



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



**ASSESSMENT PROTOCOL – VULNERABLE ROAD USER
PROTECTION**

Version 10.0.1
February 2019

Copyright ©Euro NCAP 2019 - This work is the intellectual property of Euro NCAP. Permission is granted for this material to be shared for non-commercial, educational purposes, provided that this copyright statement appears on the reproduced materials and notice is given that the copying is by permission of Euro NCAP. To disseminate otherwise or to republish requires written permission from Euro NCAP.

EUROPEAN NEW CAR ASSESSMENT PROGRAMME (Euro NCAP)

ASSESSMENT PROTOCOL – PEDESTRIAN PROTECTION

Table of Contents

1	INTRODUCTION	2
2	METHOD OF ASSESSMENT	3
PART I PEDESTRIAN IMPACT ASSESSMENT		
1	PEDESTRIAN IMPACT ASSESSMENT	5
1.1	Criteria and Limit Values	5
1.1.1	Headform	5
1.1.2	Upper Legform	5
1.1.3	Legform	5
1.2	Modifiers	6
1.3	Scoring & Visualisation	6
1.3.1	Scoring	6
1.3.2	Headform Correction factor	6
1.3.3	Visualisation of results	11
PART II PEDESTRIAN AEB ASSESSMENT		
1	ASSESSMENT OF AEB VULNERABLE ROAD USER SYSTEMS	13
1.1	Introduction	13
1.2	Definitions	13
1.3	Criteria and Scoring	16
1.3.1	Autonomous Emergency Braking (AEB)	16
1.3.2	Forward Collision Warning (FCW)	17
1.4	Scoring and Visualisation	17
1.4.1	AEB Pedestrian	17
1.4.2	AEB Cyclist	18
1.4.3	Visualisation	19

1 INTRODUCTION

Important changes have been made to the Euro NCAP ratings resulting in the introduction of the overall rating scheme. Individual documents are released for the four main areas of assessment:

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

In addition to these four assessment protocols, a separate 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.

The following protocol deals with the assessments made in the area of Pedestrian Protection, in particular in the adult and child head, the upper leg form, lower leg form impacts and AEB VRU.

2 METHOD OF ASSESSMENT

The assessment of pedestrian protection is made with the use of headform, upper legform, lower legform impact and AEB test data. In the legform areas, the bumper and front of the bonnet of the car will be marked with a grid and are assessed using the two legform impactors. Euro NCAP will test “worst case” grid points and manufacturers may nominate additional tests to be performed and the results will be included in the assessment.

In the headform impact area, a grid will be marked on the outer surface of the vehicle. The vehicle manufacturer is required to provide the Euro NCAP Secretariat with data detailing the protection offered by the vehicle at all grid locations. The data shall be provided to the Euro NCAP Secretariat before any test preparation begins. The predicted level of protection offered by the vehicle is verified by Euro NCAP by means of testing of a sample of randomly selected grid-points and the overall prediction is corrected accordingly.

For AEB testing, the vehicle manufacturer is also required to provide the Euro NCAP with data detailing the expected performance of the AEB VRU system for all four of the test scenarios. The expected performance will be used to as a reference to identify discrepancies between the expected results and the test results.

2.1 Points Calculation

For the legform impact areas, a sliding scale system of points scoring has been used to calculate points for each measured criterion. This involves two limits for each parameter, a more demanding limit (higher performance), below which a maximum score is obtained and a less demanding limit (lower performance), beyond which no points are scored. Where a value falls between the two limits, the score is calculated by linear interpolation. No capping is applied to any of the measurements. The maximum score for each grid point is one point for bumper and bonnet leading ledge tests. The total score will then be scaled to a maximum of six points for each impactor.

For the headform impact area, the protection predicted by the vehicle manufacturer will be compared to the outcome of the randomly selected test locations. The results at those test locations will be used to generate a correction factor, which will then be applied to the predicted score. Only data that results in a correction factor of between 0.850 and 1.150 are accepted. Where this is not the case, the cause will be investigated and the Secretariat will subsequently take a decision as to how to proceed. Where the data are accepted, the headform score will be based on the predicted data score with correction applied.

For AEB, a sliding scale based on the speed reduction is applied for test speeds up to 40 km/h/. Higher test speeds are assessed as pass/fail only.

PART I

PEDESTRIAN IMPACT ASSESSMENT

1 PEDESTRIAN IMPACT ASSESSMENT

1.1 Criteria and Limit Values

The assessment criteria used for the pedestrian impact tests, with the upper and lower performance limits for each parameter, are summarised below. Where multiple criteria exist for an individual test, the lowest scoring parameter is used to determine the performance of that test, unless indicated otherwise.

1.1.1 Headform

The manufacturer must provide predicted data for all grid points. This data shall be expressed as a colour according to the corresponding colour boundaries for the predicted HIC_{15} performance below. Alternatively, HIC_{15} values may be provided.

<i>Green</i>	$HIC_{15} < 650$
<i>Yellow</i>	$650 \leq HIC_{15} < 1000$
<i>Orange</i>	$1000 \leq HIC_{15} < 1350$
<i>Brown</i>	$1350 \leq HIC_{15} < 1700$
<i>Red</i>	$1700 \leq HIC_{15}$

The manufacturer is allowed to colour a limited number of grid points blue where the performance is unpredictable. These grid points will always be tested. The procedure is detailed in the Pedestrian Protection Test protocol.

1.1.2 Upper Legform

Higher performance limit

Bending Moment	285Nm
Sum of forces	5.0kN

Lower performance limit

Bending Moment	350Nm
Sum of forces	6.0kN

1.1.3 Legform

Higher performance limit

Tibia Bending Moment	282Nm
MCL Elongation	19mm
ACL/PCL Elongation	10mm

Lower performance limit

Tibia Bending Moment	340Nm
MCL Elongation	22mm
ACL/PCL Elongation	10mm

1.2 Modifiers

There are no modifiers applied.

1.3 Scoring & Visualisation

1.3.1 Scoring

A maximum of 24 points is available for the headform test zone. The total score for all grid points is calculated as a percentage of the maximum achievable score, which is then multiplied by 24 points. The bonnet leading edge and bumper test zone will be awarded a maximum of 6 points each. A total of 36 points are available in the pedestrian protection assessment.

1.3.1.1 Headform

Each of the grid points can be awarded up to one point, resulting in a maximum total amount of points equal to the number of grid points. For each predicted colour the following points are awarded to the grid point:

$HIC_{15} < 650$	1.00 point
$650 \leq HIC_{15} < 1000$	0.75 points
$1000 \leq HIC_{15} < 1350$	0.50 points
$1350 \leq HIC_{15} < 1700$	0.25 points
$1700 \leq HIC_{15}$	0.00 points

1.3.2 Headform Correction factor

The data provided by the manufacturer is scaled using a correction factor, which is calculated based on a number of verification tests performed. The verification points are randomly selected grid points, distributed in line with the predicted colour distribution.

The actual tested total score of the verification test points is divided by the predicted total score of these verification test points. This is called the correction factor, which can be lower or higher than 1.

$$\text{Correction Factor} = \frac{\text{Actual tested score}}{\text{Predicted score}}$$

The correction factor is multiplied to all the grid points (excluding defaulted and blue points). The final score for the vehicle can never exceed 100% regardless of the correction factor.

1.3.2.1 HIC tolerance

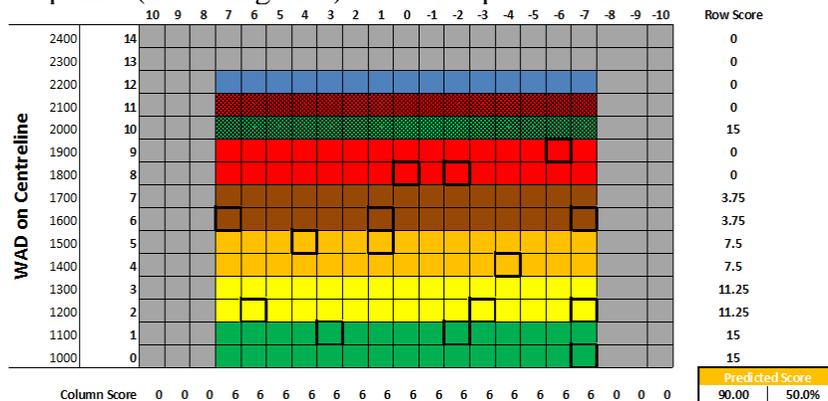
As test results can be variable between labs and in-house tests and/or simulations a 10% tolerance to the HIC value of the verification test is applied. The tolerance is applied in both directions, meaning that when a tested point scores better than predicted, but within tolerance, the predicted result is applied. The tolerance only applies to verify whether the predicted colour of the tested verification point is correct. When, including tolerance, the colour is not in line with the prediction, the true colour of the test point will be determined by comparing the actual measured HIC value with the colour band in section 1.3.1.1 without applying a tolerance to the HIC value.

Prediction	HIC₁₅ range	Accepted HIC₁₅ range
Green	$HIC_{15} < 650$	$HIC_{15} < 722.22$
Yellow	$650 \leq HIC_{15} < 1000$	$590.91 \leq HIC_{15} < 1111.11$
Orange	$1000 \leq HIC_{15} < 1350$	$909.09 \leq HIC_{15} < 1500.00$
Brown	$1350 \leq HIC_{15} < 1700$	$1227.27 \leq HIC_{15} < 1888.89$
Red	$1700 \leq HIC_{15}$	$1545.45 \leq HIC_{15}$

1.3.2.2 Example:

Headform testing:

Manufacturer X has provided the following prediction to Euro NCAP with a total score of 90 points (excluding blue) out of the possible 195:



The prediction consists of the following:

15 Default Green	$x 1.00 =$	15.00
30 Green	$x 1.00 =$	30.00
30 Yellow	$x 0.75 =$	22.50
30 Orange	$x 0.50 =$	15.00
30 Brown	$x 0.25 =$	7.50
30 Red	$x 0.00 =$	0.00
15 Default Red	$x 0.00 =$	0.00
15 Blue		
195 grid points		90.00 points

15 verification points were chosen for testing:

Verification												Score
1-10	GRID-point	R2 C-7	R2 C-3	R1 C-2	R4 C-4	R5 C1	R5 C4	R8 C-2	R6 C-7	R2 C6	R1 C3	
	Prediction											6
	Test result (HIC)	750	600	500	1200	1492	850	2000	1400	1112	660	
	Test result (pts)	0.75	0.75	1	0.5	0.5	0.75	0	0.25	0.5	1	6
11-20	GRID-point	R8 C0	R6 C7	R0 C-7	R9 C-6	R6 C1						
	Prediction											1.50
	Test result (HIC)	2000	1822	700	1544	1450						
	Test result (pts)	0	0.25	1	0.25	0.25						1.75
Correction factor											1.033	

$$\text{Correction Factor} = \frac{\text{Actual tested score}}{\text{Predicted score}} = \frac{6.00 + 1.75}{6.00 + 1.50} = 1.033$$

8 Blue zones were tested containing 15 blue points:

Blue points											Score
Blue	Blue Zone	1	2	3	4	5	6	7	8		
	GRID-point	12,7 12,6	12,5 12,4	12,3 12,2	12,1 12,0	12,-1 12,-2	12,-3 12,-4	12,-5 12,-6	12,-7		
	Test result (HIC)	1000	650	1700	1500	1700	1699	1350	1349		
	Test result (pts)	0.5	0.75	0	0.25	0	0.25	0.25	0.5		4.5

The final score will be:

<i>150 Predicted</i>	<i>75.00 x 1.033 = 77.475</i>
<i>15 Default Green</i>	<i>15.000</i>
<i>15 Default Red</i>	<i>0.000</i>
<i>15 Blue</i>	<i>4.500</i>
<i>195 grid points</i>	<i>96.975 points</i>

The score in terms of percentage of the maximum achievable score is 96.975/195 = 49.730%

The final headform score is 49.730% x 24 = **11.935 points**

1.3.2.3 Upper Legform

Each of the grid points can be awarded up to one point resulting in a maximum total of points equal to the number of grid points. A linear sliding scale is applied between the relevant limits of each parameter. The upper legform performance for each grid point is based upon the worst performing parameter.

The total score for the upper legform area will be calculated out of six by scaling the sum of grid points score by the relevant number of grid points.

Example:

For a vehicle that has 9 grid points and tests are performed to points U0, U-2 & U-4 with the following results:

Test result U0	Score	Total
Femur upper bending moment = 281.40Nm	1.000	
Femur middle bending moment = 342.60Nm	0.114 =>	0.114
Femur lower bending moment = 324.10Nm	0.398	
Femur sum of forces = 5.26kN	0.740	

Test result U-2	Score	Total
Femur upper bending moment = 395.81Nm	0.000	0.000
Femur middle bending moment = 467.69Nm	0.000	
Femur lower bending moment = 435.69Nm	0.000	
Femur sum of forces = 6.80kN	0.000	

Test result U-4	Score	Total
Femur upper bending moment = 152.00Nm	1.000	1.000
Femur middle bending moment = 208.00Nm	1.000	
Femur lower bending moment = 245.00Nm	1.000	
Femur sum of forces = 4.89kN	1.000	

Grid points that have not been tested will be awarded the worst result from one of the adjacent points. Given that U-1 and U-3 have not been tested, both will be awarded the result from the adjacent point U-2. Symmetry will also be applied to all grid points on the opposite side of the vehicle (U+1 to U+4).

U+4	U+3	U+2	U+1	U0	U-1	U-2	U-3	U-4
1.000	0.0	0.0	0.0	0.114	0.0	0.0	0.0	1.000

The score for each individual grid point is then summed, this produces a score in terms of the maximum achievable percentage of $2.114/9 = 23.488\%$

The final upper legform score is $23.488\% \times 6 = \mathbf{1.409 \text{ points}}$

1.3.2.4 Legform

Each of the grid points can be awarded up to one point resulting in a maximum total of points equal to the number of grid points. A linear sliding scale is applied between the relevant limits of each parameter. The one point per grid point is divided into two independent assessment areas of equal weight:

1. Tibia injury assessment based on the worst performing of tibia moments T1, T2, T3, T4 (0.500 point).
2. Knee injury assessment based upon MCL elongation, as long as ACL/PCL elongation is smaller than the threshold (0.500 point).

The total score for the legform area will be calculated out of six by scaling down the sum of grid points scores by the relevant number of grid points.

Example:

For a vehicle that has 11 grid points and tests are performed to points L1, L+3 & L+5 with the following results:

Test result L+1	Score		Total
Tibia bending moment = 280.00Nm	0.500	0.500	
ACL or PCL elongation = 10.00mm	Fail	} 0.000	0.500
MCL elongation = 15.00mm	0.500		
Test result L+3	Score		Total
Tibia bending moment = 320.00Nm	0.172	0.172	
ACL or PCL elongation = 9.50mm	Pass	} 0.250	0.422
MCL elongation = 20.50mm	0.250		
Test result L+5	Score		Total
Tibia bending moment = 340.00Nm	0.000	0.000	
ACL or PCL elongation = 10.00mm	Fail	0.000	0.000
MCL elongation = 19.00mm	0.000		

Grid points that have not been tested will be awarded the worst result from one of the adjacent points. Given that L0, L+2 & L+4 have not been tested, L0 will be awarded the score from L+1, L+2 will be awarded the score from L+3 and L+4 will be awarded the score from L+5. Symmetry will also be applied to the other side of the vehicle.

L+5	L+4	L+3	L+2	L+1	L0	L-1	L-2	L-3	L-4	L-5
0.0	0.0	0.422	0.422	0.500	0.500	0.500	0.422	0.422	0.0	0.0

The score for each individual grid point is then summed, this produces a score in terms of the maximum achievable percentage of $3.188/11 = 28.981\%$

The final upper legform score is $28.981\% \times 6 = \mathbf{1.739 \text{ points}}$

1.3.3 Visualisation of results

1.3.3.1 Headform results

The protection provided by each grid location is illustrated by a coloured area, on an outline of the front of the car. Where no grid is used in the assessment and the fallback scenario is adopted, the same 5 colour boundaries and HIC650 – HIC 1700 values will be applied. The headform performance boundaries are detailed below.

<i>Green</i>	$HIC_{15} < 650$
<i>Yellow</i>	$650 \leq HIC_{15} < 1000$
<i>Orange</i>	$1000 \leq HIC_{15} < 1350$
<i>Brown</i>	$1350 \leq HIC_{15} < 1700$
<i>Red</i>	$1700 \leq HIC_{15}$

1.3.3.2 Legform & upper legform results

The protection provided by each grid location is illustrated by a coloured point on an outline of the front of the car. The colour used is based on the points awarded for that test site (rounded to three decimal places), as follows:

<i>Green</i>	$grid\ point\ score = 1.000$
<i>Yellow</i>	$0.750 \leq grid\ point\ score < 1.000$
<i>Orange</i>	$0.500 \leq grid\ point\ score < 0.750$
<i>Brown</i>	$0.250 \leq grid\ point\ score < 0.500$
<i>Red</i>	$0.000 \leq grid\ point\ score < 0.250$

PART II

PEDESTRIAN AEB ASSESSMENT

1 ASSESSMENT OF AEB VULNERABLE ROAD USER SYSTEMS

1.1 Introduction

AEB Vulnerable Road User (VRU) systems are AEB systems that are designed to brake autonomously for pedestrian and/or cyclists. For the assessment of AEB VRU systems, two areas of assessment are considered; AEB Pedestrian and AEB Cyclists. Both are assessed in different scenarios.

1.2 Definitions

Throughout this protocol the following terms are used:

Autonomous Emergency Braking (AEB) – braking that is applied automatically by the vehicle in response to the detection of a likely collision to reduce the vehicle speed and potentially avoid the collision.

Forward Collision Warning (FCW) – an audiovisual warning that is provided automatically by the vehicle in response to the detection of a likely collision to alert the driver.

Autonomous Emergency Steering (AES) – steering that is applied automatically by the vehicle in response to the detection of a likely collision to steer the vehicle and potentially avoid the collision.

Emergency Steering Support (ESS) – a system that supports the driver steering input in response to the detection of a likely collision to alter the vehicle path and potentially avoid a collision.

Vehicle width – the widest point of the vehicle ignoring the rear-view mirrors, side marker lamps, tyre pressure indicators, direction indicator lamps, position lamps, flexible mud-guards and the deflected part of the tyre side-walls immediately above the point of contact with the ground.

Car-to-Pedestrian Farside Adult 50% (CPFA-50) – a collision in which a vehicle travels forwards towards an adult pedestrian crossing its path running from the farside and the frontal structure of the vehicle strikes the pedestrian at 50% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Nearside Adult 25% (CPNA-25) – a collision in which a vehicle travels forwards towards an adult pedestrian crossing its path walking from the nearside and the frontal structure of the vehicle strikes the pedestrian at 25% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Nearside Adult 75% (CPNA-75) – a collision in which a vehicle travels forwards towards an adult pedestrian crossing its path walking from the nearside and the frontal structure of the vehicle strikes the pedestrian at 75% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Nearside Child 50% (CPNC-50) – a collision in which a vehicle travels forwards towards a child pedestrian crossing its path running from behind and obstruction from the nearside and the frontal structure of the vehicle strikes the pedestrian at 50% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Longitudinal Adult 25% (CPLA-25) – a collision in which a vehicle travels forwards towards an adult pedestrian walking in the same direction in front of the vehicle where the vehicle strikes the pedestrian at 25% of the vehicle's width when no braking action is applied or an evasive steering action is initiated after an FCW.

Car-to-Pedestrian Longitudinal Adult 50% (CPLA-50) – a collision in which a vehicle travels forwards towards an adult pedestrian walking in the same direction in front of the vehicle where the vehicle strikes the pedestrian at 50% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Turning Adult 50% (CPTA-50) – a collision in which a vehicle turns towards an adult pedestrian crossing its path walking from the opposite direction at an intersection (before the VUT made the turn) and the frontal structure of the vehicle strikes the pedestrian at 50% of the vehicle's width when no braking action is applied.

Car-to-Pedestrian Reverse Adult 50% (CPRA-50) – a collision in which a vehicle travels rearwards towards an adult pedestrian crossing its path walking from the nearside and the rear structure of the vehicle strikes the pedestrian at 50% of the vehicle's width when the VUT continuous at constant speed.

Car-to-Pedestrian Reverse Adult stationary (CPRA-s) – a collision in which a vehicle travels rearwards towards an adult pedestrian standing still and the rear structure of the vehicle strikes the pedestrian at 25, 50 or 75% of the vehicle's width when the VUT continuous at constant speed.

Car-to-Bicyclist Nearside Adult 50% (CBNA-50) – a collision in which a vehicle travels forwards towards a bicyclist crossing its path cycling from the nearside and the frontal structure of the vehicle strikes the bicyclist when no braking action is applied.

Car-to-Bicyclist Nearside Adult Obstructed 50% (CBNAO-50) – a collision in which a vehicle travels forwards towards a bicyclist crossing its path cycling from the nearside from behind an obstruction and the frontal structure of the vehicle strikes the bicyclist at 50% of the vehicle's width when no braking action is applied.

Car-to-Bicyclist Farside Adult 50% (CBFA-50) – a collision in which a vehicle travels forwards towards a bicyclist crossing its path cycling from the farside and the frontal structure of the vehicle strikes the bicyclist at 50% of the vehicle's width when no braking action is applied.

Car-to-Bicyclist Longitudinal Adult 25% (CBLA-25) – a collision in which a vehicle travels forwards towards a bicyclist cycling in the same direction in front of the vehicle where the vehicle would strike the cyclist at 25% of the vehicle's width when no braking action is applied or an evasive steering action is initiated after an FCW.

Car-to-Bicyclist Longitudinal Adult 50% (CBLA-50) – a collision in which a vehicle travels forwards towards a bicyclist cycling in the same direction in front of the vehicle where the vehicle would strike the cyclist at 50% of the vehicle's width when no braking action is applied.

Vehicle under test (VUT) – means the vehicle tested according to this protocol with a pre-crash collision mitigation or avoidance system on board

Euro NCAP Pedestrian Target (EPTa) – means the adult pedestrian target used in this protocol as specified in the [Articulated Pedestrian Target Specification document version 2.0](#).

Euro NCAP Child Target (EPTc) – means the child pedestrian target used in this protocol as specified in the [Articulated Pedestrian Target Specification document version 2.0](#).

Euro NCAP Bicyclist and bike Target (EBT) – means the bicyclist and bike target used in this protocol as specified in the [Bicyclist Target Specification document version 1.0](#).

Time To Collision (TTC) – means the remaining time before the VUT strikes the EPT, assuming that the VUT and EPT would continue to travel with the speed it is travelling.

T_{AEB} – means the time where the AEB system activates. Activation time is determined by identifying the last data point where the filtered acceleration signal is below -1 m/s^2 , and then going back to the point in time where the acceleration first crossed -0.3 m/s^2

T_{FCW} – means the time where the audible warning of the FCW starts. The starting point is determined by audible recognition.

V_{impact} – means the speed at which the profiled line around the front end of the VUT coincides with the square box around the EPTa, EPTc and EBT.

1.3 Criteria and Scoring

To be eligible for scoring points in AEB Pedestrian or AEB Cyclist, the AEB system must be default ON at the start of every journey. It may not be possible to switch off the system with a momentary single push on a button.

For AEB Pedestrian, the system needs to operate (i.e. warn or brake) from speeds of 10 km/h in the CPNA-75 scenario in both day and night. In addition, the system must be able to detect pedestrians walking as slow as 3 km/h and reduce speed in the CPNA-75 scenario at 20 km/h, also for both day and night.

For both AEB Pedestrian as for AEB Bicyclists, the system may also not automatically switch off at a speed below 80 km/h.

The total score is conditional to the subsystem test score, see section 1.4.

1.3.1 Autonomous Emergency Braking (AEB)

For the AEB system tests (except for CPTA and CPRA), the assessment criteria used is the (relative) impact speed. For test speeds up to 40 km/h, the available points per test speed are awarded based on the relative speed reduction achieved. Where there is no full avoidance a linear interpolation is applied to calculate the score for every single test speed.

$$Score_{test\ speed} = ((V_{rel_test} - V_{rel_impact}) / V_{rel_test}) \times points_{test\ speed}$$

Where:

V_{rel_test} Theoretical relative test speed

V_{rel_impact} Measured relative impact speed

For test speeds above 40km/h points are available on a pass/fail basis. For each of these test speeds points are awarded when a speed reduction of at least 20 km/h is achieved related to the actual measured test speed.

For CPTA and CPRA tests, points are awarded on a pass/fail basis based on full avoidance for each test speed. For CPRA-s this means that for all three overlaps need to be avoided per test speed to be assessed as a pass.

Additionally, for CPRA the system may not release the brakes after an intervention, unless the threat (EPT) has left the vehicle path or in case of a positive action by the driver.

1.3.2 Forward Collision Warning (FCW)

For the FCW system tests in the longitudinal scenarios, the assessment criteria used is the Time-To-Collision (TTC). The available points per test speed are awarded when the warning is issued at a $TTC \geq 1.70s$.

Alternatively, when the FCW issued at a $TTC < 1.70s$ in the CPLA-25 and CBLA-25 scenarios, the manufacturer has the option to demonstrate to Euro NCAP that their ESS system will provide the appropriate support to avoid the collision by steering to have the available points awarded.

1.4 Scoring and Visualisation

AEB VRU scoring is conditional to the total points achieved in subsystem tests, i.e. the sum of pedestrian Headform, Upper Legform & Lower Legform scores:

- If the subsystem total test score is lower than 22 points, no points are available for AEB VRU, regardless whether the system is fitted and would achieve a good score.

1.4.1 AEB Pedestrian

A maximum of 9 points is available for AEB Pedestrian, 6 points for daytime performance (all scenarios) and 3 points for performance at night conditions (CPNA-25, CPNA-75, CPLA-25 and CPLA-50).

For each scenario a normalised score is calculated and multiplied with the available points for that specific scenario.

The following points are available for the different test speeds in each AEB Pedestrian scenario for both day and night conditions:

Test speed	Daytime										Nighttime				
	CPFA		CPNA		CPNC	CPLA		CPTA		CPRA		CPNA		CPLA	
	50%	25%	75%	50%	50%	25%	Farside	Nearside	Stationary	Moving	25%	75%	50%	25%	
4 km/h									1.000	1.000					
8 km/h									1.000	1.000					
10 km/h	1.000	1.000	1.000	1.000			1.000	1.000			1.000	1.000			
15 km/h	1.000	1.000	1.000	1.000			1.000				1.000	1.000			
20 km/h	1.000	1.000	1.000	1.000	1.000		1.000				1.000	1.000	1.000		
25 km/h	1.000	1.000	1.000	1.000	1.000						1.000	1.000	1.000		
30 km/h	2.000	2.000	2.000	2.000	1.000						1.000	1.000	1.000		
35 km/h	3.000	3.000	3.000	3.000	2.000						2.000	2.000	2.000		
40 km/h	3.000	3.000	3.000	3.000	2.000						2.000	2.000	2.000		
45 km/h	3.000	3.000	3.000	3.000	3.000						3.000	3.000	3.000		
50 km/h	2.000	2.000	2.000	2.000	3.000	3.000					3.000	3.000	3.000	3.000	
55 km/h	2.000	2.000	2.000	2.000	3.000	3.000					3.000	3.000	3.000	3.000	3.000
60 km/h	1.000	1.000	1.000	1.000	2.000	2.000					2.000	2.000	2.000	2.000	
65 km/h						1.000									1.000
70 km/h						1.000									1.000
75 km/h						1.000									1.000
80 km/h						1.000									1.000
TOTAL	20.000	20.000	20.000	20.000	30.000	4.000	2.000	2.000	20.000	20.000	30.000				
Scenario points	0.500	0.250	0.250	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

1.4.1.1 AEB Pedestrian Scoring Example

AEB Pedestrian	Daytime			Night-time		
	Points	Percentage	Score	Points	Percentage	Score
CPFA	20.000	100%	0.500			
CPNA	39.120	97.8%	0.489	30.440	98.6%	1.972
CPNC	8.420	42.1%	0.421			
CPLA	25.824	80.7%	0.807	25.824	80.7%	0.807
CPTA	3.000	75%	0.750			
CPRA	2.000	50%	1.000			
TOTAL	3.967			2.779		
	6.746					

1.4.2 AEB Cyclist

A maximum of 9 points is available for AEB Cyclist. For each scenario a normalised score is calculated and multiplied with the available points for that specific scenario.

The following points are available for the different test speeds in each AEB Pedestrian scenario:

Test speed	CBFA	CBNA	CBNAO	CBLA	
10 km/h	1.000	1.000	1.000		
15 km/h	1.000	1.000	1.000		
20 km/h	1.000	1.000	1.000		
25 km/h	1.000	1.000	1.000	1.000	
30 km/h	1.000	1.000	1.000	1.000	
35 km/h	1.000	1.000	1.000	2.000	
40 km/h	1.000	1.000	1.000	2.000	
45 km/h	1.000	1.000	1.000	3.000	
50 km/h	1.000	1.000	1.000	3.000	3.000
55 km/h	1.000	1.000	1.000	3.000	3.000
60 km/h	1.000	1.000	1.000	1.000	1.000
65 km/h					1.000
70 km/h					1.000
75 km/h					1.000
80 km/h					1.000
TOTAL	11.000	11.000	11.000	27.000	
Scenario points	3.000	1.500	1.500	3.000	

1.4.2.1 AEB Cyclist Scoring example

AEB Bicyclist	Daytime		
	Points	Percentage	Score
CBFA	6.562	59.7%	1.791
CBNA	11.000	100.0%	1.500
CBNAO	5.779	52.5%	0.788
CBLA	27.000	100%	3.000
TOTAL	7.079		

1.4.3 Visualisation

The AEB Pedestrian and AEB Cyclist scores are presented separately using a coloured top view of the different scenarios; crossing and longitudinal (where applicable). The colours used are based on the scenario scores respectively, rounded to three decimal places.

Colour	Verdict	Applied to Total Score	Applied to Scenario
<i>Green</i>	<i>'Good'</i>	<i>6.751 - 9.000 points</i>	<i>75.0% - 100.0%</i>
<i>Yellow</i>	<i>'Adequate'</i>	<i>4.501 - 6.750 points</i>	<i>50.0% - 75.0%</i>
<i>Orange</i>	<i>'Marginal'</i>	<i>2.251 - 4.500 points</i>	<i>25.0% - 50.0%</i>
<i>Brown</i>	<i>'Weak'</i>	<i>0.001 - 2.250 points</i>	<i>00.0% - 25.0%</i>
<i>Red</i>	<i>'Poor'</i>	<i>0.000 points</i>	<i>00.0%</i>