

## Safety Ratings

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## 1 Overview

This summary presents an introduction to the safety rating systems in use internationally. Given the wide variety of systems, their different methodologies and the volume of valuable information which they provide, this summary seeks to provide a gateway to the websites which explain these systems in appropriate detail.

### What are safety ratings?

Safety ratings in use today are objective, essential *Safe System* tools for benchmarking key aspects of road traffic system safety quality and potential for improvement. The safety ratings in use either predict safety outcomes for given designs or provide a retrospective assessment based on crash data.

### Who are they for?

The impartial and objective information provided by safety rating systems is designed for use by policymakers, employers, road and vehicle planners, engineers and operators, road safety professionals, practitioners, and economists in the establishment, implementation and monitoring of road safety targets, strategies and interventions as well as to assist fleet buyers and car buyers in their purchasing decisions.

### Why use safety ratings?

The level of ambition associated with global and European goals and targets and *Safe System* approaches require greater attention than before to the provision of a safer network, safer vehicles, better emergency care systems and compliance of users with key safety rules as well as meaningful shared responsibility and partnerships on the part of system providers. Safety ratings today address many of these needs and provide a basis on which to assess both results that are desired as well as the changes needed to provide them. They can be used as road safety interventions, road safety policy and strategy monitoring tools and for setting specific intermediate outcome targets for road safety strategies around which stakeholders can focus activity and resource.

### Safety ratings in use?

A wide variety of safety rating systems are currently in use or under development providing an impartial means of assessing the relative performance of:

- New vehicles in crash tests (e.g. [Euro NCAP](#), [Australasian NCAP](#), [US NCAP](#), [Japan NCAP](#), [Korean NCAP \(South Korea\)](#), [China NCAP](#) and [Latin NCAP](#). A new [Global NCAP](#) organisation was announced in June 2011.
- The safety performance of 'on the road' vehicles in crashes (e.g. [Folksam car safety rating](#)).
- Different parts of the road network through risk-mapping and road protection scores (e.g. [iRAP](#), [EuroRAP](#), [AusRAP](#), [KiwiRAP](#) (now being used widely in low and middle income countries) and [usRAP](#) which is under development as a national scheme.
- Safety equipment (child restraints e.g. [UK TRL Child Seat Rating Scheme](#), Australia's [CREP](#) and crash helmets [SHARP](#)).

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- National road safety performance in relation to other countries (e.g. [ETSC PIN](#))
  - The safety quality of commercial road transport operations (e.g. the [Q3 - work-related safety ratings in Sweden](#)).
  - A model for star rating the safety of school walking routes has been devised and piloted in Australia but requires further testing.

### Effectiveness of safety ratings?

Safety ratings are an influential road safety tool for policymakers and research and experience shows that, when used in combination with legislative standards either planned or in use, they can contribute to large reductions in road traffic casualties. High quality data are a prerequisite for effective rating systems.

**Euro NCAP:** Three years after its introduction, Euro NCAP research reported that cars with three or four stars were approximately 30% safer, compared to two star cars or cars without an Euro NCAP score, in car to car collisions. In the last decade, crash data has confirmed that a 50% reduction in the risk of serious injury in car crashes has been achieved in new car models. The latest research has concluded that a good correlation exists between Euro NCAP test results and real-world injury outcomes with 5-star rated Euro NCAP cars found to have a 68% lower risk of fatal injury and a 23% lower risk of serious injury compared to 2-star rated cars.

**EuroRAP:** A recent [EuroRAP review](#) found some evidence of a link between average crash rates or crash costs associated with increasing Star Rating and *vice versa* in different models that include elements of both crash protection and crash likelihood *and* from the model with only crash protection elements. While there was some variation between studies, the review reported that the more robust studies showed a crash rate reduction in the region of a third to a half when moving from a 2-star to 3-star rating. The reduction was often found to be less when moving between higher Star Ratings.

### Communicating results?

There are several issues regarding presentation of results. Since safety rating systems need to be built on and promote objective, comparable safety data, it is important that the 'messenger' is actually independent as well as seen to independent of commercial influence, particularly where the results of safety tests of manufactured products are being compared. Most rating systems have achieved this with broad international consortiums of motoring and consumer organisations, governments from several countries and independent experts (See the [EuroRAP](#) and [Euro NCAP](#) partnerships). The assessment procedures and protocols also need to be transparent. Given the variety of safety rating systems which exist, each publication needs to explain clearly what the particular safety rating in question means and draws attention to any limitations. Given the wide audience for results, these need to be disseminated widely but targeted at the same time at the road-using public, car and infrastructure providers, fleet buyers and decision makers in general.

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## 2 What are safety ratings?

Safety ratings in use today are objective and influential tools for the assessment and improvement of aspects of the safety of vehicles and crash protective equipment, the road network, work-related road safety and international safety performance.

Safety ratings either predict safety outcomes for given designs or provide a retrospective assessment based on crash data. Different safety rating systems currently in use provide an impartial means of assessing the relative performance of:

- New vehicles in crash tests (e.g. [Euro NCAP](#), [Australasian NCAP](#), [US NCAP](#), [Japan NCAP](#), [Korean NCAP \(South Korea\)](#), [China NCAP](#) and [Latin NCAP](#). A new [Global NCAP](#) organisation was announced in June 2011 which will serve as a platform promoting the development of NCAPs worldwide and encourage best practice in the use of consumer information to promote road safety.
- The safety performance of 'on the road' vehicles in crashes (e.g. [Folksam car safety rating](#)).
- Different parts of the road network through risk-mapping and road protection scores (e.g. [EuroRAP](#), [AusRAP](#), [iRAP](#) (now being used widely in low and middle-income countries) and [usRAP](#)).
- National road safety performance in relation to other countries (e.g. [ETSC PIN](#))
- The safety quality of commercial road transport operations ((e.g. the [Q3 - work-related safety ratings in Sweden](#)).
- Safety equipment (child restraints e.g. [UK TRL Child Seat Rating Scheme](#), Australia's [CREP](#) and for crash helmets ([SHARP](#)).

## 3 Who are they for?

The impartial and objective information provided by safety rating systems is designed for use by:

- Policymakers, employers, professionals and practitioners in the establishment, implementation and monitoring of road safety targets, strategies and interventions at country or organisational levels;
- Car and equipment manufacturers so they can benchmark the safety performance of their products against other products and make improvements;
- Road planners, engineers, operators;
- Fleet and car buyers to inform choice in purchasing;
- Transport economists;
- Road users in general who benefit from the use of safety rating tools.

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## 4 Why use safety ratings?

Over the last decade, safety ratings have been established as an important tool in managing for ambitious road safety results.

The growing global crisis of road traffic injury for low and middle-income countries and the increasing level of ambition associated with global, European Union, national goals and targets and *Safe System* approaches requires:

- greater attention than before to the provision of a safer network, safer vehicles, better emergency care systems and compliance of users with key safety rules.
- more account to be taken than before of human limitations, speed and kinetic energy in road safety interventions and in the institutional arrangements needed to deliver them.
- meaningful shared responsibility to improve safety on the part of system providers (for the road network, vehicles and the emergency medical system) as well as ensuring that users comply with the system rules, focusing particularly on the linkages necessary between different parts of the system.

Safety ratings today address such needs and are used as:

- road safety interventions to improve standards and designs through the publication of impartial information which gives system providers an incentive to make improvements.
- policy monitoring tools.
- sources of data to aid the setting of specific interim and intermediate outcome targets for road safety strategies around which stakeholders can focus results-focused activity and resource.

Several countries include EuroRAP and Euro NCAP protocols and performance indicators in national safety strategies.

### 4.1 Ratings as interventions

The potential contribution of vehicle and road engineering measures to achieving interim national road safety targets and long-term goals is very large (Koornstra et al, 2002), (Broughton et al., 2000; Castle et al., EuroRap 2007). Safety ratings can be used as an intervention to identify, promote and encourage improved standards and designs to improve levels of crash protection in vehicles and in the road network.

For example, whereas legislation provides a long-discussed minimum statutory standard of safety for new cars, it is the aim of [European New Car Assessment Programme \(Euro NCAP\)](#) to encourage manufacturers to exceed these minimum requirements in a short space of time. Policymakers, practitioners, fleet and car buyers, and road users all need impartial, evidence-based data to inform policymaking, for day-to-day road safety activity, and for purchasing and travel decisions. Car buyers, for example, need to assess the safety claims made by manufacturers made in car advertising. Relevant and impartial information allows consumers to make well-informed decisions when buying a car. When Euro NCAP was first introduced in the late 1990s, a level of safety performance equivalent to a 2 star rating

comprised the industry norm. Now, 4 and 5-star cars for adult occupant protection comprise the majority of new cars being offered for sale. Such ratings can also encourage manufacturers to make progress in key areas not yet covered in legislation such as the fitment of seat belt reminders, whiplash prevention systems and other proven driver assistance safety technologies.

Road assessment programmes e.g. [iRAP](#), [EuroRAP](#), aim to help prevent crashes and to make those that occur survivable through its risk-mapping and road protection score methodologies. Responsible, law-abiding drivers are frequently injured fatally or disabled permanently on Europe's roads because of small errors. Safe roads minimise the chance of these situations arising, and when they occur, minimise the severity of the crash.

Crash helmet and child restraint assessment programmes can also be thought about as potential interventions, encouraging buyers to choose the safest equipment currently on the market.

## 4.2 Ratings as monitoring tools

Vehicle, vehicle equipment and road network safety ratings provide a useful policy tool for monitoring the safety quality of the vehicle fleet and the road network and the related intermediate outcomes of specific interventions adopted and implemented in the national road safety strategy. Such information provides more detailed as well as more immediate information about safety performance than can be achieved by final outcome data on deaths and serious injuries. For countries starting out in road safety and which have not yet set up usable, quality crash injury data systems, then safety rating assessments of the high-volume part of the network will allow intervention work to proceed, albeit when resource and capacity allow. Examples of performance indicators from safety rating systems used in Sweden's last road safety plan are shown in Table 1.

Table 1: Safety rating performance indicators used in Sweden

Percentage of vehicle mileage on roads that fulfil EuroRAP four stars (rural areas)
Percentage of vehicle mileage with vehicles that fulfil Euro NCAP five stars (newly registered)
Percentage of vehicle mileage with vehicles that fulfil Euro NCAP five stars (existing vehicle fleet)

Source: SRA, 2006



Through its risk-mapping methodology and performance tracking protocol, EuroRAP and other road assessment programmes provide an opportunity to produce a regular measure of safety performance on a consistent basis. This shows in detail how risk is changing in different parts of the road network in different countries, and also the potential for improvement in a way that can be linked to specific programmes. EuroRAP also shows how infrastructure improvements in each country can contribute to EU targets for casualty reduction (Lynam et al., 2004).

### 4.3 Ratings as intermediate outcome targets

Some countries set targets using safety rating data. For example, a target can be set to increase the percentage of cars with 5 star Euro NCAP ratings in the national fleet or to increase the percentage of vehicle mileage on roads that fulfil EuroRAP 4 star ratings in rural areas by a specified amount over a given time period. The approach to achieving this is likely to be a combination of mass action implementation of effective safety measures, and major upgrading of some parts of the network to a higher standard. EuroRAP thus provides a basis on which to assess both what risk levels are desired, and what changes to the road infrastructure are needed to provide these levels (Lynam et al., 2004). An example of the current use of safety rating systems used for intermediate outcome target-setting purposes is given in Table 2.

Table 2: Safety ratings used for intermediate outcome targets: Sweden 2011

Indicator/outcome measurement	Starting point	2008	Proposed targets to 2020	Potential saving in fatalities
Share of new passenger cars sales with the highest Euro NCAP score	66%	71%	100%	90

Swedish Transport Administration, 2012

The Netherlands is continuing its programme to achieve minimum 3 star safety performance on national roads by 2020 and the Dutch automobile club ANWB is financing widespread and long-term road inspection surveys to generate star ratings in a regular basis. In Great Britain, proposals for the same benchmark to be adopted have also been made public, with the launch of a large scale economic study examining the economics of upgrading motorways and main roads to a minimum 3-star level (Source:Hill & Starrs, 2011).

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## 5 Safety ratings in use

### 5.1 Vehicle safety

A wide variety of vehicle safety ratings have been developed since the 1970s and these have evolved largely independently of each other. Predictive systems provide information on the performance of new cars and equipment in various crash tests, whereas retrospective systems inform about the safety performance of cars already on the road on the basis of crash data. Predictive systems provide a more objective assessment of vehicle safety, but only for the conditions tested, whereas retrospective rating systems, when controlling for external factors, offer useful information on performance across the range of crash conditions and for all seating positions. Each system has been shown to usefully contribute to the provision of safety information to the consumer (ETSC, 1995).

#### 5.1.1 Predictive vehicle safety ratings

Predictive systems aim to assess a car's safety performance before it is used on the road. The predictions are based on controlled whole car crash tests of individual models; tests of components of the car which have been proven to be important in crashes; and/or visual inspections and rating of the interior of cars and expert assessments.

Consumer information based on crash tests started in Europe in the late 1980s with German motoring organisation and magazine publication of results of frontal crash tests. In the early 1990s the UK WHICH? Magazine published the results of the Secondary Safety Rating System in Cars – a mix of visual inspection and component testing (Consumers Association 1993). This system later became the European Secondary Safety System which was used by the EU-wide umbrella organisation – the European Consumers organisation (BEUC) and International Testing (IT, 1994).

#### ***New Car Assessment Programmes (NCAPs)***

New Car Assessment Programmes (NCAPs) assess a new car's safety performance before it is used on the road. They have been established in the US, Australia, Japan, Korea, China, Latin America, Malaysia and Europe and are an important catalyst for improving vehicle safety. While tests vary over different NCAPs, predictions can be based on controlled whole car crash tests of individual models; tests of components of the car which have been proven to be important in reducing fatal and long-term injury in crashes; and/or visual inspections and rating of the interior of cars. The aim of this information is to provide objective data to highlight the maximum level of protection available to car buyers and to complement regulation which, in EU Whole Vehicle Type Approval, should stipulate a high but only a minimum level of protection. The UN's five pillar Global Plan for the Decade of Action recommends that countries should support the "implementation of new car assessment programmes in all regions of the world in order to increase the availability of consumer information about the safety performance of motor vehicles".

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**- Global New Car Assessment Programme (GNCAP)**

- [GNCAP](#) is a newly established non-profit organisation registered in the UK and launched in June 2011 in support of the Decade of Action. Its Mission Statement (FIA Foundation News Archive) outlines that:
- GNCAP aims to support the development of new consumer crash test programmes in emerging markets where vehicle growth is strong but independent consumer information on crashworthiness is frequently not readily available. To achieve this GNCAP will offer support to New Car Assessment Programmes in emerging economies and regions by offering technical support guidance and quality assurance.
- GNCAP will also provide a platform for cooperation for NCAPs and like organisations around the world to share best practice, to further exchange information, and to promote the use of consumer information to encourage the manufacture of safer cars across the global automotive market.
- GNCAP will carry out research on innovations in vehicle safety technologies, their application in global markets, the range of policies that will accelerate their use and monitor the progress of vehicle safety across the globe.
- GNCAP will also develop a global awards scheme to recognise achievement in vehicle safety, innovation in safety related technologies, and products.

**- European New Car Assessment Programme (Euro NCAP)**

[Euro NCAP](#) which was established in 1997 has over the last fifteen years adopted progressive methodologies and protocols for assessing new car safety performance under certain conditions. Euro NCAP provides motoring consumers, with an independent assessment of the safety performance of some of the most popular cars sold in Europe. It has tested more than 400 vehicles since 1997. Through its stringent protocols for vehicle crash testing, Euro NCAP has rapidly become a catalyst for encouraging significant safety improvements to new car design. (See links to the Euro NCAP website throughout the Euro NCAP section for more than summarised information).

Euro NCAP is backed by five European governments, the European Commission as well as motoring and consumer organisations in every EU country. Euro NCAP is acknowledged as the most advanced of all the current NCAP programmes, and several NCAPs such as the Australian New Car Assessment programme have aligned their protocols to it. Euro NCAP provides star ratings of the performance of new cars using [state of the art crash tests and inspection protocols](#).

***The Euro NCAP rating***

Since 2009, Euro NCAP has released an overall rating for each car tested with a maximum of 5 stars for nine classes of vehicle from super-minis to large off-road 4x4 vehicles. The rating is comprised of scores in four important areas:

- **Adult protection (driver and passenger):**

Points are awarded from frontal, side and pole impact tests. Modifiers are also given to extend the assessment to cover different sizes of people in a variety of seating positions, in particular for the knee contact area. The Adult Protection score is completed with the result of the Whiplash test that is carried out separately on the driver or passenger seat. Euro NCAP ratings are comparable only between cars of similar mass and with broadly similar structures. Euro NCAP groups cars into the following structural categories: passenger car, MPV, off-roader, roadster and pickup. Within each of those categories, cars which are within 150kg of one another are considered comparable.

- **Child protection:**

As part of this assessment, Euro NCAP uses 18 month old and 3 year old sized dummies in the frontal and side impact tests. As well as studying the results from the impact tests, Euro NCAP verifies the clarity of instructions and seat installation in the vehicle to ensure that the child seat can be fitted safely and securely. The score depends on the child seat dynamic performance in front and side impact tests but also on the fitting instructions for the child restraints, airbag warning labels, and the car's ability to accommodate the child restraints safely.

- **Pedestrian protection**

Euro NCAP's results in this rating are achieved through state of the art leg form, upper leg form and child/adult head form tests which are more stringent than the legislative tests coming into force for all new EU registered vehicles in 2015. The original pedestrian protection rating was based on adult and child head form tests and two leg form tests. As of 2009, the pedestrian score has become an integral part of the overall rating scheme and the technical assessment has remained the same. With inclusion of the pedestrian score into the overall rating, Euro NCAP aims to encourage improvement of vehicle performance in this assessment. Euro NCAP believes more effort by manufacturers in pedestrian protection would save the lives of many pedestrians and negate the emotional trauma encountered by many drivers every year as they live with the consequences of injuring or fatally wounding a pedestrian.

- **Safety assist technologies**

The introduction of Safety Assist allows Euro NCAP to consider driver assistance systems and active safety technologies. These technologies play an increasingly important role in crash avoidance and injury mitigation. Euro NCAP currently rewards manufacturers for the fitment of electronic stability control, in addition to points given for the presence of a speed limitation device and intelligent seat belt reminders.

The overall score is calculated by weighing the four scores in respect of each other, while ensuring that no one area is underachieving. For cars tested before 2009, Euro NCAP released three ratings: adult protection, child occupant and pedestrian protection and recommended that all three ratings were taken into consideration during car buying.

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### **The Euro NCAP tests**

The dynamic tests include full-scale frontal and side-impact tests, front-end component tests for pedestrian protection and sled tests for whiplash prevention during rear-end crashes. Seat belt reminders, speed limiters, and electronic stability control also boost a vehicle's rating. See also ERSO web texts on [Vehicle Safety](#) and [eSafety](#).

The [Frontal impact](#) test is based on that developed by European Enhanced Vehicle-safety Committee as a basis for legislation, but impact speed has been increased by 8 km/h to reflect more real life crashes resulting in severe injury. Frontal impact takes place at 64km/h (40mph), car strikes deformable barrier that is offset using an offset deformable barrier intended to represent the most frequent type of road crash, resulting in serious or fatal injury. This tests the car's ability to survive the impact without sustaining passenger compartment intrusion. Readings taken from dummies are used to assess protection given to adult front occupants. [Example of a Euro NCAP crash test](#)

A [car to car side impact](#) test addresses the second most important crash configuration of car to car side impact although the lower end of severe and fatal crash severity. Euro NCAP simulates this type of crash by having a mobile deformable barrier (MDB) impact the driver's door at 50 km/h. The injury protection is assessed by a side impact test dummy in the driver's set

A [pole side impact](#) test addresses head injury in side impact which is the most frequently seriously injured body region in side impacts. In the test, the car tested is propelled sideways at 29km/h (18mph) into a rigid pole. The pole is relatively narrow, so there is major penetration into the side of the car.

A [child protection](#) protocol is used to encourage manufacturers to take responsibility for protecting children and to provide suitable facilities for the fitment of child restraints. Many child restraint users fail to attach the child restraint securely to the car and this compromises the protection afforded to the children. Euro NCAP has encouraged improved designs and the fitment of ISOFIX mounts and child restraints. ISOFIX provides a much more secure method of attaching the child restraint to the car, provided that additional provision is made to prevent rotation of the child restraint, due to seat cushion compression and rebound. In the frontal and side impact barrier tests, dummies representing 1½ and 3 year old children are placed in the rear of the car in the type of child restraint, recommended by the car manufacturer.

[Pedestrian protection](#) sub-system tests based on those devised by the [EEVC](#) are carried out to replicate crashes involving child and adult pedestrians where impacts occur at 40km/h (25mph). A Leg form test assesses the protection afforded to the lower leg by the bumper, an Upper Leg form assesses the leading edge of the bonnet and child and adult Head forms are used to assess the bonnet top area. Impact sites are then assessed and rated fair, weak and poor. Euro NCAP released a separate star rating for pedestrian valid from 1997 to 2009. The pedestrian protection rating was based on the adult and child head form tests and the two leg form tests. As of 2009, the pedestrian score has become integral part of the overall

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rating scheme but the technical assessment has remained the same. In general, the car industry has still to respond well to these tests in their designs. In order to encourage further progress Euro NCAP will require from 2012 that a minimum 60% score in the pedestrian tests will be required for new cars to receive a 5 star rating.

**Electronic Stability Control** Since 2008, Euro NCAP has been promoting broad fitment of Electronic Stability Control – ESC – by all vehicle manufacturers. To drive greater levels of fitment, in 2009 Euro NCAP has begun awarding three Safety Assist points to a car if ESC is fitted as standard across the model range, or if it is an option on every variant and the manufacturer also expects to sell at least 95 percent of cars with the system as standard equipment. This fitment requirement is steadily increasing and by 2012 (when ESC becomes mandatory for all new cars sold in the EU) Euro NCAP will only reward equipment which is fitted as standard across the whole of the model range. So far, analyses of real-world crashes have demonstrated that cars equipped with ESC are involved in fewer accidents and less serious ones, than cars without. However, it has not yet been possible to differentiate between the safety offered by different types of ESC systems. See [ESC performance tests](#).

**Seat belt reminders** Research shows that occupants are much more likely to wear their belts in cars equipped with a seatbelt reminder (SBR) than in those without. Euro NCAP rewards any effort made to ensure that seatbelts are worn. Euro NCAP assesses manufacturers' SBR systems to ensure that they are robust and that they provide clear, unambiguous information to the occupants about the status of their seatbelts. Trained inspectors perform a multitude of tests on each system: the car is driven on a test track and the belts are buckled and unbuckled; the loudness, and duration of the audible signal is assessed; the position and clarity of any visual warning is checked to ensure that it is visible to occupants of different sizes. The assessment tries to recreate every possible scenario where an occupant might be vulnerable by being unbelted, and checks to see if the system responds appropriately. One point is available for each of the driver, passenger and rear seats for those systems that pass the assessment.

**Speed limitation devices** Euro NCAP rewards systems that help drivers to control their speed. Currently, Euro NCAP rewards only systems which are voluntarily set by the driver. In the future, systems may become available which automatically detect the speed limit at any point in the road network and limit a car's maximum speed appropriately. Euro NCAP currently rewards two types of system: those which can be set by the driver and which actively prevent the car from exceeding that maximum; and those which simply warn the driver when the car's speed is above the set maximum. The functionality of the system is considered to make sure that the system can be set and unset easily and without undue distraction to the driver. The clarity of the signals given to the driver are assessed to make sure that there is no confusion about the current set maximum and to ensure that a suitable warning is given if the system is unable to limit the speed to that maximum. For active systems, a check is made to ensure the system is able to limit the speed of a car to the maximum set by the driver. At each of three speeds, the accuracy with which the set maximum can be maintained is determined. A maximum of one point is available to active

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systems which meet Euro NCAP requirements. Warning-only systems can receive a maximum of 0.5 points.

**Rear impact (whiplash)** Whiplash injuries are common in rear impacts. While the mechanisms by which the injuries are caused are not fully understood, it is known that seat and head restraint design can influence the risk of injury. Euro NCAP assesses the geometry of the restraint in relation to the head and tests the seats in three severities of impact – high, medium and low – using a dummy specially designed for rear impacts. Seats at the top of the table are likely to offer better protection than those at the bottom. Rating categories are good, medium and poor.

**Euro NCAP Advanced** Launched in July 2011, Euro NCAP Advanced is a complementary reward system to the existing star rating system. Cars are eligible for a Euro NCAP Advanced reward only if they have already achieved a creditable three star rating in the overall rating scheme. In response to many new features being offered as options in new cars such as Lane Departure Warning, Blind Spot Monitoring, Attention Assist, Autonomous Braking and Emergency Call, Euro NCAP aims to provide advice to car buyers about the potential safety benefits offered by technologies which have a scientifically proven safety benefit. Many of the technologies are so new that no accepted standards exist to assess them. Euro NCAP has developed a unique methodology which allows the potential safety benefits of any new technology to be determined. Unlike Euro NCAP's well established assessments involving physical tests at a crash laboratory, the new process is based entirely on the assessment of scientific evidence presented by the vehicle manufacturer. An independent panel of experts looks at the extent of the safety problem which a new technology aims to address. Through analysis of the way in which the technology has been developed, tested and validated, and from any real-world experience that may exist, the aim is to determine the system's performance and its expected effectiveness.

**Future Euro NCAP Plans** In 2012-15, Euro NCAP will be conducting extensive reviews of almost all its testing and assessment procedures. The objective is to make the 5-star rating system even more meaningful in terms of real-world performance and the advancement of safety technology. Work has commenced on the development of an additional full-width frontal impact test using different-size dummies. There are also plans to implement a number of new test procedures focusing on emerging crash avoidance technologies and speed support systems.

#### ***Euro NCAP test results 2010 – overview***

During 2010, Euro NCAP crash tested 29 vehicles, 65% of which reached the five star rating, compared to 90% in 2009. This decrease of 25% clearly shows that Euro NCAP's latest criteria to reach a five star rating are tougher. To be top achiever means that the car has obtained a high combined score based on the scores in each of the individual four areas of Euro NCAP's assessment, while notably exceeding the minimal thresholds for a 5 star overall rating. The top achievers by category identified by Euro NCAP are shown in Table 3.

Table 3: Top achievers in Euro NCAP tests 2010

Euro NCAP vehicle class	Make and Model	Star rating	Adult score	Child score	Pedestrian score	Safety Assist score
Executive category	BMW 5 Series	5*	95%	83%	78%	100%
Small Family category	Alfa Romeo Giulietta	5*	97%	85%	63%	86%
Supermini category	Honda CR-Z	5*	93%	80%	71%	86%
Small off-road 4x4 category	Kia Sportage	5*	93%	86%	49%	86%
Small MPV category	Toyota Verso	5*	89%	75%	69%	86%

Source: www.euroncap.org

Euro NCAP's poorest results of 2010 are shown in Table 4.

Table 4: Poorest results in Euro NCAP tests 2010

Euro NCAP vehicle class	Make and Model	Star rating	Adult score	Child score	Pedestrian score	Safety Assist score
Small MPV category	Citroen Nemo	3*	59%	74%	55%	29%
Small MPV category	Landwind CV9	2*	34%	45%	31%	29%

Source: www.euroncap.org

### 5.1.2 Retrospective vehicle safety ratings

Retrospective safety ratings can be of particular help in assisting buyers of used cars, which have the lion share of the car sales market (ETSC, 1995). In retrospective systems, safety ratings are based on the actual performance of cars in real crashes. Here, the frequency and severity of injury to car occupants in individual model cars are determined by examination of police crash statistics and/or insurance injury claim data. The earliest ratings to back to 1975 to those published based on insurance claims data by the Highway Loss Data institute (HLDI 1994). In general, they have been in use over the last 15 years.

While the general approach is the same for all systems, there are many differences in the exact methodology, such as the types of crashes included in the analyses, whether seat belt usage is accounted for, how the effects of exposure are controlled and whether or not the rating also takes into account the effects on other road users outside the vehicle. Aspects of



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the [different methodologies](#) and the adjustments made for exposure have been summarized (ETSC, 1995), (Cameron et al, 2001), [SARAC II](#). The more these potentially confounding factors are controlled, the better the rating system (ETSC, 1995).

#### **- Folksam Car Safety Rating System (Sweden)**

The Folksam ratings comprise the main retrospective ratings in use in Europe. Since the 1980s, the Folksam insurance company publishes injury risk ratings based on statistical analysis of real-world crashes using police and insurance databases. The paired comparison method using 2-car crashes is used to control for crash speed and the mass differences between cars of different weights is normalized. The injury outcome in both vehicles is considered. For every car insurance policy issued by Folksam, the customer pays 5 Swedish kronor towards research. The latest rating was published in 2009 and the rating composition is shown in Box 1 (Folksham, 2009).

Box 1: [Folksam's safety rating \(2009\)](#)

Safest:	At least 30% higher safety than the average car
Good safety:	At least 20% higher safety than the average car
Average safety:	At least as safe as the average car
Avoid	Less safe than the average car

In the 2009 rating, results are presented for the same car categories as used by Euro NCAP: superminis, small family cars, large family cars, executive, small MPVs, large MPVs, small SUVs and large SUVs. For all cars an average crash safety rating is calculated. Early Folksam ratings indicated that if all cars were designed to be equal to the best current car in each class, 50% of all fatal and disabling injuries could be avoided (Hägg et al., 1992). An analysis of Folksam data on car to car crashes in Sweden between 1994 and 1996 showed a decrease of 35% in the relative risk of fatal and severe injury associated with 'new' car designs compared with 'old' designs (Larsson et al., 1996). Good correspondence has been found between Euro NCAP and Folksam real-world crash and injury ratings (Kullgren, Lie & Tingvall 2010).

#### **- Used Car Safety Ratings (UCSR) (Australia)**

The UCSR were developed by Monash University's Accident Research Centre MUARC based on records of over 2.8 million crashes on Australasian roads. The UCSR rates cars according to their on-road crash performance and how well they protect drivers in a crash. Also rated is the risk each vehicle presents to other drivers involved in a crash with that particular model. The ratings are presented in governmental websites e.g. VicRoads [Used Car Safety Ratings \(Australia\)](#), the Transport Accident Commission and Land Transport New Zealand as well on websites of the Australasian motoring organisations.

Other rating systems which have been developed in the past include the University of Oulu Passive Safety Ratings (Finland) and the Car and Driver: Injury Accident and Casualty Rates publication (UK). Starting in 1987, the Traffic Safety Committee of Insurance Companies

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(VALT) in Finland regularly published ratings compiled by the University of Oulu comparing crash performance of cars in two-car collisions between passenger cars on Finnish roads. Ratings conducted in the mid 1990s concluded that if the crash protection of all the car models in the same weight class matched the best then 27% fewer drivers would be injured in urban car to car collisions (Tapio, Pirtala & Ernvall, 1995). In 1991 in the UK the first edition of “Car and Driver: Injury Accident and Casualty Rates” was published giving information on comparative accident involvement and injury risks of popular makes and models of car (DoT, 1991). The rating, based on the risk of driver-only injury in car-to-car injury crashes reported to the police showed that if the safety of all models were improved to the level achieved or exceeded by the safest twentieth of models then the number of drivers injured in car to car crashes would fall by 12% and the number killed or seriously injured by 22%.

**- Retrospective ratings: SARAC conclusions**

The EU [Safety Rating Advisory Committee \(SARAC\)](#) project brought together an international forum initiated by the German insurance organisation GDV and the European Comité Européen des Assurances (CEA) of experts from the crash research community, government agencies, universities and automobile manufacturers. Research was undertaken in the SARAC 1 and SARAC II projects between 1999-2006 funded by the European Commission and the Comité Européen des Assurances (CEA). In [SARACII](#), safety ratings from around the world were examined to identify and develop advanced methods to assess crashworthiness and aggressivity and other aspects of statistical reliability, presentation of results and areas requiring further research.

SARACII indicated that an ideal retrospective rating should have:

- A measure of impact severity
- A range of variables that provide good proxies for impact severity if no measure is available
- Good data on non-vehicle variables that affect injury outcomes and differ from vehicle to vehicle
- Full reporting of injury and non-injury crashes

None of the existing data sets on which rating systems are based meet these requirements in full. No existing rating has a measure of impact severity and it is not clear how well the available proxy measures represent impact severity. In addition to the need for action on assessing and recording impact severity, SARAC also highlights the need for action on the recording of vehicle annual kilometrage/mileage, the Vehicle Identification Number (as required in the US) and the availability of Event Data Recorders all of which would improve the retrospective rating data sets.

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## 5.2 Road network safety ratings

Road assessment programmes have been developed in recent years to monitor the safety quality of the road network, to draw attention to the need for improvements and to help inform road network safety policies and programmes. See also ERSO web text on [Roads](#). Road assessment programmes are based on the expectation that the design of the road infrastructure should minimize the risk of predictable mistakes resulting in serious and fatal crashes, and should offer sufficient protection such that crashes do not result in death or permanent disability.

Road assessment programmes can comprise *predictive safety ratings* which look at the protective quality of various elements of a road network as well as *retrospective safety ratings* which involve risk-mapping and performance tracking according to specific protocols.

Road assessment programmes address the main crash types identified by research as resulting in the vast majority of deaths and serious injuries on the road network. These are:

- single vehicles leaving the road,
- impacts at junctions,
- head-on impacts with opposing vehicles
- impacts involving vulnerable road users (OECD, 1999; Lynam et al., 2003)

The proportion within each of the four groups varies between countries depending on the characteristics of the road network and traffic flow levels. The proportion also varies between road types and at different flow levels (Lynam & Lawson, 2005).

Road Assessment Programmes (RAP) were first developed in 2001 with the launch of the EuroRAP programme and are in use in more than 70 countries throughout Europe, Asia Pacific, North, Central and South America and Africa. [iRAP](#) is the umbrella organisation for [EuroRAP](#), [AusRAP](#), [KiwiRAP](#), [us RAP](#) and MyRAP (Malaysia) and others.

This section first summarises the generic characteristics of predictive and retrospective safety ratings (4.2.1- 4.2.2) and then outlines the characteristics of the different road assessment programmes in use in different parts of the world (4.2.3). While there are many similarities between the different programmes, subtle differences are present.

### 5.2.1 Predictive safety rating protocols – Road Protection Scores

Road protection scores (RPS) and star ratings are based on road inspection data and provide a simple and objective measure of the level of safety (comprising either crash protection or crash avoidance features or both depending on the specific road assessment programme, as shown below), which is 'built-in' to the road for different types of road users.

RPS provides information that is not readily available through crash histories. Crashes are always random and crash rates subject to statistical fluctuation. Over time as crash numbers decrease, identification of higher risk sites through variations in observed crash numbers will

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become more difficult. The RPS aims to provide a consistent assessment of the potential long-term risk of a given road design.

Road protection scores are used in low, middle and high-income countries and are of especial value in providing network safety information where quality crash injury data are not available for use by road designers. As a critical tool for a *Safe System* approach, road protection scoring uses vehicle speed and its role in the injury outcome of both vehicle-vehicle impacts and vehicle infrastructure impacts, as a key factor in the assessment. In Sweden, a new speed limit classification is being developed using the principles underlying road protection scores to ensure that the protective qualities of the road and roadside are aligned to allowable posted speed limits.

Using specially equipped vehicles and software, teams undertake detailed road inspections. All road assessment models use measures of risk that can be collected from a drive-through inspection or can be augmented by retrospective coding of a video recording towards a star rating.

The Road Assessment Programme ethos is one of continuous improvement and several RPS (Road Protection Score) versions have been developed or tested over recent years (EuroRAP, 2011).

- EuroRAP RPS1.0 is the original EuroRAP RPS launched in 2001. Only crash protection items (secondary safety elements) relating to car occupants are included. Section lengths can be based upon start and end points at which the character of the road changes or divided every 100m, the latter analysed using an online calculator developed in 2010. Data collection can be completed whilst travelling the road and recorded via a touch-sensitive pad. Star rating = 1-4 stars.
- EuroRAP RPS2.0 includes crash likelihood factors. It uses the car elements from the iRAP model and a multiplicative model, rating roads every 100m. Typically, data for RPS2.0 can be taken partly from a drive-through inspection and partly (or wholly) by retrospective assessment of the videos of the inspection route. Star rating = 1-5 stars.
- iRAP RPS this includes assessments for four separate modes (car, motorcycle, pedal cycle and pedestrian), and requires some or all of the data to be obtained retrospectively by rating the inspection videos. Data have been collected in more than 20 countries using versions 2.1 and 2.2 of this model. Star rating = 1-5 stars.
- The Australian and New Zealand models (AusRAP and KiwRAP) have most of the same core factors of the iRAP version but incorporate several variations.

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## 5.2.2 Retrospective safety rating protocols – Risk Mapping

Risk Mapping provides a means of measuring and mapping the number of crashes on individual road sections and is used in several Road Assessment Programmes globally. In regions where detailed crash data is available, iRAP produces Risk Maps that indicate the distribution of road fatalities and where crash risks are greatest. The maps capture the combined risk arising from the interaction of road users, vehicles and the road environment.

EuroRAP also maps crash density and is able to show both where the risks are high to individual drivers and where collective risk is high due to high traffic volumes. This allows an assessment to be made of the investment required to bring risk down to defined levels on different road types (Lynam & Lawson, 2005; Lynam, 2006; Castle et al. Star Ratings 2007). See EuroRAP section below for further information

## 5.2.3 International Road Assessment Programme (iRAP)

iRAP is a registered charity and is financially supported by the FIA Foundation for the Automobile and Society and Road Safety Fund. Projects receive support from the World Bank's Global Road Safety Facility, automobile associations, regional development banks and donors.

iRAP is being used as a major tool in diagnosing road safety engineering needs in low and middle-income countries in which almost half of those killed are vulnerable road users motorcyclists, bicyclists and pedestrians.

iRAP's vision is 'a world free of high-risk roads'. iRAP's objectives and processes which build on the methodologies of EuroRAP and AusRAP are set out in Box 2 and Figure 1.

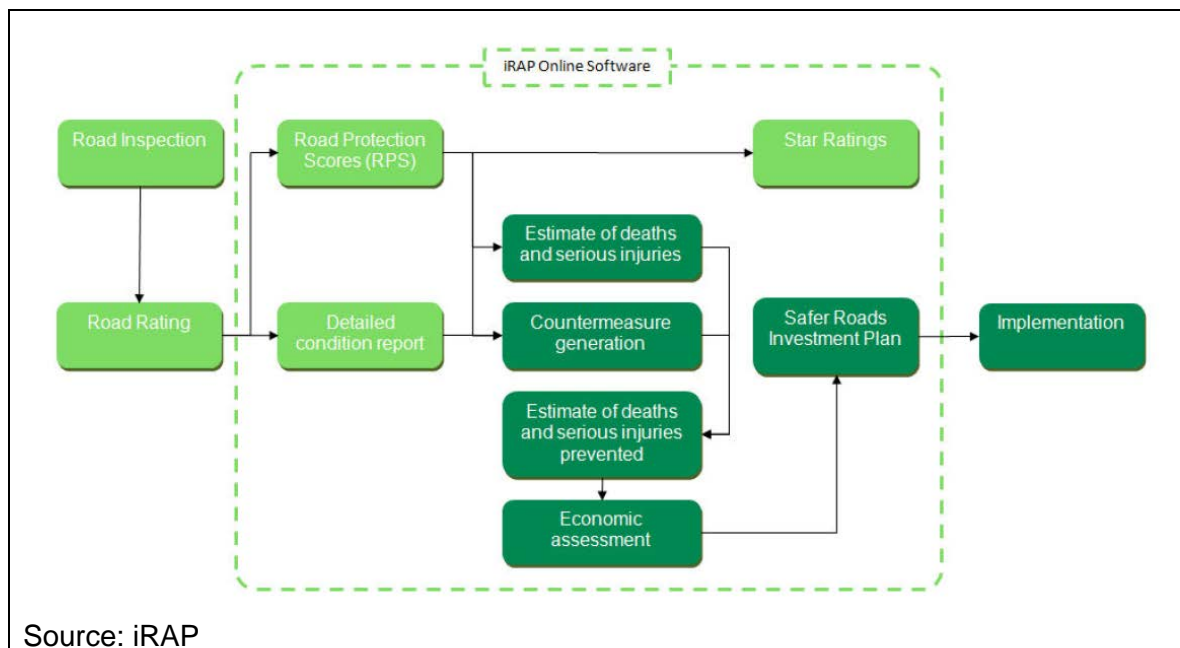
### Box 2 iRAP's objectives

iRAP works in partnership with government and non-government organisations to:

- inspect high-risk roads and develop Star Ratings and Safer Roads Investment Plans
- provide training, technology and support that will build and sustain national, regional and local capability
- track road safety performance so that funding agencies can assess the benefits of their investments.

Source: [www.irap.net](http://www.irap.net)

Figure 1: The iRAP road inspection, Star Rating and Safer Roads Investment Plan process



See [iRAP library](#) for technical publication list.

### ***iRAP Star Ratings***

iRAP Star Ratings provide a simple and objective measure of the level of safety which is ‘built-in’ to the road for car occupants, motorcyclists, bicyclists and pedestrians. A road’s Star Rating is based on an inspection of infrastructure elements that are known from extensive research to influence the *likelihood* of crashes occurring and the *severity* of those crashes that do occur. Star Ratings can be completed without reference to detailed crash data, which are often unavailable in low-income and middle-income countries.

***Methodology*** iRAP Star Ratings are based on a detailed visual inspection of a road’s infrastructure elements. iRAP currently uses two types of road inspections: *drive-through* and *video-based*. The type of inspection conducted depends on the availability of technology, the complexity of the road network and the degree to which a project is focused on building the capacity of road safety stakeholder organisations.

***Drive-through inspections*** involve at least two people: one driving a vehicle and a passenger recording road infrastructure elements as they travel using a RAP Inspection Device (RAPID). This type of inspection is technical and requires inspectors to hold iRAP accreditation RAPID inspections are often used in situations where the road network is not overly complex or it is difficult or time-consuming to import a vehicle that is equipped for video-based inspections. The RAPID inspection equipment includes a video camera, touch-

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sensitive laptop (see Figure 3) and Global Positioning System (GPS) antenna. Although road infrastructure elements are primarily recorded during the drive-through inspection, the video is also later used as a means of quality checking and assurance.

Video-based inspections differ from drive-through inspections because data is first collected by video and this is later used by raters to record road infrastructure elements. The videos are recorded with a specially equipped survey vehicle that records images of a road at intervals of 5–10 metres using an array of cameras aligned to pick up panoramic views (such as forward, side-left, side-right, and often, rear). The main forward view is calibrated to later allow measurements of key road infrastructure elements. The vehicle is also equipped with GPS that enables the video images to be correlated to precise locations on the road network. The vehicles can drive along the road at legal speeds while collecting this information. After the video data is collected, raters undertake desktop inspections of road infrastructure elements by conducting a virtual drive-through of the network. The raters use specialised software to make accurate measurements of elements such as lane widths, shoulder widths and distance between the road edge and fixed hazards, such as trees and large poles

Although the drive-through inspections involve a continuous record of road infrastructure elements, and the video-based inspection records video images at 5-10 metre intervals, the Star Ratings are based on 100 metre long sections of road. At the completion of each type of inspection, it is possible to produce a detailed condition report that summarizes many roadway characteristics for the inspected network. The report contains information such as the proportion of the network that has paved shoulders and number of locations that have adequate pedestrian crossings. These data form the basis of Star Ratings.

These inspections focus on more than 75 different design features known to influence the likelihood of crashes as well as their severity. These features include intersection design, road cross-sections and markings, roadside hazards, footpaths and bicycle lanes.

The rating In the iRAP rating, five-star roads are the safest while one-star roads are the least safe. The safest roads (4- and 5-star) have road safety features that are appropriate for the prevailing traffic speeds. Road infrastructure elements on a safe road might include separation of opposing traffic by a wide median or barrier, good line-marking and intersection design, wide lanes and sealed (paved) shoulders, roadsides free of unprotected hazards such as poles, and good provision for bicyclists and pedestrians such as dedicated paths and crossings.

The least safe roads (1- and 2-star) lack safety features that are appropriate for the prevailing traffic speeds or safely accommodate mixed road use between slow and faster moving traffic or motorized and non motorized users. iRAP analyses show that these are often single-carriageway roads with relatively high posted speed limits, with frequent curves and intersections, narrow lanes, unsealed shoulders, poor line markings, hidden intersections and unprotected roadside hazards such as trees, poles and steep embankments close to the side of the road.

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See [Star rating roads for safety: the iRAP methodology](#)

### ***iRAP Risk mapping***

In regions where detailed crash data is available, iRAP produces Risk Maps that indicate the distribution of road fatalities and where crash risks are greatest. The maps capture the combined risk arising from the interaction of road users, vehicles and the road environment. See [Star rating roads for safety: the iRAP methodology](#)

### **5.2.4 European Road Assessment Programme (EuroRAP)**

Developed as a partner programme to Euro NCAP, the EuroRAP programme was piloted in 2001 in four countries and has been rolled out widely to provide risk mapping, performance tracking and protection score star ratings for major rural roads [in many European countries](#). EuroRAP's objectives are shown in Box 3.

#### **Box 3: EuroRAP's objectives**

- To reduce death and serious injury on European roads rapidly through a programme of systematic testing of risk that identifies major safety shortcomings which can be addressed by practical road improvement measures;
- To ensure assessment of risk lies at the heart of strategic decisions on route improvements, crash protection and standards of route management;
- To forge partnerships between those responsible for a safe roads system - motoring organisations, vehicle manufacturers and road authorities.

Source: [www.eurorap.org](http://www.eurorap.org)

Death rates on European regional single carriageway roads typically average 5-10 times higher than those seen on motorways in the same country - even though motorway operating speeds may be 30-40km/h higher (EuroRAP/Euro NCAP 2011). EuroRAP thus focuses on covering a network of inter-urban roads on which at least 30% of national fatalities occurred. Route lengths within the EuroRAP networks typically average around 20kms, but many of the links are much shorter. Comparisons are made between roads of similar types, both within and between countries.

Three main predictive and retrospective rating protocols shown in Box 4 have been developed by EuroRAP. EuroRAP analyses aim to contribute at three levels – providing a systematic audit of the road network, understanding the sources of risk, and indicating the priorities for network improvement (Lynam et al., 2007).



#### **Box 4: EuroRAP's protocols and outputs**

Risk Rate Mapping: the numbers of killed and seriously injured road users per billion vehicles are shown on a colour-coded road map.

Performance Tracking: Identifies whether fewer people are being killed or seriously injured on road over time and identifies the countermeasures that are most effective.

Road Protection Scores (RPS): assess how much or how little protection a road environment will provide for the occupants of a car in the event of a crash. On the basis of this score, each road is given a star rating varying from 1 to 4, with 4-star (EuroRAP RPS1.0) or 1-5 stars (EuroRAP RPS2.0) representing a road which is engineered to minimise the likelihood of a crash resulting in a fatal injury to car occupants.

Source: [www.eurorap.org](http://www.eurorap.org)

#### ***EuroRAP's Star Rating:***

EuroRAP's Star Rating is a scale showing how well a road protects the user from death or serious injury *once a crash occurs*. The aim of the assessment is to evaluate the safety that is 'built in' to the road through design, in combination with the way traffic is managed on it. Data on road design and the standard of a road's safety features is collected by drive-through inspections in specially equipped vehicles. Large scale inspection has taken place in Sweden and Germany. Trained inspectors assess and score each road's safety features and hazards, either in real time (as the road is driven), or later from video images captured along the route. This standard inspection formula can be used on a variety of road types and allows roads across Europe to be assessed and compared on the same basis. EuroRAP's Star Rating differs from normal road safety audits in that the aim is to assess the general safety standard of a route not to identify individual high-risk sites. The scoring system is based on the road design elements that correspond to each of the four main crash types on Europe's roads shown in Box 5.

#### **Box 5: The elements of EuroRAP's Safety Rating scoring system**

*Head-on Crashes*: measures of how well traffic lanes are separated

*Run-off Crashes*: checks for roadside protection (for example, safety fencing protecting rigid poles, lampposts and trees)

*Junction Crashes*: checks for junction layout and frequency

*Pedestrians and Cyclists*: checks for facilities and separation from vehicles where vulnerable road-users are present.

Source: [www.eurorap.org](http://www.eurorap.org)

The protection scoring system is closely linked to vehicle speed, and demonstrates that an appropriate balance between speed and road design is needed to produce high levels of protection on most road types. The initial focus on scoring the passive safety of the road allows a direct link to be made with vehicle safety assessment by considering injury severity in both cases as a function of the biomechanical forces involved in the impact. To make this link, minimum relative risks for the Road Protection Score rating are based on the speeds at which car occupants can be expected to survive an impact in a car rated highly in EuroNCAP – 70km/h or below for head on crash protection, 50km/h for intersection crashes and run off crashes (although here occupant protection will depend on the nature of the obstacle hit) and 30 km/h for impacts with pedestrians. Pedestrian and vehicle movements need to be segregated on any roads with higher speed limits, in order to gain maximum Road Protection Score ratings for this crash type. Findings of a EuroRAP Road Protection Scores review in 2004 are shown in Box 6.

#### **Box 6: EuroRAP Road Protection Scores (RPS) Review (2004)**

The review indicated that:

- on many roads there is substantial scope to improve the potential for injury prevention and crashes involving fatal injury.
- on average, single carriageway RPS scores are lower than divided (dual carriageway) roads. Single carriageways show more variability in their design and associated injury protection.
- many roads score poorly for run-off protection, reflecting that fatal injuries are likely to occur unless barriers or very wide safety zones can be provided. There is considerable variability in run-off protection along individual routes.
- The lowest scoring roads score poorly for head-ons, single-vehicle runoffs and those at junctions.
- most of the assessed divided roads do not score the full four stars available, even though they are the safer roads in all highway networks. Scope remains to reduce serious injuries from crashes at uncontrolled junctions and from vehicle run-offs.
- On ordinary 2-lane roads, despite the lower speeds adopted, protection is often limited by narrow safety zones, poor access provision and by the lack of measures to limit the interaction of opposing traffic streams. Some good examples of median treatment of these roads can be seen in Sweden, the Netherlands and Ireland.
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Source: Lynam et al., 2004.

#### **European results**

Within Europe, EuroRAP ratings have been carried out in 23 countries - See [European road safety atlas](#). Risk-mapping has been carried out in 20 countries covering 180,000 kilometres of network and star rating has been carried out to some extent in 16 countries covering 60,000 kilometres. In the EU, road inspections have been extensively used in Sweden (See Box 7) and Germany, and trialed in Britain, Ireland and Northern Ireland, the Netherlands



Project co-financed by the European Commission Directorate General for Mobility & Transport

and Spain (Box 8). Results from the four largest of these show that, for example, between a quarter and a half of motorways in these countries fail to score four stars, mainly due to lack of high quality roadside protection (Lynam et al., 2007). See [Star Rating results](#). However, the pressing need is to find better median, run-off and junction protection at reasonable cost on single carriageway roads. See EuroRAP website for information on [national launches](#) and [technical publications](#).

### **Box 7: Road Protection Star Rating in Sweden**

Sweden was the first to begin and publish a programme of Star Rating based on the first EuroRAP RPS protocol. Using a specially equipped Toyota Hiace loaned to the programme from Toyota Sweden, inspections started in October 2003 and covered 1000km of the national road network, concentrating on two main roads between Stockholm and Gothenburg. Pilot results were launched in February 2004, and generated great interest amongst media, professionals and the public.

Inspections continued in 2004 with the addition of data for a further 7090km. Results for 3780km in the south of the country were launched in December of that year, whilst 3310km in the north were launched in February 2005. See [EuroRAP results for Sweden](#).

EuroRAP star ratings have been used in the review of speed limits in Sweden, matching speed limits to the level of crash protection provided by the road.

Of particular significance in the Swedish programme has been the finding that a correlation exists between the number and location of fatal crashes and the Star Rating awarded to particular road sections. Sections with a high number of fatalities generally received a poor Star Rating.

Source: [www.eurorap.org](http://www.eurorap.org)

### ***EuroRAP Risk Mapping***

Under EuroRAP's Risk Mapping protocols, safety indicators based on the road network, crash numbers and traffic flow are used to produce four maps charting:

- Risk per kilometre
- Risk per vehicle kilometre travelled
- Risk in relation to roads with similar flow levels
- Economic potential for crash reduction

Risk is divided into five coloured bands from high-risk (black) to low risk (green). EuroRAP maps give various insights into risk and are designed to support messages aimed at the differing needs and levels of expertise of the target audiences, ranging from the public through to road engineers and policymakers. For example, EuroRAP explains that the maps directed to policymakers and roads authorities comprise:



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*Crash density* - showing crash rates per kilometre of road, illustrating where highest and lowest numbers of crashes occur within a network.

*Crash rate in relation to similar roads* - comparing the crash rate of similar roads with similar traffic flows, illustrating which road sections have a higher rate. Separate road groups are considered - for example, motorways, main roads with traffic flows below 10,000 vehicles per day, main roads with daily traffic flow between 10,000 and 20,000 vehicles per day, and main roads with daily traffic flow greater than 20,000 vehicles per day.

*Potential for crash reduction* - providing information on the number of crashes that might be saved if crash rates of road sections, with risk above the average roads of a similar flow, were reduced to the average or to an alternative defined standard risk. This information can be used for considering investment decisions, providing authorities and policymakers with a valuable tool for estimating the total number of crashes that could potentially be avoided if safety on a road were improved. Used with cost information, this map can indicate locations where the largest return on investment can be expected.

Results to date indicate that there are large differences in fatality rate between groups of countries for similar road types. For EuroRAP results on risk mapping in several European countries, see [Risk Mapping results](#) and [EU Road Safety Atlas](#).

The [EU Trans-European Road Network](#) has also been mapped and provides a first comprehensive safety analysis of TEN-T roads. It shows that, among the network surveyed, 15% of the TEN-T road network has unacceptably high safety risk and that just 31% of the network are 4-star roads. Of the 15 countries analysed in depth, Sweden, Netherlands, Great Britain and Switzerland top the league when it comes to achieving 'best possible' safety levels on the TEN-T. The most remarkable country in the survey is Slovenia with its newly engineered network which is now outperforming most others. Nearly half of the network was awarded the best possible rating, but away from the new TEN-T motorway network, road risk rates are commonly ten times higher. The Czech Republic is making some progress and getting close to Belgium in performance with 15% at best possible levels. Poland and Slovakia have major challenges: only 5% or less of the networks achieved best possible rating and their networks contained the most sections with high risk ratings. see [TEN-T results](#).

**Box 8: EuroRAP Risk Mapping in Spain**

Spanish Risk Mapping began in 2002 with the production of a pilot risk map for Catalonia - the first time that such information had been made publicly available.

The Spanish EuroRAP programme has been extended progressively to cover the complete road network, including over 20,600km of the national system.

In 2003 the first map illustrating risk on the Spanish RCE (Carreteras del Estado) was published. The most dangerous region was found to be Galicia, with 52% of road sections in the area categorised as high (black) or medium-high (red) risk. Examination of results by province showed Pontevedra, Lugo, Asturias and Burgos to have the highest risk overall.

In 2004, further developments were made with the publication of both a crash density map and updated risk map - the first time national EuroRAP results had been launched using both forms of information. The meaning of risk was not well understood by the Spanish public and density maps were used to explain how road administrations set priorities for action and the connection between high traffic flows and high accident numbers. Mapping is being extended to other regions.

Source: [www.eurorap.prg](http://www.eurorap.prg)

***EuroRAP Performance Tracking***

Performance tracking provides a means of monitoring the number of crashes occurring on individual road sections over time - which are getting safer, which are getting worse, and which are staying the same. The EuroRAP process of tracking the performance of road sections over time has several stages: data is initially analysed to identify road sections which have shown a reduction in the number of collisions over time and those where there has been little or no change; data for individual years is then checked to assess consistency of the patterns; and finally, highway authorities are asked for information on remedial, enforcement or education measures that have been implemented that might explain the reduction in crashes. For EuroRAP results of performance tracking in several European countries, see [Performance Tracking results](#).

**5.2.5 Examples of other national road assessment programmes*****Australian Road Assessment Programme (AusRAP)***

[AusRAP](#) aims to provide a safety rating for the national highway network across Australia and estimates that 47% of road fatalities could be prevented by improved roads. The aim is to generate consumer information for the public and give road engineers and planners vital benchmarking information to show them how well, or badly, their roads are performing compared with others, both in their own and other countries. AusRAP is an initiative of the

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[Australian Automobile Association \(AAA\)](#). AAA is the national association of Australia's State and Territory motoring clubs and its first report was published in 2005.

AusRAP's objectives are:

- To reduce deaths and injuries on Australia's roads by systematically assessing risk and identifying safety shortcomings that can be addressed with practical road-improvement measures
- To put risk assessment at the heart of strategic decisions on road improvements, crash protection and standards of road management.

AusRAP uses two protocols:

- [Risk Mapping](#), based on a road's history of casualty crashes and traffic flow. Previous AusRAP reports, released in 2004 and 2005, used risk-maps to provide a measure of the safety performance of the AusLink National Network. Road crash fatalities on this network typically account for around 15% of annual road deaths in Australia
- [Star Ratings](#) which include the influence of crash likelihood as well as injury severity, involve an inspection of a number of design elements such as lane and shoulder width as well as, for example, the presence of safety barriers. Between 1 and 5-stars are awarded to road links depending on the level of safety which is 'built-in' to the road. The star ratings do not take into account a road's crash history.

### ***KiwiRAP***

The New Zealand Road Assessment Programme, KiwiRAP, is a road safety partnership between the Automobile Association and New Zealand government agencies: NZ Transport Agency, Ministry of Transport, Accident Compensation Corporation, and New Zealand Police. The objectives of KiwiRAP are:

- to reduce deaths and injuries on New Zealand's roads by systematically assessing risk and identifying safety shortcomings that can be addressed with practical road improvement measures
- to have risk assessment as a key factor in strategic decisions on road improvements, crash protection and standards of road management
- to provide meaningful information on where the greatest levels of risk are faced, and in turn to influence behaviour.

Like AusRAP, KiwiRAP carries out risk-mapping and star ratings. In January 2008 KiwiRAP published the first set of risk maps for New Zealand. These were followed with the publication of Star Ratings in June 2010. See [KiwiRAP reports](#)

The Star Rating approach focuses on the elements influencing the three most common and which contribute over 80% of all fatal and serious crashes and severe types of crashes on New Zealand's rural state highways.

- Run-off road crashes (which account for over 50% of all crashes)
- Head-on crashes
- Crashes at intersections

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The Star Rating system includes some additional elements to those included in iRAP or EuroRAP rating schemes and uses a combination of video rating and high-speed geometry data for 100m road sections.

### 5.3 Protective equipment safety ratings

Manufacturing standards for safety equipment, in particular, child restraints and safety helmets are in place in a wide variety of jurisdictions and are supported internationally by dedicated ISO standards. However, variations in performance identified by research have given rise to evaluation systems designed to be more user-friendly to consumers and which draw on state of the art knowledge to maintain pressure on manufacturers to produce equipment that performs well in advance of national and international standards.

#### 5.3.1 Child restraint safety rating

##### **- Euro NCAP testing**

In Europe, child restraint safety rating is carried out as part of whole car testing and safety rating within EuroNCAP, given the shared responsibility of car manufacturers and child restraint manufacturers for the safe design and installation of child restraints in cars. In the frontal and side impact barrier tests, dummies representing 1½ and 3 year old children are placed in the rear of the car in the type of child restraint, recommended by the car manufacturer. The score depends on the child seat dynamic performance in front and side impact tests but also on the fitting instructions for the child restraints, airbag warning labels, and the car's ability to accommodate the child restraints safely. See EuroNCAP's [child protection](#) protocol.

##### **- UK TRL Child Seat Rating Scheme**

An additional scheme launched in 2009 operates in the UK which rates the performance of child restraint systems from 1-5 stars and aims to provide consumers with performance ratings for all child restraint systems. The star rating is based on a suite of tests to assess the front and side impact performance and the usability of the product. Performance information for each of these is available for added clarity. All child restraint systems tested will have already achieved Regulatory Approval to R44 - a minimum mandatory requirement for sale in Europe. However, R44 offers no differentiation of product quality or effectiveness to the consumer. Additionally, within R44 there is no assessment of side impact performance which is considered to be of great importance. TRL's rating scheme requirements are laid out in Transport Research Specification, TRS1002:2009, which calls up a bespoke suite of tests and assessments based largely on the NPACS (New Programme for the Assessment of Child Restraint Systems) protocols, published by TRL for the Department for Transport.

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**- UK Consumers Association Which? rating**

The UK Consumers Association also publishes a child restraint Best Buy and Don't Buy rating based on the Euro NCAP test results and expert inspection but requires a membership fee to access results online.

**- Australian Child Restraint Evaluation Programme (CREP)**

In Australia the Child Restraint Evaluation Programme ([CREP](#)) has been created as a stand-alone safety rating system but one involving whole car testing. In 1992, the Roads and Traffic Authority of New South Wales (RTA), the National Roads and Motorists Association (NRMA) and the Australian Consumers' Association (ACA) came together to create a child restraint evaluation program in order to provide consumers with better information and to maintain pressure on manufacturers. After some early problems with working methods and the addition of support from other motoring organisations and the federal Traffic Accident Commission, a review of the programme was undertaken in 2005 which defines current protocols, methodology and results (Brown et al, 2005).

The current CREP Stage 4 Series recognises eight types of restraint equipment which are shown in Box 9.

**Box 9: Types of restraint tested in CREP**

ASC	Anti-submarining clip
A1	Rearward-facing restraint for babies up to six months*
A1/B	Convertible forward-facing restraint for babies up to six months* in rearward-facing mode then for toddlers up to 4 years* in forward-facing mode
A2	Rearward-facing restraint for babies up to 12 months*
A2/B	Convertible forward-facing restraint for babies up to 12 months* in rearward-facing mode then for toddlers up to 4 years* in forward-facing mode
B	Forward-facing restraint
B/E	Convertible booster seat
E	Booster seat

\*Approximate guide

Source: [CREP website](#)

Each of the above categories is subjected to [three simulated crash tests](#), frontal, side and oblique impacts and given a star rating from 1-5. A rating of 1 represents acceptability under AUS/NZ standards and 2 signifies the average performance. A further star rating with the same registration is given for [ease of correct use](#). Here, an expert assessor examines five aspects of use: packaging, instructions, labeling, ease of securing/releasing the child and ease of securing/releasing the restraint. A sample of assessments is reviewed by a second assessor and a panel of experts then provides final moderation if needed. Traditionally,



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CREP periodically publishes its findings in a brochure which is widely distributed and is now available to download as a PDF file from a number of websites. The current edition is [Child Restraint Safety Ratings – Your guide to buying child restraints](#) (CREP), February 2011.

### 5.3.2 UK Safety Helmet Assessment and Rating Programme ([SHARP](#))

Head injuries cause some three-quarters of all fatalities to motorcyclists, while about one quarter of all injured riders suffer a head injury and about 20% of fatal and serious head injuries could be reduced by a recommended and achievable improvement in crash helmet performance (COST 327).

In its [Motorcycling Strategy](#) published in 2005, the UK Department for Transport (DfT) stated its intention to devise a safety rating scheme for motorcycle helmets and the SHARP helmet test/rider information initiative was developed and launched in 2007. UK research had estimated that as many as 50 lives a year in the UK could be saved if motorcyclists wore the safest helmets available to them (See DfT 2008 [SHARP](#)).

SHARP's method is to purchase helmets anonymously at ordinary retail outlets and to test them rigorously in a battery of [thirty-two tests](#) that reflect 'real world' crash conditions. Helmets are initially laser calibrated to ensure proper comparison and then subject to impacts against flat and kerb type surfaces at varying speeds in a range from above to below those specified in regulatory standards. The results of the tests are then analysed to give a star rating between 1 and 5. 5 star helmets offer good levels of protection in impacts all round the helmet. All helmets in the UK are required to meet at least one regulatory standard but this only ensures a minimum level of protection. From its commencement in 2007 to mid 2011 SHARP has tested a total of 247 helmets. Testing has identified a variation of up to 70% in performance between high and low scoring helmets.

Consumers access SHARP's data through an 'easy to use' website that can be searched using variables such as make, model and type if an assessment of an individual helmet is sought and by price and star rating if a more general search is required. The site emphasises the importance of *helmet fit* and provides an [animated guide to helmet fitting](#). It is possible for individuals to subscribe to a newsletter and for traders to register.

## 5.4 Other safety ratings

### 5.4.1 Star rating school walking routes

A model for star rating the safety of school walking routes was devised by Monash University Accident Research Center. The model was based on the determinants of pedestrian crash and injury risk at specified pedestrian road crossings. These include:

- The speed limit applicable to drivers and riders at the crossing point during the periods when children walk to and from school;
- The average number of vehicles per hour at the crossing point during the periods when children walk to and from school;
- The width of road to be traversed to complete an individual crossing movement;

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- The number of directions of conflicting traffic that must be assessed by a pedestrian crossing at the crossing point; and
  - Whether there is a formal crossing facility provided (such as traffic signals, a school crossing, a zebra crossing, etc) to facilitate the crossing manoeuvre.

Then based on established relationships and expert consensus, these are mathematically combined to obtain a star rating between zero and five at each crossing point along the route. The model demonstrated that it is feasible to objectively rate the safety of individual crossing points as well as to provide overall indications of route safety (Corben, 2008)

The model was subsequently piloted within realistic settings (Liu et al., 2010). The main findings from the data analyses revealed that:

- Participants who took part in the trial were largely supportive of the Star-Rating concept such that the availability of such information would have the potential to influence their decision regarding their children walking to and from school; and
- An approximate two-star difference was established between objective and subjective ratings.

The pilot concluded that future research should aim to address additional trialing of the tool in a greater variety of settings, as well as population groups, with the results used to help further develop and enhance the Star-Rating tool's reliability.

#### **5.4.2 Q3 - Work-related safety ratings in Sweden**

Swedish trade unions in cooperation with environmental and road safety organisations have developed a ranking system for heavy goods transport. This ranking system is called **Q3** and is based on working environment, environmental and road safety requirements (See <http://www.q3.se/> for details). The system is becoming well accepted and is considered a worthwhile initiative.

#### **5.4.3 ETSC Performance Index**

The ETSC's Road Safety Performance (PIN) Index is a new policy instrument to help EU Member States to improve road safety. Started in June 2006, the Index covers several areas of road safety including road user behaviour, infrastructure and vehicles, as well as road safety policymaking more generally. National research organisations and independent researchers from 30 countries participating in the programme ensure that any assessment carried out within the programme is based on scientific evidence and is effectively communicated to European road safety policymakers.

To facilitate the collection of accurate data from all 27 EU Member States, as well as Norway, Switzerland and Israel, ETSC has set up a the **PIN Panel** of national focal points comprising 30 high level national experts from ETSC's network of member organisations and other organisations.

Eight individuals, who are particularly committed to ETSC and road safety policy, form the [PIN Steering Committee](#) providing guidance to the PIN Programme Secretariat. PIN to date has concentrated on final outcomes – the fall or otherwise in road deaths - as well as intermediate outcomes for speed, seatbelt wearing and drink driving. For key findings to date, see [PIN publications](#).

**Box 10: The ETSC PIN programme comprises:**

- PIN Flashes – profile-raising quarterly overviews of specific road safety topics
- PIN Reports – wider-ranging annual reviews of a range road safety performance indices
- PIN International events – to launch the annual PIN Reports
- PIN Talks - National events in each Member State to encourage that country's road safety effort

Source: [www.etsc.eu](http://www.etsc.eu)

**Box 11: EU country performance towards the EU 2010 road safety target**

Monitoring of EU country progress against the EU target carried out by the ETSC PIN Project showed that Latvia, Estonia, Lithuania, Spain, Luxembourg, Sweden, France and Slovenia all reached the EU 2010 target. Portugal very nearly reached it with a reduction of 49.4%. Ireland, Germany, the UK, Italy, Slovakia and Belgium achieved reductions above the EU average, while the other countries progressed to a lesser extent (ETSC, 2010).

ETSC estimates that had road deaths remained at the same level as in 2001, there would have been 102,000 more deaths in the EU. The total value to society of the reductions in road deaths in EU27 over the years 2002-2010 compared with 2001 is estimated as 176 billion euro.

Source [ETSC PIN Report 5](#)

## 6 Effectiveness of safety rating systems

A prerequisite for effective rating systems is high quality information. Rating systems are of value when the tests used in them are realistic and evidence-based; when the tests and analysis take account of possible factors which might bias the results; where the publication or website explains clearly what the particular rating means and where the results are disseminated very widely while, at the same time, being targeted at specific users.

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## 6.1 Changing design, upgrading standards and reducing risks

Whilst evidence-based legislation can ensure a uniform minimum level of safety across the product range, predictive and retrospective safety ratings can create a demand for safety products and outcomes which can produce more rapid responses in individual product design.

### 6.1.1. In-car safety

New Car Assessment Programmes around the world are playing a key role in encouraging improvements in in-car safety. Since the US NCAP programme started, the NHTSA report there has been around a one-third reduction in the probability of a life-threatening injury in NCAP passenger cars as measured by controlled crash test results. In recent years NCAP light vehicle performance has led to about a 25 per cent reduction in the calculated probability of AIS 4 or above injured (Hackney & Quarles, 1982; Hackney, Kahane & Chan 1996). In Australia, research has also indicated a good correlation between ANCAP testing and the retrospective crash data in terms of injury risk and injury severity (Newstead & Cameron, 1999).

#### ***Euro NCAP***

Monitoring has shown that together with key legislative provisions, Euro NCAP has had a significant influence on the way that cars are designed (Fails & Minton, 2001). Only three years after its introduction, Euro NCAP research reported that cars with three or four stars were approximately 30% safer, compared to two star cars or cars without an Euro NCAP score, in car to car collisions (Lie & Tingvall, 2000). In the last decade, crash data has confirmed that a 50% reduction in the risk of serious injury has been achieved in new car models [SARAC II](#). The European Commission stated in 2000 that Euro NCAP had become the single most important mechanism for achieving advances in vehicle safety (CEC, 2000).

Recent research shows that this effect is being sustained. A Swedish study compared Euro NCAP safety ratings of cars with those published by the Folksam real-world injury ratings; and compared injury risk measures between Euro NCAP 2 and 5 Star cars with real-world injury and disability outcomes using police and insurance injury data. It concluded that a good correlation exists between Euro NCAP test results and real-world injury outcomes. In addition, .5-star rated Euro NCAP cars were found to have a 68% lower risk of fatal injury and a 23% lower risk of serious injury compared to 2-star rated cars (Kullgren, Lie & Tingvall 2010).

While car manufacturers were initially hostile to the development of Euro NCAP, standards have increased to the extent that cars typically achieve this rating and manufacturers see 5 stars as the goal for all their new models [Euro NCAP, 2007](#). Today only a 5 star rating is truly acceptable (EuroRAP/Euro NCAP 2011) and the car industry has achieved significant improvements in in-car safety.

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“Not only Euro NCAP has been instrumental in bringing forward concrete safety advances, but it has also managed to instil a consideration for safety in the minds of consumers and to effectively change their patterns. The European Automobile Manufacturers are proud to be associated with this initiative, and we warmly congratulate all involved in Euro NCAP for their good work, for their dedication, for their achievements”.

Statement by Chief Executive of Fiat, Euro NCAP’s 10<sup>th</sup> Anniversary, Brussels, 2005

**Frontal impact protection:** Euro NCAP testing has encouraged car manufactures to work to improve crash protection in frontal impacts:

- to prevent intrusion such that the chances of the occupant impacting the car’s interior is minimised with space remaining for the restraint system to operate effectively and thus reduce the risk of serious and fatal injury.
- to adopt seat belt pre-tensioners, load limiters and dual stage airbags, to help attenuate the forces transmitted to the occupant. It has also helped to avoid situations where the chest is directly loaded by the steering wheel.
- to remove hazardous structures from the areas that the knees can impact with the aim of avoiding serious and disabling leg injury.
- To reduce intrusion of the footwell and secure greater control of foot pedals displacement in order to minimise injury.

**Side impact protection:** Through the programme, Euro NCAP has seen large improvements in side impact performance. The provision of side impact airbags has helped. It is now typical for the cars tested by Euro NCAP to be fitted with side impact airbags.

**Child protection:** As a consequence of the child protection rating, Euro NCAP has seen improved designs, where the child is less likely to strike the car’s interior, whilst at the same time experiencing reduced forces from the restraint system.

**Electronic stability control:** Fitment is steadily increasing and by 2012 Euro NCAP will only reward equipment which is fitted as standard across the whole of the model range.

### 6.1.2 Pedestrian protection

The car industry’s response to improving pedestrian protection in vehicle design has been much less responsive, although some progress has been reported. During the first two years of Euro NCAP, the typical pedestrian rating (which was then separate from the overall rating) was one or two stars; in 1997 30% of the tested cars were given one star and 70% two stars. However, in 2007 the distribution of stars was 13% one star, 65% two stars and 19% three stars (Euro NCAP, 2008). In 2009 the new overall rating system was introduced and the average score was 16.8 points and in 2010 19.1 points (Strandroth et al., 2011). New EU legislation comes into force for all new type approvals in 2015 and for new registrations in 2019 . Euro NCAP’s requirement from 2012 that a five star rating will require at least 60% of the pedestrian tests requirements to be met (i.e. 21 points) should encourage faster progress.

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A recent Swedish study found significant correlation between Euro NCAP pedestrian score and injury outcome in real-life car to pedestrian crashes. The results showed a significant reduction of injury severity for cars with better pedestrian scoring, although cars with a high score could not be studied, due to lack of cases. The reduction of risk of serious consequences for average performing cars in comparison with low performing cars was 17%, 26% and 38% for 1%, 5% and 10% of medical impairment, respectively. These results applied to urban areas with speed limits up to 50 km/h, although no significant reduction was found in higher speed zones. While Brake Assist (BA) was found to contribute to a small injury reduction of about 5%, the results were non-significant. It was also found that the combined effect of BA and higher pedestrian scoring was greater than the two effects separately (Strandroth et al, 2011).

### 6.1.3 Road network safety

Several years of annual reporting of risk mapping results in Britain and Spain has generated substantial media interest in the variation in risk between roads, and the roads where risk is reducing or remaining high. Many safety engineers in Britain are beginning to use the EuroRAP risk data alongside their more traditional accident analysis techniques. Performance tracking of risk over the period 1999 to 2004 has identified reductions of about half in the length of roads in the highest risk band in Spain, Britain and Sweden (Lynam et al, 2007).

An assessment of 1200kms of motorway in Germany (ADAC Press Release, July 2006) comparing the EuroRAP star rating system with relevant crash data showed that motorways rated with four stars produced 50% fewer severe run-off crashes than three star routes. Studies in Sweden and Britain (Castle et al., 2007) comparing average fatal and serious crash rates for roads with different star ratings have shown differences in rating of one star to be associated with 25-33% reduction in crashes. More detailed comparisons of ratings and crash rates for individual crash types show the correlation to hold for run-off and head-on crashes, but suggested at one stage of development that the junction assessment methodology needed to be improved.

A recent [EuroRAP review](#) found some evidence of a link between average crash rates or crash costs associated with increasing Star Rating and *vice versa* in different models that include elements of both crash protection and crash likelihood *and* from the model with only crash protection elements. While there was some variation between studies, the review reported that the more robust studies showed a crash rate reduction in the region of a third to a half when moving from a 2-star to 3-star rating. The reduction was often found to be less when moving between higher Star Ratings. On-going evaluation will be useful to explore these issues further.

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#### 6.1.4 Communicating results

There are several issues regarding presentation of results. It is important that:

- Given that safety rating systems need to be built on objective safety data, the ‘messenger’ i.e. the safety rating partnership is actually independent as well as seen to independent of national governmental and industry concerns. Most rating systems have achieved this with broad international consortiums of motoring and consumer organisations, governments from several countries and independent experts (See the [EuroRAP](#) and [Euro NCAP](#) partnerships for examples).
- Given the variety of safety rating systems which exist, each publication explains clearly what the particular safety rating in question means and draws attention to any limitations;
- Given the wide audience for results, that these are disseminated widely but targeted at the same time at the road using public, car and infrastructure providers, fleet buyers and decision makers in general.

##### ***Euro NCAP***

With online information and results available in several languages, Euro NCAP has successfully communicated its findings both to road safety professionals, the car industry and the media. As Bernard Gauvin, the French delegate to Europe NCAP stated at Euro NCAP’s 10<sup>th</sup> Anniversary, the rating system was delivered “in a proper way and using very simple and easy-to-use information. It was non-controversial information both in scientific and commercial aspects and so it was accepted by everybody including consumer associations, media and manufacturers”.

Governmental lead agencies for road safety have also been key to successful promotion of new car assessment programmes. In Europe, the Swedish Road Administration (now STA) has created a demand for a high star rated vehicles through its in-house travel and procurement policies and uses higher Euro NCAP ratings as a performance target and performance indicator in its national strategy.

Mandatory stickers of Euro NCAP ratings on car windscreens in car show rooms have been promoted by safety organisations. However, this activity has not had the same level of promotion in Europe as the [Stars on Cars](#) initiatives in some of the Australian States, following the example of Western Australia, which involve promotion by the road safety lead agencies and others of take up of Australasian NCAP.

A SARAC survey of Euro NCAP ratings in Spain and Sweden concluded that Euro NCAP needed to be promoted more widely and effectively so it plays a higher role in fleet purchasing decisions and encourages fleet managers to develop fleet purchase policies to include specific safety criteria. The postal and telephone survey also concluded that both members of the public and fleet purchases needed be educated about sources of information about vehicle safety. Price and reliability seem to be more important than safety in the purchasing decisions of fleet management [SARAC II](#) .

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Euro NCAP's strategy 2010-2015 recognizes the importance of a strong communication strategy and timely and accessible communication. It states its intention to support and better coordinate its activities with its member organisations and other stakeholders as part of a 'consumer' targeted dissemination strategy. To provide further focus for Euro NCAP's communication activity, the organisation also intends to carry out clear target-setting, periodic monitoring of key indicators and the demonstration of return on investment (Euro NCAP 2009).

### ***EuroRAP***

The value of identifying risk distributions across the major inter-urban road network, and showing roads which have been improved substantially and those that continue to show persistent safety problems, is now well established through the regular publication of EuroRAP results in many countries.

EuroRAP has focused on multi-agency working in its research and dissemination and in popularising topics in the messages it provides. This has commanded widespread media attention. EuroRAP has also provided a full programme of launches/conferences, and a website which attracts many visitors.

According to EuroRAP, awareness of the road safety maps amongst drivers is steadily increasing, although it varies between countries. Website publicity is the most effective way of reaching drivers, although television and motoring magazines are also important sources of information. Over 60% of drivers perceive, correctly, that single carriageway roads are the most dangerous, and more than three quarters of drivers are now influenced by safety concerns when planning their journey.

The campaign in Spain has been particularly successful, with over 40% of Spanish drivers being aware of the maps, but countries which have produced their maps more recently, such as Poland, have also demonstrated rapid progress and show what can be achieved. More than one third of Polish drivers know about the maps and over half report that they frequently choose their route for safety reasons.



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