C-NCAP MANAGEMENT REGULATION

(2021 EDITION)

China Automotive Technology and Research Center Co.,Ltd.

TABLE OF CONTENTS

FOREWORD.....3

CHAPTER I GENERAL PROVISIONS.....6

1 OBJECTIVES.....6

2 MANAGEMENT BODY.....7

3 C-NCAP TEST ITEMS.....7

4 ASSESSMENT RESULTS.....11

5 DESIGNATED WEBSITE AND MEDIA.....11

6 C-NCAP'S EXCLUSIVE LABEL.....11

7 STATEMENT.....12

CHAPTER II OPERATION MANAGEMENT.....13

1 SELECTION OF VEHICLE TYPES FOR ASSESSMENT.....13

2 VEHICLE AND SPARE PARTS PURCHASING.....13

3 TESTS.....13

4 RELEASE OF ASSESSMENT RESULTS.....16

5 FUNDS.....17

6 MANAGEMENT OF THIRD-PARTY PERSONNEL AND RELATED AFFAIRS DURING TEST.....17

7 COMPLAINTS OVER THE RESULTS AND THE SOLUTION.....18

8 PROCESSING OF POST-TEST VEHICLES.....18

9 USE OF C-NCAP ASSESSMENT RESULTS AND RELATED SIGNS.....18

10 TECHNOLOGICAL COMMUNICATION.....18

11 COMMUNICATION AND PUBLIC PROPAGANDA ACTIVITIES.....19

CHAPTER III ASSESSMENT PROCEDURES.....20

1 OCCUPANT PROTECTION.....20

1.1 Test items.....20

1.2 Performance criteria and scoring method.....23

2 PEDESTRIAN PROTECTION.....74

2.1 Test items.....74

2.2 Performance criteria and scoring method.....75

3 ACTIVE SAFETY.....79

3.1 Test items.....79

3.2 Performance criteria and scoring method.....89

4 SCORING AND RATING.....107

4.1 Score rate calculation formula of occupant protection.....108

4.2 Score rate calculation formula of pedestrian protection..... 108
4.3 Score rate calculation formula of active safety..... 108
4.4 Overall scoring rate calculation formula..... 108

ANNEX 1..... 110

ANNEX 2..... 113

ANNEX 3-1..... 114

ANNEX 3-2..... 118

ANNEX 3-3..... 123

ANNEX 3-4..... 131

ANNEX 4..... 132

ANNEX 5..... 133

ANNEX 6..... 134

ANNEX 7..... 135

FOREWORD

Starting from 1979 when USA adopted NCAP system - New Car Assessment Programme, the safety of vehicle is gradually accepted by consumers. Various countries/districts have launched NCAP rating for more than 40 years. In 2006, in order to promote the rapid development of China's automobile product safety technology level, to reduce the rate of casualties in road traffic accidents and to achieve the goal of building a harmonious automobile society, taking fully consideration of China road traffic situation and combination of China vehicle standards, technology and economy development level, CATARC officially established C-NCAP (China New Car Assessment Program).

In NCAP system, test method is as same as the one used in regulation approval test, but with more and stricter test items. Taking example, quantization test in NCAP includes head injury, thorax reflection and thigh axial force, as well as neck, abdomen, pelvis, knee, lower leg, foot and ankle. Meanwhile, for making up the shortage of bio-mechanics, NCAP also tests the deformation of body, occupant compartment and steering system, to evaluate the possible causes of occupants' injury. More importantly, NCAP has a set of mature safety assessment methods, converting the determination of "pass" and "fail" for the regular test into the perceivable and qualified star rating assessment. Due to the wide influence, strict standard, normative tests, justice, direct result release to customers and reflection on the actual safety situation the vehicle, NCAP attaches attention of all main auto manufacturers, who take it as key evaluation reference for vehicle R&D. Manufacturers who obtain good rating in NCAP test, take the test result as the promotion for market launch.

Experiences prove that NCAP does improve auto safety and road traffic safety. For ten years of C- NCAP implementation, the safety technology of local vehicles and assessment scoring are increasingly upgraded, fitment ratios of safety devices significantly increase, large numbers of Chinese consumers use safer car products and access safer driving experience, it has a significant effect to improve China's road traffic safety situation. Following the further research and implementation of C-NCAP, CATARC has optimized and enhanced "C-NCAP Management Protocol" for several times, and C-NCAP has experienced updates of 2006 edition, 2009 edition, 2012 edition, 2015 edition and 2018 edition. Nowadays, vehicle passive safety technology is increasingly refined, and active safety technology has entered a leap forward stage of development. The integration of passive safety and active safety technology will constitute a comprehensive safety protection system for vehicle occupants and vulnerable road users. At the same time, with the research on road traffic accidents in China, the research on fundamental data in China's automobile market, and the in depth of a series work of international cutting-edge automobile test technologies etc., C-NCAP make updates based on original crash tests: frontal 50% overlapping car to car crash test is added to promote the harmonious traffic environment of big cars and small cars through compatibility assessment; side pole test is introduced to strengthen crash safety assessment of battery system of electric vehicles; seat whiplash test is extended to the second row of occupant protection; child protection assessment item is added; seat belt reminder device is changed as a penalty item from a bonus item; aiming at the high incidence of accidents of vulnerable groups in China's road traffic, not only the pedestrian protection test is integrated with protection of two wheelers,

but also Automated emergency braking(AEB) has included tests of two wheelers; assessment of the headlamp performance is added, which is closely related to driving safety; and more and more advanced driving assistance systems have become part of the assessment.

Compared with 'C-NCAP management protocol (2018 edition)', main updates of 'C-NACP management protocol (2021 edition)' is as followings:

OCCUPANT SAFETY:

- Adopt the test and assessment method of 50% overlap MPDB test, instead of 40% overlap ODB test;
- For new energy vehicle, test and assessment method of side pole crash test is added, instead of AEMDB test;
- Add assessment requirement of vehicle body and components in terms of crash safety risk, with the modifiers;
- Increase numbers of on board dummies in AEMDB side crash;
- Add test and assessment method of outward passenger whiplash test in second row;
- Add assessment method of 2nd row child protection and static assessment method of child passengers;
- Revise technical requirements of side curtain airbag;
- Add technical requirements of accident emergency call system as bonus points;
- Seat belt reminder device is revised as penalty item, instead of bonus item;
- Revise assessment method of electric safety in occupant safety crash tests.

PEDESTRIAN PROTECTION:

- Revise test and assessment method of pedestrian protection, adopt advanced pedestrian legform impactor(aPLI), instead of traditional FLEX-PLI and TRL upper legform;
- Extend test area of headform test in pedestrian protection.

ACTIVE SAFETY:

- Add test scenario of Automated emergency braking(AEB);
- Add test and assessment method of lane keeping assist (LKA);
- Add checking item technical requirement of lane departure warning(LDW), blind spot detection system(BSD), speed assisted system(SAS);
- Add test and assessment method of Vehicle-level headlamp performance.
- Revise the scoring system. Active safety part weight is increased to 25% from 15%.

C-NCAP management protocol (2021 edition)' will take into implementation since Jan 1st, 2022.

Need of special note is, in Chapter 3, 2.2.2 in terms of assessment of legform test, the criteria threshold of aPLI is set referring SBL-B version. In Annex B, the upcoming revised final version of aPLI has to be followed to update technical standards of aPLI legform, calibration technical requirements and test technology etc.

Due to the different edition of management regulation, there are the discrepancy of test method and items, so the final evaluation results are not comparable. Therefore, It has to be clarified regarding the edition and date of the test and results when using C-NCAP test result, to avoid any negative impact caused by wrong quotation of C-NCAP results.

In the future, the car will continuously move from "zero death" to "zero casualties", and then to reach the ultimate goal of "zero accident". With the continuous development of vehicle safety technology, car safety will eventually enter a new realm. C-NCAP will continue to lead the Chinese automotive safety technology to achieve new goals. We would like to thank all relevant governmental and industry organizations, domestic and foreign enterprises and professional organizations, and news media for their supports and cooperation in the development of C-NCAP. We hope to get the long-term support and help from all of you in future.

CATARC co.,ltd.

Aug 2020

CHAPTER I GENERAL PROVISIONS

1 OBJECTIVES

1.1 Purposes

1.1.1 C-NCAP aims at establishing high standard, fair and impartial methods for assessing vehicle safety performance under impact, so as to promote the development of vehicle technologies in pursuit of a higher concept for safety. The intention of the program is to provide consumers with safety information concerning the newly marketed vehicles, encourage the manufacturers to attach higher importance to safety standards, improve the safety performance and technical standards of the vehicles while giving publicity by means of the assessment process to the vehicles that excel in occupant protection.

1.1.2 These assessment procedures are to be progressively enhanced based on vehicle technology development and in depth study on China road traffic situation.

1.2 Notes

(1) No stylized test procedure can fully reflect the protection provided by a vehicle in the wide variety of accidents which occur on the roads. The methods provided by C-NCAP for assessing and rating the vehicles' safety performance in qualitative and quantitative terms can reflect the vehicle's safety performance to certain extent only.

(2) No anthropometrical dummies are available which can measure all potential risks of injury to humans or assess protection for different sizes of occupant in different seating positions.

(3) 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) The manufacturers of the vehicles are required to compare the results of the C-NCAP tests with those of their own tests that may have been conducted, and to report any anomalies that they have found together with the enterprises' own test results for comparison. Such data will not be taken as a basis for rating the vehicles and will be 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.

(4) The requirements of the national standards were set to provide the lowest level of protection only. For car occupants, these limits are too lenient to adequately identify the best practice in current car production and to provide a goal for further improvement. Therefore, by referencing to the NCAP data available overseas, more demanding limits have been set to identify aspects of a car's performance which offer significantly greater protection.

2 MANAGEMENT BODY

China Automotive Technology and Research Center Co.,Ltd.(CATARC) is the administration body of C-NCAP(hereinafter referred to Administration Center), in charge of the organizing and implementation affairs regarding to C-NCAP, including determining the annual plan, selecting the vehicle model to be assessed, reviewing the assessment results, handling disputes and confusions and determining on other incidental issues. The management center consists of General Administration Group, Brand Promotion Department, Test Management Department and Technical Management Department, each department has the following functions:

General Administration Group: Determining annual implementation plan and financial budget; analyzing and determining vehicle models to be assessed; responsible for communication with consumers; responsible for daily contact with enterprises and exchange events, etc.

Brand Promotion Department: Organizing release of results; organizing various events; launch public popularization for science; responsible for brand management, official platform operation, etc.

Test Administration Department: Arranging test purchase, management and disposal; responsible for test vehicle bulletin, plan, procedure supervision, special issue handling; calculating test results as per test data; coordinating test resource and process, etc.

Technology Administration Department: Organizing research on evaluation procedure and technical roadmap; organizing research on assessment in various section, technology evaluation and revision for assessment procedure; responsible for technology exchange with expertise domestic and aboard, etc.

In addition, a C-NCAP Consultant Committee is established, which will be mainly responsible for putting forward suggestions and opinions concerning the technical requirements and operations of C-NCAP. The members of the Consultant Committee will consist of: experts and scholars from vehicle enterprises, institutions of higher learning, research institutes, and governmental authorities and their agencies, consumer organizations and media representatives, etc.

3 C-NCAP TEST ITEMS

This version of the C-NCAP evaluation test is divided into three parts:

1) Occupant protection, including crash tests, child protection static assessment and low-speed rear-impact neck protection test ("whiplash test"). For conventional vehicles, crash tests include frontal 100% overlap rigid barrier impact test, frontal 50% overlap moveable progressive deformable barrier impact test and mobile deformable barrier test, in total 3 tests. For new energy vehicles (including pure battery and plug-in hybrid vehicles), crash tests include frontal 100% overlap rigid barrier impact test, frontal 50% overlap moveable progressive deformable barrier impact test and side pole crash test, in total 3 tests.

2) Pedestrian protection, including headform and legform tests.

3)Active safety, including the Automated emergency braking (AEB), lane keeping assist (LKA), vehicle-level headlamp tests, and checking items of electronic stability control system (ESC) , lane departure warning (LDW), blind spot detection system, speed assist system(SAS).

3.1 Occupant protection

3.1.1 Crash tests

3.1.1.1 Frontal impact test against rigid barrier with 100% overlapping

The test shall be conducted such that the test vehicle frontally crashes against a fixed rigid barrier with 100% overlapping at an impact speed of 50_{0}^{+1} km/h (test speed not lower than 50km/h). The test vehicle approaches the barrier in a route that does not deviate sideways from the theoretical trail by 150mm in either transverse direction. Place a Hybrid III 50 percentile male dummy in the driver's seat and occupant seat respectively in the front row, to measure the injuries to the front seat occupants. Place a Hybrid III 5 percentile female dummy on one side of the second row; and place a child restraint system and a Q-series dummy representing a 3-years-old child on the other side, so as to measure the injuries suffered by the second-row occupants. Under the permission conditions, Hybrid III 5% female dummy and 3 year-old dummy should be put randomly left or right. Please refer to Appendix A.1 for detailed test method.

3.1.1.2 Frontal 50% overlap moveable progressive deformable barrier crash test

Test vehicle impacts with moveable progressive deformable barrier (MPDB) at respectively 50_{-1}^{+1} km/h with 50% overlap. The overlap range between test vehicle and progressive barrier should be controlled at 50% of vehicle width ±25mm. A THOR 50th male dummy and Hybrid III 5th female dummy are placed in front row driver side and passenger side respectively, to measure injury situation of front row. A Hybrid III 5th female dummy is placed at most left side seat of the second row; A CRS and Q10 dummy are placed at the most right side seat of the second row, to measure injury situation of second row passenger. Check appendix A.2 for detailed test method.

3.1.1.3 Side impact test against mobile deformable barrier

The trolley fitted with a deformable barrier at front end to impact against left or right side of test vehicle randomly. The mobile barrier is to move in a direction perpendicular to the test vehicle, with the center line of the barrier aligned with the position 250mm rearwards from the R point of the test vehicle, and the impact speed shall be 50_{0}^{+1} km/h (test speed no lower than 50km/h). The longitudinal perpendicular plane of the mobile barrier shall be within ±25mm from the transverse vertical plane that passes the position 250mm rearwards from the R point of the front row seat on the test vehicle's impact side. A WorldSID 50th dummy and a SID-IIs (version D) are placed at front row and second row at impact side, to measure and evaluate injury situation of impact side. An ES-2 dummy is placed in passenger position of front row, to collect crash data of the occupant. No assessment for currently. Refer to appendix A.4 for test method.

3.1.1.4 Side pole crash test(New Energy Vehicle Test Item)

Slide or drive vehicle transversely against a rigid pole, to result impact between vehicle driver side and the rigid pole. The angle between vertical plane against vehicle moving vector and vehicle longitudinal centerline is formulated 75°±3°. Center line of rigid pole surface should be aligned with the intersection line of the exterior surface of the vehicle and a vertical plane passing through the center of gravity of the head of the dummy (impact reference line), and it should be in range ±25mm from the impact reference line in the vertical plane of vehicle moving direction. Vehicle impact speed is $32^{+0.5}_{-0.5}$ km/h, and the speed should stay stable before at least 0.5m before impact. A WorldSID 50th dummy is placed in driver side front row, to measure occupant injury situation. Refer to appendix A.5 for test method.

3.1.2 Static assessment of child protection

There are 2 parts of child protection static assessment: evaluation based on vehicle and checking of CRS installation. C-NCAP test engineers will evaluate compatibility, applicability etc. of vehicle child protection according to appendix A.7. Refer to A.7 for test method.

3.1.3 Neck protection test in low-speed rear impact (hereinafter "whiplash test")

By simulating the original vehicle structure, install the driver's seat of test vehicle together with the restraint system onto the movable sled. The sled is launched by the special acceleration waveform having the speed variation at (20.0±1.0) km/h, so as to simulate the rear impact process. Place a BioRID II dummy on the seat; through measuring the neck injuries resulted from the rear impact, assess the protection performance of the vehicle seat head restraint in favor of the occupant neck. The test method of second row is the same as front row. Place a BioRID II dummy in left or right position of the second row randomly, to evaluate the protection performance of seat headrest of second row against occupant neck through measurement of neck injury of rear impact. Refer to appendix A.8 for test method.

3.2 Pedestrian protection

The adult headform and the child headform impact vehicle specific parts respectively at $40^{+0.72}_{-0.72}$ km/h speed according to the specified impact angle. Comprehensive scoring will be conducted based on HIC15 values of headform each time. aPLI legform impactor impacts vehicle bumper with $40^{+0.72}_{-0.72}$ km/h at specified angle. Comprehensive scoring will be conducted based on criteria, such as leg bending moment and elongation of knee ligaments etc. Headform test and legform test are used to evaluate the protection performance of vehicle front against pedestrians. Refer to appendix B for pedestrian protection test method.

3.3 Active safety

3.3.1 Advanced driving assisted system (ADAS)

3.3.1.1 Automated emergency braking system (AEB) performance test

AEB system will brake automatically in case of emergency situation to avoid or

mitigate impact injuries. For vehicles configured with AEB system, AEB CCR, AEB VRU-Ped and AEB VRU_TW will be tested. Vehicle under test in driven at different speeds towards simulated vehicle targets, pedestrian targets and two wheeler targets in the test of AEB CCR, AEB VRU_Ped and AEB VRU_TW, to test braking and warning situation without human being's intervene, so as to check the performance of AEB system. Refer to appendix C for test method.

3.3.1.2 Lane keeping assist system (LKA) performance test

LKA will intervene automatically for lateral movement control when it detects vehicle departure from driving lane markings, to keep vehicle driving in the original lane. For vehicles configured with LKA system, scenario with solid marking and dotted marking will be conducted respectively. Refer to appendix C for test method.

3.3.1.3 Performance test report audit of electronic stability control system (ESC)

ESC system has a significant effect to ensure vehicle driving stability. For vehicles equipped with electronic stability control system (ESC), performance test report should be audited to determine whether these systems have the required performance. Vehicle manufacturer should provide the report by qualified third-party testing organizations issued on the model to meet the relevant requirements of the performance tests on the vehicle. Check chapter 3.2.1.1 for details.

3.3.1.4 Performance test report audit of blind spot detection (BSD)

BSD system monitors vision blind area of drivers, and warns driver when there are other road users in vision blind area. For vehicles configured with BSD system, performance test report should be audited to determine whether these systems have the required performance. Vehicle manufacturer should provide the report by qualified third-party testing organizations issued on the model to meet the relevant requirements of the performance tests on the vehicle. Check chapter 3.2.1.1 for details.

3.3.1.5 Performance test report audit of lane departure warning (LDW)

LDW system warns driver when it detects vehicle departure from its driving lane marking. For vehicles configured with LDW system, performance test report should be audited to determine whether these systems have the required performance. Vehicle manufacturer should provide the report by qualified third-party testing organizations issued on the model to meet the relevant requirements of the performance tests on the vehicle. Check chapter 3.2.1.1 for details.

3.3.1.6 Performance test report audit of speed assist system (SAS)

SAS system could detect road speed sign and indicate driver. It could give warning of speeding up according to speed limit information and intervene speed control proactively, to ensure vehicle speed kept in highest allowed limited speed. For vehicles configured with SAS system, performance test report should be audited to determine whether these systems have the required performance. Vehicle manufacturer should provide the report by qualified third-party testing organizations issued on the model to meet the relevant requirements of the performance tests on the

vehicle. Check chapter 3.2.1.1 for details.

3.3.2 Vehicle-level vehicle headlamp performance test

Vehicle-level headlamp performance test includes low beam and high beam test in total vehicle level. The tested and evaluated criteria include: straight lane/curve lane guiding distance, left side pedestrian visibility, pedestrian detection width of cross road, curve lane illumination width and glare of opposite driver for low beam; illumination scope, pedestrian detection width of cross road etc. for high beam. Refer to appendix D for test method.

4 ASSESSMENT RESULTS

C-NCAP evaluates the star ratings based on the overall scoring ratios of occupant protection, pedestrian protection and active safety. The scoring ratios of three parts of occupant protection, pedestrian protection and active safety are calculated respectively according to evaluation tests, and then respectively multiply the weight coefficients of three parts. The sum of each scoring ratios is the overall points.

The star rating is defined by the overall scoring ratio (check table 1.1 for details). In addition to the overall scoring ratio requirements, the occupant protection, pedestrian protection and active safety of the three parts must also meet the minimum scoring ratio requirements (See chapter. III, Article. 4)

Vehicles meeting electrical safety requirements, will be identified by the electrical safety mark separately, in addition to the published star rating.

Table 1.1 overall scoring ratio and star rating

Overall scoring ratio	Star rating
≥92%	5+ (★★★★★☆)
≥83% and <92%	5 (★★★★★)
≥74% and <83%	4 (★★★★)
≥65% and <74%	3 (★★★)
≥45% and <65%	2 (★★)
<45%	1 (★)

5 DESIGNATED WEBSITE AND MEDIA

The website www.c-ncap.org and the magazine “World Auto” (monthly) will be C-NCAP Management Center’s designated media for releasing C-NCAP information and test results. The website www.c-ncap.org will focus on introducing the C-NCAP organization, its work procedures, latest developments and test results etc. It will also have a media service area for other forms of media to download information about test result comments. The “World Auto” carries information about C-NCAP operations and detailed reports on the assessment results in the form of dedicated columns and special issues, which are not to be quoted without permission.

6 C-NCAP’S EXCLUSIVE LABEL

C-NCAP has applied and registered the following lettering and label for its exclusive use:

7 STATEMENT

C-NCAP is China's New Car Assessment Program developed by China Automotive Technology and Research Center Co.,Ltd.(CATARC), which reserves all rights over C-CNAP. No institution is allowed to conduct C-NCAP based tests or assessments on vehicles for publicity or commercial purposes without permission by CATARC, except for the technology development test by enterprises themselves.

The test results, scores and star ratings granted are applicable only to the type of vehicle (same model and configurations) used for the test. Any party applying the C-NCAP assessment results shall be responsible for their trueness, completeness and correctness.

CHAPTER II OPERATION MANAGEMENT

1 SELECTION OF VEHICLE TYPES FOR ASSESSMENT

1.1 Selection principle

1.1.1 The vehicles to be assessed shall be passenger cars (Category M1 vehicles) newly marketed within the recent two years, and the sales volume of this vehicle model shall exceed 3,000 units (Except new energy vehicles and hot models), which is selected by management center as per market performance.

1.1.2 Hot model refers to vehicle types launched on market within 6 months and with high attention from the customers, based on open vote.

1.1.3 The vehicles to be assessed shall not be scheduled for end-of-production in near future;

1.2 Identifying procedure

1.2.1 The Administration Center determines one batch of candidate vehicle types as per Principle in 1.1.

1.2.2 The manufacturer will be informed of the candidate vehicle types and will provide technical information of the vehicle type. (see Annex 1)

1.2.3 Upon receipt of the manufacturer's feedback information, the Administration Center will finalize the vehicle types to be assessed, and determine the version with larger sales configuration.

2 VEHICLE AND SPARE PARTS PURCHASING

After determining the evaluation model and its configuration, the C-NCAP Administration Center, based on the principle of random sampling, purchases all the testing vehicles and the correspondent seats for Whiplash test, as well as the required hood and front bumper and other parts for pedestrian protection test from the dealer without beforehand informing the relevant manufacturers such purchase. The process of purchase is under supervision of the media and customers.

After purchase, the vehicle models and the configuration to be tested will be publicized on the official platform, and the manufacturers will be informed with notification letter.

3 TESTS

3.1 Test performing notice

After the vehicle and spare parts are purchased, test date will be determined by administration center. 10 to 15 working days prior to the test, a C-NCAP Test Performing Notice (see Annex 2) will be delivered to the manufacturer stating the vehicle type to be tested, its configuration, test items, and test date, etc.

3.2 Preparation of test

3.2.1 Within 5 workdays after receipt of the Test Performing Notice, the manufacturer shall provide the Administration Center with a table of basic information and parameters of the test vehicle (check Annex 3).

3.2.2 All preparations before the active safety ADAS test, including test vehicle preparation, vehicle running- in, test equipment installation, test equipment calibration and so on, shall be conducted by professional testing staff from Test Administration Department. The technical staff of the manufacturer can observe the preparation of the test and confirm the necessary parameters within the specified time, but shall not carry out any operation on the vehicles and testing equipment.

3.2.3 All the preparation work before the vehicle light performance test includes vehicle running-in, vehicle cleaning, confirmation of the quality of the vehicle, inspection and confirmation of vehicle parameters before the test, counterweight and immerse vehicle, the preparation work is organized by the technicians of Test Administration Department to operate. The technicians of manufactures may watch the preparation of the test within the specified time and confirm the necessary parameters, but shall not perform any operations on the headlight samples and equipment. For headlamps with adaptive low beam, adaptive high beam function, low beam automatic light-on function and automatic headlamp leveling system, the enterprise shall provide relevant technical descriptions and provide corresponding technical support if necessary.

3.2.4 All the preparations before the pedestrian protection test, including confirmation of the normal driving height, testing area of head and leg tests, grid position of the head impactor, head impactor prediction results, the test sample consistency and the proving material of active hood system shall be conducted by professional testing staff from the Test Administration Department. The manufacturer shall provide adequate technical support and information, including but not limited to the following information: the head test prediction results, active hood working principle and working status parameters. Technicians of the manufacturer can observe the preparation of the test and confirm the necessary parameters within the specified time, but shall not carry out any operation on the vehicles and testing equipment.

3.2.5 All pre-test preparation including the preparation of the vehicle, adjustment of the occupant compartment, calibration of the dummy, positioning and measuring of the dummy, and preparation of test equipment will be performed by professional test personnel arranged by the Test Administration Department. Technicians of the manufacturer may, within the specified time limit, view the test preparations, and verify the necessary parameters; provided, however, no manipulation is allowed as to the equipment/apparatus, including vehicle, test dummies, etc.

3.2.6 All the preparations necessary for the whiplash test (including preparation of seat fixture, seat adjustment and measurement, dummy certification, dummy placement and measurement, preparation of test equipment, etc.) shall be unfolded by the professional test staff engaged by the Test Administration Dept. Manufacturer shall provide second-row seat test tooling and furnish adequate technical supports, e.g., installation parameters of seat track and others, lead wire for supply coupler of power seat and its definition, special properties such as setting of the memory module, lead

wire for the triggering line of seat proactive head restraint and its definition, etc.). Technical professional of manufacturer may, within the prescribed time span, view the test preparations, and verify the necessary parameters; provided, however, no manipulation is allowed to the vehicle, dummy under test or other instrumentation/equipment.

3.3 Testing execution

Tests and data processing shall be carried out by the test professionals according to the operating procedures. Technical personnel of the manufacturer and representatives of the media, group and organizations who have interest may view the test process.

3.4 Reviewing the assessment results

Administration Center will review and summarize the C-NCAP test results regularly, on which basis the information to be released will be determined.

4 RELEASE OF ASSESSMENT RESULTS

4.1 The form of result releasing

The release will be in the form of the star rating finally credited to the vehicle, and the individual scores of all the tests, the score ratio of each section and the overall score ratio are published at the same time. Vehicles that have been evaluated for electrical safety should publish results of electrical safety evaluation.

4.1.1 Description of vehicle's configuration

Brand, model, basic parameters, structural characteristics, powertrain, safety configuration of the vehicle under assessment (including: configuration of seat belt and pretensioner, configuration of safety airbag and curtain, as well as the availability of seat belt reminder, ESC system, ADAS system (including AEB, LDW , LKA, BSD, SAS etc.), adaptive low-beam function, low-beam automatic light-on function, automatic headlight leveling system, adaptive high-beam function and active headrest, etc..)

4.1.2 Specimen of releasing the results and supplemental explanations

The specimen of releasing the results and the items therein are shown in Annex 5; if appropriate, the following supplemental explanations (not exhaustive) may be inserted:

a) The star rating provided by the test results shall only apply to the vehicle type of the same model and configurations as assessed therein.

b) Reasons shall be indicated when the star rating and the overall score ratio does not match with each other according to Article 4 of Chapter 3.

4.2 Frequency and method of result releasing

Release frequency: normally once every 2-3 months. In particular cases, the assessment result would be released at any time.

Releasing method:

1) Through C-NCAP designated website (www.c-ncap.org);

2) Through dedicated column or special issue of "World Auto", or by media authorized by C-CNAP Management Center;

3) By C-NCAP assessment result release conferences, news report and live broadcasting.

Other media are allowed to carry assessment results downloaded from www.c-ncap.org website's media service area, but are required to register and receive

authorization before they can make use of such information, and are to indicate the source of such information they release.

"World Auto" will release assessment results and related information in more details in its special issues and dedicated columns, and will allow other media to make in-depth reports by way of copy-right cooperation with World Auto.

5 FUNDS

CATARC will set aside annually dedicated budget funds to cover the costs for purchasing the vehicles, conducting the tests and overall management to ensure long-term operation of C-NCAP.

6 MANAGEMENT OF THIRD-PARTY PERSONNEL AND RELATED AFFAIRS DURING TEST

6.1 Management of test viewers

6.1.1 The each testing schedule of the vehicle to be assessed will be informed to the manufacturer concerned in advance and will be announced on C-NCAP's designated website.

6.1.2 The manufacturer shall submit to the Administration Center the names of those to view the test three days prior to the date of test.

6.1.3 Manufacturer's personnel may view the preparations of impact tests at the specified time spans, and view the test process through the duration beginning half an hour before the test and ending half an hour after the test. Such personnel will be rejected to enter the impact test lab unless with the viewing permit issued to the manufacturer.

6.1.4 Media, groups and organizations representatives wishing to view the tests shall submit an application and a list of the attendants to the Administration Center three days prior to the date of test. Media, groups and organizations representatives should enter the impact test lab with temporary view card, and follow the relevant rules (enclosed) of the Administration Center.

6.1.5 Due to the complicated procedure and long cycle and limited test site of active safety test and pedestrian protection test, any media, group or organization who wishes to view the test shall submit the application one week ahead to the Administration Center; temporary view card is required at test site, the relevant rules (enclosed) of the Administration Center are required to follow.

6.2 Management of manufacturer's personnel and test related affairs

6.2.1 The manufacturer personnel can confirm the status of the test vehicle before each test. If the problem is found, those personnel should timely communicate with professional testing staff from the department of testing evaluation, and eventually reach an agreement.

6.2.2 When manufacturer personnel confirm the test conditions, the content with possibly significant effect on the results shall be confirmed by both professional

testing staff from the department of testing evaluation and manufacturer staff. They should be simultaneously recorded in an additional record sheet prepared by the department of testing evaluation.

6.2.3 The manufacturer personnel shall not carry out any operation on the vehicles and spare parts during confirmation of the test vehicle status. However, when it is confirmed that there will be some special operation, the relevant operations can be carried out by professional testing staff from the department of testing evaluation after the agreement of the person in charge of the department of testing evaluation.

6.2.4 The checking by the manufacturer personnel shall not exceed a limit of 60 minutes, which can be extended for a suitable length when there is a justifiable reason and when the permission is granted by the person in charge of the Test Assessment Department. In such case a summary of opinions can be proposed backed by appropriate reasons, and modifications to the test conditions can be made after permission by the Test Assessment Department is granted.

6.2.5 Views from the manufacturer personnel are allowed to take photos or videos before and during the tests only after the permission by the person in charge of the Test Assessment Department is obtained.

7 COMPLAINTS OVER THE RESULTS AND THE SOLUTION

In the case of dispute over the result of assessment on the part of the manufacturer, a complaint in the form of a Complaint Form (see Annex 4) can be submitted to the Administration Center within 10 days after the announcement of the results. The Administration Center shall give a reply within one month after receipt of the Complaint Form. If the dispute still remains, the Administration Center may arrange debates on the issue at the request of the manufacturer.

Significant discrepancies in the assessment arising from problems caused by failure in applying the required test procedures during the test are entitled to re-assessment, and such situation will be indicated with the result release. Costs for re-assessment of this type will be borne by the Administration Center.

8 PROCESSING OF POST-TEST VEHICLES

In case of no request after the release of the results, the Administration Center shall implement the storage and scrapping of vehicles in accordance with the internal management documents.

9 USE OF C-NCAP assessment results and related signs

The results and related signs as released by C-NCAP may be freely used; provided, however, if they are used for any commercial purpose, the user shall submit a prior statement to Administration Center, explaining the sites and formats to use such signs. Administration Center shall have right to put forward any requirements in restricting the use.

10 TECHNOLOGICAL COMMUNICATION

Administration Center holds at least one C-NCAP symposium and technical communication activities each year, it could be combined with the evaluation results release activities. OEM and related organizations can carry out various forms of communication and technical cooperation with Administration Center.

11 COMMUNICATION AND PUBLIC PROPAGANDA ACTIVITIES

Administration Center may, based on actual demands, attend car shows or organize public propaganda activities including exhibition tours, and conduct various forms of communication to promote safety knowledge and safety consciousness of the public.

CHAPTER III ASSESSMENT PROCEDURES

1 OCCUPANT PROTECTION

1.1 Test items

1.1.1 Frontal 100% overlap rigid barrier crash test

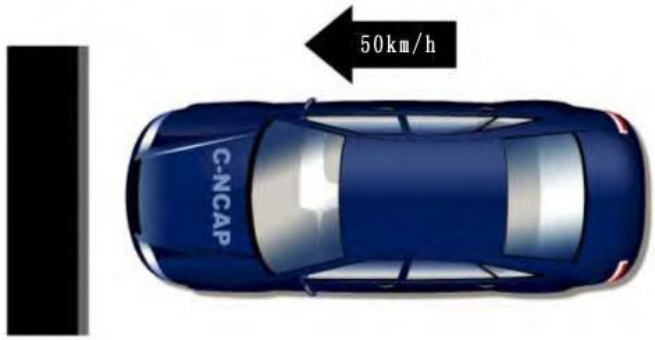


Figure 3-1 Frontal 100% overlap rigid barrier crash test

As shown in Figure 3-1, the test shall be carried out in accordance with the C-NCAP testing procedure. The test vehicle frontally crashes against a fixed rigid barrier with 100% overlapping, which shall be covered by 20mm-thick plywood boards. The impact velocity is 50^{+1}_{0} km/h (the test speed shall be not less than 50 km/h). The test vehicle shall not deviate by 150mm from the theoretic track in any transverse direction before crashing against the barrier. A Hybrid III 50th male dummy shall be placed at driver and front occupant positions respectively, to measure the injury to front occupants. Place a Hybrid III 5th female dummy on one side of the second row, and place a child restraint system and a Q-series dummy representing a 3-year-old child on the other side of the second row, so as to measure the injuries suffered by the second-row occupants. If the situation allows, place the Hybrid 5th female dummy and Q3 dummy left or right randomly. For vehicle model with two-door and single-row seat, only Hybrid III 50th male dummies shall be placed at driver and front occupant positions respectively, to measure the injury to front occupants.

1.1.2 Frontal 50% overlap moveable progressive deformable barrier (MPDB) crash test

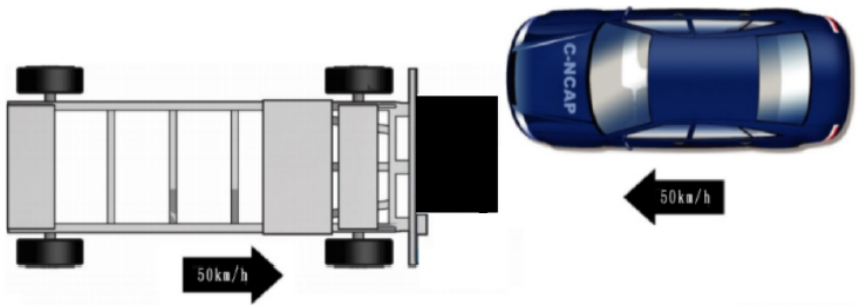


Figure 3-2 Frontal 50% overlap MPDB crash test

As shown in Figure 3-2, the test shall be performed in accordance with C-NCAP testing procedure. Test vehicle and MPDB trolley impact each other frontally at the speed of 50^{+1}_{-1} km/h respectively with overlap. The overlap between vehicle and progressive barrier should be in the range of 50% vehicle width ±25mm. A THOR 50th male dummy and Hybrid III 5th female dummy are placed in front row driver side and passenger side respectively, to measure injury situation of front row. A Hybrid 5th female dummy is placed at most left side seat of the second row; A CRS and Q10 dummy are placed at the most right side seat of the second row, to measure injury situation of second row passenger. For vehicle model with two-door and single-row seat, only a THOR 50 percentile male dummy and a Hybrid III 5th female dummy shall be placed at driver and front occupant positions respectively, to measure the injury to front occupants. The deformation of progressive barrier of moveable trolley front end shall be measured, to evaluate aggressiveness of the test vehicle.

1.1.3 Side impact test against a mobile deformable barrier(Test item for conventional vehicles)

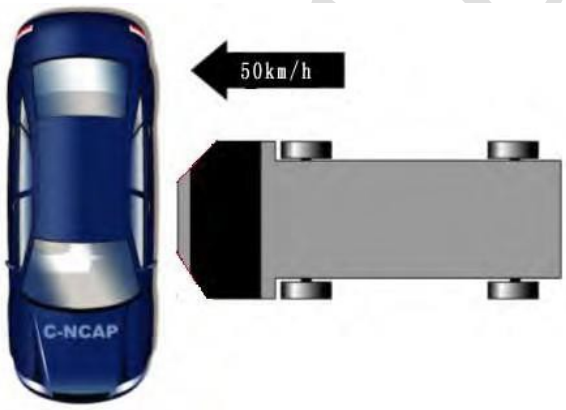


Figure 3-3 Side impact test against a mobile deformable barrier

As shown in Figure 3-3, the test shall be performed in accordance with the C-NCAP testing procedure. A deformable cell bond is to be attached to the front end of trolley. The mobile barrier shall move in the direction perpendicular to the test vehicle. The centerline of the barrier shall align with the 250mm backward of vehicle R-point position. The impact velocity is 50^{+1}_{0} km/h (the test speed shall be not less than 50km/h). The longitudinal vertical median plane of the mobile deformable barrier shall be coincident within ±25mm with a transverse vertical plane passing through the 250mm backward of R-point of the front seat adjacent to the struck side of the tested vehicle. A WorldSID 50th dummy and SID-IIs (version D) shall be placed at front row and the second row respectively of the impact side, so as to measure the injuries suffered by occupants of impact side. For the other side, A ES-2 dummy is placed in front row, to collect crash data of the occupants. It will be not evaluated for currently. For vehicle model with two-door and single-row seat, only a WorldSID 50th dummy and an ES-2 dummy shall be placed at impact side and non impact side respectively.

1.1.4 Side pole crash test (test item for new energy vehicles)

As shown in figure 3-4, the test shall be conducted in accordance with C-NCAP test protocol. Slide or move vehicle transversely against a rigid pole, to result impact

between vehicle driver side and the rigid pole. The angle between vertical plane against vehicle moving vector and vehicle longitudinal centerline is formulated 75°±3°. Center line of rigid pole surface should be aligned with the intersection line of the exterior surface of the vehicle and a vertical plane passing through the center of gravity of the head of the dummy (impact reference line), and it should be in range ±25mm from the impact reference line in the vertical plane of vehicle moving direction. Vehicle impact speed is $32^{+0.5}_{-0.5}$ km/h, and the speed should stay stable before at least 0.5m before impact. A WorldSID 50th dummy is placed in driver side front row, to measure occupant injury situation.

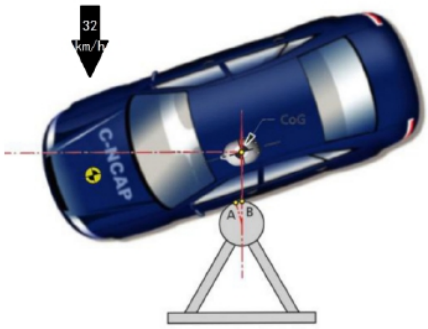


Figure 3-4 side pole crash test

1.1.5 Static assessment of child protection

Static assessment of child protection is conducted on total vehicle before crash test. Vehicle seat position, seat belt etc. restraint system position etc. are set to test position according to C-NCAP frontal crash test method. Use the module specified in GB 14166-2013 to check the applicability of the CRS. And then check the installation of all seat positions (exclude driver position) that are suitable for CRS with CRS list provided by C-NCAP, to evaluate the status of CRS installation of the vehicle. Additionally check communication function between CRS and vehicle, to make sure CRS status could be monitored.

1.1.6 Whiplash test

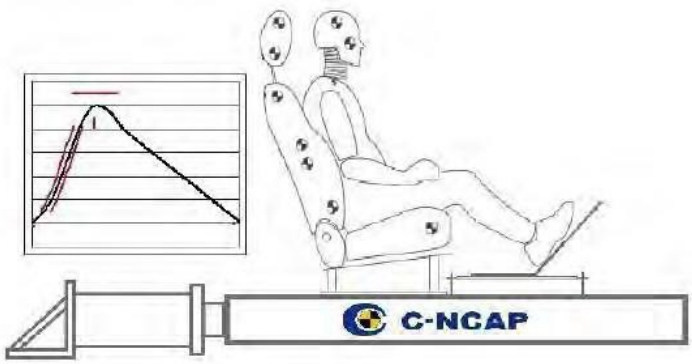


Figure 3-4 Neck protection test in low-speed rear impact (whiplash test)

As shown in Figure 3-4, the test shall be conducted in accordance with C-NCAP test protocol. By simulating the original vehicle structure, install the driver seat together

with the restraint system onto the movable sled. The sled is launched by the special acceleration waveform having the speed variation at (20.0±1.0) km/h so as to simulate the rear impact process. Place a BioRID II dummy on the seat to measure the neck injuries during the rear impact. The test method of second row is the same as front row. Place a BioRID II dummy in left or right position of the second row randomly, to evaluate the protection performance of seat headrest of second row against occupant neck through measurement of neck injury of rear impact.

1.2 Performance criteria and scoring method

1.2.1 Dynamic testing part

1.2.1.1 Frontal 100% overlap rigid barrier crash test

In this test, a maximum score of 24 points is available. Maximum score for the front-row dummy is 16 points, and the dummy body areas to be evaluated are head, neck, thorax, upper leg and lower leg, which can be awarded up to 5, 2, 5, 2 and 2 points respectively. The scoring for the frontal-row dummies shall be based on the injury criteria of the driver-side dummy. The scores of the occupant-side dummy may be validated only if they are less than the scores for corresponding areas of the driver-side dummy. The maximum score for the second-row female dummy is 4 points; the body parts of the female dummy are divided into head, neck and thorax, which can be awarded up to 1.6, 0.4 and 2 points respectively. For child dummy second row, the maximum score available is 4 points; the body parts of child dummy are divided into head, neck, and thorax, which can be awarded up to 2, 1 and 1 points.

The basic scoring principle for the adult dummies in front row and the second row is: to set two limits for each parameter, a higher performance limit, threshold for maximum scores; and a lower performance limit, threshold for zero point; if a group involves the scoring of several body parts, the lowest point thereof shall be taken as the final score of the group concerned; the lowest score will be validated for a body region where multiple assessment criteria exist. If the corresponding body part injury criterion exceeds the capping limits, 0 point will be granted for all body parts of the dummy. The scores for each assessment shall be rounded to three decimal places.

1.2.1.1.1 Scoring of front row dummy

1.2.1.1.1.1 Scoring of head

The maximum and minimum scores for head are 5 points and 0 point respectively.

The score of dummy's head is obtained by measuring relevant parameters of the dummy. The dummy head assessment parameters involve the head injury criterion (HIC15) and the resultant 3ms cumulative 3ms cumulative acceleration (check table 3-1 for higher performance limits and lower performance limit and capping limit). A maximum score of 5 points is available for each criteria. Higher and lower performance limits are to be used for calculation.

Table 3-1 head criteria of front row in front 100% crash

Head criteria		Driver/ passenger side dummy of front row		
		Higher performance limit	Lower performance limit	Capping limit
Head HIC_{15}	/	500	700	700
Resultant 3ms cumulative acceleration	g	70	80	80

The lower performance limits and the higher performance limits correspond to 0 point and 5 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.1.2 Scoring of neck

The maximum and minimum scores for neck are 2 points and 0 point respectively.

The score for neck is generated by measuring relevant criteria of the dummy. The assessment criteria include shearing force Fx, tension force Fz and extension bending moment My (check table 3-2 for higher performance limit, lower performance limit and capping limit), which can each be awarded up to 2 points.

Table 3-2 assessment criteria of dummy neck in 100% front impact

Neck criteria		Driver/ passenger side dummy front row		
		Higher performance limit	Lower performance limits	Capping limit
Shearing force Fx	kN	1.9kN @ 0 ms, 1.20kN @ 25-35ms, 1.10kN @ 45ms	3.10kN @ 0ms, 1,50 Kn@25-35 ms, 1.10kN @ 45ms	3.10kN @ 0ms, 1,50 Kn @25-35 ms, 1.10kN @ 45ms
Tension force Fz	kN	2.70kN @0 ms, 2.30kN @ 35 ms, 1.10kN @ 60ms	3.30kN @0 ms, 2,90kN@ 35kN, 1.10kN @60ms	3.30kN @ 0ms, 2.90 kN@35 ms, 1.10kN @ 60ms
Extension bending moment My	Nm	42.00	57.00	57.00

Neck shearing force and tension are assessed from cumulative curve, with the limits being functions of time. By interpolation, a plot of points against time is computed. The score for each point may be calculated by linear interpolation, and the minimum point on this plot gives the score. Plots of the limits and rating boundaries are given in Figure 3-6, Figure 3-7 and Figure 3-8.

For extension bending moment, the score is calculated by linear interpolation and rounded to three decimal places.

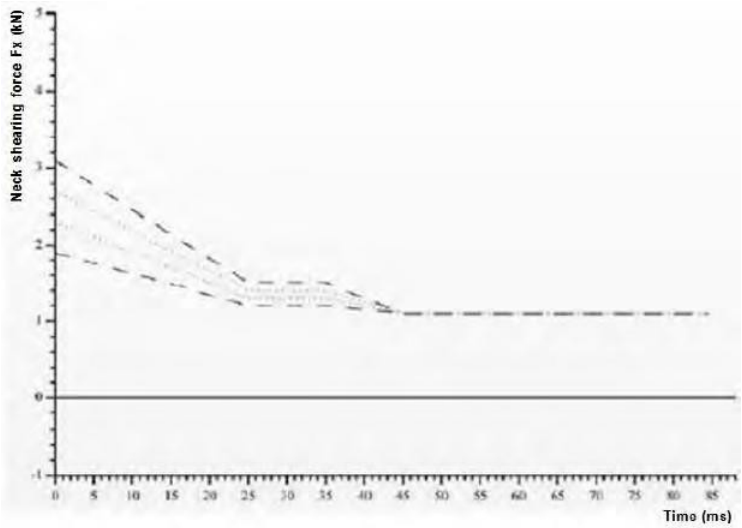


Figure 3-6 Neck shearing force Fx (positive direction)

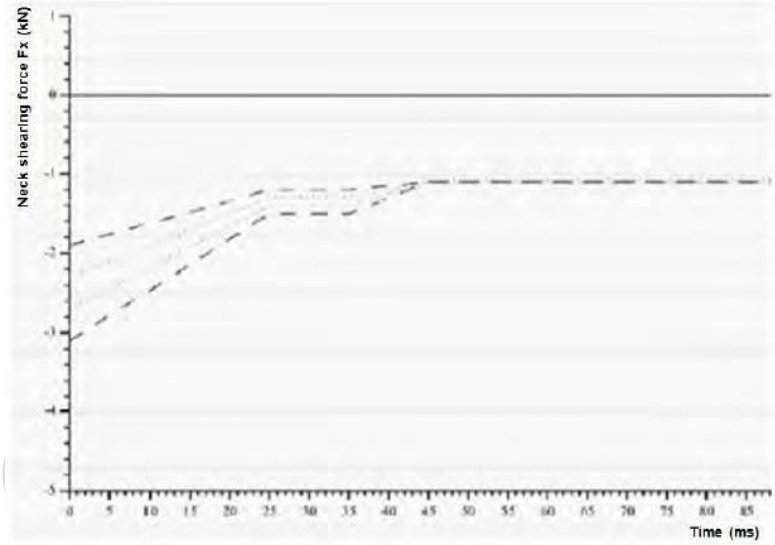


Figure 3-7 Neck shearing force Fx (negative direction)

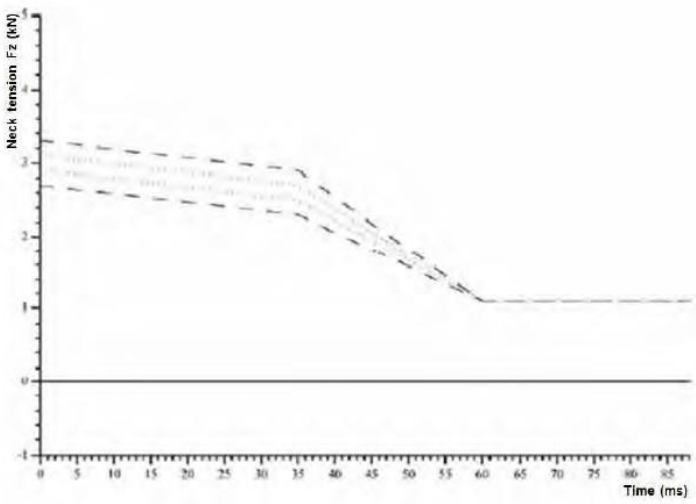


Figure 3-8 Neck tension Fz (positive direction)

1.2.1.1.1.3 Scoring of thorax

The maximum and minimum scores for this body area are 5 points and 0 point respectively.

The score for dummy's thorax is generated by measuring relevant criteria of the dummy, The dummy chest assessment criteria include the deflection and the Viscosity Criterion (VC) (check table 3-3 for higher performance limit, lower performance limit and capping limit), a maximum score of 5 points is available for each criteria.

Table 3-3 thorax assessment criteria of front row in frontal 100% crash test

Thorax criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	22	50	50
Viscosity Criterion (VC)	m/s	0.5	1.0	1.0

The lower performance limits and the higher performance limits correspond to 0 point and 5 points respectively. Where a measurement value falls between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.1.4 Scoring of upper legs

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

The score for femur is generated by measuring relevant criteria of the dummy. The femur assessment criteria include the femur compression force and the knee sliding displacement. A maximum score of 2 points is available for each criteria.

Table 3-4 upper leg assessment criteria of front row in frontal 100% crash test

Upper leg criteria		Driver/ passenger side dummy front row	
		Higher performance limit	Lower performance limit
Compression force	kN	3.8kN	9.07kN @ 0ms, 7.56kN @≥10ms
Knee sliding displacement	mm	6	15

Femur compression force is assessed from a cumulative plot, with the limits being functions of time. By interpolation, a plot of points against time is computed. The score for each point may be calculated by linear interpolation, and the minimum point on this plot gives the score. Plots of the limits and score rating boundaries are given in Figure 3-9.

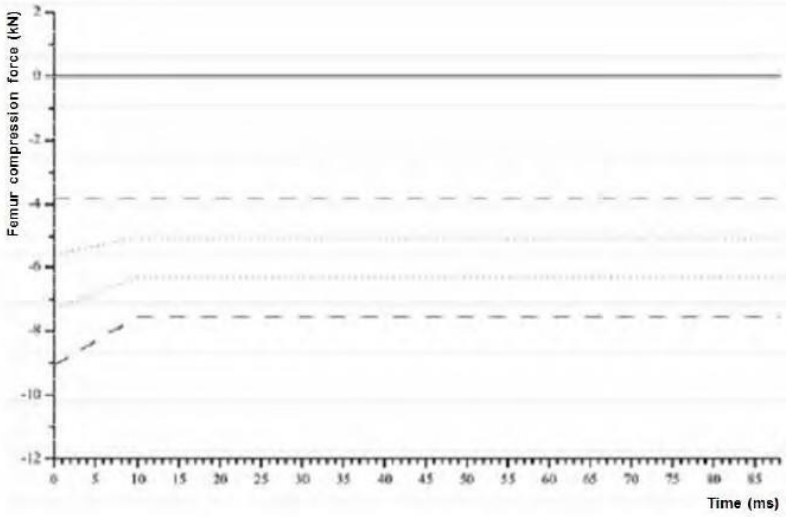


Figure 3-9 Femur compression force

1.2.1.1.1.5 Scoring of lower legs position

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

The score for lower legs is generated by measuring relevant parameters of the dummy. The lower leg assessment parameters include the tibia index (TI) and lower legs compression force, which can each be awarded up to 2 points.

Table 3-5 lower leg assessment criteria of front row dummy in frontal 100% crash test

Lower leg criteria		Driver/passenger side dummy of front row	
		Higher performance limit	Lower performance limit
Tibia index T1	/	0.4	1.3
Lower leg compression force	kN	2	8

The lower performance limit and the higher performance limit correspond to 0 point and 2 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.2 Scoring of second-row female dummy

To the maximum, the second-row female dummy may obtain 4 points, and to the minimum, 0 point. The scoring parts are head, neck and thorax of female dummy.

1.2.1.1.2.1 Scoring of head

To the maximum, this part may obtain 1.6 points, and to the minimum, 0 point.

If the head of the second-row female dummy involves no secondary impact during the forward motion, it is calculated by only resultant 3ms cumulative acceleration3ms acceleration. The criterion is awarded up to 1.6 points. In case of secondary impact

(against, e.g., seat, pillar-B, etc.) during the forward motion, the assessment criteria shall be the head injury criterion (HIC15) and resultant 3ms cumulative acceleration3ms acceleration(check table 3-6 for higher performance limit, lower performance limit and capping limit); for this criterion, the maximum score is 1.6 points.

Table 3-6 head criteria of female dummy second row in frontal 100% crash test

Head criteria		Female dummy of second row		
		Higher performance limit	Lower performance limit	Capping limit
HIC_{15}	/	500	700	700
Resultant 3ms cumulative acceleration3ms acceleration	g	72	80	80

Lower performance limit and higher performance limit correspond to 0 point and 1.6 points, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

The secondary impact is defined as follows: the head presents the trace of contact with vehicle components, and, according to Clause 5 to SAE J2052, the calculated head contact load exceeds 500N (excluding any secondary impact of the female dummy itself, e.g., between head and knee, between chin and thorax, etc.).

1.2.1.1.2.2 Scoring of neck

For this part, the max. score is 0.4 points, and the min., 0 point.

The neck score shall be obtained by measuring appropriate criteria of dummy neck. If the head of the second- row female dummy involves no secondary impact during the forward motion, the neck assessment criteria shall be the tension Fz, for which the maximum score is 0.4 points; if a secondary impact is involved, the neck assessment criteria shall be the shearing force Fx, tension Fz and extension bending moment My (check table 3-7 for higher performance limit, lower performance limit and limits), each of which may get 0.4 points to the maximum.

Table 3-7 neck criteria of female dummy second row in frontal 100% crash test

Neck criteria		Female dummy of second row		
		Higher performance limit	Lower performance limit	Capping limit
Shearing force Fx	kN	1.2	1.95	2.7
Tension Fz	kN	1.7	2.62	2.9
Extension bending moment My	Nm	36	49	57

Lower performance limit and higher performance limit respectively correspond to 0 point and 0.4 points; for a measurement value falling within them, the score shall be calculated by means of linear interpolation, which shall be subsequently rounded to

three decimal places.

Check Paragraph 1.2.1.1.2.1 for relevant description of secondary impact.

1.2.1.1.2.3 Scoring of thorax

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

The score for dummy's thorax is generated by measuring relevant criteria of the dummy, The dummy chest assessment criteria include the deflection and the Viscosity Criterion (VC) (check table 3-8 for higher performance limit, lower performance limit and limits), a maximum score of 2 points is available for each criteria.

Table 3-8 thorax assessment criteria of front row in frontal 100% crash test

Thorax criteria		female dummy of the second row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	18	42	42
Viscosity Criterion (VC)	m/s	0.5	1.0	1.0

The lower performance limits and the higher performance limits correspond to 0 point and 2 points respectively. Where a measurement value falls between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.2.4 Scoring of second row child dummy

The maximum score of child dummy in second row is 4 points, while minimum score is 0 points. Evaluation parts are head, neck and thorax of child dummy.

1.2.1.1.3.1 Scoring of head

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

If the head of the second-row child dummy involves no secondary impact during the forward motion, it is calculated by only resultant 3ms cumulative acceleration3ms acceleration. In case of secondary impact with front seat or B pillar during the forward motion, the assessment criteria shall be the head injury criterion (HIC15) and resultant 3ms cumulative acceleration3ms acceleration(check table 3-9 for higher performance limit, lower performance limit); and the lower one will be taken as final score.

Table 3-9 head criteria of child dummy second row in frontal 100% crash test

Criteria	Higher performance limit	Lower performance limit
HIC_{15}	500	700
Resultant 3ms cumulative acceleration 3ms acceleration	60g	80g

Lower performance limit and higher performance limit correspond to 0 point and 2 points, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

The secondary impact is defined as follows: the head presents the trace of contact with vehicle components, and, according to Clause 5 to SAE J2052, the calculated head contact load exceeds 500N (excluding any secondary impact of the child dummy itself, e.g., between head and knee, between chin and thorax, etc.).

1.2.1.1.3.2 Scoring of neck

For this part, the max. score is 1 point, and the min., 0 point.

The neck score shall be obtained by measuring tension force Fz. The higher performance limit of Fz is 1555N; and lower performance limit is 2840N.

Lower performance limit and higher performance limit correspond to 0 point and 1 point, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.3.3 Scoring of thorax

For this part, the max. score is 1 point, and the min., 0 point.

The thorax score shall be obtained by measuring resultant 3ms cumulative3ms acceleration of dummy thorax. The higher performance limit of resultant acceleration is 41g; and lower performance limit is 55g.

Lower performance limit and higher performance limit correspond to 0 point and 1 point, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.3 Modification of dummy scoring

1.2.1.1.4 Dummy front row

1.2.1.1.5 Head

1.2.1.1.6 Unstable contact of airbag

When dummy moving forward, the head score shall be modified by -1 point if head protection by airbag is limited, resulting from head gravity center is outside of airbag

outline or other reasons. For example, steering wheel breaks away from steering column or ‘bottoming out’ situation happens when head impact airbag.

Judgement of head ‘bottoming out’: there are one or more obvious increasing phase of acceleration curves of external force, during head in depth contacting with airbag. After smoothing processing of these starting points and ending points of curve peaks. The peak value shall be 5g more than normal value lasting at least 3ms (shown in figure 3-10).In the above judgment process, the case caused by the collapse of steering column "touching the bottom" is excluded

Head acceleration of external force is calculated according to the following formula:

$$a_{外力} = \sqrt{[(Ma_x - F_x)^2 + (Ma_y - F_y)^2 + (Ma_z - Fz')^2}\ / M$$

Of the formula: M – head mass, for 50th dummy it is 4.54kg;

ax, ay and az – acceleration of three direction of head

Fx, Fy and Fz – force of three direction of neck

Fz’ – force (or equivalent force) in Z direction in neck; for Hybrid III 50th dummy, Fz’=Fz; for THOR 50th dummy, Fz’ is the corrected value of neck Fz considering front and rear rope forces, Fz’=Fz+Frear rope – Ffront rope.

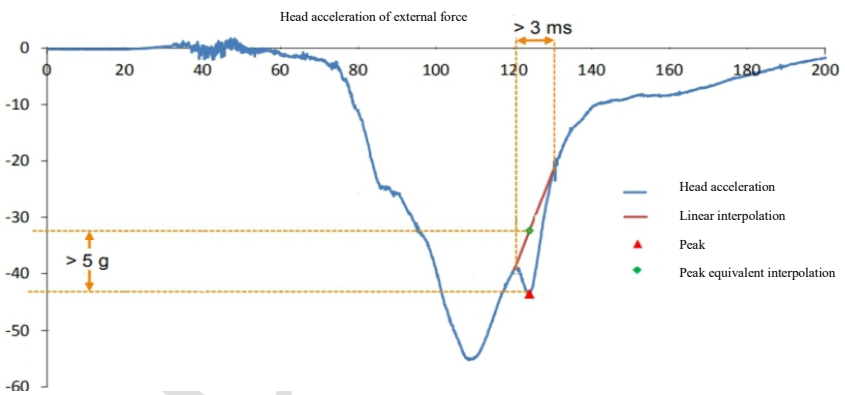


Figure 3-10 example of head ‘bottoming out’

1.2.1.1.6.1.1.1 Hazardous deployment of airbag

1.2.1.1.4.1.1.2.1 Define a plane perpendicular to longitudinal axis, 150mm in front of dummy face. Airbag hazardous deployment is assessed in the area of the backward of the plane.

1.2.1.1.4.1.1.2.2 If airbag sweeps dummy face in horizontal or vertical direction during deployment, the corresponding head score shall be modified by -1 point.

1.2.1.1.4.1.1.2.3 Head score shall be modified by -1 point, if deployment velocity exceeds 90m/s.

1.2.1.1.4.1.1.3 Incorrect deployment of airbag

If airbag is not deployed according to deigned way, head score shall be modified by -1 point; if the incorrect deployment influence multi body parts, score of each part influenced will be applied for -1 point modification.

1.2.1.1.4.1.1.4 Unstable contact of steering wheel (no airbag of driver side)

-1 modifier of head score will be applied if head gravity center exceeds outline of steering wheel or steering wheel break away from steering column.

1.2.1.1.4.1.1.5 Displacement of steering column (only driver side)

If steering wheel upward displacement is too big, the head score shall be modified by 0~-1. Referring to EEVC requirements, the limit of this criterion is 80mm. when calculating the modifier, no modifier will be applied if the displacement is not more than 90% of the limit (namely 72mm). On the contrary, if the displacement reaches 110% of EEVC limit (namely 88mm), 1 modifier will be applied. Check table 3-10 for details.

Table 3-10 upward displacement of steering wheel in frontal 100% crash test

Upward displacement of steering wheel	Modifier
≤ 72mm	0
≥ 88mm	1

For value between the two limits, it is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.4.1.2 Thorax

1.2.1.1.4.1.3 Displacement of steering column (only driver side)

If steering wheel rearward displacement is too big, the head score shall be modified by 0~-1. Referring to EEVC requirements, the limit of this criterion is 100mm. when calculating the modifier, no modifier will be applied if the displacement is not more than 90% of the limit (namely 90mm). On the contrary, if the displacement reaches 110% of EEVC limit (namely 110mm), 1 modifier will be applied. Check table 3-10 for details.

Table 3-10 rearward displacement of steering wheel in frontal 100% crash test

Upward displacement of steering wheel	Modifier
≤ 90mm	0
≥ 110mm	1

For value between the two limits, it is calculated by linear interpolation and rounded to three decimal places.

1.2.1.1.4.1.2.1 Contact of steering wheel

If steering wheel loads directly on thorax obviously, -1 point shall be applied to modify thorax score.

1.2.1.1.4.1.2.2 Seat belt wearing position

Under natural wearing position of seat belt, after adjustment of upper fix position of seat belt, if shoulder belt cannot still fulfill the requirement of position under adjustment screw, thorax score shall be modified by -1 point.

1.2.1.1.4.1.2.3 Shoulder belt load

If seat belt load MAseatbelt exceeds 6kN, thorax score shall be modified by -2 points. MAseatbelt is calculated as followings,

$$MA_{seatbelt} = \max(MA_{seatbelt}(t))$$

$$MA_{seatbelt}(t) = \frac{1}{2n+1} \sum_{i=t-n}^{j=t+n} F_{seatbelt}(j),$$

Note: $F_{seatbelt}$ – filtered by CFC60, n is sampling number in 2.5ms.

1.2.1.1.4.1.3 Upper leg and knee

Modification consists of 2 parts: variable area contact and concentrated load. Each leg will be assessed independently, and the modifier will be applied to leg score accordingly.

1.2.1.1.4.1.3.1 Variable area contact

1.2.1.1.4.1.3.1.1 Knee assessment area is divided by the contact imprint of dummy knee and dashboard after test.

1.2.1.1.4.1.3.1.2 In vertical direction: area range is 50mm upwards and downwards respectively from upmost points of the imprint.

1.2.1.1.4.1.3.1.3 In horizontal direction: the corresponding area to driver left leg is defined that steering column center moves towards end of dashboard or vehicle door(closed) until leg movement blocked; the corresponding area to driver right leg is defined that steering column center moves towards end of instrument desk until leg movement blocked. For front passenger right leg, it defined that seat center moves towards end of dashboard or vehicle door (closed) until leg movement blocked; left leg area is defined that seat center moves towards end of instrument desk until leg movement blocked.

a) Driver left leg area: (inspector) put left foot on foot rest or the positon on floor which is closest to test status. Heel could move 100mm backwards, 50mm towards Seat center line direction based on the position as reference. Knee could move as left side as possible (shown in figure 3-11). If necessary, seat shall be moved to the position of 95th dummy, to find the possible contact position with knee during crash.

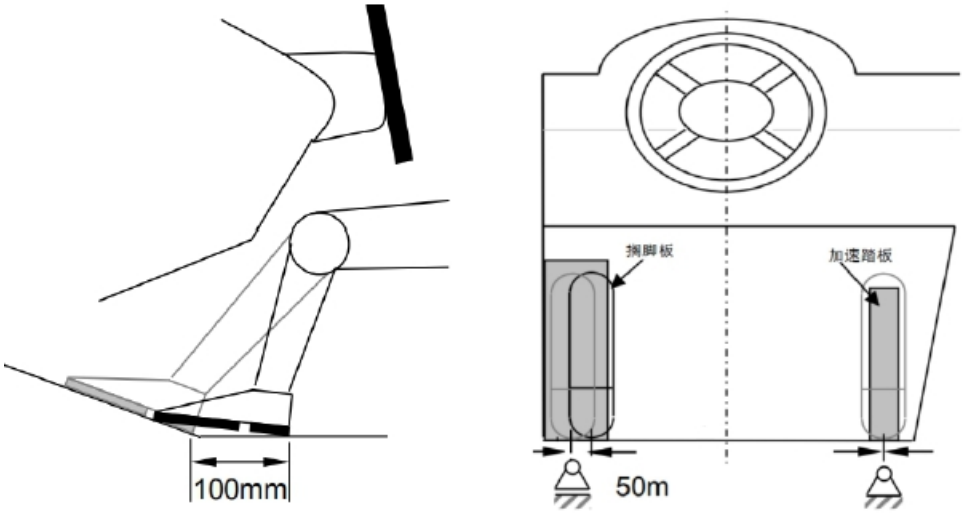


Figure 3-11 driver left foot movement

b) Driver right leg area: (Inspector) put right foot on acceleration pedal and keep foot fixed. And then try to move knee as right side as possible, to find the area knee could contact. If necessary, seat shall be moved to the position of 95th dummy, to find the possible contact position with knee during crash.

c) Front passenger left leg area: (inspector) put left foot on foot rest or the positon on floor which is closest to test status. Heel moves 100mm backwards, 50mm towards Seat center line direction direction based on the position as reference. Knee could move as left side as possible. If necessary, seat shall be moved to the position of 95th dummy, to find the possible contact position with knee during crash.

d) Front passenger right leg area: (Inspector) put right foot on foot rest or the positon on floor which is closest to test status. Heel moves 100mm backwards, 50mm towards Seat center line direction based on the position as reference. Knee could move as right side as possible. If necessary, seat shall be moved to the position of 95th dummy, to find the possible contact position with knee during crash.

1.2.1.1.4.1.3.1.4 The lower end of the knee contact mark after the impact test is taken as the reference point, extending 20mm inside of dashboard, a vertical plane is formulated, which is defined as longitudinal assessment area.

1.2.1.1.4.1.3.1.5 Check figure 3-12 for variable contact area. In the assessment area, if there exists impact points resulting femur force exceeding 3.8kN and/or knee displacement exceeding 6mm, the corresponding leg score will be modified by -1 point. OEM could eliminate the modifier by KNEE-MAPPING (check Appendix A.3 for test procedure).

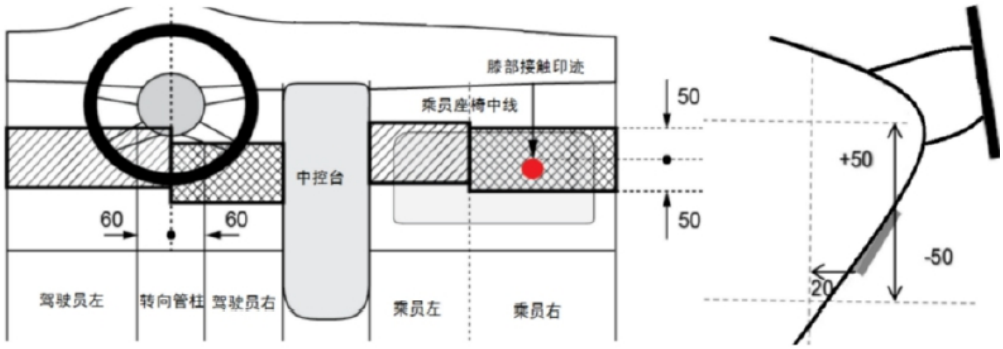


Figure 3-12 area division of knee assessment area

1.2.1.1.4.1.3.2 Concentrated load

In the area of knee assessment defined in 1.2.1.1.4.3.1, if there exists hard points resulting femur force exceeding 3.8kN, the corresponding leg score will be modified by -1 point. OEM could eliminate the modifier by KNEE-MAPPING (check Appendix A.3 for test procedure).

For driver, if the concentrated load is not suitable, divide above assessment area into steering column are and other dashboard area. Steering column area is defined as center line of steering column extending outside to 60mm at both sides. For each leg, the -1 modifier of variable area contact will be changed to -0,5 point for steering column area and -0,5 point for other dashboard area (refer to figure 3-12).

1.2.1.1.4.2 Female dummy of the second row

1.2.1.1.4.2.1 Head

1.2.1.1.4.2.1.1 Refer to modifier described in 1.2.1.1.4.1.1 for airbag unstable contact, hazardous deployment, and incorrect deployment.

1.2.1.1.4.2.1.2 If head exceeds the vertical displacement line 450mm or 550mm ahead of dummy H point, score shall be modified. Modifiers are -0.5 point and -1 point respectively. When driver seat back most point is located between 450mm and 550mm, if dummy head exceeds the corresponding vertical displacement line of seat back most point, head modifier is -1 point. In the above situation, modifier could be eliminated if OEM could use simulation or sled test result to prove that, HIII 50TH dummy head will not contact front row seat or HIC15 is lower than 700 when contacting.

1.2.1.1.4.2.2 Thorax

1.2.1.1.4.2.2 .1 Seat belt wearing position

Under natural wearing position of seat belt, after adjustment of upper fix position of seat belt, if shoulder belt cannot still fulfill the requirement of position under adjustment screw, thorax score shall be modified by -0.5 point.

1.2.1.1.4.2.2 .2 Shoulder belt force

If shoulder belt force MAseatbelt exceeds 6kN, thorax score will be modified by -1 point.

1.2.1.1.4.2.2 .3 Abdomen and pelvis

If dummy 'submarine' happens, score of abdomen and pelvis will be modified by -1 point. Submarine could be judged by ilium force and video: during pelvis moving forward and ilium force decreasing phase, if one of two ilium force decreasing rate is more than 700N/ms continuous 1ms, and confirmed by camera video, submarine will be confirmed.

1.2.1.1.4.3 Child dummy of the second row

During crash, if restraint system failed, such as seat belt unlocked, ISO fix broken, built-in child restraint system falling away, the score of child dummy in the test will be 0 point.

1.2.1.1.5 Door open during crash

For any door of the 2 sides, if door opens during crash, 1 penalty point will be applied respectively.

1.2.1.1.6 Door open after crash

For vehicle with automatic locking function, vehicle will be tested with locked status. If locking function cannot be removed, there will be 1 penalty point. For each row, if there is door and both side cannot be opened without tools, there will be 1 penalty point for the corresponding row.

1.2.1.1.7 Seat belt open force

When taking dummy out of restraint system, if it is locked and more than 60N applied on the unlock device it is still locked, then 1 penalty point respectively.

1.2.1.1.8 Electrical safety of electric vehicle/ plug-in hybrid electric vehicle

1.2.1.1.8.1 Performance of protection against electrical shock

Evaluation indexes of performance of protection against electrical shock are divided into basic item (required item) and optional item (left to choice of any item). The basic item is insulation resistance at the side of rechargeable energy storage system (REESS), suitable for main relay (disconnect switch) is placed outside of battery package; optional items are four items of low voltage, low electric energy, physical protection and insulation resistance at load side of power system, each high voltage bus should at least meet one of the four optional items. electric vehicle/ plug-in hybrid electric vehicl should meet both requirements of basic item and optional item at the same time. For vehicle not suitable for basic item, it is fine to just fulfill optional items.

1.2.1.1.8.1.1 Basic item

Measure the insulation resistance between the high voltage bus at REESS side and the electric chassis, the insulation resistance value measured or calculated in accordance with the stipulations of A.1.12.4.1.1 in appendix A should be more than or equal to 100Ω/V.

1.2.1.1.8.1.2 Optional items.

1.2.1.1.8.1.2.1 Voltage safety

Within 5s-60s after end of the impact test, measure voltage Vb of the high voltage bus (voltage between the positive pole and the negative pole of the high voltage bus) according to A1.12.4.1.2 in appendix A, V1 (voltage between the negative pole of the high voltage bus and the electric chassis) and V2 (voltage between the positive pole of the high voltage bus and the electric chassis) for multiple times in accordance with the stipulations of 1.12.5.1.2, the measured results of at least one group of Vb, V1 and V2 should be not more than 30V AC or 60V DC.

When impact test is performed under condition where REESS of vehicle is actively disconnected from power system load, this clause does not apply to the power system load.

1.2.1.1.8.1.2.2 Electric energy safety

Within 5s-60s after end of the impact test, measure the total electric energy TE of X-capacitor and the energy stored in the Y-capacitors (TEy1, TEy2) in accordance with the stipulations of A.1.12.4.1.3 in appendix A, the measured and calculated values of TE and TEy1+TEy2 should be less than 0.2J.

When impact test is performed under condition where REESS of vehicle is actively disconnected from power system load, this clause does not apply to the power system load.

1.2.1.1.8.1.2.3 Physical protection

Physical protection measurement is divided into two parts of direct contact measurement and indirect contact measurement. The direct contact measurement is contact test of high voltage live parts of vehicle by using IPXXB test finger in accordance with the stipulations of A.1.12.4.1.4.1 in appendix A; and the indirect contact measurement is to measure the resistance between exposed conductive parts and electric chassis in accordance with the stipulations of A.1.12.4.1.4.2 in appendix A. IPXXB test finger for direct contact measurement during measurement test should not be in contact with high voltage live position, and resistance value of the indirect contact measurement should be lower than 0.1Ω. This requirement is deemed as satisfied if the galvanic connection has been established by welding.

1.2.1.1.8.1.2.4 Insulation resistance of load side of power system

After end of impact test, perform measurement of the insulation resistance between the high voltage bus at load side and the electric chassis in accordance with the stipulations of A.1.12.4.1.5 in appendix A, and adopt different evaluation method of

insulation resistance measurement results as per the galvanic connection or galvanic insulation between AC high voltage buses at load side and DC high voltage buses.

If AC high voltage buses and DC high voltage buses are galvanically isolated from each other, insulation resistance between the DC high voltage bus and the electric chassis should be more than or equivalent to 100Ω/V, and insulation resistance between the AC high voltage bus and the electric chassis should be more than or equivalent to 500Ω/V.

If AC high voltage buses and DC high voltage buses are galvanically connected, insulation resistance between the high voltage bus and the electric chassis should be more than or equivalent to 500Ω/V. If after impact, the protection level of all AC high voltage buses reaches IPXXB or AC voltage is equivalent to or less than 30V, then the insulation resistance between the high voltage bus at load side and the electric chassis should be more than or equivalent to 100Ω/V.

1.2.1.1.8.2 Electrolyte leakage

Within 30min after end of the impact, measure or inspect electrolyte leakage situations in accordance with the stipulations of A.1.12.4.2 in appendix A. There should be no electrolyte spillage from the REESS into the occupant compartment, and there should be no more than 5L of electrolyte spilling from the REESS to the outside.

1.2.1.1.8.3 REESS safety evaluation

1.2.1.1.8.3.1 Position of REESS

REESS which is located inside the occupant compartment should remain in the installed location and REESS components should remain inside REESS enclosure; and no part of any REESS that is located outside the occupant compartment should enter the occupant compartment.

1.2.1.1.8.3.2 Fire or explosion of REESS

Within 30min after end of impact, REESS has no fire or explosion, it is deemed as safe.

1.2.1.1.8.4 High voltage automatic disconnection device

1.2.1.1.8.4.1 For vehicle installed with high voltage automatic disconnection device, manufacturer may determine whether to perform verification of the validity of the high voltage automatic disconnection device.

1.2.1.1.8.4.2 If manufacturer determines to perform verification test of the validity of the high voltage automatic disconnection device, verification test method can be determined through joint negotiation between manufacturer and Administration Center, and verification test results should be publicized.

1.2.1.1.9 Overall rating for the fontal impact test against the rigid barrier with100% overlapping

Given in Table 3-12 is the overall rating principle for the fontal impact test against the

rigid barrier with 100% overlapping:

Table 3-12 Overall rating principle for the fontal impact test against the rigid barrier with 100% overlapping

Area		Penalty item	Area score	Overall rating
Front-row dummy	Head	• The score for the driver-side dummy's head is modified with 0~-1 for excessive upward displacement of the steering column; • Unstable contact with front airbag (or steering wheel), modifier is -1 point; • Hazardous deployment of airbag, modifier is -1 point; • Incorrect deployment of front airbag, modifier is -1 point	0~5	0~24
	Neck	-	0~2	
	Thorax	• The score for the driver-side dummy's thorax is modified with 0~-1 for excessive rearward displacement of the steering column; • Steering wheel loading on chest directly and obviously, modifier is -1 point; • Incorrect deployment of front airbag (or influence chest), modifier is -1 point; • Seat belt wearing cannot fulfill requirement, modifier is -1 point; • Shoulder load force exceeds 6kN, modifier is -2 points	0~5	
	Upper leg/knee	• For each leg, if there exists variable area contact and concentrated load, modifier is -1 respectively; • Knee airbag incorrect deployment[1], modifier is -1 point.	0~2	
	Lower leg	-	0~2	
	Restraint system	If seat system fails[2] in the process of test, then deduct 1 point.	-1~0	
		If seat belt system fails[3] in the process of test, then deduct 1 point.	-1~0	
Second-row female dummy	Head	• Unstable contact of head and front airbag, modifier is -1 point • Hazardous deployment of front airbag, modifier is -1 point; • Incorrect deployment of front airbag1, modifier is -1 point. • If head moves forward exceeds 450mm, 550mm (or vertical line of front seat back most point), modifier is -0.5 point, -1 point respectively.	0~1.6	
	Neck	-	0~0.4	
	Thorax	• Seat belt wearing does not fulfill requirements, modifier is -0.5 point; • Shoulder load force exceeds 6kN, modifier is -1 points	0~2	
	Abdomen/ pelvis	Pelvis submarine, modifier is -1 point	-1 ~ 0	
	Restraint system	If seat system fails[2] in the process of test, then deduct 1 point.	-1 ~ 0	

		If seat belt system fails3 in the process of test, then deduct 1 point.	-1 ~ 0	
Second-row child dummy	Head	-	0 ~2	
	Neck	-	0~ 1	
	Thorax	-	0~1	
	Restraint system	During crash, if fix device of restrain system fails[4], the score of child dummy in this test is 0 point.	-	
Overall penalty item		A minus one-point modifier will be applied for every door liable to open during the impact.	maximum overall penalty is 4 points	
		A minus one-point modifier will be applied for the restraint system if, when removing the dummy from the restraint system.		
		A minus one-point modifier will be applied for the doors fitted corresponding to each row of seats on both sides of the vehicle, which fail to be opened without the use of any tools after the test.		
		A minus one-point modifier will be applied for vehicle featuring automatic locking function if locking function is not released after test of vehicle with door locked.		
Remark		For vehicle model with two-door and single-row seat, calculate score of the front row dummy only.		

Note 1: Incorrect deployment of front airbag correction is suitable for impact scenario in which airbag tending to provide impact protection. For example, if side airbag cannot be deployed correctly in front crash, modifier will be applied to side impact and side pole impact test; If knee airbag cannot be deployed correctly in 100% full frontal crash, modifier will be applied to frontal 100% crash and frontal 50% MPDB crash test. Another example, if any airbag incorrect deployment happens in frontal crash, KNEE-MAPPING test will not be accepted in the corresponding position.

Note 2: Seat failure includes complete fracture or disengagement of anchorage device, connection device, adjustment device, displacement folding device or locking device in the process of test or after test; but permanent deformation is allowed during impact process (such as partial fracture or generation of crack, etc).

Note 3: “Failure of adult seat belt” means any situation below occurring with the seat belt and restraint system:

(1)Rupture of the strap;

(2)Rupture/disengagement of the buckle, adjusting device or connector; or

(3)Malfunction of the retractor;

(4)Squib pre-tensioning phase of seat belt, which causes naked flame in occupant compartment.

Note 4: Child restraint system fixture failure means Breakage or disengagement of the ISOFIX device or seat belt for fixing child restraint system;

1.2.1.2 Fontal 50% overlap moveable progressive deformable barrier (MPDB) test

During the test, a maximum score is 24 points. For the assessment of the front-row dummy, the body regions of the test dummy are classified into four groups each of which can be awarded up to 4 points. The maximum score that can be obtained is 16 points. The grouped regions are:

Group 1: Head, neck

Group 2: Thorax

Group 3: Knee, upper leg, pelvis

Group 4: Lower leg, foot and ankle (only assess lower leg of driver side)

For the assessment of the front-row dummy, the scoring shall be based on the injury criteria of the driver-side dummy. The scores of the occupant-side dummy may be validated only if the scores is lower than the scores for corresponding areas of the driver-side dummy.

The maximum score for the second-row female dummy is 4 points; the body parts of the female dummy are divided into 2 groups; for each group, the maximum score is 2 points; concretely, neck and head constitute the first group (Group 1), and thorax, the second group (Group 2). Maximum score for child dummy is 4 points. The body parts of child dummy are divided into head, neck and thorax, the corresponding maximum score is 2 points, 1 point and 1 point respectively.

The basic scoring principle for the adult dummies in the frontal row and the second row is: to set two limits for each parameter, a higher performance limit, threshold for a maximum score and a lower performance limit, threshold for zero point; the lowest point will be validated for a group where multiple-body region criteria exist; the lowest point will be validated for a body region where multiple criteria exist. The scores for all individual parameters shall be rounded to three decimal places.

1.2.1.2.1 Dummy scoring

1.2.1.2.1.1 Scoring of front-row dummy

1.2.1.2.1.1.1 Scoring of head and neck (Group 1)

The sliding scale for this group is from 0 to 4 points.

1.2.1.2.1.1.1.1 Scoring of head

The maximum of this part is 4 points and minimum score is 0 point.

Score is based on measurement of relevant criteria of dummy head. The criteria consist of head injury criteria (HIC15) and resultant 3ms cumulative 3ms acceleration(refer to table 3-13 for higher performance limit, lower performance limit and capping limit), max. score for each criterion is 4 points, calculated by higher limit and lower limit.

Table 3-13 First row dummy head assessment criteria of frontal MPDB test

Head criteria		Driver/ passenger side dummy of front row		
		Higher performance limit	Lower performance limit	Capping limit
Head HIC_{15}	/	500	700	700
Resultant3ms cumulative acceleration 3ms cumulative acceleration	g	72	80	80

The lower performance limits and the higher performance limits correspond to 0 point and 5 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.1.1.2 Scoring of neck

The maximum and minimum scores for neck are 4 points and 0 point respectively.

The score for neck is generated by measuring relevant criteria of the dummy. The assessment criteria include shearing force Fx, tension force Fz and extension bending moment My (check table 3-14 for higher performance limit, lower performance limit and capping limit), which can each be awarded up to 4 points.

Table 3-14 neck criteria of front row dummy in front MPDB

Neck criteria		Driver side dummy front row			Passenger side dummy front row		
		Higher performance limit	Lower performance limits	Capping limit	Higher performance limit	Lower performance limits	Capping limit
Shearing force Fx	kN	1.9	3.1	3.1	1.2	1.95	2.7
Tension force Fz	kN	2.7	3.3	3.3	1.7	2.62	2.9
Extension bending moment My	Nm	42	57	57	36	49	57

For shearing force, tension force and extension bending moment, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.1.2 Scoring of thorax and abdomen(Group 2)

The maximum and minimum scores for this group area are 4 points and 0 point respectively.

The score for dummy's thorax is generated by measuring relevant criteria of the dummy (check table 3-15 for higher performance limit, lower performance limit and capping limit). For driver dummy, assessment criteria consist of max deflection of thorax 4 ribs and max deflection of left and right abdomen. For front passenger dummy, assessment criteria consist of deflection and Viscosity Criterion (VC). A

maximum score of 4points is available for each criteria.

Table 3-15 thorax and abdomen criteria of front row dummy in frontal MPDB

Thorax and abdomen criteria		Driver side dummy front row			passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit	Higher performance limit	Lower performance limit	Capping limit
Chest max deflection	mm	35	60	60	18	42	42
Chest viscosity Criterion (VC)	m/s	/	/	/	0.5	1.0	1.0
Max deflection of abdomen (left or right)	mm	/	88	/	/	/	/

The lower performance limits and the higher performance limits correspond to 0 point and 4 points respectively. Where a measurement value falls between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.1.3 Scoring of knee, femur, pelvis position (Group 3)

The sliding scale for this group is from 0 to 4 points.

The assessment criteria of this group are femur force, knee sliding displacement and acetabulum force (refer to table 3-16 for higher performance limit, lower performance limit). Each criterion accounts for max. 4 points.

Table3-16 assessment criteria of knee, femur and pelvis position of front dummy in frontal MPDB

Knee, femur and pelvis		Driver side dummy		Passenger side dummy	
		Higher performance limit	Lower performance limit	Higher performance limit	Lower performance limit
Femur force	kN	3.8	9.07kN @ 0 ms, 7.56kN @ ≥ 10 ms	2.6	6.2
Knee sliding displacement	mm	6	15	/	/
acetabulum force	Nm	3.28	4.10	/	/

Femur force is assessed from a cumulative plot, with the limits being functions of time. By interpolation, a plot of points against time is computed. The score for each point may be calculated by linear interpolation, and the minimum point on this plot gives the score. Plots of the limits and score rating boundaries are given in Figure 3-9.

1.2.1.2.1.1.4 Scoring of lower leg, foot and ankle position (Group 4)

The sliding scale for this group is from 0 to 4 points.

Assessment criteria of driver side are tibia index (TI) and lower leg compression force (refer to table 3-17 for higher performance limit, lower performance limit). The highest score of each criteria is 4 points. Lower leg of passenger is not included for assessment.

Table 3-17 assessment criteria of lower leg of front row dummy in frontal MPDB

Lower leg criteria		Driver side dummy	
		Higher performance limit	Lower performance limit
Tibia index (TI)	/	0.4	1.3
Lower leg compression force	kN	2	8

The scores corresponding to lower performance limit and higher performance limit are 0 point and 4 point respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.2 Scoring of second-row female dummy

The maximum assessment score of second row female dummy is 4 points, while minimum is 0 point. The body parts of the female dummy are divided into 2 groups; for each group, the maximum score is 2 points; concretely, head and neck (Group 1), and thorax (Group 2).

1.2.1.2.1.2.1 Scoring of head and neck position (Group 1)

Max. score for this group is 2 points, and min. score is 0 point.

1.2.1.2.1.2.1.1 Scoring of head

For this part, maximum score is 2 points and minimum is 0 point.

If the head of the second-row female dummy involves no secondary impact during the forward motion, it is calculated by only resultant 3ms cumulative 3ms acceleration. The criterion is awarded up to 2 points. In case of secondary impact (against, e.g., seat, pillar-B, etc.) during the forward motion, the assessment criteria shall be the head injury criterion (HIC15) and resultant 3ms cumulative 3ms acceleration(check table 3-18 for higher performance limit, lower performance limit and capping limit); each criterion is corresponded with maximum score 2 points.

Table 3-18 head criteria of female dummy second row in frontal MPDB

Head criteria		Female dummy of second row		
		Higher performance limit	Lower performance limit	Capping limit
HIC15	/	500	700	700
Resultant 3ms cumulative acceleration 3ms acceleration	g	72	80	80

Lower performance limit and higher performance limit correspond to 0 point and 2 points, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.2.1.2 Scoring of neck

Max. score for this part is 2 points, and min. score is 0 point.

The neck score shall be obtained by measuring appropriate criteria of dummy neck. If the head of the second- row female dummy involves no secondary impact during the forward motion, the neck assessment criteria shall be the tension Fz, for which the maximum score is 2 points; if a secondary impact is involved, the neck assessment criteria shall be the shearing force Fx, tension Fz and extension bending moment My (check table 3-19 for higher performance limit, lower performance limit and capping limit), each of which may get 2 points to the maximum.

Table 3-19 neck criteria of female dummy second row in frontal MPDB

Neck criteria		Famle dummy of second row		
		Higher performance limit	Lower performance limit	Capping limit
Shearing force Fx	kN	1.2	1.95	2.7
Tension Fz	kN	1.7	2.62	2.9
Extension bending moment My	Nm	36	49	57

Lower performance limit and higher performance limit respectively correspond to 0 point and 2 points; for a measurement value falling within them, the score shall be calculated by means of linear interpolation, which shall be subsequently rounded to three decimal places.

1.2.1.2.1.2.2 Scoring of thorax (Group 2)

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

The score for dummy's thorax is generated by measuring relevant criteria of the dummy. The dummy chest assessment criteria include the deflection and the Viscosity Criterion (VC) (check table 3-20 for higher performance limit, lower performance

limit and capping limit), a maximum score of 2 points is available for each criteria.

Table 3-20 thorax assessment criteria of front row in frontal MPDB

Thorax criteria		female dummy of the second row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	18	42	42
Viscosity Criterion (VC)	m/s	0.5	1.0	1.0

The lower performance limits and the higher performance limits correspond to 0 point and 2 points respectively. Where a measurement value falls between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.3 Scoring of second row child dummy

The maximum score of child dummy in second row is 4 points, while minimum score is 0 point. Evaluation parts are head, neck and thorax of child dummy.

1.2.1.2.1.3.1 Scoring of head

The maximum and minimum scores for this body area are 2 points and 0 point respectively.

If the head of the second-row child dummy involves no secondary impact during the forward motion, it is calculated by only resultant 3ms acceleration. In case of secondary impact during the forward motion, the assessment criteria shall be the head injury criterion (HIC15) and resultant 3ms acceleration (check table 3-12 for higher performance limit, lower performance limit); and the maximum score of each criterion is 2 points.

Table 3-21 head criteria of Q10 child dummy second row in frontal MPDB

Criteria	Higher performance limit	Lower performance limit
HIC15	500	700
Resultant 3ms acceleration	60g	80g

Lower performance limit and higher performance limit correspond to 0 point and 2 points, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

The aforesaid secondary impact is defined as follows: the head presents the trace of contact with vehicle components, and, according to Clause 5 to SAE J2052, the calculated head contact load exceeds 500N (excluding any secondary impact of the child dummy itself, e.g., between head and knee, between chin and thorax, etc.).

1.2.1.2.1.3.2 Scoring of neck

For this part, the max. score is 1 point, and the min., 0 point.

The neck score shall be obtained by measuring tension force Fz. The higher performance limit of Fz is 1555N; and lower performance limit is 2840N.

Lower performance limit and higher performance limit correspond to 0 point and 1 point, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.1.3.3 Scoring of thorax

For this part, the max. score is 1 point, and the min. is 0 point.

The thorax score shall be obtained by measuring resultant 3ms acceleration of dummy thorax. The higher performance limit of resultant acceleration is 41g; and lower performance limit is 55g.

Lower performance limit and higher performance limit correspond to 0 point and 1 point, respectively; between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.2.2 Modification of dummy scoring

1.2.1.2.2.1 Driver side dummy front row

1.2.1.2.2.1.1 Head

Refer to 1.2.1.1.4.1.1 for airbag (steering wheel) unstable contact, airbag hazardous deployment and airbag incorrect deployment.

If steering wheel displacement upward, sideward and backward is too big, the head score shall be modified by 0~-1. No modifier will be applied if the displacement is not more than 90% of the EEVC limit. If the displacement reaches 110% of EEVC limit (110mm), 1 modifier will be applied (refer to table 3-22).

Table 3-22 displacement of steering column after test of frontal MPDB

Displacement of steering column		90% of EEVC limit	110% of EEVC limit
Upward	Mm	72	88
Sideward	Mm	90	110
Backward	Mm	90	110

1.2.1.2.2.1.2 Thorax

1.2.1.2.2.1.2.1 Contact with steering wheel

-1 point modifier will be applied if steering wheel loads on chest directly obviously.

1.2.1.2.2.1.2.2 A pillar displacement

If A pillar displacement backward is too much, thorax score shall be modified with 0~-1. If displacement is not more than 100mm, no modifier. If the displacement reaches 200mm, modifier is 2 points. Check table 3-23 for details.

Table 3-23 A pillar displacement after test of frontal MPDB

Displacement backward of A pillar	modifier
≤100mm	0
≥200mm	2

For value between the limits, linear interpolation will be applied to get the corresponding score, and the final result will be rounded to three decimal points.

1.2.1.2.2.1.2.3 Integrity of passenger compartment

If the Integrity of passenger compartment is damaged, thorax score shall be modified with -1 point. If this modifier applies, KNEE-MAPPING will not be accepted. Indication of loss of Integrity of passenger compartment is one of the followings,

a) Door lock or hinges fail, except door is adequately retained by door frame;

b) Door bends or other failure forms, resulting in strength against forward and backward compressive strength lost severely;

c) Separation or near separation of the cross facia rail to A pillar joint.

d) Strength of door frame is lost severely.

1.2.1.2.2.1.2.4 Shoulder belt load

If shoulder belt load (MAseatbelt) exceeds 6kN, thorax score shall be modified with -2 points.

1.2.1.2.2.1.3 Abdomen and pelvis

The score for the Knee, Femur & Pelvis is reduced by 4 points when submarining occurs. The modifier is applied when a drop in any of the two iliac forces measured is seen within 1ms and when the submarining is confirmed on the high speed film.

1.2.1.2.2.1.4 Lower leg, foot and ankle

1.2.1.2.2.1.4.1 Pedal displacement

If pedal displacement of backward and upward is too much, score shall be modified with 0~-1. Check table 3-24 for details.

Table 3-24 pedal displacement of backward and upward after test of frontal MPDB

Pedal displacement	/	limit	Modifier	displacement
Backward	Pedal is not deadlocked	100~200mm	0~-1 point	X1-X2(figure3-13)
	Pedal deadlocked[1]	50~175mm	0~-1 point	X1-X3 (figure 3-13)
Upward	/	72~88mm	0~-1 point	/

Note 1: when pedal is applied with 200N horizontally, if the forward displacement smaller than 25mm, it is judged as pedal locking (figure 3-13).

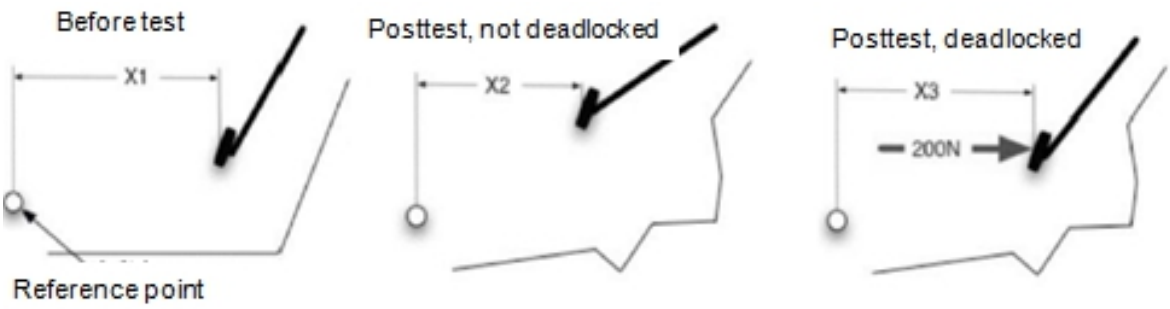


Figure 3-13 pedal displacement

For value between the limits, linear interpolation will be applied to get the corresponding score, and the final result will be rounded to three decimal points.

For all pedals of vehicle, take the one with highest modifier as the final modifier of this item. If pedals are designed to break away during crash and there is no obvious moving resistance force, no modifier applies.

1.2.1.2.2.1.4.2 Broken of foot space

Due to failure of welding points resulting in severe broken of foot space, the score shall be modified with -1 point. If this modifier applies, KNEE-MAPPING will not be accepted.

1.2.1.2.2.2 Female dummies of front row and the second row

1.2.1.2.2.3 Head and neck

1.2.1.2.2.2.1.1 Refer to modifier described in 1.2.1.1.4.1.1 for airbag unstable contact and incorrect deployment; For front row female dummy,Hazardous deployment modifier will take the result direct from 100% frontal crash, no need to evaluate independently.

1.2.1.2.2.2.1.2 For second row female dummy, refer to 1.2.1.1.4.1.2 for head movement modifier.

1.2.1.2.2.2.2 Thorax

1.2.1.2.2.2.2.1 Seat belt wearing position

Under natural wearing position of seat belt, after adjustment of upper fix position of seat belt, if shoulder belt cannot still fulfill the requirement of position under adjustment screw, thorax score shall be modified by -1 point for front row dummy and -0.5 point for second row dummy.

1.2.1.2.2.2.2.2 Shoulder belt force

If shoulder belt force Mseatbelt exceeds 6kN, thorax score will be modified by -1 point.

1.2.1.2.2.2.2.3 Abdomen and pelvis

If dummy 'submarine' defined in 1.2.1.1.4.2.3 happens, score of abdomen and pelvis will be modified by -2 points for front row dummy and -1 point for second row dummy.

1.2.1.2.2.3 Child dummy of the second row

1.2.1.2.2.3.1 Abdomen

If dummy abdomen pressure is more than 1.2 bar, dummy total score will be deducted 1 point as penalty. Take the maximum of average curves of the two sensor channels as abdomen pressure.

1.2.1.2.2.3.2 Penalty item

During dummy moving forward before getting biggest displacement position, If the seatbelt strangles the neck or slides off the shoulder, 1 point will be deducted.

1.2.1.2.2.3.3 Negation item

During crash, if restraint system failed (such as seat belt unlocked, ISO fix broken, built-in child restraint system falling away), the score of child dummy will be 0 point.

1.2.1.2.3 Door open during crash

For any door of both sides, if door opens during crash, 1 penalty point will be applied respectively.

1.2.1.2.4 Door open after crash

For vehicle with automatic locking function, vehicle will be tested with locked status. If locking function cannot be removed, there will be 1 penalty point. For each row, if there is door and both side cannot be opened without tools, there will be 1 penalty point for the corresponding row.

1.2.1.2.5 Seat belt open force

When taking dummy out of restraint system, if it is locked and more than 60N applied

on the unlock device it is still locked, then 1 penalty point respectively.

1.2.1.2.6 Compatibility assessment

Compatibility is assessed based on four criteria: standard deviation of barrier deformation, occupant load criterion (OLC), barrier intrusion depth and height. For implementation phase I (Jan 2022 to Jan 2023), maximum modifier for this part is 3 points; for implementation phase II (Jan 2023 until end of validity period of this version), maximum modifier for this part is 6 points.

1.2.1.2.6.1 Standard deviation of barrier deformation (SD)

1.2.1.2.6.1.1 Assessment area

The assessment area on barrier surface is rectangle (shown in figure 3-14). Lower boundary is located at 250mm above ground (100mm to lower edge of barrier), upper boundary is 650mm above ground; right boundary is 200mm to right side edge of MPDB surface, left boundary is relevant to test vehicle width. The distance to right side edge is 45% of vehicle width.

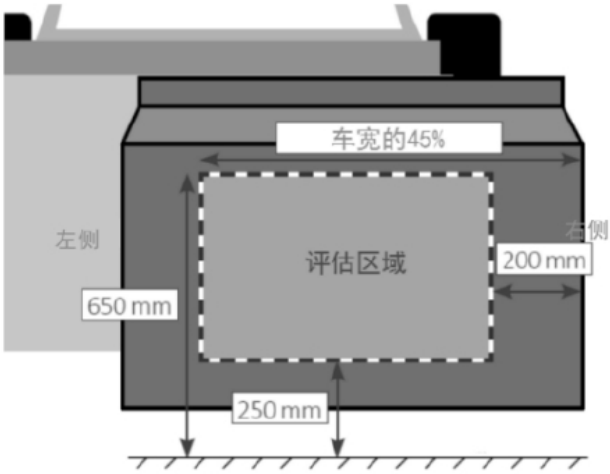


Figure 3-14 assessment area of barrier surface

1.2.1.2.6.1.1.2 Barrier scan data

Scan deformable barrier, Create a mesh from this point cloud. As parameter a maximum edge length of 10mm shall be used. Create a grid of points with an equal distance of 20mm centered on the undeformed barrier surface. This will be a number of 1400 points in total. The grid points shall be projected on the mesh of the scanned barrier surface along the X axis. .

1.2.1.2.6.1.1.3 Calculation of standard deviation (SD)

The standard deviation of intrusion depth of MPDB barrier is calculated according to formula below,

$$SD = \sqrt{\frac{\sum_{i-1}^{n}(X_n - \bar{x})^2}{n-1}}$$

In which, SD—Standard deviation

Xn – sample points

$\bar{x}$ -- average intrusion depth

SD is to evaluate sample elements deviating from average value in the assessment area defined in 1.2.1.2.6.1.1. Bigger SD is, more disperse the data is. Max modifier for implementation phase I is 1 point; while max modifier for implementation phase II is 2 points. If SD is lower than 50mm, no modifier; if more than 150mm, max points modifier applied. For value between the limits, linear interpolation will be applied to calculate the results and it will be rounded to three decimal points.

1.2.1.2.6.2 Trolley occupant load criterion (OLC)

The maximum modifier for this criterion in phase I is 1 point; while the max modifier in phase II is 2 points. If OLC value is less than 25g, no modifier; if more than 40g, max points modifier applied. For value between the limits, linear interpolation will be applied to calculate the results and it will be rounded to three decimal points.

1.2.1.2.6.2.1 OLC definition

Velocity curve Vt (CFC 180 filtering) of MPDB barrier can be obtained by integral of acceleration Ax of X direction of gravity center of MPDB barrier:

$$V_t = \int A_X(t)dt + V_0$$

In the formula: V_0 –initial velocity of barrier t=0s.

$$\int_{t=0}^{t=t_1} V_0 dt - \int_{t=0}^{t=t_1} V(t)dt = 0.065$$

$$\int_{t=t_1}^{t=t_2} (V_0(t))\, dt - \int_{t=t_1}^{t=t_2} V(t)dt = 0.235$$

T1 is the time when virtual dummy in MPDB trolley moves 65mm forward freely; t2 is the time when virtual dummy starting to be restrained and moving 235mm forward. Assuming that the deceleration of the restrained virtual dummy is constant, the value is OLC.

1.2.1.2.6.2.2 OLC calculation

OLC is calculated according to formula as below,

$$V_0(t) = V_0 - OLC_{SI-unit} \times (t - t_1)$$

$$V_0 - OLC_{SI-unit} \times (t_2 - t_1) = V(t_2)$$

In the formula: V0 ---initial velocity of trolley (m/s)

V(t) – velocity curve of trolley (m/s)

t_1 – the time when virtual dummy moving 0.065m to trolley movement (s)

t_2 – the time when virtual dummy moving 0.235m to trolley movement (s)

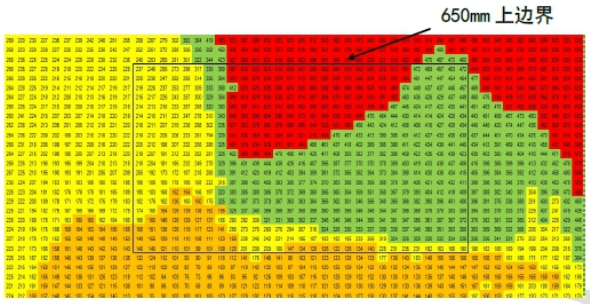
$OLC_{SI\text{-}unit}$ – curve slope of velocity of virtual dummy from t1 to t2 during impact (m/s2)

1.2.1.2.6.3 Barrier intrusion depth

When intrusion depth reaches 630mm and the area is bigger than 40mmX60mm, it is defined as 'bottoming out'. When it happens, max points modifier will be applied. The max modifier in phase I is 1 point; while max modifier in phase II is 2 points.

1.2.1.2.6.4 Barrier intrusion height

For vehicles under curb mass status, the height of lower end of longitudinal tube is more than 508mm; if the upper boundary of assessment area is in the area above 650mm, and main energy absorption structure caused at lease continuous 6 elements (area 20mmX20mm) compressed depth more than 480mm, and stress pattern of the area outside 480mm area shows no attenuation trend (figure 3-15), then 1 point modifier will be applied. The height of lower end of longitudinal tube is located at complete vertical cross section of front most of main energy absorption structure, and it should be the height of lower end of complete cross section rectangle, which can envelope the front end of main energy absorption structure. The non-energy absorption parts like welding revers should not be considered in the rectangle.



(Red area is the area with depth more than 480mm)

Figure 3-15 example of intrusion height modifier

1.2.1.2.7 Electrical safety of battery electric vehicle/hybrid electric vehicle (EV/HEV)

Refer to 1.2.1.1.8 for electrical safety assessment.

1.2.1.2.8 Overall scoring of MPDB

Table 3-25 overall scoring principle of MPDB

group	Parts		Penalty item	Area score	Overall rating
Front-row driver side	Group 1	Head, neck	The score for the driver-side dummy's head is modified with 0~-1 for excessive displacement of the steering column; Unstable contact with front airbag (or steering wheel), modifier is -1 point; Hazardous deployment of airbag, modifier is -1 point; Incorrect deployment of front airbag1, modifier is -1 point	0~4	0~24
	Group 2	Thorax, abdomen	Incorrect deployment of front airbag1 (if influence chest). modifier is -1 point Steering wheel contacts chest obviously, modifier is -1 point; Excessive backward displacement of A pillar, modifier 0~-2 points; Integrity of passenger compartment damaged, modifier is -1 point; Shoulder load force exceeds 6kN, modifier is -2 points	0~4	
	Group 3	Upper leg/ knee/ pelvis	Submarine happens, modifier -4 points; Knee airbag incorrect deployment1, modifier is -1 point.	0~4	
	Group 4	Lower leg/ foot/ ankle	Pedal excessive displacement backward and upward, modifier is 0~-1 point; Foot space is broken severely, modifier is -1 point.	0~4	
	Restraint system		If seat system fails2 in the process of test, then deduct 1 point.	-1~0	
			If seat belt system fails3 in the process of test, then deduct 1 point.	-1~0	
Front passenger	Group 1	Head, neck	Unstable contact of head and front airbag, modifier is -1 point Hazardous deployment of front airbag, modifier is -1 point; Incorrect deployment of front airbag1, modifier is -1 point.	0~4	
	Group 2	Thorax	Incorrect deployment of front airbag1 (if influence chest). modifier is -1 point Seat belt wearing position cannot fulfill defined requirement, modifier is -1 point Shoulder load force exceeds 6kN, modifier is -2 points	0~4	
	Group 3	Upper leg and pelvis	Submarine happens, modifier -2 points; Knee airbag incorrect deployment1, modifier is -1 point.	0~4	
	Restraint system		If seat system fails2 in the process of test, then deduct 1 point.	-1~0	
			If seat belt system fails3 in the process of test, then deduct 1 point.	-1~0	
	Group	Head, neck	Unstable contact of head and front airbag,	0~2	

Second-row female dummy	1		modifier is -1 point Hazardous deployment of front airbag, modifier is -1 point; Incorrect deployment of front airbag1, modifier is -1 point. If head moves forward exceeds 450mm, 550mm (or vertical line of front seat back most point), modifier is -0,5 point, -1 point respectively.		
	Group 2	Thorax	Seat belt wearing does not fulfill requirements, modifier is -0.5 point; Shoulder load force exceeds 6kN, modifier is -1 points	0~2	
	Group 3	abdomen and pelvis	Pelvis submarine, modifier is -1 point	-1 ~ 0	
	Restraint system		If seat system fails2 in the process of test, then deduct 1 point.	-1 ~ 0	
			If seat belt system fails3 in the process of test, then deduct 1 point.	-1 ~ 0	
Second-row child dummy	Head		/	0 ~2	
	Neck		/	0~ 1	
	Thorax		/	0~1	
	Abdomen		Abdomen pressure exceeds 1.2 bar, 1 point deducted.	-1 ~ 0	
	Restraint system		During dummy moving forward before getting biggest displacement position,If the seatbelt strangles the neck or slides off the shoulder, 1 point will be deducted	-1~0	
			During crash, if fix device of restrain system fails4, the score of child dummy in this test is 0 point.	/	
Compatibility	Standard deviation SD		SD less than 50mm, no modifier; more than 150mm, max points modifier applied. For value between the limits, linear interpolation will be applied to calculate the results and it will be rounded to three decimal points.	-2*~0	
	Trolley OLC		OLC less than 25g, no modifier; more than 40g, max points modifier applied. For value between the limits, linear interpolation will be applied to calculate the results and it will be rounded to three decimal points.	-2*~0	
	Barrier intrusion depth		Bottoming out, max points modifier applied.	-2*~0	
	Barrier intrusion height		Above assessment area, at least continuous 6 elements depth more than 480mm, and no attenuation trend, modifier is 1 point	-1~0	
	Note		For implementation phase I (Jan 2022 to Jan 2023), maximum modifier for this part is 3 points; for implementation phase II (Jan 2023 until end of validity period of this version), maximum modifier for this part is 6 points. * SD, OLC and barrier intrusion depth criterion have a max modifier 1 point for		

		phase I, and max modifier 2 points in phase II.		
Overall penalty item		-1 point modifier will be applied for every door open during the impact.	maximum overall penalty is 4 points	
		A minus one-point modifier will be applied for the restraint system if, when removing the dummy from the restraint system, the dummy is locked and the application of a force of over 60N on the release system cannot set it free.		
		A minus one-point modifier will be applied for the doors fitted corresponding to each row of seats on both sides of the vehicle, which fail to be opened without the use of any tools after the test.		
		A minus one-point modifier will be applied for vehicle featuring automatic locking function if locking function is not released after test of vehicle with door locked.		
Remark		For vehicle model with two-door and single-row seat, calculate score of the front row dummy only.		

Note 1: Incorrect deployment of front airbag correction is suitable for impact scenario in which airbag tending to provide impact protection. For example, if side airbag cannot be deployed correctly in front crash, modifier will be applied to side impact and side pole impact test; If knee airbag cannot be deployed correctly in 100% full frontal crash, modifier will be applied to frontal 100% crash and frontal 50% MPDB crash test. Another example, if any airbag incorrect deployment happens in frontal crash, KNEE-MAPPING test will not be accepted in the corresponding position.

Note 2: Seat failure includes complete fracture or disengagement of anchorage device, connection device, adjustment device, displacement folding device or locking device in the process of test or after test; but permanent deformation is allowed during impact process (such as partial fracture or generation of crack, etc).

Note 3: “Failure of adult seat belt” means any situation below occurring with the seat belt and restraint system:

(1)Rupture of the strap;

(2)Rupture/disengagement of the buckle, adjusting device or connector; or

(3)Malfunction of the retractor;

(4)Squib pre-tensioning phase of seat belt, which causes naked flame in occupant compartment.

Note 4: Child restraint system fixture failure means broken or falling away of the fix device of CRS, such as ISOFIX or seat belt etc., build-in child restraint system parts falling away etc.

1.2.1.3 Side impact test against the mobile deformable barrier

For the test, a maximum score of 20 points is available. For the front-row dummy, a maximum score of 16 points may be obtained; the dummy body regions to be rated include head, thorax, abdomen and pelvis which can each be awarded up to 4 points. For the second-row female dummy, a maximum score of 4 points may be obtained, and the scoring parts are dummy's head, chest, abdomen and pelvis, for each of which the maximum score is 1 point.

For the adult dummies in the frontal row and the second row, the basic scoring principle for each dummy is: to set higher performance limit and lower performance limit, corresponding to the maximum score and 0 point of each body part; the lowest point will be validated for a body region where multiple criteria exist. 0 point will be granted if injury value exceeds capping limit. The scores for all individual parameters shall be rounded to three decimal places.

For non impact side dummy of front row, the injury criteria are not involved for assessment, only for data collection.

1.2.1.3.1 Scoring of front-row dummy

1.2.1.3.1.1 Scoring of head position

The maximum and minimum scores for head are 4 points and 0 point respectively.

The score of dummy's head is obtained by measuring relevant parameters of the dummy. The dummy head assessment parameters involve the head injury criterion (HIC15) and the resultant 3ms cumulative acceleration (check table 3-26 for higher performance limits and lower performance capping limit). A maximum score of 4 points is available for each criteria. Higher and lower performance limits are to be used for calculation.

Table 3-26 head criteria of front row impact side dummy

Head criteria		Driver/ passenger side dummy of front row		
		Higher performance limit	Lower performance limit	Capping limit
Head HIC15	/	500	700	700
resultant 3ms cumulative acceleration	g	72	80	80

The lower performance limits and the higher performance limits correspond to 0 point and 4 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.3.1.2 Scoring of chest position

The maximum and minimum scores for this body area are 4 points and 0 point respectively.

The score for dummy's thorax is generated by measuring relevant criteria of the dummy, The dummy chest assessment criteria include the deflection (check table 3-27

for higher performance limit, lower performance limit and capping limit), a maximum score of 4 points is available for each criteria.

Table 3-27 thorax assessment criteria of front row impact side dummy

Thorax criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	28	50	50

The lower performance limits and the higher performance limits correspond to 0 point and 4 points respectively. Where a measurement value falls between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

No score for thorax in case of any situation below:

a) Shoulder lateral force (direction Y) bigger or equal to 3kN;

b) VC value is bigger or equal to 1.0m/s.

1.2.1.3.1.3 Scoring of abdomen position

The sliding scale for this body region is from 0 to 4 points.

The score for the dummy's abdomen is generated by measuring relevant parameters of the dummy. The assessment criterion is the compression deflection of abdomen (refer to table 3-28 for higher limit, lower limit and capping limit) which can each be awarded up to 4 points. Higher and lower performance limits are to be used for calculation.

Table 3-28 abdomen assessment criteria of front row impact side dummy

abdomen criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	47	65	65

If the abdomen rib VC value is more than or equivalent to 1.0m / s, the abdomen cannot score.

The lower performance limit and the higher performance limit correspond to 0 point and 4 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.3.1.4 Scoring of pelvis position

The sliding scale for this body region is from 0 to 4 points.

The score for the dummy's pelvis is generated by measuring relevant parameters of the dummy. The pubis force is subject to assessment (refer to table 3-29 for higher

performance limit, lower performance limit and capping limit). A maximum score of 4 points is available for it. Higher and lower performance limits are to be used for calculation.

Table 3-29 pelvis assessment criteria of front row impact side dummy

Pelvis criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
pubis force	kN	1.7	2.8	2.8

The lower performance limit and the higher performance limit correspond to 0 point and 4 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.3.2 Scoring of second-row female dummy

For the second-row female dummy, limits are set for the performance criteria of dummy's head, chest, abdomen and pelvis, with each body part corresponding to 1 point.

1.2.1.3.2.1 Scoring of head position

Maximum score for this part is 1 point, and minimum score, 0 point.

Score of dummy head is resulted from measuring dummy's related criterion; its assessment criterion is assumed by head injury criterion (HIC15), which corresponds to 1 point to the maximum, and is calculated by means of higher performance limit and lower performance limit.

Lower performance limit and higher performance limit respectively correspond to 0 point and 1 point; for a measurement value falling within them, the score shall be calculated by means of linear interpolation, which shall be subsequently rounded off to 0.01.

For the higher and lower performance limits, consult the pertinent text in Paragraph 1.2.1.3.1.1.

1.2.1.3.2.2 Scoring of chest position

The sliding scale for this body region is from 0 to 1 point.

The score for the dummy's abdomen is generated by measuring relevant parameters of the dummy. The assessment parameter is the compression deflection of chest rib (refer to table 3-30 for higher limit, lower limit and capping limit) which can each be awarded up to 1 point. Higher and lower performance limits are to be used for calculation.

Table 3-30 thorax assessment criteria of second row impact side dummy

Thorax criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	31	41	41

The lower performance limit and the higher performance limit correspond to 0 point and 1 point respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

If the chest rib VC value is more than or equivalent to 1.0m / s, the chest cannot score.

1.2.1.3.2.3 Scoring of abdomen position

The sliding scale for this body region is from 0 to 1 point.

The score for the dummy's abdomen is generated by measuring relevant parameters of the dummy. The assessment criterion is the compression deflection of abdomen (refer to table 3-31 for higher limit, lower limit and capping limit) which can each be awarded up to 4 points. Higher and lower performance limits are to be used for calculation.

Table 3-31 abdomen assessment criteria of second row impact side dummy

abdomen criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Deflection	mm	38	48	48

The lower performance limit and the higher performance limit correspond to 0 point and 4 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

If the abdomen rib VC value is more than or equivalent to 1.0m / s, the abdomen cannot score.

1.2.1.3.2.4 Scoring of pelvis position

Maximum score for this part is 1 point, and minimum score, 0 point.

The score for the dummy's pelvis is generated by measuring relevant parameters of the dummy. The pelvis resultant force of hip bone force and iliac bone force is subject to assessment (refer to table 3-32 for higher performance limit, lower performance limit and capping limit). A maximum score of 4 points is available for it. Higher and lower performance limits are to be used for calculation.

Table 3-32 pelvis assessment criteria of second row impact side dummy

Pelvis criteria		Driver/passenger side dummy front row		
		Higher performance limit	Lower performance limit	Capping limit
Pelvis resultant force	kN	3.5	5.5	5.5

The lower performance limit and the higher performance limit correspond to 0 point and 4 points respectively. Between the two limits, the score is calculated by linear interpolation and rounded to three decimal places.

1.2.1.3.3 Assessment of deployment performance of side curtain and thorax/head integrated airbag

Assessment shall be conducted in terms of performances of external dimensions, deployment mode and dynamic protection of curtain and thorax/head integrated airbag in side impact test. If any cannot meet the requirement, corresponding modifier shall be applied (refer to table 3-33). In which, 1 point modifier (overall modifier) is set for external dimension and deployment mode respectively; max 2 points modifier (dummy head of both front row and second row) for dynamic protection. Max 4 points modifier could be applied for this part.

Determination is performed at driver's side. After test, deploy side curtain/airbag at non impact side and perform auxiliary determination. In case of asymmetry between two sides due to differences of curtain airbag structure and installation position, it is necessary to evaluate separately and perform final evaluation of the test results as per the principle of penalty.

1.2.1.3.3.1 External dimensions

1.2.1.3.3.1.1 Side curtain

Curtain airbag should cover the seating positions from the front row to the 3rd row (if any). For the 3rd row seats which are removable or movable/foldable, or seats not suitable for adult (it should be clarified in user's manual), it is only required to cover to the 2nd row seating positions.

1.2.1.3.3.1.1.1 Curtain airbag should cover evaluation zones of all rows (with the exception of areas corresponding to side wall top part, B-pillar, C-pillar and door waistline).

1.2.1.3.3.1.1.2 Evaluation zone is a quadrilateral with round corners. The centers of the circle of four round corners are defined through the coordinate of center of gravity (CoG) of dummy head, as shown in Figure 3-16.

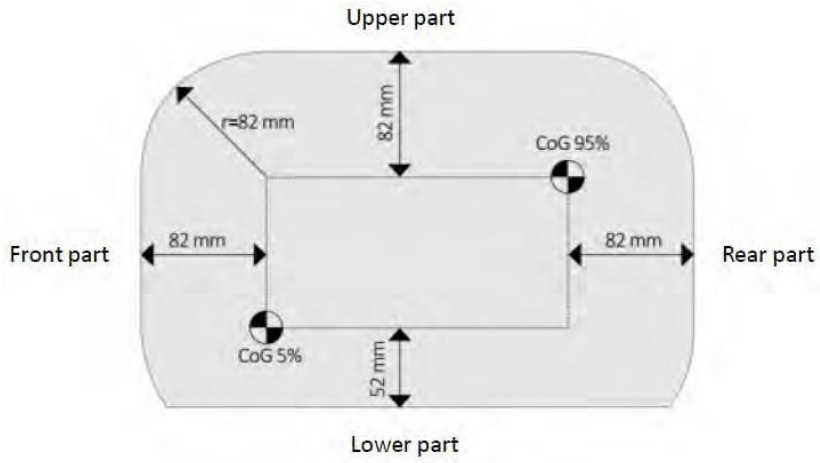


Figure 3-16 Schematic diagram of HPM evaluation zone

1.2.1.3.3.1.1.3 Head CoG position is defined in relation to H-point of 50% dummy, as shown in Figure 3-17, check the determination procedure of H-point as per A.4.6.1. For front row seat, specified H point is according to A.4.6.1.1.12 in appendix A; H-point determined in A.4.6.1.2.9 in appendix for the 2nd and 3rd row seats.

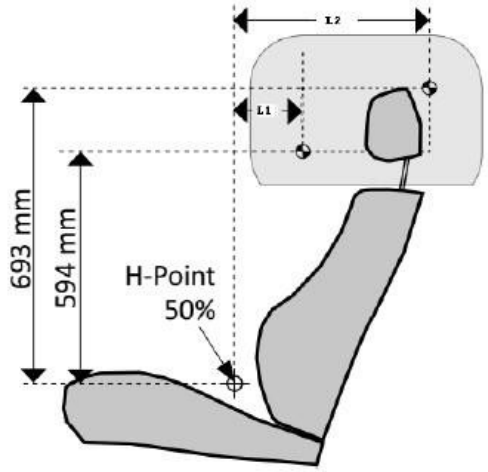


Figure 3-17 Schematic diagram of head CoG position definition

For front row seat:

5% female head CoG:

$X_{CoG,5th}$=H-point(X)+126mm–travel along horizontal direction of seat (seat 5% human body design position to position 20mm rearwards from center of seat travel)

ZCoG,5th=H-point(Z)+594mm

95% male head CoG:

$X_{CoG,95th}$=H-point(X)+147mm + travel along horizontal direction of

seat (position 20mm rearwards from center of seat travel to seat 95% human body design position)

ZCoG,95th=H-point(Z)+693mm

For the 2nd and the 3rd row seats:

5% female head CoG at the foremost seat position:

XCoG,5th=H-point(X)+126mm–travel along horizontal direction of seat (the foremost of seat travel to central position)

ZCoG,5th=H-point(Z)+594mm

95th percentile male head CoG at the rearmost seat position:

XCoG,95th=H-point(X)+147mm + travel along horizontal direction of seat (central position of seat to rearmost position)

ZCoG,95th=H-point(Z)+693mm

1.2.1.3.3.1.2 Thorax/head integrated airbag

1.2.1.3.3.1.2.1 The integrated airbag should cover head area of different percentile human being body.

1.2.1.3.3.1.2.2 Head assessment area is a quadrangle with round angle. The four circle center of round angles are specified by 50th dummy CoG in different positions, check figure 3-18. For front WorldSID 50th, it is the position where head contacts airbag; for second row, according to the contact position of SID-IIs dummy head CoG and airbag, referring 1.2.1.3.3.1.1 for the relationship between 5th and 50th dummies regarding CoG, so as to determine corresponding position of 50th dummy head gravity center.

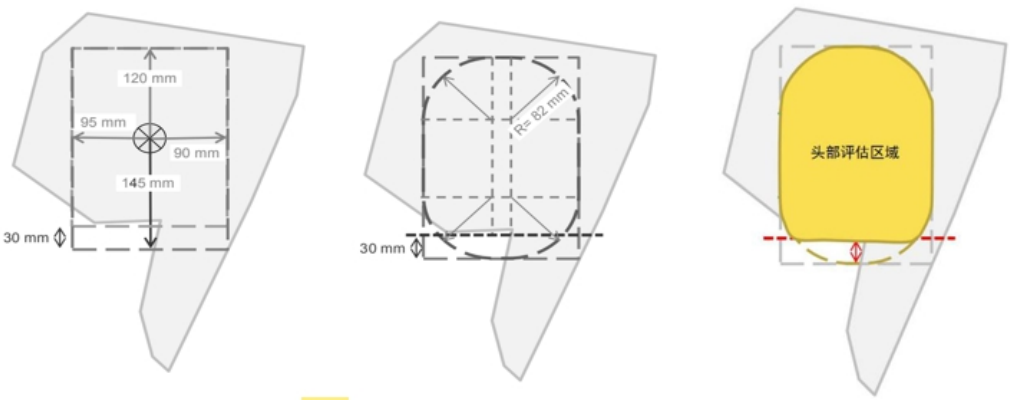


Figure 3-18 assessment area of integrated airbag

1.2.1.3.3.1.2.3 According to the contact sign on airbag of dummy head tape outline, define the coordinate system on airbag (figure3-19). Assessment on external dimensions is conducted according to 1.2.1.3.3.1.1.2.

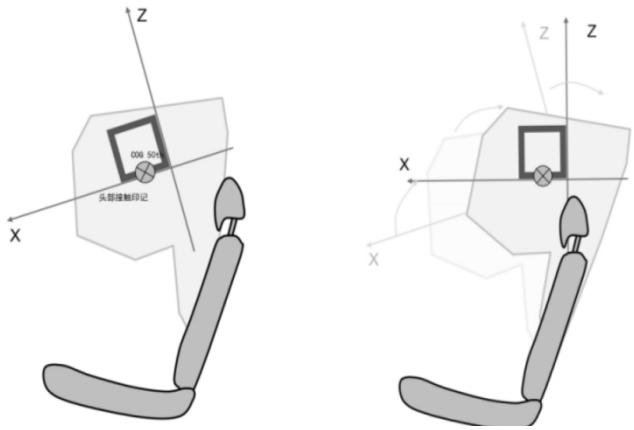


Figure 3-19 coordinate definition on integrated airbag

1.2.1.3.3.1.3 Stitching line area

Deploy curtain/airbag statically, keep the pressure in the range of OEM recommendation or 0.1bar~0.4bar, to make sure bag is inflated effectively. The dimensions and design position of stitching line area in the curtain airbag evaluation zone should meet the following requirements:

a) Joint width between non-inflated areas should not exceed 15mm;

b) Diameter of non-inflated areas should be not more than 50mm or equivalent area is not more than 650πmm2;

1.2.1.3.3.2 Deployment mode

1.2.1.3.3.2.1 There should be no situations such as hitching, cracking, jamming and so forth.

1.2.1.3.3.2.2 After falling off or rupture of interior trim parts, there should be no features such as sharp edge, sharp angle and burr that may injure occupant.

1.2.1.3.3.2 3 There should be no hard splashes (such as hard plastic scrap and metal scrap, etc); the maximum allowable weight of single piece of soft splashes (such as separating foam block of vertical Pilar and so forth) is 3g and the maximum allowable total weight is 5g.

1.2.1.3.3.3 Dynamic protection

During side impact process of vehicle, the dummy head contact position of front row and the 2nd row shall fall within the inflation zone of side curtain airbag (stitching line area should meet the requirements of 1.2.1.3.3.1.3) and ‘hard’ contact or ‘bottom out’ situation should not happen.

1.2.1.3.3.4 Overall rating for the side impact test against the mobile deformable barrier

The overall rating principle for the side impact test against the mobile deformable barrier is set out in Table 3-33.

Table 3-33 Overall rating principles for the side impact test against the mobile deformable barrier

parts		Penalty item	Area score	Overall rating
Front-row dummy	Head	For side curtain / integrated airbag, if deployment mode does not fulfill requirement,1 point modifier will be applied	0~4	0~20
	Chest	Chest score is 0 when shoulder lateral force is more than or equivalent to 3kN.	0~4	
		Chest score is 0 when chest rib VC is more than or equivalent to 1.0m/s.		
	Abdomen	Abdomen score is 0 when abdomen rib VC is more than or equivalent to 1.0m/s	0~4	
	Pelvis	-	0~4	
	Restraint system	If side airbag is not completely deployed in the process of test, then deduct 1 point.	-1~0	
		If seat belt system fails in the process of test, then deduct 1 point.	-1~0	
Second-row female dummy	Head	For side curtain / integrated airbag, if deployment mode does not fulfill requirement,1 point modifier will be applied	0~1	
	Chest	Chest score is 0 when chest rib VC is more than or equivalent to 1.0m/s.	0~1	
	Abdomen	Abdomen score is 0 when abdomen rib VC is more than or equivalent to 1.0m/s	0~1	
	Pelvis	-	0~1	
	Restraint system	If side airbag is not completely deployed in the process of test, then deduct 1 point.	-1~0	
		If seat belt system fails in the process of test, then deduct 1 point.	-1~0	
Overall penalty item		For side curtain / integrated airbag, if deployment mode or external dimension does not fulfill requirement,1 point modifier will be applied respectively		
		1 point modifier will be applied for every door liable to open during the impact.		
		1 point modifier will be applied for vehicle featuring automatic locking function if locking function of non-impact side door is not released after test of vehicle with door locked.		
		When a dummy is released from the restraint system, if seatbelt is locked and has not been unlocked by applying a pressure force more than 60N on release device, then1 point modifier will be applied respectively		
Remark		For vehicle model with two-door and single-row seat, calculate score of the front row dummy only, and count score of the second row female dummy as full score (2 points) into total score of the item of test.		

1.2.1.4 Side pole impact test

Only when both sides of the vehicle is equipped with side curtain or head/thorax airbag, is it allowed to conduct side pole test. Otherwise the score this test item is 0 point.

In this test, total score of front row is 16 points, assessment parts are: head, thorax,

abdomen and pelvis, each part awarded up to 4 points.

For front row dummy, the basic scoring principle for each dummy is: to set higher performance limit and lower performance limit, corresponding to the maximum score and 0 point of each body part; the lowest point will be validated for a body region where multiple criteria exist. 0 point will be granted if injury value exceeds capping limit. The scores for all individual parameters shall be rounded to three decimal places.

1.2.1.4.1 Dummy scoring

Except capping limit of chest deflection, refer to 1.2.1.3.1 for other injury criteria. The capping limit of chest deflection in this scenario is 55mm.

1.2.1.4.2 Assessment on deployment performance of side curtain/thorax and head integrated airbag

Refer to 1.2.1.3.3 for the requirements. Deployment mode and dynamic protection are conducted on impact side, while external dimensions is conducted on non impact side. If any cannot meet the requirement, corresponding modifier shall be applied (refer to table 3-34). In which, 1 point modifier (overall modifier) is set for external dimension and deployment mode respectively; 1 point modifier (dummy head of front row) for dynamic protection. Max 3 points modifier could be applied for this part.

1.2.1.4.3 Electrical safety of BEC/HEV

Refer to 1.2.1.1.8 for assessment.

1.2.1.4.4 Overall scoring of side pole impact test

Table 3-34 shows the overall scoring principle of side pole test.

Table 3-34 overall scoring principle of side pole test

parts		Penalty item	Area score	Overall rating
Front-row dummy	Head	For side curtain / integrated airbag, if deployment mode does not fulfill requirement,1 point modifier will be applied	0~4	0~16
	Chest	Chest score is 0 when shoulder lateral force is more than or equivalent to 3kN.	0~4	
		Chest score is 0 when chest rib VC is more than or equivalent to 1.0m/s.		
	Abdomen	Abdomen score is 0 when abdomen rib VC is more than or equivalent to 1.0m/s	0~4	
	Pelvis	-	0~4	
	Restraint system	If side airbag is not completely deployed in the process of test, then deduct 1 point.	-1~0	
		If seat belt system fails in the process of test, then deduct 1 point.	-1~0	
Overall penalty item		For side curtain / integrated airbag, if deployment mode or external dimension does not fulfill requirement,1 point modifier will be applied respectively		
		A minus one-point modifier will be applied for vehicle featuring automatic locking function if locking function of non-impact		

parts	Penalty item	Area score	Overall rating
	side door is not released after test of vehicle with door locked.		
	When a dummy is released from the restraint system, if seatbelt is locked and has not been unlocked by applying a pressure force more than 60N on release device, then subtract 1 point respectively		

1.2.1.5 Whiplash test

1.2.1.5.1 Whiplash for driver seat

Maximum score for the whiplash test is 5 points, and the scoring is based on the injury criteria measured through sensors installed on the dummy; dummy measuring data comprise three sets: one set represents the neck injury criterion calculated from head acceleration and thorax acceleration, and the maximum score is 2 points; the second set is represented by upper neck load and torque, for which the maximum score is 1.5 points; the third set is represented by lower neck load and torque, for which the maximum score is 1.5 points. The scoring is based on dummy injury criteria; for each injury criterion, both higher and lower performance limits are established, corresponding to the maximum score and 0 point respectively; for a value falling between them, the score shall be calculated by means of linear interpolation, and the score of each test item shall be rounded off to 0.01. For this test, penalty of 2 points, 2 points and 5 points shall apply respectively in case of non-conformity below: maximum dynamic flare angle of seat back, head interference space of head restraint, and seat track dynamic displacement.

1.2.1.5.1.1 Neck injury criterion (NIC)

For this group, the maximum score is 2 points, and the minimum score, 0 point. Scoring shall be resulted from the measurement of dummy head acceleration and thorax T1 acceleration. Through calculation, the neck injury criterion (NIC) can be obtained.

Check table 3035 for lower performance limit and higher performance limit, which correspond to 0 point and 2 points respectively; for a value falling between them, the score shall be calculated by means of linear interpolation, and the score of each test item shall be rounded to three decimal points.

1.2.1.5.1.2 Upper neck load and torque

Maximum score for this group is 1.5 points, and minimum score, 0 point. The scoring is based on the measurement of related criteria of dummy upper neck, including upper neck shearing force Fx+, upper neck tension Fz+ and upper neck torque My. Calculate score of all indexes respectively, and take the lowest value of three items of score as the score of the group.

Refer to table 3-35 for lower performance limit and higher performance limit, which correspond to 0 point and 1.5 points, respectively; for a measurement value falling between them, the score shall be computed by means of linear interpolation, which shall be subsequently rounded to three decimal points.

1.2.1.5.1.3 Lower neck load and torque

Maximum score for this group is 1.5 points, and minimum score, 0 point. The scoring is based on the measurement of related criteria of dummy lower neck, including lower neck shearing force Fx+, lower neck tension Fz+ and lower neck torque My. Calculate score of all indexes respectively, and take the lowest value of three items of score as the score of the group.

Lower performance limit and higher performance limit correspond to 0 point and 1.5 points, respectively; for a measurement value falling between them, the score shall be computed by means of linear interpolation, which shall be subsequently rounded off to 0.01.

1.2.1.5.1.4 Penalty items for whiplash test

1.2.1.5.1.4.1 Seat back dynamic flare angle

For this item, the maximum penalty score is 2 points. Based on image analysis, the maximum variation of seat back flare angle is obtained during the impact; the limit for this item is 25.5º. No penalty score applies for a value below such limit, i.e., 0 point is obtained; 2 points shall be deducted if such limit is exceeded or equaled, i.e., -2 points are obtained.

1.2.1.5.1.4.2 Head interference space of head restraint

For this item, the maximum penalty score is 2 points. In the course of seat adjustment and measurement, 2 points shall be deducted if HRMD measurement is interfered by the head restraint, i.e., -2 points are obtained.

1.2.1.5.1.4.3 Seat track dynamic displacement

This penalty item is only applied to test seat where there is seat position behind. If the test is most rear row, no this penalty item for this part.

For this item, the maximum penalty score is 5 points. Based on the high-speed video data, 5 points shall be deducted if the maximum dynamic displacement of track in relation to fixed part exceeds or equals to 20mm in the course of dynamic impact, i.e., -5 points are obtained.

1.2.1.5.2 Second row whiplash test

Maximum score of second row is 2 points. The dummy injury criteria and assessment method is exactly the same as 1.2.1.5.1. A score could be obtained according to driver seat whiplash scoring method. The final result is the score multiply 0.4.

1.2.1.5.3 Overall scoring of whiplash test

The minimum score for the whiplash test is 0 point. It will not be negative score due to penalty score. Table 3-35 presents the overall scoring principles for the whiplash test:

Table 3-35 Overall scoring principles for whiplash test

Criteria			Higher performance limit	Lower performance limit	score	Score of whiplash test
Driver seat	Parts	NIC	$8m^2/s^2$	$30m^2/s^2$	0～2	0～5
		Upper neck Fx+	340 N	730 N	0～1.5	
		Upper neck Fz+	475 N	1130 N		
		Upper neck My	12 N·m	40 N·m		
		Lower neck Fx+	340 N	730 N	0～1.5	
		Lower neck Fz+	257 N	1480 N		
		Lower neck My	12 N·m	40 N·m		
	Penalty items	Seat back dynamic flare angle	≥25.5°		-2	
		Head interference space of head restraint	Y		-2	
		Seat track dynamic displacement	≥20mm		-5	
Second row	parts	NIC	$8m^2/s^2$	$30m^2/s^2$	0～0.8	0～2
		Upper neck Fx+	340 N	730 N	0～0.6	
		Upper neck Fz+	475 N	1130 N		
		Upper neck My	12 N·m	40 N·m		
		Lower neck Fx+	340 N	730 N	0～0.6	
		Lower neck Fz+	257 N	1480 N		
		Lower neck My	12 N·m	40 N·m		
	Penalty items	Seat back dynamic flare angle	≥25.5°		-0.8	
		Head interference space of head restraint	Y		-0.8	
		Seat track dynamic displacement	≥20mm		-2	

1.2.2 Child protection static assessment

Max score of child protection static assessment is 3 points, of which 'assessment based on vehicle' accounts for 2 points and 'assessment of CRS installation check' accounts for 1 point. For vehicle cannot fulfill requirement of airbag forbidden information, 1 penalty point will be applied.

1.2.2.1 Assessment based on vehicle

The maximum score for this part is 2 points.

Evaluation items: applicability of seat belt CRS, applicability of ISOFIX CRS, applicability of big size CRS and communication function. For each item, 0.5 point is granted if fulfill the requirement. Final score is the sum of the 4 items.

1.2.2.2 CRS installation check

Max score of CRS installation check is 1 point

Use both seatbelt CRS and ISOFIX CRS in the 'product list of CRS static assessment' for installation check. For each category max 0.5 point is granted. Total score of this part is the sum of scores of the two category.

1.2.2.3 Penalty item of child protection static assessment

Max 1 point will be applied for the penalty item.

Check relevant information in vehicle manual. It shall be defined clearly in the manual the installation applicability for seats with airbag or curtain (including all seats in the vehicle). If the requirement cannot be fulfilled, -1 penalty point will be applied.

1.2.3 Penalty item of seat belt reminder

For vehicle not configured with seat belt reminder (SBR) or the performance of reminder meets not fulfill the specified technical requirements, then relevant points can be deducted, a maximum of 2 points is deducted for the item.

For the passenger position of front row, seat belt reminder and passenger presence detection function shall be available at the same time, otherwise penalty item shall be applied: if warning signal cannot fulfill the following requirements or no passenger detection function, 1 penalty point will be applied, that is -1 point.

For the positions of second row, seat belt reminder and passenger presence detection function shall be available at the same time, otherwise penalty item shall be applied: if warning signal cannot fulfill the following requirements or it cannot distinguish sitting position, 1 point will be deducted; if warning signal could distinguish sitting position and fulfill requirements of 1.2.3.1~1.2.3.5 and 1.2.3.7, but no passenger detection function, 0.5 point will be deducted.

1.2.3.1 Signal

Visual signal should be sufficiently and the signal position is clearly visible for driver sitting in normal position, such as instrumental panel, eye level display, rear view mirror and center console etc. initial audible signal and final audible signal shall be loud and clear, ensuring that driver could hear easily when normal using condition. There should be a relevance between visual signal and audible signal: once seat belt audible signal activated, visual signal should flash and at the same pace with audible signal. No need to have the same frequency, but at least it is relevant with integral multiple (such as 2 times flash with once ring)

1.2.3.2 Safety airbag switch

Vehicle front airbag and front row passenger SBR signal should be independent. Front row passenger SBR function should not be deactivated by airbag switch.

1.2.3.3 Using status change

During driving, if the status of seat belt changed (seat belt in unbuckled status), seat belt reminder signal shall be activated when one of the status below fulfilled,

a) Vehicle has been moving forward for 500m;

b) Vehicle driving forward speed exceeds 25km/h.

If system could trace the number of buckled in rear row, when all doors are kept closed and the buckled number stay unchanged, there is no need to change the status of reminding signal. For example, children change seats at traffic lights.

1.2.3.4 Passenger position of front row

The front passenger position shall meet the requirements of visual and auditory signals at the same time.

1.2.3.4.1 Visual signal

When ignition is put in the position of 'on' (no matter engine is running or not), if seat belt is not buckled up or using status changed as in 1.2.3.3 in this chapter, visual reminding signal has to be activated; if it can be confirmed that there is no passenger in the front seat, no need to activate.

1.2.3.4.2 Initial audible signal

If seat belt is under status of unbuckled, when vehicle is under one of the status below, initial audible signal shall be activated,

a) Vehicle has moved forward more than 60s;

b) Vehicle has moved forward 500m;

c) Vehicle driving speed has exceeded 25km/h.

Initial audible signal could last maximum 30s, and it has to start with positive going audio visual signal, and no gap more than 10s.

1.2.3.4.3 Final audible signal

If seat belt is under status of unbuckled, when vehicle is under one of the status below, final audible signal shall be activated,

a) vehicle has moved forward 90s;

b) Vehicle has moved forwards 1000m;

c) Vehicle driving forward speed exceeds 40km/h;

d) Initial audible signal ends

Final audible signal lasts at least for 90s (gap more than 3s is not accounted), and it

has to be started with positive going signal (not gap), and no gap more than 10s.

1.2.3.4.4 Choose of audible signal

OEM could choose to take initial audible signal as final audible signal. But the initial audible signal has to be 'loud and clear', and lasts for at least 90s (gap more than 3s is not accounted). And it has to be started with positive going signal (not gap), and no gap more than 10s.

1.2.3.5 Second row seat

1.2.3.5.1 Visual signal

1.2.3.5.1.1 When ignition is put in the position of 'on' (no matter engine is running or not), if seat belt is not buckled up or using status changed as in 1.2.3.3 in this chapter, visual reminding signal has to be activated; if it can be confirmed that there is no passenger in the front seat, no need to activate.

1.2.3.5.1.2 If there is no status monitoring function of the second row, visual signal has to show the position information of seat belt used or not.

1.2.3.5.1.3 System allows driver to confirm signal and switch off it. But this should not prevent activation of next time reminding signal.

1.2.3.5.2 Audible signal

1.2.3.5.2.1 There is no requirement of audible signal for vehicle without seat status monitoring function.

1.2.3.5.2.2 For vehicles with seat status monitoring function, if passenger is not belted or status of seat belt is change (from buckled to unbuckled), in case of one of conditions below, 'clear and loud' audible signal has to be activated,

a) Vehicle has moved forward 500m;

b) Vehicle driving forward speed has exceeded 25km/h.

Audible signal shall last at least 30s (gap more than 3s is not accounted), and there is no gap more than 10s. OEM could also take the same audible reminding way in 1.2.3.4 in this chapter, including initial and final reminder.

1.2.3.5.3 Second row installed with CRS

If vehicle could detect the installation of CRS automatically, signal could be switched off.

1.2.4 Bonus items

Maximum bonus points in total is 4 points

1.2.4.1 Side curtain pressure keeping performance

For vehicle configured with side curtain, 2 bonus points will be granted if either

FMVSS226 or internal pressure keeping requirement is fulfilled. If OEM choose to be tested according to FMVSS226 requirement, test certificate by qualified testing institute could be provided. Management center will review on the technical and performance requirement for judgement; If pressure keeping test is chosen, it will be tested on the non-impact side of the post-crash car of side (side pole) impact test.

1.2.4.1.1 FMVSS226 test

Head model with mass (18±0.05) kg is taken to test relevant parts (side curtain in deployed status) of vehicle performance of avoiding occupant ejection out. The test is conducted in 2 energy levels: 278J ((20±0.5)km/h) and 178J ((16±0.5)km/h). The movement distance shall be not more than 100mm after it shoots inner surface of daylight window (figure 3-20). Check appendix A.6 for details.

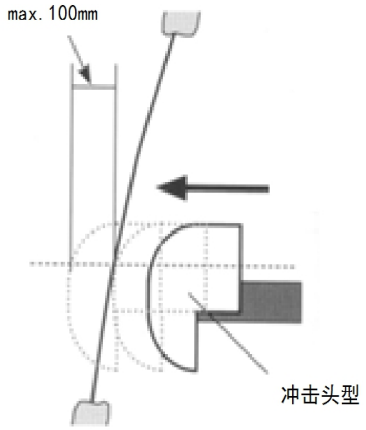


Figure 3-20 judgement of head moving distance

1.2.4.1.2 Pressure keeping test of curtain

For post-test vehicle of side (side pole) impact, fire the non-impact side curtain, if pressure of position of head protection area (CFC180) is 50% more than working pressure（average pressure 40ms-70ms） within 6s, it is confirmed to fulfill the technical requirement. Refer to Appendix A4.11.1.2 for details.

1.2.4.2 Accident emergency call system (E-CALL)

1.2.4.2.1 E-CALL system

For vehicles equipped with E-CALL system, in terms of all 3 test vehicles in C-NCAP test, if every vehicle's E-CALL performance could fulfill technical requirement, the bonus point will be granted. Maximum point is 2 points. The system should have 2 kinds of emergency call function: manual mode and automatic mode. If only one of the modes works, then 1 bonus point will be granted.

1.2.4.2.2 Manual mode

For vehicles with both manual and automatic modes, manual emergency call shall be tested before crash test. But if automatic emergency call fails after test, manual emergency call shall be conducted again. For vehicles with only manual mode,

manual emergency call shall be conducted both before crash test and after test. Manual call mode should be switched over easily and easy to operate. When the call is activated manually, the call shall be connected and answered in 60s. If call can be answered and accurate orientation information can be obtained, 1 bonus point will be granted.

1.2.4.2.3 Automatic mode

After crash test, the system could activate the call automatically. the call shall be connected and answered in 60s. If call can be answered and accurate orientation information can be obtained. Then 1 bonus point will be granted.

1.2.4.2.4 Response party

No detailed requirement of response party of the call.

2 PEDESTRIAN PROTECTION

2.1 Test items

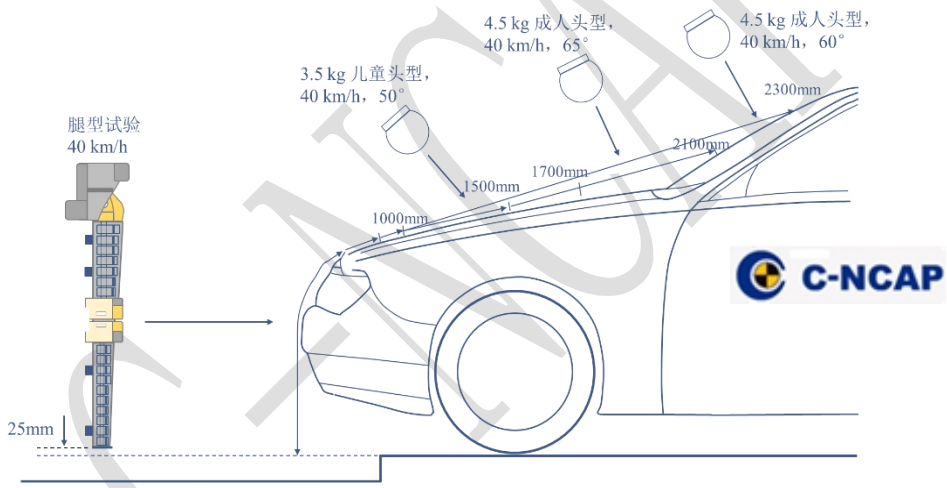


Figure 3-21 Pedestrian protection test

Pedestrian protection test item includes headform test and legform test, so as to respectively evaluate headform test zone and legform test zone of vehicle, as shown in Figure 3-21. Adult headform or child headform is selected for headform test by taking WAD1700 wrap around line (or bonnet rear reference line) as boundary in accordance with vehicle structure characteristics, and the specified position of vehicle headform test zone is impacted; aPLI legform is used for legform test and the specified position of legform test zone is impacted.

2.1.1 Headform test

Adjust vehicle to normal ride attitude, with headform impacting vehicle headform test zone at speed of $40^{+0.72}_{-0.72}$ km/h, and evaluate the impact protection performance of vehicle for pedestrian head. Headform test is divided into child headform test and adult headform test, the impact angle is 50º±2º when child headform is used for test, and the impact angle is 65º±2º or 60º±2º when adult headform is used for test.

Headform should be under free flight condition upon the moment of impact, and deviation of test point impact position should be not more than ±10mm. In test, calculate HIC15 value through acquisition of acceleration along three directions of headform in impact process, so as to evaluate impact protection performance of vehicle for pedestrian head.

2.1.2 Legform test (aPLI test)

Adjust vehicle to normal ride attitude, with legform impacting vehicle front legform test zone horizontally at speed of $40^{+0.72}_{-0.72}$ km/h,and evaluate impact protection performance of vehicle for pedestrian leg. The legform should be under free flight condition at the moment of impact, velocity vector should be within horizontal plane and vehicle longitudinal vertical plane, the angle deviation should be not more than ±2º, and deviation of rotation angle of legform around its vertical axis shall be not more than ±2º, and the bottom of legform should be within the scope of 25mm±10mm above ground reference plane. During test, 8 indexes such as 4 bending moments of tibia, 3 bending moments of femur and MCL etc. of knee ligament elongation are collected during impact process, so as to evaluate impact protection performance of vehicle for pedestrian leg.

2.2 Performance criteria and scoring method

Evaluation of pedestrian protection includes evaluation of vehicle headform test zone and legform test zone. The maximum achievable score is 15 points, in which, the maximum achievable score for headform test zone is 10 points and the maximum achievable score for legform test zone is 5 points.

2.2.1 Headform test zone

The maximum achievable score for headform test zone is 10 points and the minimum score is 0 point. Headform test zone is divided into several grid points or areas, the maximum achievable score for each grid point or area is 1.000 and the minimum achievable score is 0.000. Head evaluation index is HIC15, 5 areas are set as per head evaluation index HIC15 value, each area corresponds to different score points, and is indicated by different colors, see Table 3-36. Sum of score points of all grid points or areas in headform test zone is divided by maximum achievable score of all grid points or areas to obtain percentage of headform test score. The percentage is multiplied by 10 to get the final score of headform test zone, and the score is rounded to 3 decimal places.

As per the situation whether vehicle manufacturer provides components such as bonnet required for test and predicated results of headform test zone as per requirement, perform headform test and scoring as per the specified grid point method or equivalent area division method.

Table 3-36 Determination condition of predicted results of headform test zone

Predicted result		color	Score point
"default predicted results grid point"		Default green	1.000
		Default red	0.000
"unpredictable results grid point"		Blue ■	To be determined by headform test results
"Specific predicated results grid point" or "headform test result"	HIC15 < 650	Green ■	1.000
	650 ≤ HIC15 < 1000	Yellow ■	0.750
	1000 ≤ HIC15 < 1350	Orange ■	0.500
	1350 ≤ HIC15 < 1700	Brown ■	0.250
	1700 ≤ HIC15	Red ■	0.000

2.2.1.1 Grid point method

If vehicle manufacturer provides components such as bonnet required for test and predicated results of headform test zone as per requirement, then perform test and scoring as per this method.

Prior to test, vehicle manufacturer should provide predicated results of all grid points as per the mode of color distribution (or HIC15 value) to Administration Center, see Figure 3-22. The predicated results can be divided into three parts, "specific predicated results grid point", "default predicated results grid point" and "unpredictable results grid point". When predicated result contains "unpredictable results grid point", vehicle manufacturer should provide evidence for difficulty of prediction at the same time, and number of blue areas should not exceed 8, and symmetrical position area can be deemed as 1.

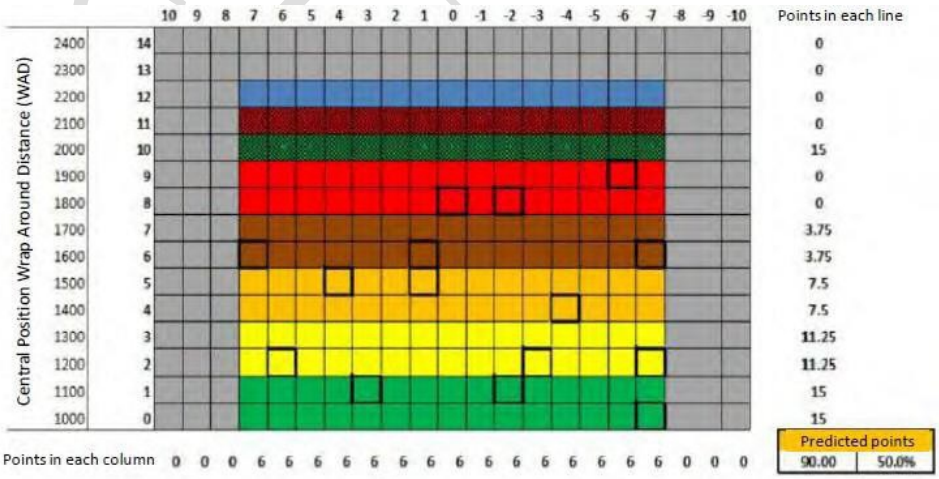


Figure 3-22 Schematic diagram of predicated results of headform test

During test evaluation, for "specific predicated results grid point", C-NCAP Test Administration Department randomly takes 10 grid points according to the color distribution for test verification. Final sum of score obtained at the verification test points is divided by sum of score of the predicted results at corresponding points to calculate correction factor, the correction factor is used to correct the predicated

results of all grid points (with predicated results), then the corrected result is used as score for calculation of evaluation results. When the correction factor is in the scope of 0.8-1.2, it is deemed that the correction factor is acceptable. If the correction factor is more than 1.2, the correction factor is “1.2”; if the correction factor is less than 0.8, the correction factor is deducted by 0.2. For “default predicated results grid point”, directly take it as score for calculation of evaluation results. For “unpredictable results grid point”, C-NCAP Test Administration Department selects the grid point potentially causing large injury to pedestrian from each blue area for test, obtains relevant score in accordance with test result HIC15 value as per Table 3-36, multiplies it by number of grid points in the blue area, and it is used as score for calculation of evaluation results.

There are differences between test results of different laboratories and between test results and simulation results, tolerance of ±10% of verification test HIC15 value is allowed, and the tolerance is only used for verification of correctness of predicated color of grid point. See the determination interval with consideration of tolerance as per the following Table 3-37. If the color of verification test is identical with the predicated color, then the predicated result color and relevant score are obtained for the point. If the color of verification test is not consistent with the predicated color, then the test result color of the grid point and relevant score are obtained in accordance with verification test HIC15 value as per Table 3-36.

Table 3-37 Determination condition of verification test result of allowable tolerance

HIC15 interval	Color
HIC15<722.22	Green ■
590.91≤HIC15<1,111.11	Yellow ■
909.09≤HIC15<1,500	Orange ■
1,227.27≤HIC15<1,888.89	Brown ■
1,545.45≤HIC15	Red ■

When manufacturer deems that it is necessary to add number of test points, so as to acquire more accurate assessment results, manufacturer may propose to add test points, the additional test points should not exceed 10, and should be proposed upon submitting of predicated results, C-NCAP Test Administration Department randomly selects the additional test point position as per color distribution proportion.

2.2.1.2 Equipartition area method

If vehicle manufacturer has not provided components such as bonnet required for test and predicated results of headform test zone as per requirement, then perform test and scoring as per the following method.

2.2.1.2.1 Enough components needed have been purchased

Divide headform test zone into 18 equipartition areas, and divide each equipartition area into 4 zones or 2 zones. C-NCAP Test Administration Department selects 1 grid point potentially causing large injury to pedestrian from each equipartition area for test. The score of each test point is obtained in accordance with test result as per the

determination condition of Table 3-36, i.e., score of area of test point. Score of the area can be used as score for all equipartition areas. For equal areas of symmetrical structure, it is allowed to select any side for test and scoring. For equal area without test point, the score of symmetrical equipartition area is awarded.

When manufacturer deems that it is necessary to add number of test points, so as to acquire more accurate assessment results, manufacturer may propose to add test points, the additional test points should not exceed 8. When it is necessary to add test points, it is necessary to propose upon submitting of vehicle test information and indicate the distribution of assessment areas of these newly added test points. For equipartition area in which manufacturer applies to add test points, C-NCAP Test Administration Department respectively selects 1 point potentially causing large injury to pedestrian from area in which evaluation is specified for additional test points and area in which no evaluation is specified for additional test points. Respectively obtain score for two test points as per the determination condition of Table 3-36, and respectively assign score to area in which evaluation is specified for additional test points and area in which no evaluation is specified for additional test points.

The score awarded to each equipartition area is the sum of score of all segments of the equipartition area.

2.2.1.2.2 Not enough components needed have been purchased

Divide headform test zone into 18 equipartition areas. C-NCAP Test Administration Department selects 9 points potentially causing large injury to pedestrian for test, each equipartition area should not contain exceed 1 point. Select 1 test point for two equipartition areas of symmetrical position. Obtain score of each test point as per the determination condition of Table 3-36 in accordance with test result. The score awarded to the equipartition area where test point is located equals to score of the test point multiplied with number of the equipartition area, and equipartition area without test point is awarded with score of its symmetrical equipartition area.

2.2.2 Scoring of legform test zone

The maximum achievable score for legform test zone is 5 points and the minimum score is 0 point. Legform test zone is divided into several grid points, the maximum achievable score for each grid point is 1.000 and the minimum achievable score is 0.000. The assessment criteria are: 4 criteria of tibia bending moment, 3 criteria of femur bending moment and knee MCL ligament elongation. Maximum achievable score of femur bending moment is 0.400, take the biggest moment value of the 3 criteria for final scoring; Maximum achievable score of tibia bending moment is 0.400, take the biggest moment value of the 4 criteria for final scoring; maximum achievable score of ligament elongation is 0.200, based on MCL value. During scoring, higher performance limit and lower performance limit are adopted for calculation. The lower performance limit and higher performance limit respectively correspond to score of 0.000 and maximum achievable score, where a measurement value falls between the two limits, the score is calculated by linear interpolation, and is rounded to 3 decimal places.

Higher performance limit:	Femur bending moment	390Nm
	Tibia bending moment	275Nm
	MCL elongation	27mm
Lower performance limit:	Femur bending moment	440Nm
	Tibia bending moment	320Nm
	MCL elongation	32mm

Note: legform limits are aiming at latest version SBL-B of aPLI. For current available SBL-A version, higher and lower performance limits could be conducted referring the response differences between this version and latest version.

Sum of score of all grid points obtained in test is divided by maximum achievable score of these grid points to obtain score percentage of legform test zone. The percentage is multiplied by total score 5 of legform test zone to obtain the final score of legform test zone, and the score is rounded to 3 decimal places.

Legform test zone is divided into several grid points, select one grid point from every other grid points starting from L0 or L1. C-NCAP Test Administration Department will select program potentially causing large injury to pedestrian for test. Calculate the awarded score as per test results. Grid points that have not been tested will be awarded with the lowest score of the adjacent grid points. Vehicle is deemed as bilateral symmetry by default, grid point of the side not tested will be awarded with score of the symmetrical grid point of the tested side.

If vehicle manufacturer deems that grid points not tested cannot get accurate evaluation or symmetry should not be applied to a certain grid point, manufacturer may propose to add test for the point, and the additional test points should not exceed 3 and should be proposed before start of test.

If manufacturer has not provided components such as front bumper as per the purchase requirements of C-NCAP, then grid points that have not been tested will be awarded score of adjacent test points.

3 ACTIVE SAFETY

3.1 Test items

3.1.1 Advanced driving assistance system (ADAS)

3.1.1.1 Audit item

For vehicles equipped with ESC, LDW, SAS, BSD C2C, BSD C2TW, the test performance report of qualified 3rd test organization provided by OEM will be checked, to determine if these systems on vehicle could fulfill all the requirements.

3.1.1.2 Automated emergency braking system (AEB)

3.1.1.2.1 Vehicle rear Automated emergency braking system (AEB CCR)

AEB CCR consists of 2 test scenario: CCRs, CCRm, as shown in figure 3-23a), 3-23b) and table 3-38.

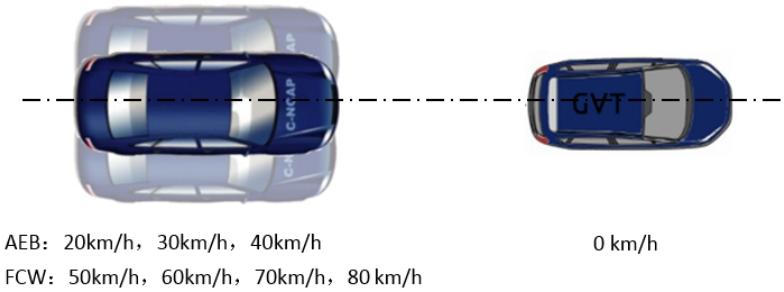


Figure 3-23a): CCRs test scenario of front car stationary

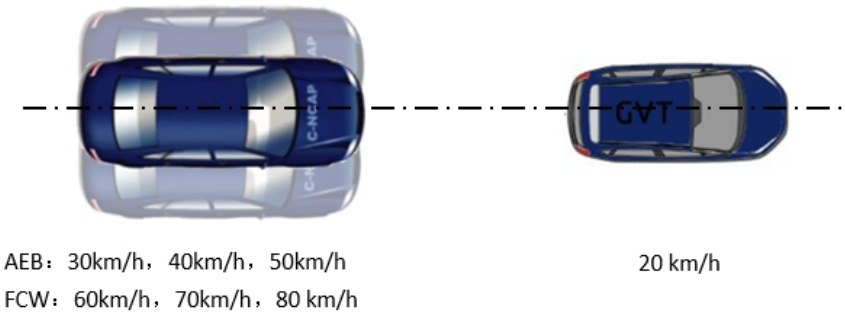


Figure 3-23b): CCRs test scenario of front car moving

Table 3-38 CCRs and CCRm test items

Test scenario	Test items	Test speed（km/h）	Overlap rate
CCRs（front car stationary）	AEB	20	-50%
		20	100%
		30	+50%
		30	100%
		40	-50%
		40	100%
	FCW	50	+50%
		50	100%
		60	-50%
		60	100%
		70	+50%
		70	100%
		80	-50%
		80	100%

	AEB	30	+50%
		30	100%
		40	-50%
		40	100%
		50	+50%
		50	100%
	FCW	60	-50%
		60	100%
		70	+50%
		70	100%
		80	-50%
		80	100%

3.1.1.2.2 Pedestrian emergency autonomous braking (AEB VRU_Ped)

Test scenario of AEB VRU_Ped consists of CPFA-25 day and night, CPFA-50 day, CPNA-25 day and CPNA-75 day, CPLA-50 day and night, CPLA-25 day and night (as shown in figure 3-24a), 3-24b), 3-24c)). For day scenario, there is no additional illumination except natural light; for night scenario, there is additional illumination. Check table 3-39 for detailed information.

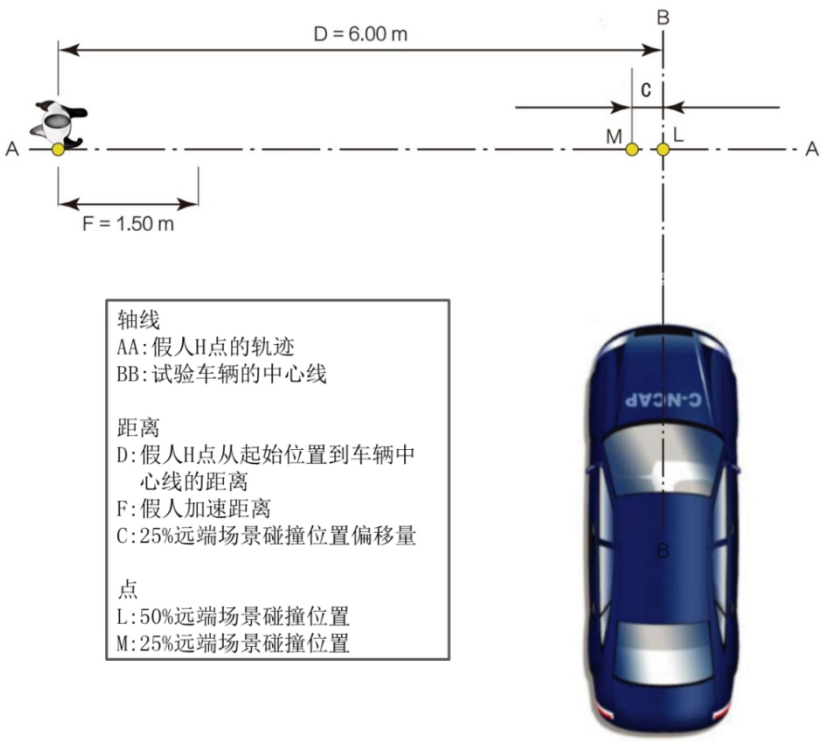


Figure 3-24a） CPFA-50，CPFA-25 pedestrian test scenario

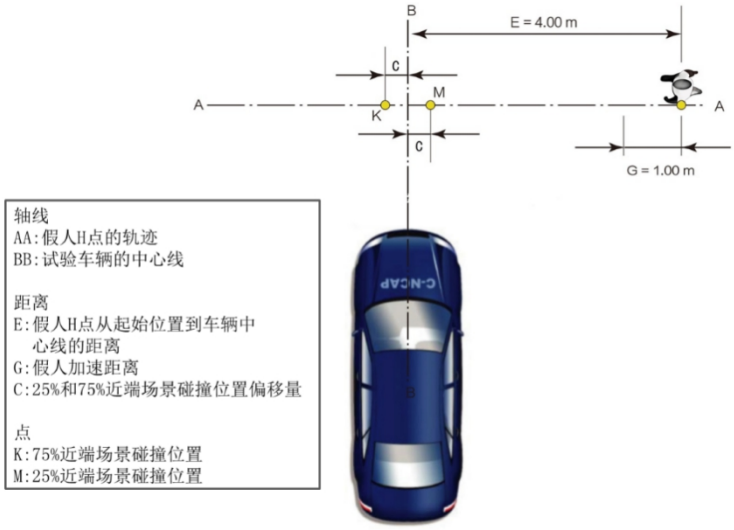


Figure 3-24b） CPNA-25，CPNA-75 pedestrian test scenario

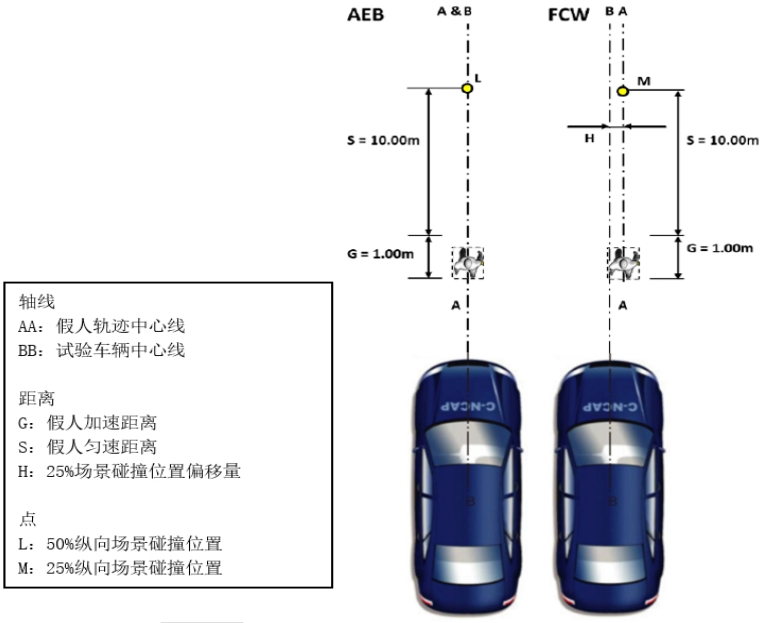


Figure 3-24c） CPLA-50，CPLA-25 pedestrian test scenario

Table 3-39 AEB VRU_Ped test items

AEB VRU_Ped	CPFA-25	CPFA-50	CPNA-25	CPNA-75	CPLA-50	CPLA-25
Test type	AEB					FCW
Test speed（km/h）	20-60					50-80
Target speed（km/h）	6.5		5			
Illumination	Day and night	day			Day and night	
headlamp	Low beam	/			High beam	
Street lamp	Street lamp				No street lamp	

Note 1： CPFA-50 （Car-to- Pedestrian Farside Adult)： Under condition without braking, vehicle will impact adult pedestrian, and impact position is ‘L’ point in figure 3-25a). CPFA-25 impact position is ‘M’ point in figure 3-24a).

Note 2: CPNA-25 （Car-to- Pedestrian Nearside Adult)： Under condition without braking, vehicle will impact adult pedestrian, and impact position is ‘M’ point in figure 3-25b). CPNA-75 impact position is ‘K’ point in figure 3-24b).

Note 3: CPLA-50 （Car-to-Pedestrian Longitudinal Adult ）： Under condition without braking, vehicle will impact adult pedestrian, and impact position is ‘L’ point in figure 3-25c). CPLA-25 impact position is ‘M’ point in figure 3-24c).

3.1.1.2.3 Two wheeler Automated emergency braking (AEB VRU_TW)

AEB VRU_TW system test scenario consists of CBNA-50 day, CSFA-50 day, CBLA-50 day，CBLA-25 day (figure 3-25a), 3-25b), 3-25c)).

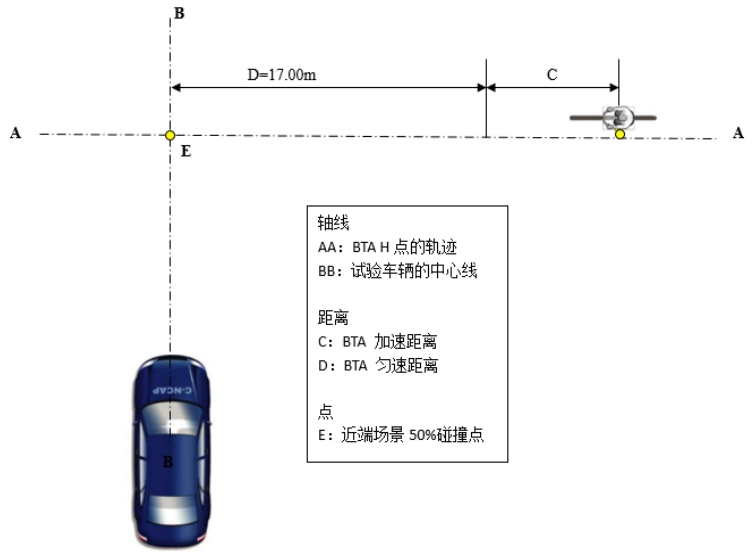


Figure 3-25a） CBNA-50 bicycle test scenario

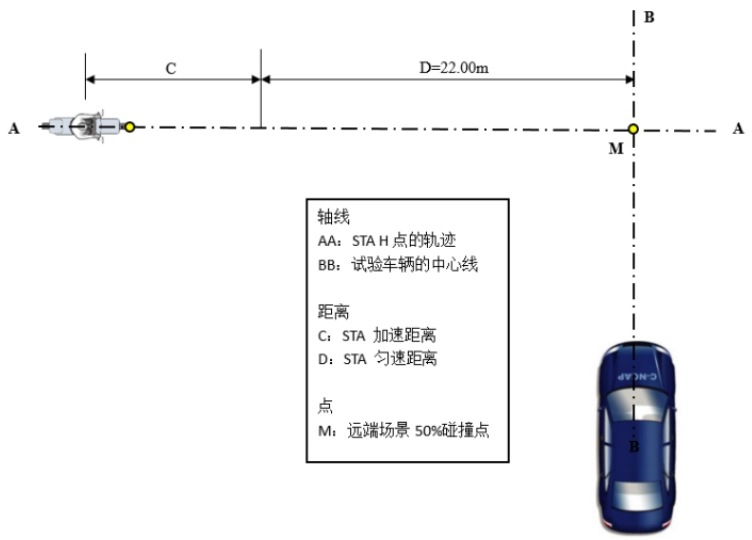


Figure 3-25b） CSFA-50 E-scooter test scenario

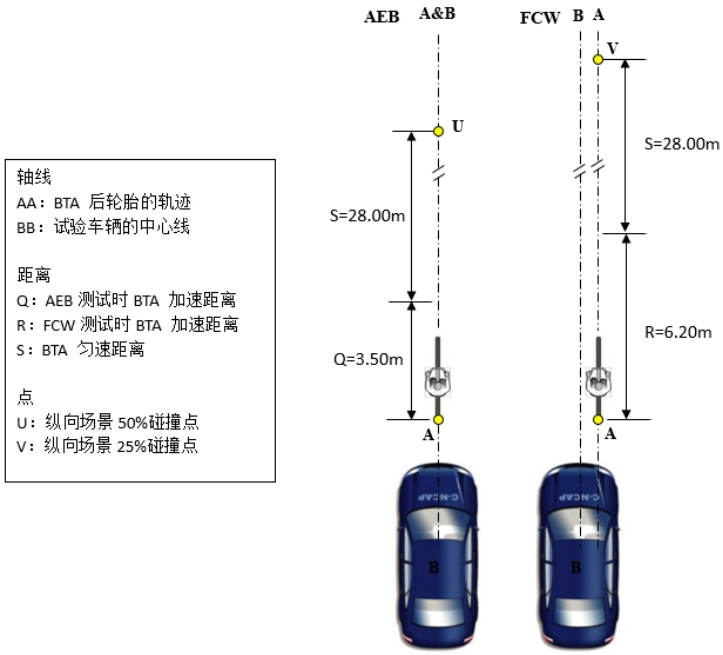


Figure 3-25c） CBLA-50，CBLA-25 Bicycle test scenario

Table 3-40 AEB VRU_TW test item

AEB 2- wheelers	CBNA	CSFA	CBLA	
Test type	AEB	AEB	AEB	FCW
VUT speed（km/h）	20-60	30-60	20-60	50-80
Target speed（km/h）	15	20	15	15
Impact position	50%	50%	50%	25%
Illumination	day	day	day	day

Note 1: CBNA-50 (Car-to-Bicyclist Nearside Adult): Under condition without braking, vehicle will impact nearside crossing bicycle, and impact position is point ‘E’ in figure 3-25a).

Note 2: CSFA-50 (Car-to-Scooter Farside Adult): Under condition without braking, vehicle will impact farside crossing E-scooter, and impact position is point ‘M’ in figure 3-25b).

Note 3: CBLA-50 (Car-to-Bicyclist Longitudinal Adult): Under condition without braking, vehicle will impact longitudinal driving bicycle, and impact position is point ‘U’ in figure 3-25c). CBLA-25 impact position is point ‘V’ in figure 3-26c.

3.1.1.3 Lane keeping assistance system (LKA)

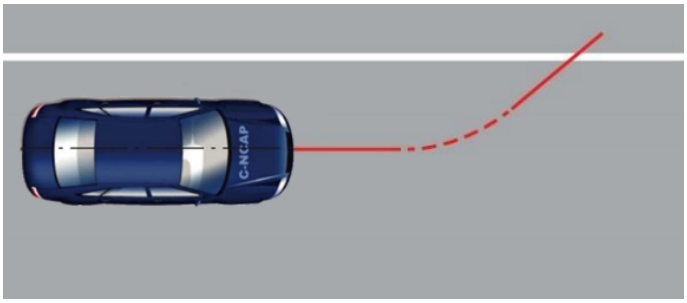


Figure 3-26a） vehicle deviating left side with solid lane marking

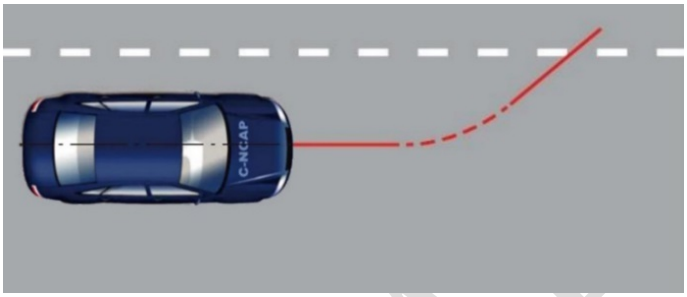


Figure 3-26b） vehicle deviating left side with dotted lane marking

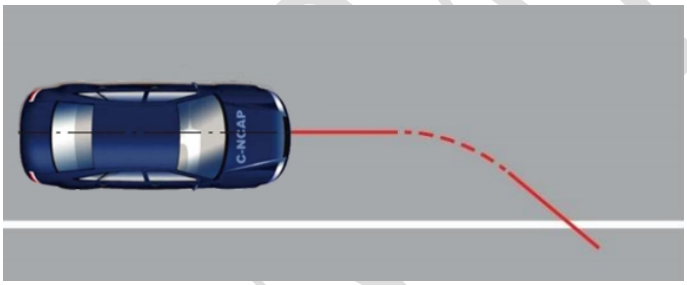


Figure 3-26c） vehicle deviating right side with solid lane marking

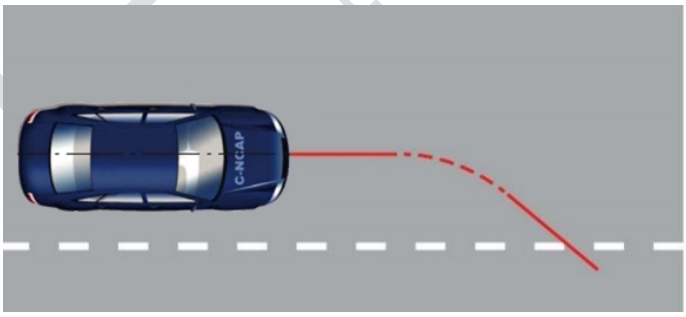


Figure 3-26d） vehicle deviating right side with dotted lane marking

LKA test scenario consists of deviation left side with solid/dotted lane marking and deviation right side with solid/dotted lane marking. Table 3-41 is the summary of LKA test items.

Table3-41 LKA system test summary

LKA test scenario			
Lane marking type	Deviation direction	Test vehicle speed （km/h）	Deviation velocity (m/s)
solid	Left side	80	0.2
			0.3
			0.4
			0.5
	Right side	80	0.2
			0.3
			0.4
			0.5
dotted	Left side	80	0.2
			0.3
			0.4
			0.5
	Right side	80	0.2
			0.3
			0.4
			0.5

3.1.1.4 HMI test assessment

HMI test includes tests of AEB CCR, AEB VRU_Ped and AEB VRU_TW, as shown in table 3-42.

3.1.1.4.1 HMI test and assessment of AEB CCR

The pre-condition of HMI scoring: when vehicle ignition on, AEB and FCW functions are default on; FCW warning signal shall be clear and loud.

If requirements above fulfilled, the following 3 items are the scoring items:

a) Switch off requirement: the system shall not be switched off by single short operation on single button.

b) Warning requirement: except for the basic acoustic/ optical warning signal, FCW is equipped with other warning forms (heads-up display, seatbelt vibration, brake jerk or other haptic warning)

c) Seat belt pre-tension: vehicle is equipped with pre-tension function. When system recognize the impact risk , seat belt could conduct pre-tension function before impact, structure design should ensure the function could be used repeatedly.

3.1.1.4.2 HMI test and assessment of VRU_Ped

The pre-condition of HMI scoring: when vehicle ignition on, AEB and FCW functions are default on; FCW warning signal shall be clear and loud.

If requirements above fulfilled, the following 2 items are the scoring items:

a) Switch off requirement: the system shall not be switched off by single short operation on single button.

b) When VVUT ＞ 40km/h and the impact risk with PTA is detected, system should activate loud and clear warning signal to warn driver. Warning should be sent out before TTC=1.2s (checked in CPNA-75 scenario, with 45km/h), to leave enough time for driver react on warning.

Note: Points can be granted only when both requirement above are fulfilled; if there is no FCW function, no points for this item.

3.1.1.4.3 HMI test and assessment of AEB VRU_TW

The pre-condition of HMI scoring: when vehicle ignition on, AEB and FCW functions are default on; FCW warning signal shall be clear and loud.

a) off requirement: the system shall not be switched off by single Switch short operation on single button.

Table 3-42 HMI test items

Items	Assessment items
AEB CCR	Switch off requirement
	FCW assisted warning requirement
	Active seat belt warning function
AEB VRU_Ped	Switch off requirement
	FCW assisted warning requirement
AEB VRU_TW	Switch off requirement

3.1.2 Vehicle-level light performance test

Vehicle-level light performance test consists of low beam Vehicle-level test and high beam Vehicle-level test. Test criteria includes: straight lane guiding distance, curve guiding distance, visibility of pedestrian left side, detection width of pedestrian in crossing road, curve illumination width and glaring for low beam; and illumination range, detection width of pedestrian in crossing road etc. for high beam.

3.1.2.1 Low beam performance test of Vehicle-level

Move test vehicle into test platform and align the center line of the vehicle, switch on the lighting system after finished test preparation. According to the initial declination setting of Vehicle-level, collect the light distribution of the basic low beam lamp by using the imaging luminance meter or illuminometer (as shown in Figure 3-27), and

calculate the 6 criteria: straight lane guiding distance, curve guiding distance, visibility of pedestrian left side, detection width of pedestrian in crossing road, curve illumination width and glaring by collecting the light distribution of the basic low beam lamp Light. Evaluate the performance of low beam Vehicle-level combined with whether it has adaptive low beam function, low beam automatic activation function and automatic headlamp leveling system to evaluate the performance of low beam vehicle.

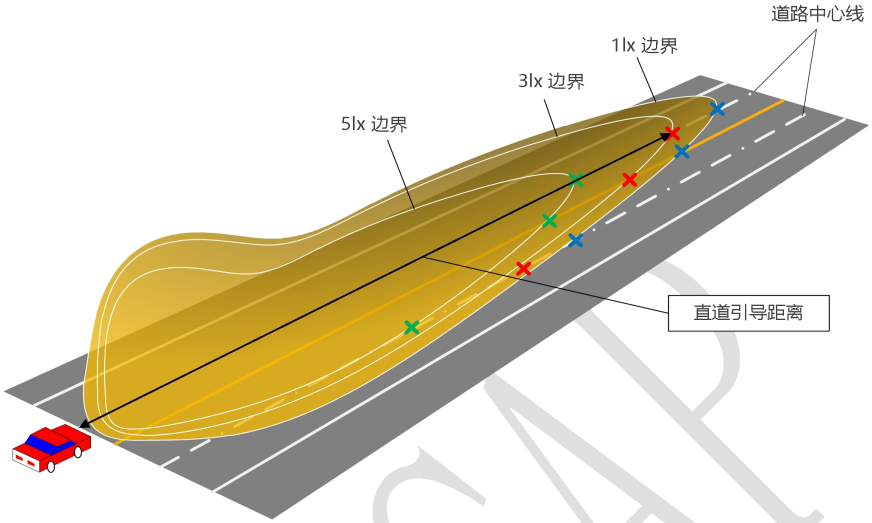


Figure 3-27 low beam performance test of Vehicle-level

3.1.2.2 High beam performance test of Vehicle-level

Move test vehicle into test platform and align the center line of the vehicle, switch on the lighting system after finished test preparation. According to the initial declination setting of Vehicle-level, collect the light distribution of the basic low beam lamp by using the imaging luminance meter or illuminometer (as shown in Figure 3-28), and calculate the 2 criteria: illumination range, detection width of pedestrian in crossing road. Evaluate the performance combining with the function of adaptive high beam function.

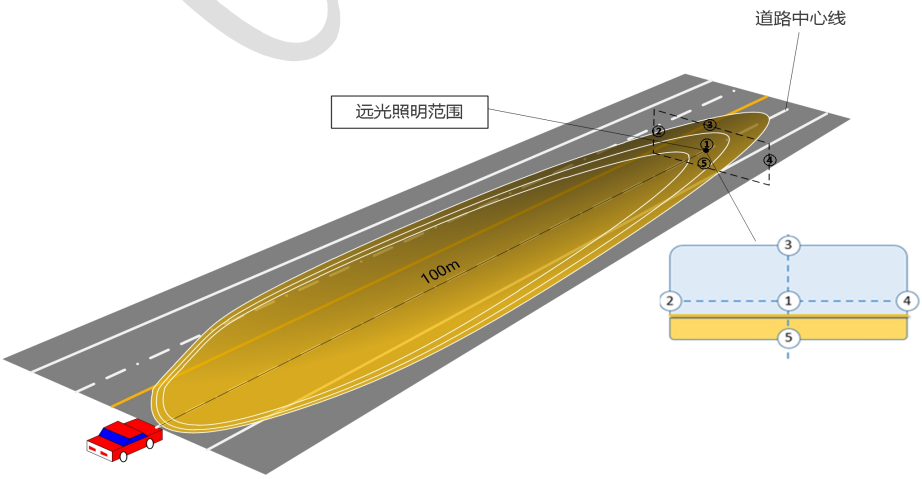


Figure 3-28 high performance test of Vehicle-level

3.2 Performance criteria and scoring method

3.2.1 Scoring of advanced driving assistance system (ADAS)

Maximum score of ADAS part is 56 points, as shown in table 3-43,

Table 3-43 overview of scoring and weight of active safety ADAS

Item type	Item	Test	Score of each item	Total score
Assessment item	AEB CCR	CCRs	4	56
		CCRm	7	
	AEB VRU_Ped	CPNA day	2	
		CPFA day	2	
		CPFA night	4	
		CPLA day	1	
		CPLA night	1	
	AEB VRU_TW	CBNA	4	
		CSFA	4	
		CBLA	3	
	LKA	/	3	
	HMI	/	6	
Audit item	ESC	/	8	
Optional audit item	BSD-C2C	/	2	
	BSD-C2TW	/	3	
	SAS	/	2	
	LDW	/	2	
Note: maximum 7 points for optional audit item.				

3.2.1.1 scoring method of audit item

3.2.1.1.1 Audit of electronic stability control (ESC)

For vehicle configured with electronic stability control system (ESC), vehicle manufacturer should provide performance test report regarding compliance of the vehicle model with relevant requirements of GB/T 30677-2014 “Performance Requirements and Testing Methods for Electronic Stability Control System (ESC) for Light Vehicles” issued by third party inspection institution with qualification, and submit description document for conformity of C-NCAP sample vehicle to ESC test report sample vehicle, in which parameters comparison Table shown in attachment 7 must be included. Points can be awarded after the submitted performance test report, description document for conformity and C-NCAP sample vehicle pass audit by Administration Center.

The performance test report should at least include the following contents:

a) Compliance with ESC function requirements of standard;

b) Test data of slow increase of turning angle of steering wheel;

c) Test data of sine with dwell;

d) Photo of test vehicle installed with test equipment and testing of vehicle in test site;

e) Parameters directly related to ESC performance, for example: wheelbase, wheelspan, tyre model, maximum total design mass, and position of center of mass, suspension structure mode and main structure parameters.

Note: Performance test report can be based on GTR No.8 "Electronic Stability Control Systems" or FMVSS 126 "Electronic Stability Control Systems Testing" or ECE R13H Appendix9 "Electronic Stability Control Systems", but should not be in violation of relevant requirements in GB/T 30677-2014.

3.2.1.1.2 Audit of other systems

For vehicles configured with LDW, BSD C2C or BSD C2CTW, vehicle manufacturer should provide performance test report regarding compliance of the vehicle model with relevant requirements of GB/T 30677-2014 "Performance Requirements and Testing Methods for Electronic Stability Control System (ESC) for Light Vehicles" issued by third party inspection institution with qualification, and submit description document for conformity of C-NCAP sample vehicle to ESC test report sample vehicle, in which parameters comparison Table shown in attachment 7 must be included. Points can be awarded after the submitted performance test report, description document for conformity and C-NCAP sample vehicle pass audit by Administration Center.

The performance report should at least consists of content below:

a）data to prove that system could fulfill relevant requirement of the protocol

b）pictures of test device, test device insulation and testing on test ground

c）parameters relating to relevant performance, check attachment 7 for details

3.2.1.2 Scoring of Automated emergency braking (AEB) test

3.2.1.2.1 AEB CCR

3.2.1.2.1.1 Weight of different speeds, scenario and items of AEB CCR

Check table 3-44 for Weight of different speeds, scenario and items of AEB CCR

Table 3-44 AEB CCR test items and weight

Test scenario	Test type	Test speed（km/h）	Overlap	weight		Scenario score
CCRs	AEB	20	-50%	2	14	4
		20	100%	2		
		30	+50%	2		
		30	100%	2		
		40	-50%	3		
		40	100%	3		
	FCW	50	+50%	1	14	
		50	100%	1		
		60	-50%	3		
		60	100%	3		
		70	+50%	1		
		70	100%	1		
		80	-50%	2		
		80	100%	2		
CCRm	AEB	30	+50%	2	16	7
		30	100%	2		
		40	-50%	2		
		40	100%	2		
		50	+50%	4		
		50	100%	4		
	FCW	60	-50%	2	16	
		60	100%	2		
		70	+50%	3		
		70	100%	3		
		80	-50%	3		
		80	100%	3		

3.2.1.2.1.2 Calculation method of score for all test speed points of AEB CCR

3.2.1.2.1.2.1 For the AEB function and FCW function tests, scoring is calculated on the basis of the relative speed reduction achieved at test speed points. For test where impact is completely avoided, full score is awarded for the test speed point; for test where there is no full avoidance of impact, a linear interpolation is applied to calculate the score of the corresponding single test, and the score is rounded to 3 decimal places in calculation.

The calculation method is as follows:

$$\text{Scoring rate at test} = \frac{V_{rel,test} - V_{rel,impact}}{V_{rel,test}}$$

In the formula: $V_{rel,test}$: Relative speed of VUT (vehicle under test) and GVT (vehicle target) at start of test (km/h);

$V_{rel,impact}$: relative speed between VUT and GVT when they collide, equals speed of VUT when impact deduce speed of GVT.(km/h).

3.2.1.2.1.2.2 If the vehicle speed reduction achieved by the system at a certain test speed point<5km/h or Vimpact (the speed of VUT when VUT impacts GVT) >50km/h, stop the test in the scenario.

3.2.1.2.1.2.3 TFCW (TTC at the moment of FCW alarm) is required to be <4s for all test speed points of FCW function, for test point of TFCW≥4s, no points are scored.

3.2.1.2.1.3 AEB CCR system score calculation step

3.2.1.2.1.3.1 Firstly, obtain the scoring rate of each test speed point in accordance with test results as per 3.2.1.2.1.2.1 of this Chapter.

3.2.1.2.1.3.2 In accordance with corresponding speed weighting percentage, calculate to obtain the scoring rate of AEB function and FCW function in each scenario.

3.2.1.2.1.3.3 In accordance with the scoring rate in each scenario and weighting percentage of the corresponding scenario, calculate to obtain the scoring rate of CCRs and CCRm.

3.2.1.2.1.3.4 In accordance with the scoring rate and weighting percentage of the corresponding scenario of CCRs and CCRm, calculate to obtain the scoring rate of AEB CCR.

3.2.1.2.1.4 Scoring method for different combinations of AEB function and FCW function

3.2.1.2.1.4.1 combination of AEB function and FCW function

AEB CCR score is calculated according to 3.2.1.2.1.3.

3.2.1.2.1.4.2 System featuring AEB function only

All test speed points of AEB and FCW are tested. Test speed point of FCW is in compliance with the test method of AEB, and the scoring method is in compliance with 3.2.1.2.1.3.

3.2.1.2.1.4.3 System featuring FCW function only

Test is performed only for FCW part, AEB function part score is zero, and the scoring method is in compliance with 3.2.1.2.1.3.

3.2.1.2.2 Pedestrian Automated emergency braking system (AEB VRU_Ped)

Prerequisite for scoring point for AEB VRU_Ped system is:

a) AEB VRU_Ped pedestrian system should start operation (warn or brake)

from speed of 10km/h in CPNA-75 scenario.

b) The system should be able to detect pedestrians walking at 3km/h and reduce vehicle speed in the CPNA-75 scenario at vehicle speed of 20km/h.

c) No point is awarded to AEB VRU_Ped system when only FCW alarm function is available.

3.2.1.2.2.1 weight of different speeds, scenario and items of AEB VRU_Ped

Check table 3-45 for weight of different speeds, scenario and items of AEB VRU_Ped

Table 3-45 AEB VRU_Ped test items and weight

Test scenario	Test itmes	Impact position	Test speed（km/h）	Weight of speed	Weight of items		Weight of scenario
CPNA day	AEB	75%	20	1	8	16	2
			30	2			
			40	2			
			50	2			
			60	1			
		25%	20	1	8		
			30	2			
			40	2			
			50	2			
			60	1			
CPFA day	AEB	50%	20	1	7	14	2
			30	1			
			40	2			
			50	2			
			60	1			
		25%	20	1	7		
			30	1			
			40	2			
			50	2			
			60	1			
CPFA night	AEB	25%	20	1	9		4
			30	1			
			40	2			
			50	3			
			60	2			
CPLA day	AEB	50%	20	1	7	11	1
			30	2			

Test scenario	Test itmes	Impact position	Test speed （km/h）	Weight of speed	Weight of items		Weight of scenario
			40	2			
			50	1			
			60	1			
	FCW	25%	50	1	4		
			60	1			
			70	1			
			80	1			
CPLA night	AEB	50%	20	1	8	14	1
			30	1			
			40	2			
			50	2			
			60	2			
	FCW	25%	50	2	6		
			60	2			
			70	1			
			80	1			

3.2.1.2.2.2 Score calculation method of speed test points of AEB VRU_Ped system

3.2.1.2.2.2.1 For the AEB VRU_Ped system function tests, scoring for Vvut (speed of VUT) ≤40km/h is based on the relative speed reduction achieved at test speed points. For test where impact is completely avoided, full score is awarded for the test speed point; for test where there is no full avoidance of impact, a linear interpolation is applied to calculate the score for the corresponding single test, and the score is rounded to 3 decimal places in calculation.

Calculation method for Vvut≤40km/h is as follows:

$$\text{Scoring rate at test points} = \frac{V_{rel,test} - V_{rel,impact}}{V_{rel,test}}$$

In the formula：$V_{rel,test}$——the relative velocity of VUT and PTA when test starts, unit is km/h

$V_{rel,impact}$—— the relative velocity of VUT and PTA when they collide, It is calculated by VUT velocity deducing PTA velocity when they collide (in longitudinal scenario) unit is km/h.impact.

3.2.1.2.2.2.2 For test points of VVUT>40km/h, full points are awarded when a speed reduction ≥20km/h is achieved by AEB function. Zero point is awarded when a speed reduction is <20km/h, and test in the scenario is stopped.

3.2.1.2.2.2.3 For FCW test scenario, assessment basis is TTC. At every test velocity scenario, if TTC≥1.7s, score will be awarded, otherwise no score.

3.2.1.2.2.3 AEB VRU_Ped system score calculation step

3.2.1.2.2.3.1 Firstly, obtain the scoring rate of each test speed point in accordance with test results as per 3.2.1.2.2.2 of this Chapter.

3.2.1.2.2.3.2 In accordance with the scoring rate of each test speed point and the corresponding speed weighting percentage, calculate the scoring rate of each scenario of AEB VRU_Ped.

3.2.1.2.2.3.3 In accordance with the scoring rate in each scenario and weighting percentage of the corresponding scenario, calculate scoring rate of AEB VRU_Ped.

3.2.1.2.3 AEB VRU_TW

3.2.1.2.3.1 weight of different velocities, scenario and items

Check table 3-46 for weight of test velocity, scenario and score in AEB VRU_TW test and assessment.

Table 3-46 AEB VRU_TW test item and weight

<table>
<tr><th>Test scenario</th><th>Test item</th><th>Impact position</th><th>Test speed（km/h）</th><th>Velocity weight</th><th colspan="2">Item weight</th><th>Scenario score</th></tr>
<tr><td rowspan="5">CBNA</td><td rowspan="5">AEB</td><td rowspan="5">50%</td><td>20</td><td>1</td><td colspan="2" rowspan="5">7</td><td rowspan="5">4</td></tr>
<tr><td>30</td><td>2</td></tr>
<tr><td>40</td><td>2</td></tr>
<tr><td>50</td><td>1</td></tr>
<tr><td>60</td><td>1</td></tr>
<tr><td rowspan="4">CSFA</td><td rowspan="4">AEB</td><td rowspan="4">50%</td><td>30</td><td>2</td><td colspan="2" rowspan="4">6</td><td rowspan="4">4</td></tr>
<tr><td>40</td><td>2</td></tr>
<tr><td>50</td><td>1</td></tr>
<tr><td>60</td><td>1</td></tr>
<tr><td rowspan="10">CBLA</td><td rowspan="5">AEB</td><td rowspan="5">50%</td><td>20</td><td>1</td><td rowspan="5">10</td><td rowspan="10">17</td><td rowspan="10">3</td></tr>
<tr><td>30</td><td>2</td></tr>
<tr><td>40</td><td>2</td></tr>
<tr><td>50</td><td>3</td></tr>
<tr><td>60</td><td>2</td></tr>
<tr><td rowspan="5">FCW</td><td rowspan="5">25%</td><td>50</td><td>3</td><td rowspan="5">7</td></tr>
<tr><td>60</td><td>2</td></tr>
<tr><td>70</td><td>1</td></tr>
<tr><td>80</td><td>1</td></tr>
</table>

3.2.1.2.3.2 score calculation method of AEB VRU_TW at different speed points

3.2.1.2.3.2.1 For the AEB VRU_TW function tests, scoring is calculated on the basis of the relative speed reduction achieved at test speed points when VVUT (VUT speed)≤40km/h. For test where impact is completely avoided, full score is awarded

for the test speed point; for test where there is no full avoidance of impact, a linear interpolation is applied to calculate the score of the corresponding single test, and the score is rounded to 3 decimal places in calculation.

The calculation method when VVUT≤40km/h is as follows:

$$\text{Scoring rate} = \frac{V_{rel,test} - V_{rel,impact}}{V_{rel,test}}$$

In the formula: $V_{rel,test}$—— relative velocity of VUT and BTA/STA when test starts, (km/h)

$V_{rel,impact}$——the relative velocity of VUT and BTA/STA impacts. It is calculated by VUT velocity deducting BTA/STA at impact time point (in longitudinal scenario)impact, unit is km/h.

3.2.1.2.3.2.2 For test points of VVUT>40km/h, full points are awarded when a speed reduction ≥20km/h is achieved by AEB function. Zero point is awarded when a speed reduction is <20km/h, and test in the scenario is stopped.

3.2.1.2.3.2.3 For FCW test scenario, assessment basis is TTC. At every test velocity scenario, if TTC≥1.7s, score will be awarded, otherwise no score.

3.2.1.2.3.3 AEB VRU_TW score calculation step

3.2.1.2.3.3.1 Firstly, obtain the scoring rate of each test speed point in accordance with test results as per 3.2.1.2.3.2 of this Chapter.

3.2.1.2.3.3.2 In accordance with the scoring rate of each test speed point and the corresponding speed weighting percentage, calculate the scoring rate of each scenario of AEB VRU_TW.

3.2.1.2.3.3.3 In accordance with the scoring rate in each scenario and weighting percentage of the corresponding scenario, calculate scoring rate of AEB VRU_TW.

3.2.1.3 LKA

3.2.1.3.1 Weight of different speeds, scenario and items of LKA

Check table 3-47 for Weight of different speeds, scenario and items of LKA.

Table 3-47 LKA test items and weight

Lane marking	Deviation direction	Test speed（km/h）	Deviation speed（m/s）	Weight of speed point	Item weight	Scenario weight
Solid lane marking	Left side	80	0.2	1	8	3
			0.3	1		
			0.4	1		
			0.5	1		
	Right side	80	0.2	1		
			0.3	1		

Lane marking	Deviation direction	Test speed （km/h）	Deviation speed （m/s）	Weight of speed point	Item weight	Scenario weight
			0.4	1		
			0.5	1		
Dotted lane marking	Left side	80	0.2	1	8	
			0.3	1		
			0.4	1		
			0.5	1		
	Right side	80	0.2	1		
			0.3	1		
			0.4	1		
			0.5	1		

3.2.1.3.2 Calculation method of LKA at different speed points

For LKA test， the criterion used is the distance between tire outside and lane marking outside. Test vehicle deviates gradually towards left side (right side), pass condition is that tire outside shall not exceed 0.2m from outer-most edge of lane marking..

Each test point is conducted by groups. For each group, test is repeated 3 times. If all 3 tests passed, it is judged as pass of this point. For each test point, maximum 2 groups test will be conducted.

3.2.1.3.3 Score calculation steps of LKA

3.2.1.3.3.1 Firstly, obtain the scoring rate of each test point in accordance with 3.2.1.3.2 of this Chapter.

3.2.1.3.3.2 scoring rate could be obtained in accordance with scoring rate of each test point and the weight.

3.2.1.4 HMI test and assessment

HMI test include AEB CCR、AEB VRU_Ped and AEB VRU_TW, as shown in table 3-48.

Table 3-48 HMI test items and weight

items	Assessment requirements	Item weight	score
AEB CCR	Switch off requirement	2	2
	FCW assisted warning	1	
	Active seat belt warning function	1	
AEB VRU_Ped	Switch off requirement	2	2
	FCW assisted warning	1	
AEB VRU_TW	Switch off requirement	/	2

Note：If scoring rate of corresponding test item is less than 60%, HMI score of this part is: HMI score×scoring rate of corresponding test item; if scoring rate of corresponding test item equal to or more than 60%, HMI score of this part is: HMI score×100%.

3.2.2 lighting performance scoring of Vehicle-level

3.2.2.1 overall scoring principle of lighting performance in Vehicle-level

Maximum score of Vehicle-level lighting performance test is 10 points, check table 3-49 for detailed scoring rules.

Table 3-49 overall scoring principle of Vehicle-level lighting performance

item	Assessment items		Assessment content	score	Total score
Low beam	Straight lane guiding distance		Illumination distance along lane	0～1.5	10
	Curve guiding distance		Illumination distance along curve	0～1.0	
	Visibility of pedestrian left side		Distance to find out pedestrian left side	0～1.0	
	Pedestrian detection width in crossing road		Width to find out pedestrian in crossing road	0～1.5	
	Curve illumination width		Illumination width to curve	0～1.0	
High beam	Illumination range	Point 1	Illumination distance to road, sign, road condition	0～1.0	
		Point 2		0～0.4	
		Point 3		0～0.2	
		Point 4		0～0.4	
		Point 5		0～0.5	
	Pedestrian detection width in crossing road		Width to find out pedestrian in crossing road	0～0.5	
Bonus	Adaptive low beam function		This function shall have at least 2 sub modes	0, 0.1, 0.2, 0.3	
	Adaptive high beam function		Adaptive high beam or automatic switchover of high/low beams, bonus point can be granted	0, 0.2, 0.5	
	Automatic on of low beam		Low beam can be switched on automatically	0, 0.1	
	Automatic headlamp leveling system		Bonus point has the function leveling headlamp automatically	0, 0.1	
Penalty	Opposing Glare		If opposing glare is out of specified limit, 1.0 points will be deducted	0, -1.0	

3.2.2.2 test scoring

For scoring convenience, each performance limit is quantified (arithmetic mean value and standard deviation), which is from statistic data of headlamp database and requirement of regulation/research documents. Check table 3-50 for the required arithmetic mean value and standard deviation.

Table 3-50 required arithmetic mean value and standard deviation for each criterion

Unit: m

Item	Assessment item		arithmetic mean value	standard deviation
Low beam	straight lane guiding distance		95.84	14.79
	curve guiding distance		95.32	23.54
	visibility of pedestrian left side		43.19	12.05
	pedestrian detection width at intersections		15.21	2.67
	curve illumination width		19.82	5.51
High beam	illumination range	point1	182.22	22.90
		point2	44.41	13.49
		point3	40.80	15.55
		point4	44.41	13.49
		point5	163.19	33.46
	pedestrian detection width at intersections		14.90	3.21

Score of each criteria can be calculated based on interpolation method, check formula below,

$$F(x)=\mathrm{I}_{\mathrm{weight}}*\int_{-\infty}^{x}\frac{1}{\sqrt{2\pi}\sigma}\exp(-\frac{(x-u)^2}{2\sigma^2})dx/0.9$$

In the formula，$\mathrm{I}_{\mathrm{weight}}$—— sub item weight

F(x) —— test result of sub item

u ——arithmetic mean value of item database

σ ——standard deviation of item database

Example: weight of low beam straight lane guiding distance in illumination safety is15%，that means full score is1.5 points. The arithmetic mean value in database is 95.84m，standard deviation is 14.79m，if the test result is 100m，then：

According to the formula above, test score of straight lane guiding distance F(x)=1.018 point.

3.2.2.2.1 Low beam Vehicle-level assessment

3.2.2.2.1.1 straight lane guiding distance

As shown in figure 3-29, take vehicle longitudinal center line as reference, based on 3 straight lines:vehicle longitudinal center line, lines of 1.75m right side of the center line and 3.5m right side of the center line paralleling with vehicle center line, measure the lateral distance of intersection points of illuminance lines of 1, 3 and 5lx and these straight lines to vehicle. Take the average value as final value.

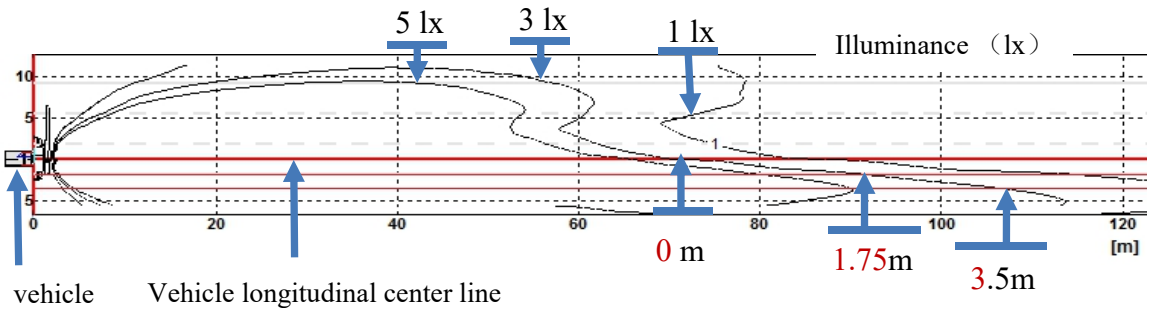


Figure 3-29 straight lane guiding distance of low beam

Comparing test result and quantified limits, if it is above 114.79m, full score 1.5 points will be granted. If it is lower than 114.79, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.1.2 curve guiding distance

As shown in figure 3-30, take vehicle longitudinal center line as reference. There are 3 lines: the intersection line of vehicle longitudinal center line and the line which is 5° right side to the center line crossing 0m of the center line, a line 1.75m to the first line right side paralleling with it and a line 3.5m to the first line right side paralleling with it. Calculate the lateral distance of intersection point of 3lx with these lines to vehicle. Take the average value as final value.

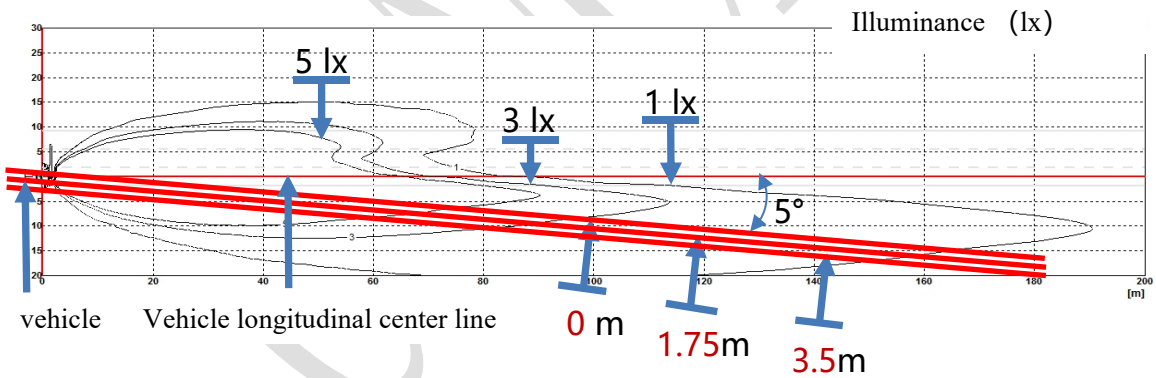


Figure 3-30 curve guiding distance of low beam

Comparing test result and quantified limits, if it is above 125.49m, full score 1 point will be granted. If it is lower than the limit, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.1.3 visibility of pedestrian left side

As is shown in figure 3-31, at the horizontal plane 0.25m above ground, taking vehicle longitudinal center line as reference, for 3 lines paralleling with the center line 3.5m, 5.25m and 7m left side to the center line, measure the lateral distance of intersection point of 3lx with these lines to vehicle. Take the average value as final value.

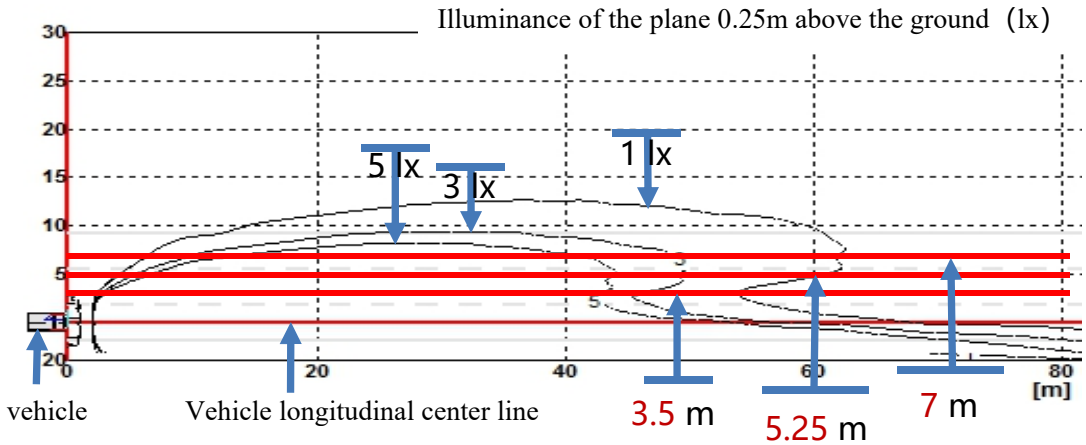


Figure 3-31 visibility of offside pedestrian

Comparing test result and quantified limits, if it is above 58.63m, full score 1 point will be granted. If it is lower than the limit, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.1.4 pedestrian detection width at intersections

As shown in figure 3-32, on the horizontal plane 0.25m above ground, for 2 lines vertical to vehicle center line 10m and 20m ahead of the vehicle respectively, measure the width of 3lx on the two lines. Take the average value as final value.

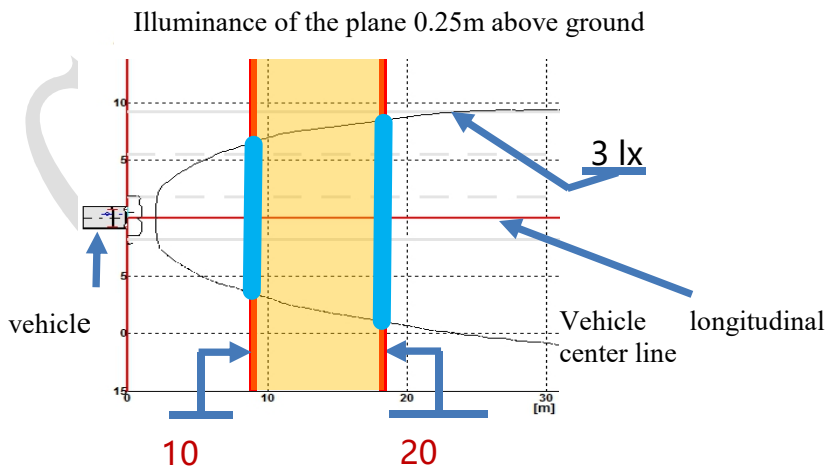


Figure 3-32 pedestrian detection width at intersections

Comparing test result and quantified limits, if it is above 18.63m, full score 1.5 point will be granted. If it is lower than the limit, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.1.5 curve illumination width

As shown in figure 3-33, on the horizontal plane 0.25m above ground, for 3 lines vertical to vehicle center line 30m, 40m and 50m ahead of the vehicle respectively, measure the width of 3lx on the three lines. Take the average value as final value.

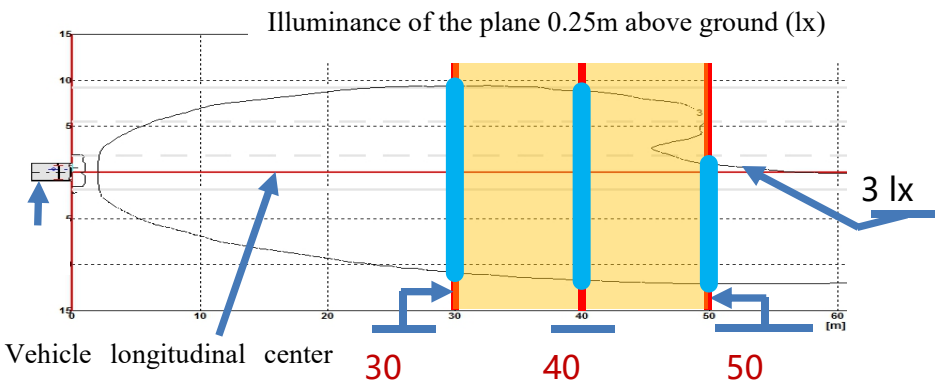


Figure 3-33 curve illumination width

Comparing test result and quantified limits, if it is above 26.88m, full score 1 point will be granted. If it is lower than the limit, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.2 Assessment of high beam Vehicle-level performance

3.2.2.2.2.1 Illumination range

As shown in figure 3-34 and 3-35, illumination range of high beam is assessed based on 5 points on the vertical plane 100m ahead of headlamp. Figure 3-35 shows the distribution of the points. Point 1 goes through vehicle center line and 0.75m above ground. Refer to the figure for other points. The illumination distance of the each point is,

$$R_i=\sqrt{I_i/E_t}$$

In the formula, I_i——light intensity of point to be assessed

E_t——3lx illuminance threshold

Compare the result with quantified limits. There are in total 5 points of high beam. Each point needs to be scored independently. The final score is the sum of the 5 points. Detailed scoring method as followings,

point1 ： If test result is above limit 211.57m, full 1 point will be granted. If it is below limit, method of interpolation will be applied to get the corresponding score. The score shall be rounded to 3 decimal places.

point2： If test result is above limit 61.69m, full 0.4 point will be granted. If it is below limit, method of interpolation will be applied to get the corresponding score. The score shall be rounded to 3 decimal places.

point3： If test result is above limit 60.73m, full 0.2 point will be granted. If it is below limit, method of interpolation will be applied to get the corresponding score. The score shall be rounded to 3 decimal places.

point4： If test result is above limit 61.69m, full 0.4 point will be granted. If it is below limit, method of interpolation will be applied to get the corresponding score. The score shall be rounded to 3 decimal places.

point5： If test result is above limit 206.8m, full 0.5 point will be granted. If it is below limit, method of interpolation will be applied to get the corresponding score. The score shall be rounded to 3 decimal places.

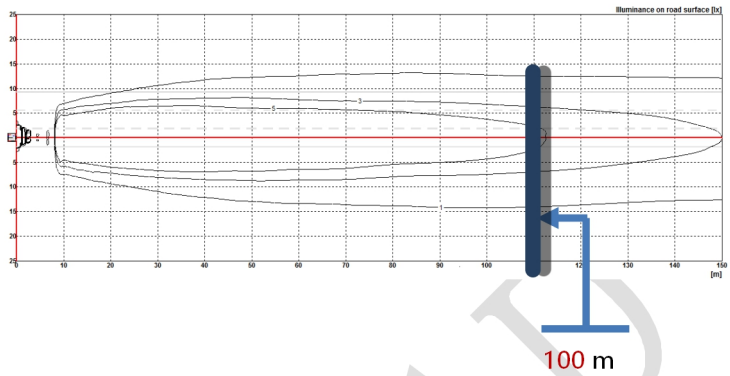


Figure 3-34 assessment area of illumination range of high beam

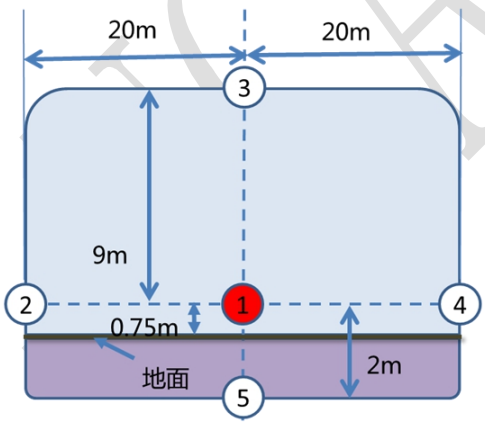


Figure 3-35 assessment space direction of headlamp illumination distance

3.2.2.2.2.2 pedestrian detection width at intersections

As shown in figure 3-36, on the horizontal plane 0.25m above ground, for 2 lines vertical to vehicle center line10m and 20m ahead of the vehicle respectively, measure the width of 3lx on the two lines. Take the average value as final value.

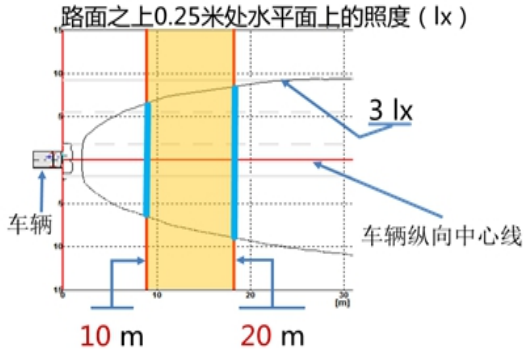


Figure 3-36 pedestrian detection width at intersections

Comparing test result and quantified limits, if it is above 19.01m, full score 0.5 point will be granted. If it is lower than the limit, use interpolation method to get the corresponding score. The score should be rounded to 3 decimal places.

3.2.2.2.3 Bonus item and penalty item

3.2.2.2.3.1 Adaptive low beam function (bonus point)

For vehicles with adaptive low beam function, OEM could provide test report by qualified third party showing that the vehicle could fulfill GB/T 33036-2013 'adaptive headlamp system for vehicles' (or ECE R123), submit document of conformity of C-NCAP test vehicle and the headlamp test vehicle. After examined by administration center in terms of performance test report, conformity document and C-NCAP test vehicle, 0.1~0.3 point will be granted. When there is 2 sub modes, o.1 bonus point is granted; for 3 sub modes, 0.2 bonus point; for 4 sub modes, 0.3 point.

Performance test report should include at least content as below:

a）adaptive low beam fulfilled the regulation requirement;

b）photometric characteristic test data;

c）test photos;

d） parameter directly relates to adaptive low beam function, such as: adaptive low beam sub modes, curve type etc.

3.2.2.2.3.2 Adaptive high beam function (bonus items)

For vehicles with adaptive high beam function, OEM could provide test report by qualified third party showing that the vehicle could fulfill ECE R123 and GB 4785 'installation requirement of outside illumination and signal device of vehicles and trailer', submit document of conformity of C-NCAP test vehicle and the headlamp test vehicle. After examined by administration center in terms of performance test report, conformity document and C-NCAP test vehicle, 0.2~0.5 point will be granted. When there is automatic switchover between high beam and low beam, 0.2 bonus point; when there is adaptive driving beam (ADB), 0.5 bonus point.
Performance test report should include at least content as below:

a）adaptive high beam fulfilled the regulation requirement;

b）photometric characteristic test data;

c）test photos;

d） parameter directly relating to adaptive high beam function, such as: adaptive high beam sub modes, curve type etc.

3.2.2.2.3.3 automatic turn-on function of low beam (bonus item)

For vehicles equipped with automatic turn-on function of low beam (for example when driving at night, entering tunnel etc., low beam will be switched on automatically), OEM could provide test report by qualified third party showing that the vehicle could fulfill the requirement of GB4785, submit document of conformity of C-NCAP test vehicle and the headlamp test vehicle. After examined by administration center in terms of performance test report, conformity document and C-NCAP test vehicle, 0.1 point will be granted.

Performance test report should include at least content as below:

a）automatic turn-on function of low beam fulfilled the regulation requirement;

b）test data;

c）test photos;

d）parameter directly relating to automatic turn-on function of low beam

If OEM cannot provide test report by qualified third institute, the C-NCAP test vehicle has to be tested. Test report shall also include content above. Check table 3-51 for the condition of low beam turned on automatically.

Table 3-51 condition of low beam turned on automatically

External environment light	Low beam	Response time
Less than1000 lx	Turn on	No more than 2s
1000 lx—7000lx	Specified by OEM	Specified by OEM
More than 7000 lx	Turn off	More than 5s，no more than 300s
Note: use the level surface with cosine corrected illuminance meter and vehicle sensor installed at the same height for measurement.		

3.2.2.2.3.4 Automatic headlamp leveling system (bonus point)

For vehicles equipped with low beam automatic leveling system (such as: based on static loading change (passenger number/position/ loading in trunk)) adjusting illumination height or changing pitch angle during driving (sudden accelerating, decelerating or uphill/downhill) based on body dynamic height, OEM could provide test report by qualified third party showing that the vehicle could fulfill the requirement of GB4785, submit document of conformity of C-NCAP test vehicle and the headlamp test vehicle. After examined by administration center in terms of performance test report, conformity document and C-NCAP test vehicle, 0.1 point will be granted.

Performance test report should include at least content as below:

a）automatic headlamp leveling system fulfilled the regulation requirement;

b）test data;

c）test photos;

d）parameter directly relating to automatic headlamp leveling system

3.2.2.2.3.5 Opposing Glare (penalty item)

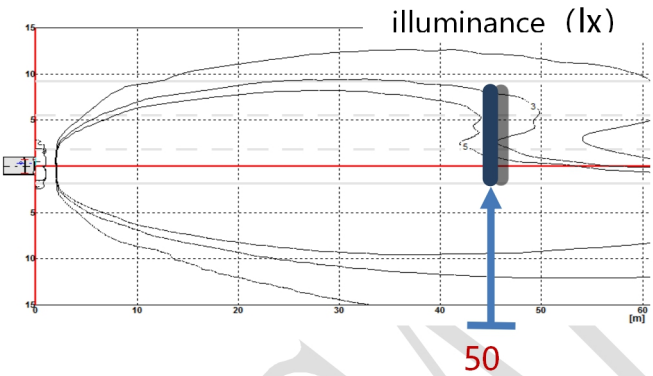


Figure 3-37 aerial view of subtend Opposing glare assessment

Figure 3-37 shows the position of subtend glaring area, which is a rectangle area in th evertical plane in 50m ahead of headlamp.

Figure 3-38 shows the detailed description of glaring area and its position referring to ground and vehicle longitudinal center line, and weight distribution of different parts in the area. The Opposing glare assessment area is 50m ahead of headlamp, and between 0.93m and 1.62m above ground and between 7.9m left side and 1.3m right side.

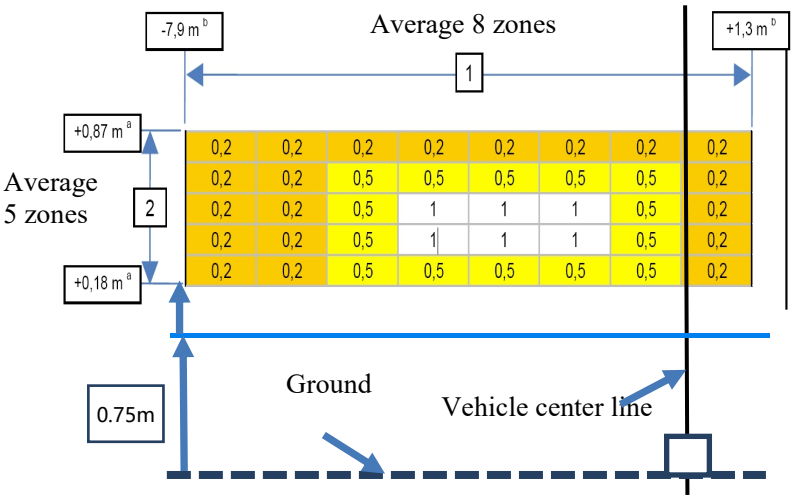


Figure 3-38 Opposing glare area on vertical plane 50m ahead of headlamp

Calculate weighted luminous flux in opposing glare assessment area. Weighted luminous flux is taken as the criterion of potential glaring effect. If luminous flux is measure between 0.26lm and 0.63lm, and luminous flux of all area with weight 1 in

the figure does not exceed 0.38lm, no penalty points; otherwise 1 point will be deducted.

4 SCORING AND RATING

C-NCAP star rating is based on overall scoring rate of occupant protection, pedestrian protection and active safety.

The score of occupant protection, pedestrian protection and active safety three parts are respectively calculated according to the test procedure, each item score shown as table 3-52.

Table 3-52 Scoring details of C-NCAP

Box	Item category		Item	Score		
				Front seat	Rear seat	Child
Occupant Protection	Test item		100% front impact	16	4	4
			MPDB impact	16	4	4
			Side impact [a)]	16	4	/
			Side pole impact [b)]	16	/	/
			Child protection static	/	/	3
			whiplash	5	2	/
	Bonus item		Side curtain	2		
			E-CALL	2		
	Penalty item		Seat belt reminder	-2 ~ 0		
Pedestrian Protection	Test item		Headform	10		
			Legform	5		
Active Safety	ADAS	Audit item	ESC	8		
		Test item	AEB CCR	11		
			AEB VRU_Ped	10		
			AEB two-wheeler	11		
			LKA	3		
			HMI	6		
		Optional audit item [c)]	BSD (car2car)	2		
			BSD (car2two-wheeler)	3		
			SAS	2		
			LDW	2		
	Lighting		Low beam	6		
			High beam	3		
			Bonus	1		

Note:
a) Only traditional vehicles take AE-MDB side impact. Taking side impact score multiplied 1.2 into the total score of occupant safety
b) Only new energy vehicles take side pole impact. Taking side pole impact multiplied 1.5 into the total score of occupant safety
c) Optional audit items only check the vehicle under test and can score a maximum of 7 points.

4.1 Score rate calculation formula of occupant protection

The scoring rate of occupant protection = the actual score of occupant protection [d)]/ its full score [e)].

Note:

d) The actual score of the traditional car's occupant protection part = the score of "100% front impact"+ the score of "MPDB impact" + 1.2 x the score of "side impact" + the score of "child protection static" + the score of "whiplash" + the score of "side curtain pressure keeping" + the score of "rescue system"

The actual score of NEV's "Occupant Protection" part = the score of "100% front impact" + the score of "MPDB impact" + 1.5 x the score of "side pole impact" + the score of "child protection static" + the score of "whiplash scores" + the score of "side curtain pressure keeping" + the score of "rescue system"

e） The total score is 86 points for multi-row (more than 2 rows) car. However the single row car does not count the rear seat score and child static assessment, in this case, occupant safety full score of traditional single row car is 60.2 points; while occupant safety full score of new energy single row car is 65 points

4.2 Score rate calculation formula of pedestrian protection

The score rate of "Pedestrian Protection" = the actual score of "Pedestrian Protection" part/15

4.3 Score rate calculation formula of active safety

The score rate of "Active Safety" = the actual score of "ADAS"/56 × 80% + the actual score of "lighting"/10 × 20%

4.4 Overall scoring rate calculation formula

The comprehensive score rate = the score rate of "Occupant Protection" × 60% + the score rate of "Pedestrian Protection" × 15% + the score rate of "Active Safety" × 25%

Except for the requirement of overall scoring rate, there is also minimum scoring rate requirement of occupant safety, pedestrian safety and active safety to be fulfilled at the same time. If any cannot be fulfilled, the final star rating will take the lowest star of the category.

Table 3-53 C-NCAP star rating requirement

overall scoring rate	Overall scoring rate	Minimum scoring rate of occupant safety	Minimum scoring rate of pedestrian safety	Minimum scoring rate of active safety
5+（★★★★★☆）	≥92%	≥95%	≥75%	≥85%
5（★★★★★）	≥83%且＜92%	≥85%	≥65%	≥70%
4（★★★★）	≥74%且＜83%	≥75%	≥50%	≥60%
3（★★★）	≥65%且＜74%	≥65%	/	/
2（★★）	≥45%且＜65%	≥60%	/	/
1（★）	＜45%	＜60%	/	/

Additionally, if there is fire (naked fire can be observed) 3 min after any crash test, final star rating level will be degraded by 1 star.

For 4 star or above vehicles, ESC function should be configured.

For new energy vehicle fulfilling electrical safety, except star rating result, there will be also marked a sign for electrical safety; for new energy vehicles do not fulfill electrical safety, there will be no star rating, only score of sub category and items of electrical safety failure will be released.

ANNEX 1

Feedback Sheet of C-NCAP Assessment Vehicle

Vehicle manufacturer					
vehicle version of maximum sales (type approval cataloge)		Sales version	Corresponding sales volume	With AEB	max sales version
				Yes□ No□	□
Sale version of maximum sales (market type)				Yes□ No□	□
				Yes□ No□	□
Trademark				Yes□ No□	□
				Yes□ No□	□
Time to market for the latest modification				Yes□ No□	□
		Total sales volume		——	More rows could be added above.
		Statistic date for sales	Y M D— Y M D		
Basic vehicle parameters and configuration	Overall dimension	L×W×H（mm）			
	Mass	Complete vehicle gross mass（kg）			
		Complete vehicle kerb mass（kg）			
	Bodywork type				
	Ground clearance（mm）	No load≥ （mm）	full load≥ （mm）		
	Engine	Model			
		Manufacturer			
		Displacement/ Power（ML/kW）			
		Number of cylinders			
		Fuel supply method			
		Fuel type/ Emission standards			
		MIIT fuel consumption (L/100km）	City condition：		
			Suburb condition：		
			Combined condition：		
	Transmission	Automatic or manual			
		Number of gears and gear ratios			
	Drive type	Front-wheel/rear-wheel/all-wheel drive			
	Restraint	Safety belt (mounting position,			

	system	number)	
		whether the second row is equipped with safety belts or not	□Yes □No
		Quantity and position of ISOFIX	
		Quantity and position of seat belt reminder	First row:
			Second row:
		Frontal airbag (mounting position, number)	
		Side airbag (curtain) (mounting position, number)	
	Driver's seat	Seat model	
		Manufacturer	
		Equipped with active headrest or not	□Yes □No
	Others	Color distribution of predicated results of pedestrian protection head form	
		Application for addition of pedestrian protection test program(Required field)	
		Active bonnet or pedestrian protection airbag	Yes□ No□(Description material attached separately, such as working principle and proof of normal work)
		ESC system	□Yes □No
		AEB system	□Rail end □Pedestrian □No
		Number of seats (number of installation points)	

How long will the pedestrian protection parts be provided?	□Unable to purchase as required	□Within 1 month	□Within 1-2 months	□Within 3 months
Submission time for vehicle of non-maximum sales with AEB	□Not provide	□Within 1 month	□Within 1-2 months	□Within 3 months
Information of previous model update	Model name:	Time for market launch: Time for end - production:	Model change: □body structure □safety configuration □others ( )	Whether it is generation update model: yes□ no□
	Model name:	Time for market launch: Time for end - production:	Model change: □body structure □safety configuration □others ( )	Whether it is generation update model: yes□ no□
	Model name:	Time for market launch: Time for end - production:	Model change: □body structure □safety configuration □others ( )	Whether it is generation update model:: yes□ no□

<table>
<tr><td></td><td colspan="4">(More added pages are accepted.)</td></tr>
<tr><td rowspan="3">Plan for model change or updating</td><td>Model name：</td><td>Time for market launch：
Time for end of production：</td><td>Model change：
□body structure
□safety configuration
□others（）</td><td>Whether it is generation update model:: yes□ no□</td></tr>
<tr><td>Model name：</td><td>Time for market launch：
Time for end of production：</td><td>Model change：
□body structure
□safety configuration
□others（）</td><td>Whether it is generation update model:: yes□ no□</td></tr>
<tr><td colspan="4">(More added pages are accepted.)</td></tr>
<tr><td>Information about dealership stores</td><td colspan="4">Give information concerning dealership stores in Beijing, Tianjin or other regions: (An additional sheet may be used if the space is not enough)

Where no vehicle of such type is available in dealership stores, is the selection of sample vehicles from production line permitted?
Yes□ No□</td></tr>
<tr><td>The main recommended models</td><td colspan="4">Is this model the main recommended model of the company? Yes □ no □</td></tr>
<tr><td rowspan="3">Communication</td><td>Contact person</td><td></td><td>Tel / cell phone</td><td></td></tr>
<tr><td>Zip code</td><td></td><td>Fax</td><td></td></tr>
<tr><td>Address</td><td colspan="3"></td></tr>
<tr><td>Other comments</td><td colspan="4"></td></tr>
<tr><td>Authorized representative’s signature or common seal</td><td colspan="4">年 月 日</td></tr>
<tr><td colspan="5">Note: The information presented above shall apply to the vehicle type with the configuration attaining the largest sales volume; pertaining proofing documents shall be furnished altogether. Where the manufacturer wishes to have other vehicle type(s) assessed, which has reached certain sales volume, any information as described above may also be given and such vehicle type(s) is to be listed as candidate vehicle type(s).</td></tr>
</table>

ANNEX 2

C-NCAP Test Performing Notice

Vehicle manufacturer					
Vehicle model					
Configuration and VIN number					
	AEB test	(d/m/y)~(d/m/y)			
	Headlamp Vehicle-level test	(d/m/y)~(d/m/y)			
	Pedestrian protection	(d/m/y)~(d/m/y)			
	Full frontal impact	(d/m/y)			
	Side impact	(d/m/y)			
	MPDB test	(d/m/y)			
	Side pole impact	(d/m/y)			
	Whiplash test	(d/m/y)			
Notes					
Contact person		Telephone		Fax.	
Common seal	(d/m/y)				

ANNEX 3-1

C-NCAP Basic Parameters of the Test Vehicle 1 (Part of Crash and Whiplash Tests)

Completed on：

Trademark, name and model of vehicle				Vehicle type	
Manufacturer					
Vehicle identification number (VIN) Engine number Date of manufacture					
Complete vehicle kerb mass and axle load (kg)					
Complete vehicle gross mass and axle load (kg)					
Engine model and manufacturer					
Engine arrangement mode		Front (horizontal□, longitudinal□), middle□, rear□	Engine displacement (ml)		
Height of longitudinal beam bottom (kerb mass）					
Half-laden tyre pressure (kPa)					
Tyre model and manufacture					
Vehicle L×W×H (mm)			Ground Clearance (mm)		
Transmission model			Transmission arrangement mode		
Rated capacity of fuel tank			Fuel type		
Rated voltage of battery (V)			Number of doors		
Number of seats in complete vehicle			Number of seats in the front row		
Model and type of steering column		Model: Adjustable（Yes□/No□） Crushable（Yes□/ No□）			
Steering wheel	Design position or middle position in forward and backward directions				
	Design position or middle position in upper and lower directions				
Safety belt and anchorage		Model and manufacturer	Pretensioner	Force limiter	Design position of upper anchorage
Safety belt	Driver		Yes□/ No□	Yes□/ No□	
	Front occupant		Yes□/ No□	Yes□/ No□	
	Left rear occupant		Yes□/ No□	Yes□/ No□	

	Middle rear occupant		Yes□/ No□	Yes□/ No□	
	Right rear occupant		Yes□/No□	Yes□/ No□	

Safety belt reminder	Fitted or not	Mounting position	Visual or audible
	Yes□ No□	Front: Driver □	Visual□ Audible□
		Occupant □	Visual□ Audible□ Monitor system：Yes□ No□
		Second row: □ Position:	Visual□ Audible□ Monitor system：Yes□ No□

Model and manufacturer of front-row frontal airbag	Driver	
	Occupant	
	Other position	
Model and manufacturer of side airbag (either side), pressure keeping req. fulfilled or not?	Front	
	Rear	
	Other position	
E-CALL system model and manufacturer		

Seat design parameters		Design R-point coordinate	Longitudinal adjustable design position	Vertical adjustable design position	Backrest angle adjustable design position
Front seat	Driver				
	Occupant				
Rear seat					

Seat parameters for frontal impact		H-point in coordinate of seat at test position	Longitudinal adjustable position	Vertical adjustable position	Backrest angle adjustable position
Front seat	Driver		Middle		
	Occupant		Middle		
Rear seat					

Seat parameters for side impact		H-point in coordinate of seat at test position	Longitudinal adjustable position	Vertical adjustable position	Backrest angle adjustable position
Front seat	Driver		Middle		

To furnish the coordinates of 8 characteristic points within the vehicle body design coordinate system; also, it shall assure that these 8 points will not undergo any deformation after the test.

1	2	3	4	5	6	7	8

Whether doors could be	Yes□ No□

locked up automatically	
If yes, whether the lock-up could be eliminated automatically	Yes□ No□

Fitted with child restraint system anchorage or not (ISOFIX)	ISOFIX number		ISOFIX position	

Model and manufacturer of seat	Driver seat	
	Rear seat	

Seat design parameters	Design H-point coordinate	Track travel	Track inclination	Longitudinal adjustable design position	Vertical adjustable design position	Backrest angle design position	Y coordinate of seat middle plane	heel point Z coordinate
Driver seat								
Rear seat								

Installation parameters for driver's seat		Coordinates			Intersection angle between the hole axis and the coordinate plane			Seat fixing bolt specification (thread, pitch, etc.)	Seat fixing bolt tightening torque
		X	Y	Z	XY plane	XZ plane	YZ plane		
	Front left								
	Front right								
	Rear left								
	Rear right								

Coordinate parameters of the second row of seats (used to build a coordinate system)	
Rigid points which are easy to measure, recommended by OEMs. Position description, pic could be attached	
The point's designed coordinate	
Whether the left and right seats are symmetrical	

Test theoretical parameters	H-point coordinates of seat at test position	Height of head restraint	Head restraint longitudinal position	Type of head restraint	Triggering moment
Driver seat				□Non-proactive	——

				head restraint	
				□Retroaction type pro-active head restraint	——
				□Triggering type pro-active head restraint	
Rear seat				□Non-proactive head restraint	——
				□Retroaction type pro-active head restraint	——
				□Triggering type pro-active head restraint	
CRS used in crash test	100% frontal	□built-in CRS □Recommended model in vehicle manual：_____ □Select from the dynamic list：_____			
	MPDB	□built-in CRS □Recommended model in vehicle manual：_____ □Select from the dynamic list：_____			

ANNEX 3-2

C-NCAP Basic Parameters of the Test Vehicle 2 (Part of Pedestrian Protection)

Completed on： Y M D

1. Basic parameters of pedestrian protection

Items	Sample situation
Name, number and brand of the Vehicle	
Vehicle type	
Vehicle manufacturer	
Configure active bonnet or pedestrian protection airbag	Yes□ No□ (Attached to the verification materials such as system working principle and normal work certificate)
Complete vehicle curb mass (kg)	
Front axle load (kg)	
Tire pressure (kpa)	
Tank nominal volume (L)	
Designed body height at normal driving condition (such as wheel blow height)	
Parameters of suspension (if active suspension or not)	
Suspension height under normal driving	
Vehicle coordinate (at least 3 observable referent points under engine cover)	X： Y： Z： X： Y： Z： X： Y： Z： *(More information can be attached.)*
Vehicle coordinates of grid points in head shape test zone	（saved as attachment X： Y： Z： ）
Head shape prediction result color distribution chart	Head shape prediction result color distribution chart(saved as attachment) Note: When the head shape prediction result contains unpredictable grid points, that is, when the prediction result has a blue area in the color distribution map, a proof of unpredictability should be provided.
Apply for additional pedestrian protection test plan	(Explanatory materials attached)

2. Test parts list of pedestrian protection

Test parts list of pedestrian protection			
No.	Part name	Quantity	Comments
1	Vehicle	1	
2	Engine cover	12	With standard installation components
3	Engine hinge (left)	3	With standard installation components
4	Engine hinge (right)	3	With standard installation components
5	Engine cover lock	2	With standard installation components
6	Engine cover sound insulation, cushioning	3	With standard installation components (10)
7	Windscreen wiper assembly	3	With standard installation components
8	Wiper groove cover assembly	3	With standard installation components
9	Bumper assembly	5	With bumper trim, foam and standard installation components
10	Wheel fender (left)	2	With standard installation components
11	Wheel fender (right)	2	With standard installation components
12	Front grille assembly	4	With standard installation components
13	Headlamp assembly (left)	2	With standard installation components
14	Headlamp assembly (right)	2	With standard installation components
15	Front windshield glass	4	
16	Active deployable bonnet system accessories	12	Actuating mechanism, Hinge,ect. With standard installation components
17	Guide book of installation of vehicle frontal structure	1	
Note: OEMs should offer additional relevant test samples, if the OEMs apply for additional tests or there are blue net points in the head shape test area.			

3. Information regarding active deployable bonnet system test

3.1. Preparation for the tests

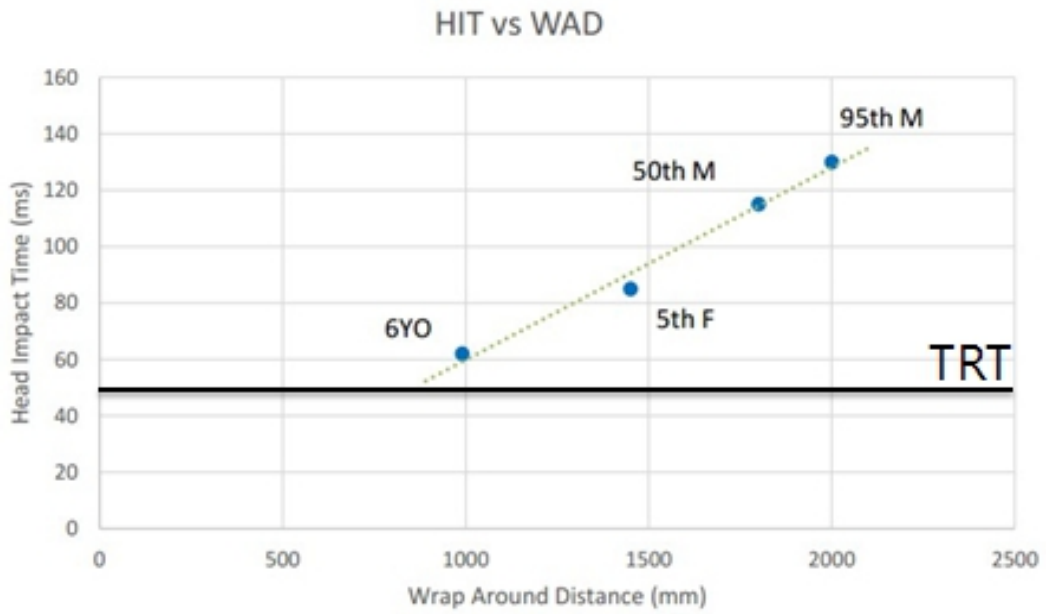
No.	Items	Details of system function				Submitted Documents	Comments
1	Detection of pedestrians	Test	Impact instrument	Impact position	Speed	The output should include: 1. High speed film; 2. Trigger time; 3. Initiation time of deployment.	C-NCAP Test Assessment Department should witness the tests or carry out the test 3.
		1	PDI2 or HTD	1. Sensor arrangement position ±50mm (for example, acceleration sensor). If the sensing system uses a combination of contact strip switch and acceleration sensor, the position of the impact acceleration sensor. 2. Vehicle center position: non-localized sensing systems (such as contact switches).	LT±2km/h		
		2	PDI2 or HTD	Leg form test zone left or right side. Impact position deviation ±50mm.	LT±2km/h		
		3	PDI2 or HTD	Farthest position from sensor ±50mm (perform if not tested already at the position).	LT±2km/h		
		4*	aPLI、FLEX-PLI or TRL lower leg	Sensor arrangement position ±50mm (for example acceleration sensor) or position where it is easy to generate large acceleration for impactor (nonlocalized sensing systems).	40km/h±2km/h		
		5	PDI2 or HTD	Sensor arrangement position or vehicle center position	50km/h		
2	Initiation time of deployment	Response time of the active bonnet system (TRT), sensing time of the active bonnet system (ST) and deployment time of the active bonnet system (DT)				Result of simulation or tests	----
		Relation diagram of wrap around distance(WAD) and heat impact test(HIT) at 40 km/h				Simulation result	

No.	Items	Details of system function	Submitted Documents	Comments
3	Pedestrian protection at lower threshold speed	40 km/h, predicated results of head form test zone when system starting	Simulation result	----
		At lower threshold speed, predicated results of head form test zone when no system starting	Simulation result	Random testing from C-NCAP Test Assessment Department(not more than 3 times)
4	Stiffness requirement to bonnet	Bonnet deformation while engine starts and not starts.	Simulation result	----

Note: 1. OEMs should provide the situation statement of the system, vehicle information, working principle and status of active deployable bonnet and bumper testing area statement.

2. The simulation environment and model information should be reflected in the calculation document provided from OEMs. The Output should accord with the experimental procedure.

3.2. Relation diagram of wrap around distance and heat impact test

Response time of the system at 40 km/h	Sensing time(ms)	Deployment time (ms)	Total response time (ms)
WAD vs HIT			
Evaluation	The area that can meet the requirement TRT≤HIT: □ the whole are； □ WAD:____mm～__ mm		

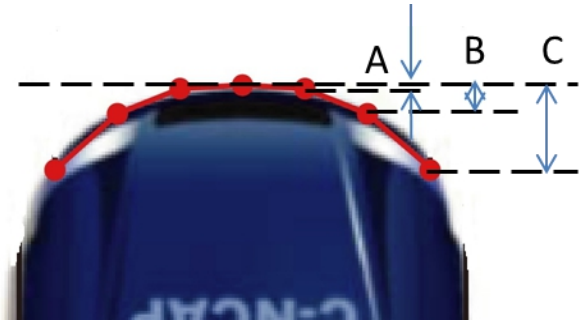
ANNEX 3-3

C-NCAP Basic Parameters of the Test Vehicle 3 (AEB part)

D-Completed on： Y M D

1. Basic test parameter of AEB test

Parameter	Statement
Vehicle number	
Vehicle type	
VIN number	
Complete vehicle kerb mass and axle load (kg)	
Complete vehicle gross mass and axle load (kg)	
Vehicle L×W×H (mm)	
Axis Count	
Wheel base(mm)	
Wheel track (mm)	
Front and rear suspensions(mm)	
Maximum design speed(km/h)	
Tire type	
Tire pressure(kPa)	
Coordinates of the center of mass(x,y,z)	
Height of the center of mass(full/no-load)(mm)	
Transmission type	
Power assisting type of travel braking system	
Braking adjustment model	
Travel braking model	
Number, tpye and supplier of laser radar	
Number, tpye and supplier of millimeter-wave radar	
Number, tpye and supplier of other radar	
Number, tpye and supplier of camera	
Number, tpye and supplier of infrared sensor	
Number, tpye and supplier of AEB ECU	
Number, tpye and supplier of LKA ECU	
Value of A, B, C(mm)	



Note: remove 50 mm width from left and right side and divide the car head outlet by 6 points equally, and measure the distance A, B, C from middel point to the 6 points, and fill in the table.

2. System information of AEB CCR

2.1 AEB type: □AEB+FCW □AEB □FCW

2.2 Realisation technique of AEB CCR : □millimeter-wave radar □laser radar □monocular camera □binocular cameras □ntegration of millimeter-wave radar and cameras □other _____

2.3 AEB CCR is default while wehicle starts: □Yes □No

2.4 If AEB CCR can be shuttled off by single button and single operation: □Yes □No

2.5 If AEB CCR includes DBS: □Yes □No

2.6 Type of warning signal（acoustic、visual and actile） , frequency of the signal: _____Hz

2.7 Besides acoustic and visual warning reqirements, FCW has other warning forms(Head-up, Seat belt vibration, snub or others): ;

2.8 If the system has the function of seat belt pre-tensioner: □Yes □No;

2.9 Working range of AEB:

AEB subspeed (the lowest working speed) CCRs: km/h, CCRm: km/h。

AEB maximum speed (the highest working speed) CCRs: km/h, CCRm: km/h。

Working range of FCW:

FCW subspeed (the lowest working speed) CCRs: km/h, CCRm: km/h。

FCW maximum speed (the highest working speed) CCRs: km/h, CCRm: km/h。

2.10 FCW The braking characteristic curve：

D4:_____mm，F4:_____N，braking speed:_____mm/s

3. AEB VRU system information

3.1 If FCW is contained: □Yes □No

3.2 Realisation technique of AEB VRU: □millimeter-wave radar □laser radar □monocular camera □binocular cameras □integration of millimeter-wave radar and cameras □Night infrared sensor □others_____

3.3 In case of CPNA-75， AEB VRU_Ped can start work at 10 km/h (warning or braking)：

3.4 □Yes □No

3.5 In case of CPNA-75，can reduce the speed of car at 20 km/h of car and 3 km/h of the pedestrian： □Yes □No

3.6 If AEB VRU can be shuttled off by single button and single operation：□Yes □No

3.7 In case of CPFA-75，at 45km/h，warning time TTC≥1.2s：□Yes □No

3.8 Type of warming signal (acoustic、visual and tactile） ，frequency of signal: _____Hz；

3.9 Working range of AEB VRU_Ped：

AEB VRU_Ped the lowest working speed：CPNA-25： km/h，CPNA-75： km/h，CPFA-25： km/h，CPFA-50： km/h；

AEB VRU_Ped the highest working speed：CPNA-25： km/h，CPNA-75： km/h，CPFA-25： km/h，CPFA-50： km/h；

3.10 Working range of AEB VRU_TW：

AEB VRU_TW the lowest working speed：CBNA-50： km/h，CSFA-50： km/h，CBLA-25： km/h，CBLA-50： km/h；

AEB VRU_TW the highest working speed：CBNA-50： km/h，CSFA-50： km/h，CBLA-25： km/h，CBLA-50： km/h；

4. LKA system information

4.1 Is there a lane centering function: □Yes □No

4.2 If LKA can be shuttled off by single button and single operation: □Yes □No

4.3 Working range:

LKA the lowest working speed: km/h

LKA the highest working speed: km/h

5. Result prediction

5.1 AEB CCR test result prediction

CCRs						
testing scenarios	Test type	Test speed（km/h）	Overlap rate	Impact velocity（km/h）	Speed weight	Scoring rate
CCRs (front car stationary)	AEB	20	-50%		2	
		20	100%		2	
		30	+50%		2	
		30	100%		2	
		40	-50%		3	
		40	100%		3	
	FCW	50	50%		1	
		50	100%		1	
		60	-50%		3	
		60	100%		3	
		70	+50%		1	
		70	100%		1	
		80	-50%		2	
		80	100%		2	
CCRs Scoring rate						
CCRm (front car moving)	AEB	30	+50%		2	
		30	100%		2	
		40	-50%		2	
		40	100%		2	
		50	50%		4	
		50	100%		4	
	FCW	60	-50%		2	
		60	100%		2	
		70	+50%		3	
		70	100%		3	
		80	-50%		3	
		80	100%		3	
CCRm Scoring rate						

5.2 AEB VRU_Ped test result prediction

CPFA-25 day			
Test speed（km/h）	Impact velocity（km/h）	Speed weight	Score
20		1	
30		2	
40		2	
50		2	
60		1	
CPFA-25 day Scoring rate			
CPFA-50 day			
Test speed（km/h）	impact velocity（km/h）	Speed weight	Score
20		1	
30		2	
40		2	
50		2	
60		1	
CPFA-50 day Scoring rate			
CPNA-25 day			
Test speed（km/h）	Impact velocity（km/h）	Speed weight	Score
20		1	
30		1	
40		2	
50		2	
60		1	
CPNA-25 day Scoring rate			
CPNA-75 day			
Test speed（km/h）	Impact velocity（km/h）	Speed weight	Score
20		1	
30		1	
40		2	
50		2	
60		1	
CPNA-75 day Scoring rate			
CPFA-25 night			

Test speed（km/h）	Impact velocity（km/h）	Speed weight	Scoring rate
20		1	
30		2	
40		2	
50		3	
60		2	
CPFA-25 night Scoring rate			

CPLA day					
Test type	impact location	Test speed/km/h	Impact velocity/km/h	Speed weight	Scoring rate
AEB	50%	20		1	
		30		2	
		40		2	
		50		1	
		60		1	
Test type	impact location	Test speed/km/h	TTC（s）	Speed weight	Scoring rate
FCW	25%	50		1	
		60		1	
		70		1	
		80		1	
CPLA day Scoring rate					

CPLA night					
Test type	impact location	Test speed/km/h	Impact velocity/km/h	Speed weight	Scoring rate
AEB	50%	20		1	
		30		1	
		40		2	
		50		2	
		60		2	
Test type	impact location	Test speed/km/h	TTC（s）	Speed weight	Scoring rate
FCW	25%	50		2	
		60		2	
		70		1	
		80		1	
Scoring rate		----			

5.3 AEB VRU_TW test result prediction

CBNA-50			
Test speed（km/h）	Impact velocity	Speed weight	Scoring rate
20		1	
30		1	
40		2	
50		2	
60		2	
CBNA-50 Scoring rate			

CSFA-50			
Test speed（km/h）	Impact velocity	Speed weight	Scoring rate
20			
30		2	
40		2	
50		1	
60		1	
CSFA-50 Scoring rate			

CBLA					
Test type	impact location	Test speed（km/h）	Impact velocity（km/h）	Speed weight	Scoring rate
AEB	50%	20		1	
		30		2	
		40		2	
		50		3	
		60		2	
Test type	impact location	Test speed（km/h）	TTC（s）	Speed weight	Scoring rate
FCW	25%	50		3	
		60		2	
		70		1	
		80		1	
CBLA Scoring rate					

5.4 LKA test result prediction

LKA					
Lane line type	Deviate direction	Test speed （km/h）	Deviate speed （m/s）	Speed weight	Result prediction (Passed or not)
Solid line	Left	80	0.2	1	
			0.3	1	
			0.4	1	
			0.5	1	
	Right	80	0.2	1	
			0.3	1	
			0.4	1	
			0.5	1	
Dotted line	Left	80	0.2	1	
			0.3	1	
			0.4	1	
			0.5	1	
	Right	80	0.2	1	
			0.3	1	
			0.4	1	
			0.5	1	
Scoring rate					

ANNEX 3-4

C-NCAP Test Vehicle Basic Information (Lights)

Filled in on: (DDMMYYYY)

1. Basic Parameters for Performance Testing of Complete Vehicle (Headlight)

Vehicle trademark, designation and model			
Manufacturer			
Vehicle identification number (VIN)			
Engine number			
Date of vehicle manufacture			
Complete vehicle kerb weight (kg)		Complete vehicle max. laden weight (kg)	
Battery rated voltage (V)		Engine displacement (ml)	
Vehicle length×width×height (mm)			

	Declination	Initial declination (%)	
	Mounting height	Mounting height low-beam (mm)	
		Mounting height high-beam (mm)	
	Gap between mounting reference centers	Gap between reference centers low-beam (mm)	
		Gap between reference centers high-beam (mm)	
	Illumination mode	Low-beam / high-beam combined unit	Yes□ No□
		Low-beam light illuminates simultaneously with active high-beam	Yes□ No□
	Light source type and model	Low-beam light	
		High-beam light	
	If low-beam illuminated by Pulse Width Modification (PWM) signal		Yes□ No□
	If high-beam illuminated by Pulse Width Modification (PWM) signal		Yes□ No□
	If adaptive low-beam available		Yes□ No□
	If adaptive high-beam available		Yes□ No□
	If low-beam automatic on		Yes□ No□
	If headlight automatic leveling system		Yes□ No□

ANNEX 4

Sheet of Complaint on C-NCAP Assessment

Manufacturer (affix common seal)	Y M D
Vehicle type	
Testing time	
Complained test items	
Complaint grounds	
Retesting time applied	
The authority's opinions (affix common seal)	Y M D

ANNEX 5

Specimen of Releasing of C-NCAP Assessment Results

C-NCAP 202X年度C-NCAP第一批车型评价结果详录

车型图片

车型名称

型号

公司名称

总体星级评价

★★★★★

综合得分率：

	部分得分率	权重	部分得分率×权重
乘员保护			
行人保护			
主动安全			
电安全			

车型种类：
车辆型号：
试验车购买价格（万元）：
长×宽×高（mm）：
发动机排量（mL）：
整备质量（kg）：
最大总质量（kg）：
正面安全气囊：
侧面安全气囊：
安全气帘：
安全带预张紧器：
安全带限力器：
驾驶员侧安全带提醒：
乘员侧安全带提醒：
乘员侧座椅使用状态监测：
ISOFIX装置：
AEB配置：
ESC：

安全系统	型号	生产企业	备注
前排双正面安全气囊及膝部气囊			
侧面安全气囊及气帘			
前排安全带			
第二排左侧安全带			
驾驶员座椅			
行人保护系统			
ESC控制器			
AEB系统			

乘员保护

■ 总得分（得分率）：

■满分 ■1/2满分≤得分<满分 ■0<得分<1/2满分 ■0分

假人颜色图片

正面100%碰撞瞬间照片

■正面100%碰撞试验得分：

	前排					后排女性			后排儿童				单项试验减分
	头部	颈部	胸部	大腿	小腿	头部	颈部	胸腹部	头部	颈部	胸部	腹部	
满分	5	2	5	2	2	1.6	0.4	2	2	1	1	0	-
试验得分													

假人颜色图片

正面50%碰撞瞬间照片

■ 可移动壁障偏置碰撞试验得分：

	前排					后排		后排儿童				单项试验减分
	头颈部	胸腹部	骨盆	大腿	小腿	头颈部	胸部	头部	颈部	胸部	腹部	
满分	4	4	4	4		2	2	2	1	1	0	-
试验得分												

假人颜色图片

侧面碰撞瞬间照片

■ 侧面碰撞试验得分：

	前排				后排				单项试验减分
	头部	胸部	腹部	骨盆	头部	胸部	腹部	骨盆	
满分	4	4	4	4	1	1	1	1	-
试验得分									

假人颜色图片

侧面柱碰瞬间照片

■ 侧面柱碰试验得分：

	前排				单项试验减分
	头部	胸部	腹部	骨盆	
满分	4	4	4	4	-
试验得分					

假人颜色图片

鞭打试验瞬间照片

■ 鞭打试验最终得分：

	前排				后排			
	NIC	上颈部载荷	下颈部载荷	减分项	NIC	上颈部载荷	下颈部载荷	减分项
满分	2	1.5	1.5	-	0.8	0.6	0.6	-
试验得分								

■ 儿童静态试验得分：

	车辆检查	车内CRS安装	减分项
满分	2	1	-
试验得分			

加分项得分：

行人保护

行人保护颜色图片

■ 总得分（得分率）：

	头部	腿型	减分项
满分	10	5	-
试验得分			

主动安全

■ 总得分（得分率）：

AEB试验照片

■ADAS试验得分：

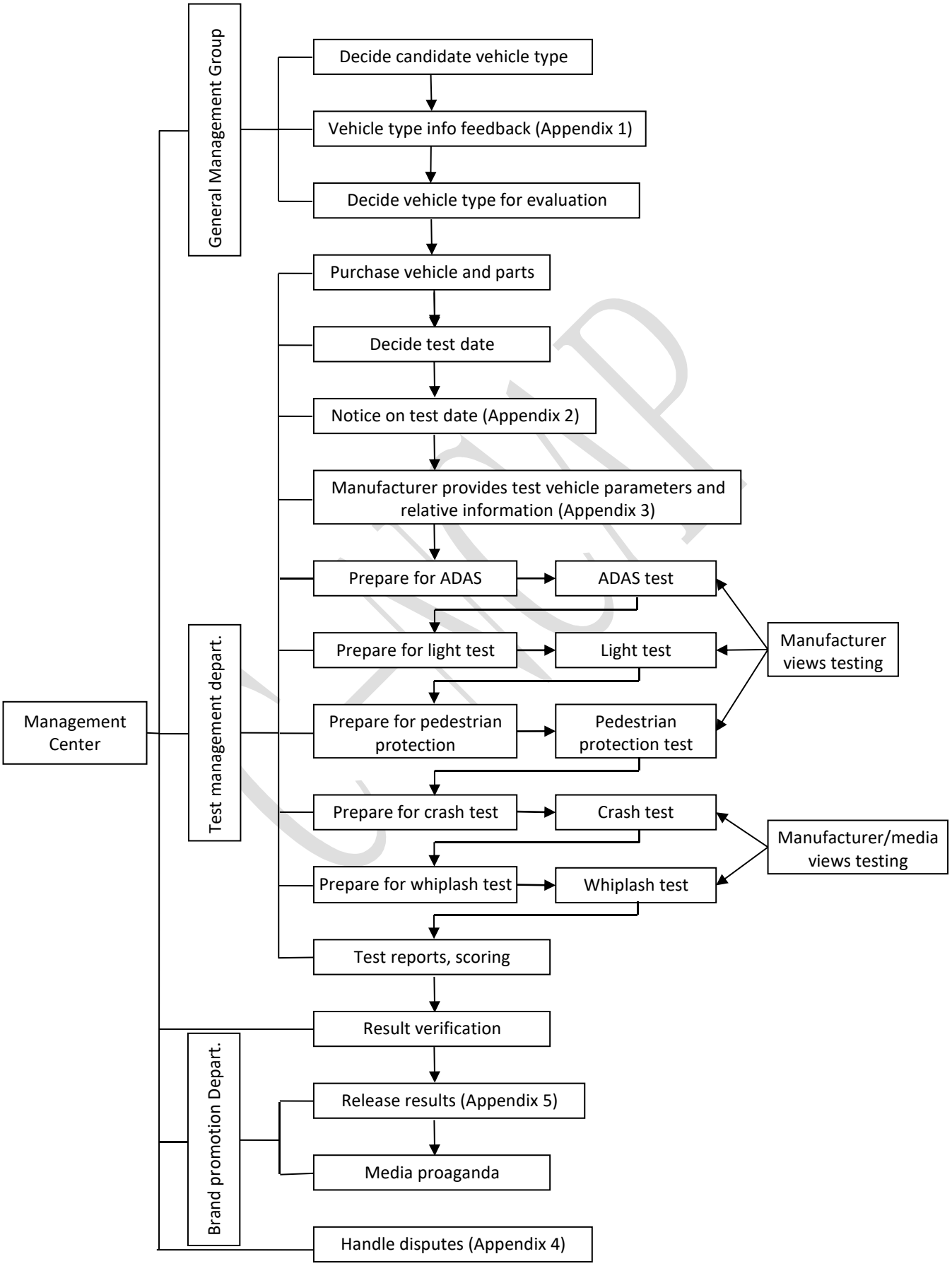
	评价项					审核项	可选审核项		
	AEB车对车	AEB车对行人	AEB二轮车	车道保持	HMI	ESC	盲区检测	速度辅助	车道偏离
满分	11	10	11	3	6	8	5	2	2
试验得分									

■汽车前照灯整车性能试验得分：

	近光灯					远光照明灯		加分项	罚分项
	直道弓	后部距离	弯道弓	后部距离	左侧行人可见度	照明范围	路口行人探测距离		
满分	1.5	1	1	1.5	1	2.5	0.5	1	-1
试验得分									

ANNEX 6

C-NCAP work flow chart



ANNEX 7

Comparison of outcomes from examination items

Items	Test vehicle for reporting	C-NCAP test vehicle
Vehicle model		
Vehicle type		
Vehicle identification number (VIN)		
Chassis model and manufacturer		
Engine model and manufacturer		
Complete vehicle kerb weight and axle load (kg)		
Complete vehicle max. laden weight and axle load (kg)		
No. of axles		
Wheelbase (mm)		
Wheel track (mm)		
Max. design speed (km/h)		
Tyre model and manufacturer		
Tyre air pressure (kPa) (front/rear)		
Suspension structure (front/rear)		
Center-of-mass height (unladen/full-laden) (mm)		
Engine rated power (kW)		
Engine max. torque (Nm)		
Engine ECU and manufacturer		
Final-drive gear ratio		
Transmission gear position and speed ratio		
Drive mode		
Power brake mode		
Brake system type		
Brake master cylinder type and manufacturer		
Brake caliper model		
Brake disc model		
Brake shoe model		
Brake drum model		
Brake lining model		
Steering system type		
Power steering gear model and manufacturer		
ESC system controller model and manufacturer		
ESC software version		
Brake-pressure regulator model and manufacturer		

Steering-wheel angle sensor model and manufacturer		
Yaw-velocity and lateral-acceleration sensor model and manufacturer		
Wheel-speed sensor model and manufacturer		
Instrument model and manufacturer		
LDW system controller model and manufacturer		
LDW software version		
SAS system controller model and manufacturer		
SAS software version		
BSD system controller model and manufacturer		
BSD software version		
Laser radar quantity, model and manufacturer		
Millimeter-wave radar quantity, model and manufacturer		
Other radar quantity, model and manufacturer		
Camera quantity, model and manufacturer		