



**EUROPEAN NEW CAR ASSESSMENT PROGRAMME
(Euro NCAP)**

ASSESSMENT PROTOCOL – OVERALL RATING

Version 6.0
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1 INTRODUCTION

Euro NCAP's original assessment protocol was developed jointly by TRL and Vehicle Safety Consultants Ltd., under contract to the UK Department of the Environment Transport and the Regions and International Testing, respectively. Subsequent versions of the protocol have been developed and released by the Euro NCAP Secretariat. Beginning with Version 5, important changes have been included that have been brought about by the introduction of the overall rating scheme in 2009. Individual documents are released for the four main areas of assessment:

- Assessment Protocol – Adult Occupant Protection;
- Assessment Protocol – Child Occupant Protection;
- Assessment Protocol – Pedestrian Occupant Protection;
- Assessment Protocol – Safety Assist;

In addition to these four assessment protocols, the present document is provided describing the method and criteria by which the overall safety rating is calculated on the basis of the car performance in each of the above areas of assessment.

2 PRINCIPLES

The Euro NCAP programme is designed to provide a fair, meaningful and objective assessment of the safety performance of cars. It is intended to inform consumers, so providing an incentive to manufacturers as well as giving credit to those who provide maximum protection. The impact tests are based on those developed for legislation by the European Enhanced Vehicle safety Committee (EEVC) for frontal and side impact protection of car occupants and for the protection of pedestrians hit by the front of cars. Other tests are derived from existing legislative tests (such as the assessment of speed limiters), based on existing consumer tests (like whiplash) or completely developed by Euro NCAP (for example seat belt reminders).

The overall safety rating covers the protection of adults and children in the event of a car crash and that of vulnerable road users who may be struck by the car. In addition, the rating addresses the ability of the car to support safer driving. No stylised test procedure fully reflects the safety provided by a car in the wide variety of accidents or near-accidents which may occur on the roads. However, cars that perform well in these tests should be generally less exposed to and provide better protection in accidents than cars which perform less well. The limitations of using standardised crash test dummies in fixed seating positions in the crash tests is partly overcome by taking into account other information related to occupant kinematics, interior contact points and vehicle structure, collected as part of post-crash vehicle inspections.

Economic constraints prevent the tests from being repeated, so to take account of vehicle and test variations a number of actions have been taken:

- a) Manufacturers have been asked to compare the results from these tests with those from tests they may have conducted and to draw our attention to any anomalies they may find. They have also been requested to supply data from their own tests to us for comparison. Several manufacturers have supplied data for this purpose. Apart from considering the effects of test variation and identifying anomalies, no account of such data is taken in rating the cars and it is kept confidential.
- b) The overall assessments are based on the combination of multiple results. Variations in any one of these will only have a limited effect on the overall rating.

The least demanding performance boundaries for the frontal and side impact parameters have been set to be equivalent to the limits proposed in regulatory test procedures. The regulatory limits were set to provide a basic minimum level of protection and to protect only in a moderate proportion of accidents. For car occupants, these limits are too lenient to adequately identify best practice in current production cars and to provide a goal for further improvement. Additional, more demanding, protection boundaries have been set, to identify aspects of a car's performance which offer significantly greater protection. Based on the performance improvements provided by car fronts over the last couple of years, a similar approach for the pedestrian body form tests has been adopted for the coming period.

Assessment of the safety assist functions is based both on fitment requirement and performance requirements or fitment requirements alone. The intention is to promote standard fitment across the car volume sold in the European Community in combination with good functionality for these systems.

3 OVERALL RATING CALCULATION

3.1 Method

The overall rating is composed of scores achieved in the four areas of assessment, also referred to as “boxes”: Adult Occupant, Child Occupant and Pedestrian Protection and Safety Assist. The score in each box is based on the car performance in different tests.

For each box, a total score is normalised with respect to the maximum achievable score available for the box. In this way, the maximum score for each box, and hence the total maximum score, is a constant. The weighted overall score is calculated from the individual assessment scores using weight factors. These weight factors reflect the relative importance of the four boxes in the final score. Foremost, the selection of percentages is guided by real world priorities and societal considerations. At the same time, the number and expected effectiveness (in terms of expected accident and injury reduction) of the protocols in each box are considered.

The overall weighted score, determined by taking the weighted average of the scores in the four boxes, is used to generate the overall star rating by applying the score against the percentage score required for each star. Vehicles that show a poor performance in one of the boxes will have their star rating restricted to show that they do not provide good all-round protection. There will be a minimum score required in each box to validate a star rating. See Figure 3.1 (Appendix I) for a flow diagram of the method of calculation of the overall star rating.

3.2 Weight Factors and Limits

The weighted overall score is calculated from the individual scores in each box using weight factors. These weight factors are fixed for a certain period but may be updated from time to time as priorities or the contents of the boxes change. A change in weight factors will become effective no sooner than at the start of the year following the year in which the decision was made. Table 3.1 summarises the weight factors applied in the upcoming period.

Table 3.1
Weight factors

Year	2013	2014	2015
Box 1: Adult Occupant Protection	50%	40%	40%
Box 2: Child Occupant Protection	20%	20%	20%
Box 3: Pedestrian Protection	20%	20%	20%
Box 4: Safety Assist	10%	20%	20%

Provided there is sufficient balance between the four boxes, the weighted score, after rounding, applies to star values according to the following scheme:

Table 3.2
Limits applied to star values, based on weighting

Year	2013	2014	2015
For five stars, at least:	80%	75%	75%
For four stars, at least:	70%	65%	65%
For three stars, at least:	60%	50%	50%
For two stars, at least:	55%	40%	40%
For one star, at least:	45%	30%	30%

Note: Percentages reflect the proportion of points in relation to the total points available. The apparent decrease of thresholds for 2014 and 2015 are the consequence of a scheduled increase of total points in the individual boxes.

3.3 Balance Criteria

Additional criteria are applied to the individual scores in order to assess all-round performance. The limits given in Tables 3.3a, 3.3b and 3.3c are applied after the individual test scores have been rounded.

3.4 Rounding

The following rounding rules will be applied in the calculation of the overall rating.

- Data is entered to 2 decimal places.
- Intermediate calculations (e.g. calculations needed to derive parameters which are then used to calculate scores) are not rounded.
- Calculation of points scores (e.g. for individual body regions) are rounded to 3 decimal points e.g. a head score of 3.1238 in frontal impact would be rounded to 3.124.
- The total points score in each box is the sum of scores rounded to 3 decimal points. To calculate the percentage score in each box, the 3 decimal points total is divided by the maximum points available for that box and the resulting percentage is rounded *down* to the nearest integer. In the example case: $25.124 / 36 * 100\% = 69.789$ is rounded to 69%.
- That integer is then compared with the balance percentage thresholds for the box in Table 3.3. In the example case, 69% qualifies for 3 stars AOP in 2013.

- The overall weighted score is calculated as follows:
 - The 3 decimal point score in each box is divided by the maximum points available in that box.
 - The resulting percentage in each box is rounded to 2 decimal places.
 - The percentages are multiplied by the respective weighting factors for each box, and then added.
 - The resulting sum is rounded *down* to the nearest integer.
 - This integer is compared with the threshold requirements for star ratings for the relevant year.

Euro NCAP provides a Calculation Spreadsheet at request.

Table 3.3a
Balance limits for year 2013

2013	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist
5 stars	80%	60%	60%	65%
4 stars	70%	60%	50%	55%
3 stars	40%	30%	25%	30%
2 stars	30%	25%	15%	20%
1 star	20%	15%	10%	10%

Table 3.3b
Balance limits for years 2014

2014	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist
5 stars	80%	75%	60%	65%
4 stars	70%	60%	50%	55%
3 stars	50%	30%	40%	30%
2 stars	30%	25%	20%	20%
1 star	20%	15%	10%	10%

Table 3.3c
Balance limits for years 2015

2015	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist
5 stars	80%	75%	65%	70%
4 stars	70%	60%	50%	60%
3 stars	50%	30%	40%	40%
2 stars	30%	25%	20%	20%
1 star	20%	15%	10%	10%

APPENDIX I

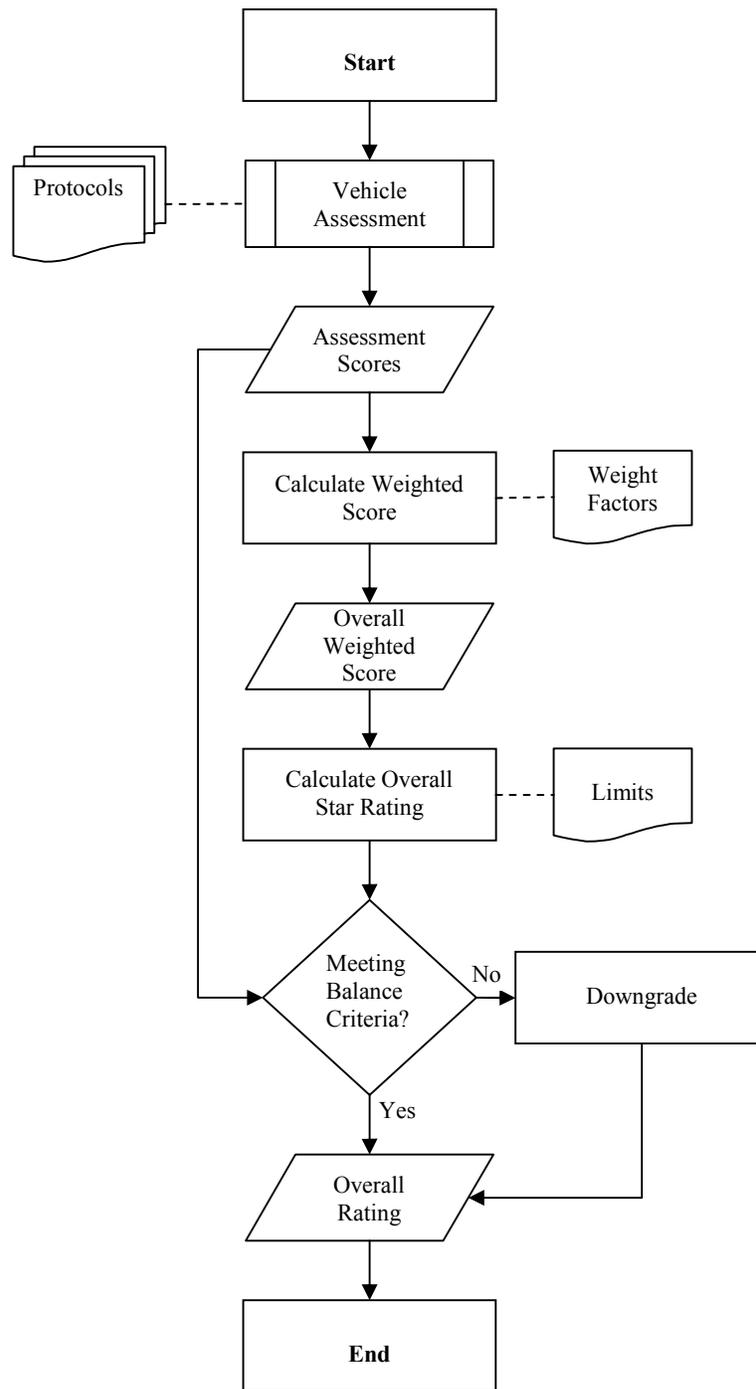


Figure 3.1
Flowchart for the Calculation of the Overall Star Rating