to the industry to increase the attractiveness of the road transport system by better protection and not let the road user take the whole responsibility to stay alive, by being more restricted by lower speeds limits etc.

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