The Assessment results of the Advanced Safety Technology in JNCAP and its future

Hiroyuki Inomata,

Director of NCAP Management Department & Planning Department, National Agency for Automobile safety and Victim's Aid (NASVA),

Ms. Yoko Kishino,

International Adviser, NASVA

Mr. Souta Miyamoto,

Staff, NASVA

Japan

15-0275

Abstract

The Japanese government has set up the target of fatalities-from-traffic-accidents reduction. Its aim is to be at the safest traffic society in the world. However, the reduction rate of the death toll in Japan has declined but it's still in a severe situation. Moreover, we have a rapidly aging society. This is another problem.

On the other hand, with the rise of a national safety consciousness, many cars equipped with advanced technology are available on Japan's market including the small sized car, so called kei-car and it is in the most diffused situation in the world at a present stage. But more promotion is desired.

Nevertheless, an understanding about a difference of the performance and the characteristic of that technology are not yet understood efficiently.

Although NCAP has so far achieved big success by the technique of the information dissemination to a consumer for improvement in the safety performance of a car, extending this to the domain of advanced safety technology is called for.

JNCAP started advanced safety technology assessment from 2014 based on our roadmap. In 2014, we adjusted the protocol of the procedure of Autonomous Emergency Braking System (AEBS) test, Lane Departure Warning System (LDWS) test and an evaluation method.

In the protocol of an evaluation method, it is prescribed that an official announcement shows the overall points of several results of advanced safety technology assessment.

We are targeting the spread of technology by evaluating various advanced safety technology synthetically and thus more technical development is urged with the digitization technique of evaluating the reduction effect of a deaths and serious injury accidents based on the actual accident data from Japan.

We implemented the assessment according to these protocols and released the result of 37 models in FY2014.

So, various characteristics for every technology became clear as a result of the AEBS tests. Although various technologies, such as laser radar equipment, millimeter-wave radar equipment, mono-eye, dual-eye camera is used, we are able to discuss about the important information we should give to a consumer and the future course of the advanced safety technology depending on current test results.

Finally, I would also like to write about the future work of JNCAP based on the discussion taken in our steering committee meetings and the WGs.

Presently, NCAPs are taking places in every region in the world. In Japan, JNCAP have made a significant progress on road safety. This article includes advanced safety assessment, analysis and results which were started in fiscal year of 2014 and further developed.

1. Background

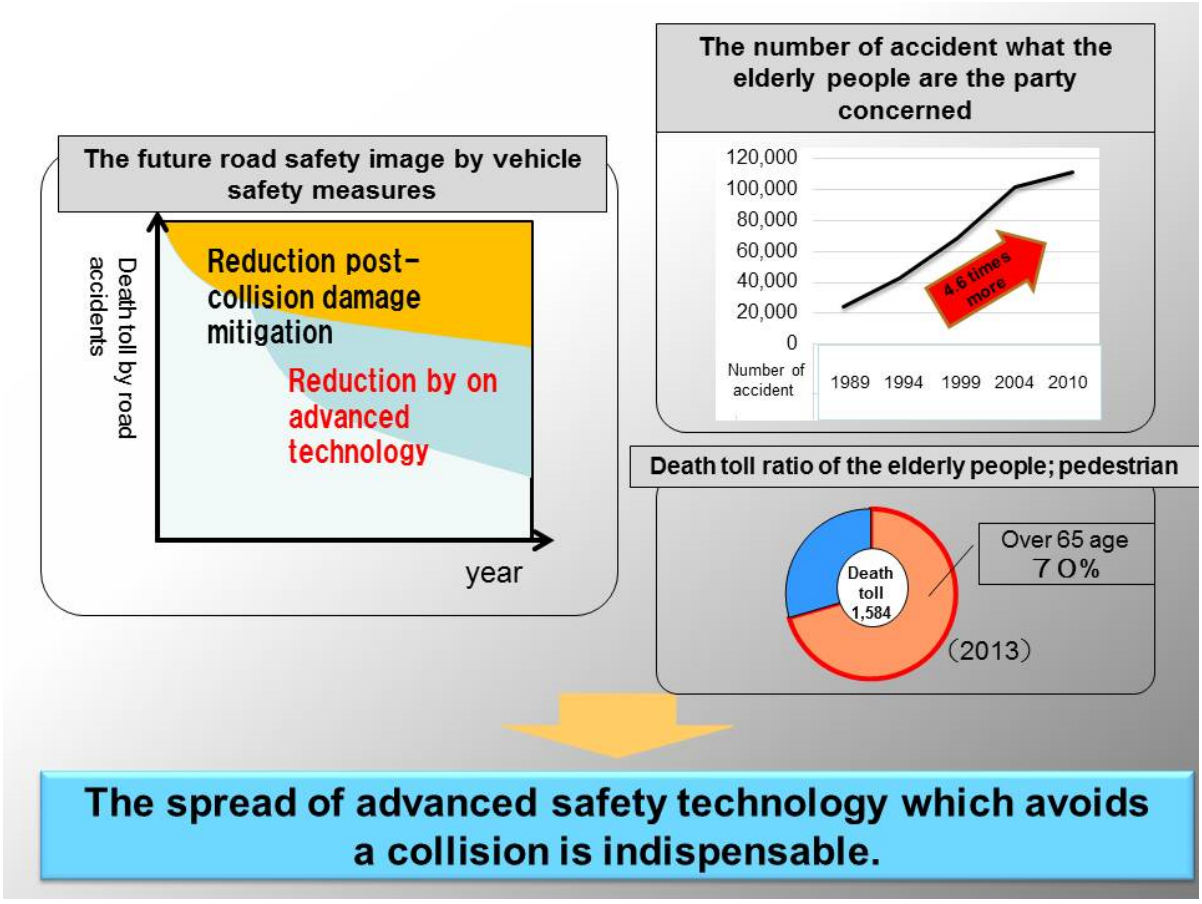
The number of road traffic deaths and serious injuries are declining recently. However, more can be done as the death toll in 2014 was 4,113 and 5,152 if it includes death within 30 days after the accident (data on 2012). NASVA (National Agency for Automotive Safety and Victim's Aid) acts to help those who are seriously injured from the road accidents. The government of Japan now sets the target of reducing death records to less than 2500. Its aim is to have the best road safety record in the world by 2018. MLIT has three measures linking each other on vehicle technical aspects for safety. JNCAP is one of them which is promoted by MLIT (Ministry of

Land, Infrastructure, Transport and Tourism), and NASVA. NASVA, as an exclusive organization, for supporting the seriously injured and their family members it carries out three types of activities; support, prevent and protect which are linked effectively. From fiscal year of 2014, JNCAP carried out passenger safety performance evaluation and pedestrian performance evaluation which prevent collision.

2. Outline of advanced safety performance assessment

To achieve the target that government sets, collision safety technologies are not quite enough. Also, older drivers directly involved in traffic accidents are increasing. Pedestrian death rate becomes over 50% is considerably high, thus clearly shows marked characteristic of an aging society. Meeting these problems, it is necessary to introduce a new safety technology such as AEBS which can avoid collision.

Under this circumstance, JNCAP steering committee has decided to enforce advanced safety technology assessment as one of measures which contributes to reducing deaths and severe injuries.



The steering committee refers to computed data of which the result of calculated the damage reduction effect is used in the ASV project which government promotes to make a roadmap for this technology. Digitization for reduction effects of deaths and injuries were calculated by multiplying relevance factor and safe contribution ratio at the time of system functioning and social loss ratio of death and severe injury is defined as 30:8. The total points of AEBS (car to car) and AEBS (car to pedestrian) refers as 100 points that is most effective.

Evaluation points for advanced assessment
(Forecast on accident reduction effect)

	ＡＳＶ technology	Estimated reduction numbers				total of microdata			main cause
		deaths	severe injuries	reduction effects		deaths	severe injuries	injuries	
(1)	Autonoomous Emergency Brake System(AEBS) [car to car]	**59**	**1,649**	33	100	**59**	**1,664**	164,453	distracted driving Misoperation
(2)	Autonoomous Emergency Brake System(AEBS) [car to pedestrian]	**552**	**1,708**	67		**700**	**2,287**	14,639	distracted driving
(3)	Lane Deoarture Warning System(LDWS)	**67**	**206**	8		**168**	**516**	1,274	distracted driving・traffic condition
(4)	Lane Keep Asist system (LKAS)	**15**	**75**	2		**15**	**75**	260	distracted driving・traffic condition
(5)	Rear View Monitoring System[rear]	**9**	**291**	6		**13**	**415**	3,638	distracted driving

Evaluation points

○The accident reduction effect of ASV technology is based on the macro accident statistical data for H 21（limiting to a passenger car/standard-sized car, and a minicar）

○Reductional effect score are calculated by multiplying the ratio of the social amount of a loss (3.75:1)and the number of and deaths and the serious injuries,then added each other.

○）making the numerical value into 100pt used as a standard by adding the accident reduction effect of car to car (1) car to pedestrian(2).

→Value of one point in the accident reduction effect of death and a serious injury for by system are calculated equarlly on 1 pt by each system

As it shows on our roadmap, we set 2 test protocols, allocation of the points, logo marks for AEBS (car to car) and LDWS and three policies for publication of test results, and started tests and evaluations in fiscal year of 2014.

3. Test procedures and evaluation methods for AEBS (car to car) and LDWS

1) Test procedures and evaluation methods for AEBS

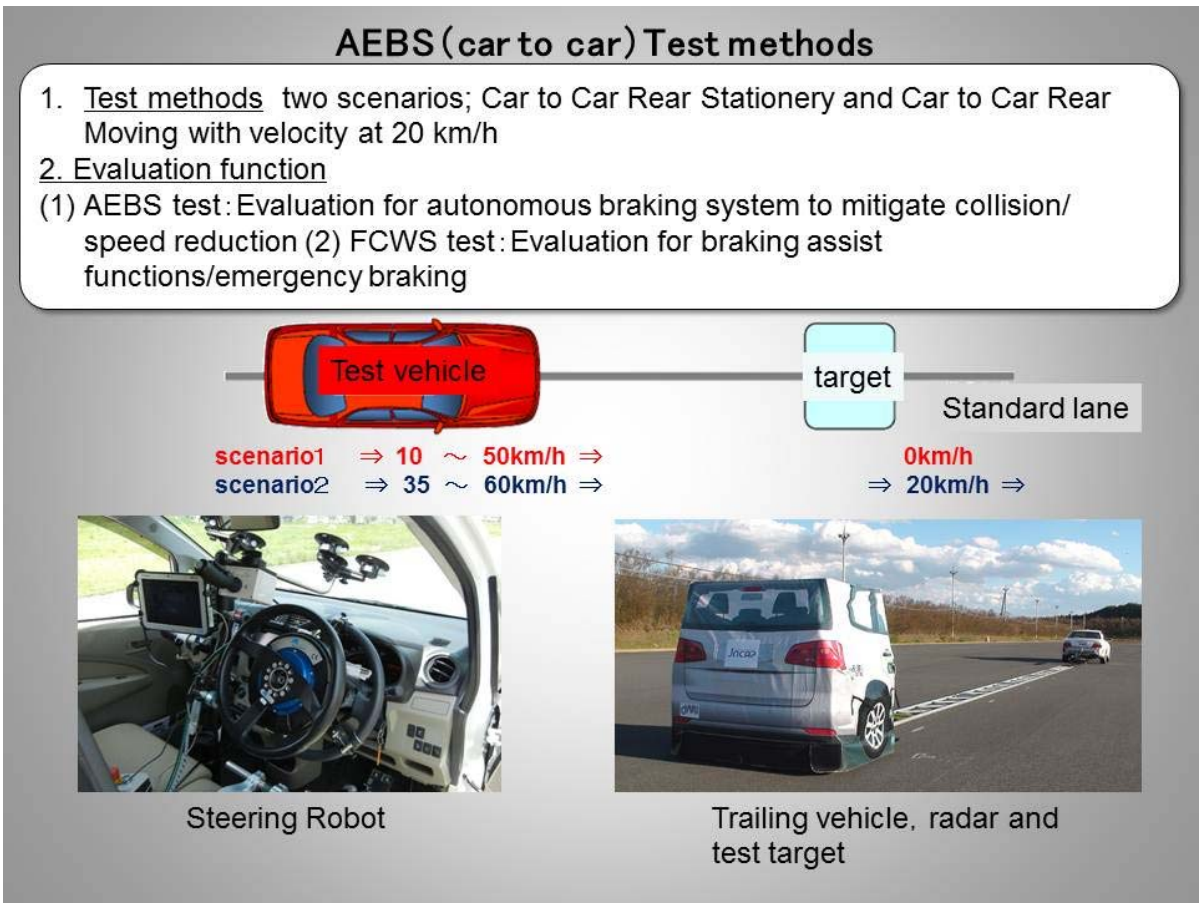
We referred to Euro NCAP's test procedure and modified the evaluating methods for meeting a real Japanese accident condition.

Test scenarios are;

1. CCRs (Car to car rear collision stationery)

2. CCRm at constant speed (Car to car rear collision moving)

The function of each AEBS and Forward Collision Warning System (FCWS) are evaluated. We evaluate the damage mitigation effect by the combination of the alert to a driver, and the brake assisting function in each scenario. In order to examine impartially and properly, we use the steering robot and the accelerator brake robot. We use the same type of target as EuroNCAP representing vehicles back to sensing technology, such as radar and a camera. It is what can absorb a shock at the time of a collision.



Each scenario, evaluating functions and speed reduction rate in each speed category are calculated with evaluation methods. (if collision is mitigated it refers as 1) are allocated this real accident data and adds up the total as for evaluation methods. All the marks are based on the forecast of the reduction effects of accidents by the government and the full marks for AEBS for car to car is 33 points. However, because of the safety reason, tests speed of 55km/h and 60 km/h are not carried out at the CCRs scenario, therefore total score at present is 32 points.

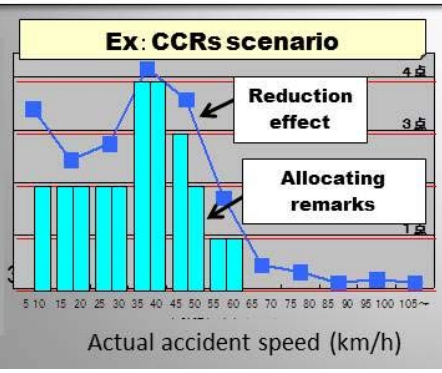
AEBS test and evaluation

3. The index of evaluation
tested with each scenario speed by 5-km/h for every function (Max.34 conditions)
The speed reduction rate at the time of a collision is calculated for every test.

$$\text{The speed reduction rate} = \frac{\Delta V_0 - \Delta V_C}{\Delta V_0}$$

Vo: Initial relative velocity, Vc : relative velocity in case of collision is able to be avoided at the time of a collision, a speed reduction rate is set to "1."

4. Allocation of marks(points)
32 points are assigned about AEBS (car to car) according to the accident reduction
Calculated the reduction effect by a system functioning in death and a serious injury accident. An alarm function and a control facility is 1:1



Score points based on effect

condition	The reduction number of deaths and seriously injured per year	The effect of reducing the social loss (Evaluation points)
total	3,968	100
car to car	1,708	33
car to pedestrian	2,260	67

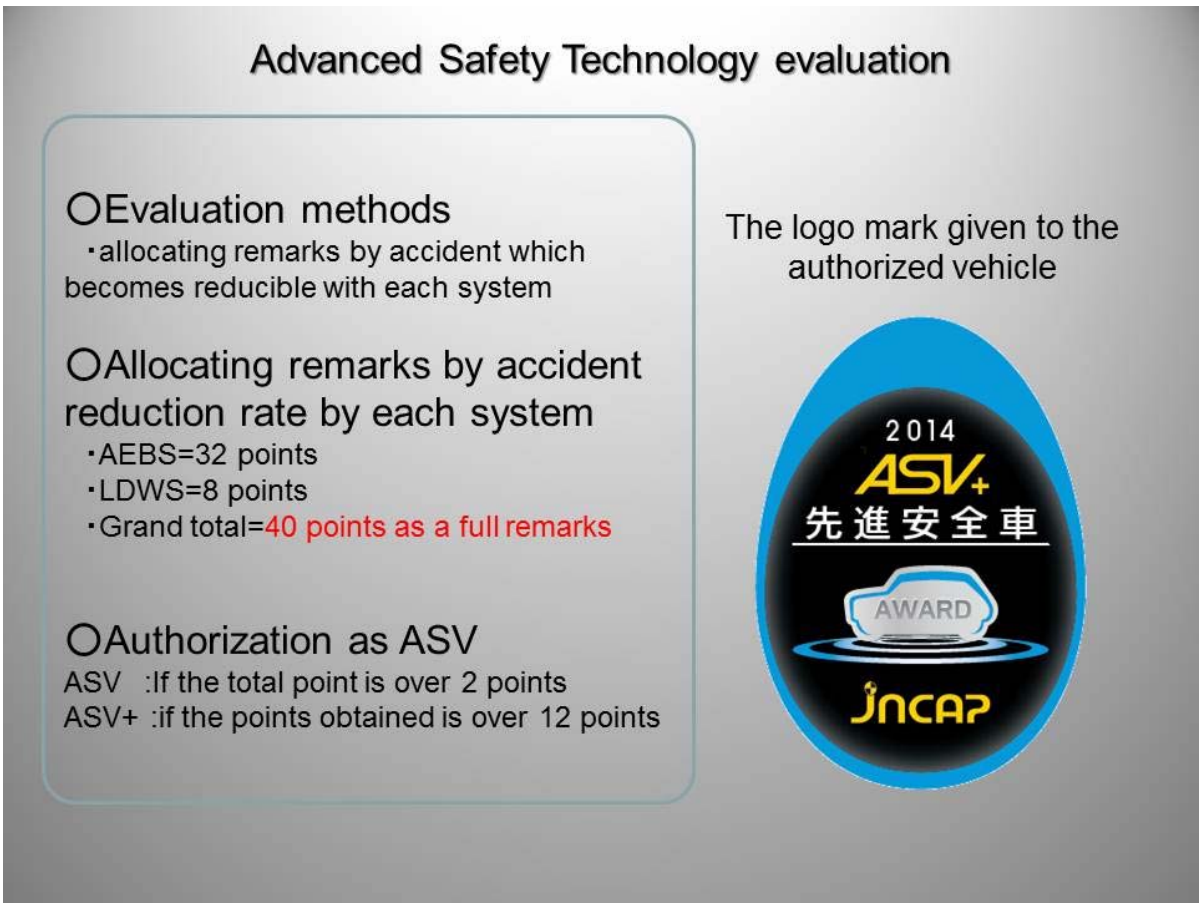
For safety reason of test, 32 points are assigned instead of 33

2) Test procedures and evaluation methods for LDWS

We referred to US NCAP's test procedure and modified the evaluating methods for meeting a real Japanese accident condition. To be concrete, audible or visual; more than two different alert at a time should be confirmed in the test area when test vehicle runs with constant lateral velocity at 60km/h or 70km/h when approaching the lane line. This is repeated five times for both sides. Points should be calculated with the evaluation methods same as AEBS test. 8 points is given when it has started appropriately with velocity at 60km/h that is forecasted from the reduction effects of accidents.

4. Publishing policy of advanced safety technology assessment

The publication of the advanced safety technology assessment is held separately from other results of the assessments with the respect of enhancing its spread. We use a logo mark for exclusive use to gain more public interests.



Moreover, we implement public relation activities including distribution of comprehensive leaflets and more than 500 thousands leaflets distributed among each manufacture's sales points. And logo mark stickers are indicated on their models.

5. The results of advanced safety assessment in fiscal year of **2014**

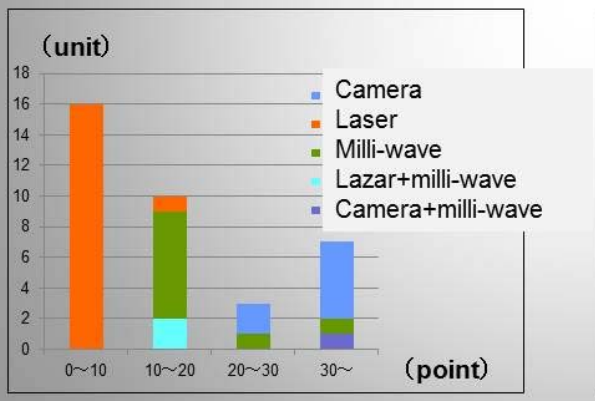
In fiscal year of 2014, we had 37 models tested as many devices are spreading rapidly to the market and it becomes competitive. As a result, all models had a definite safety performance. On the other hand, each of the technology which was used in AEBS had different characteristics and detection system to different speed range. We have found two characteristics; 1. AEBS using lazar radar mainly used in reasonable compact cars such as kei-cars, are spreading well. 2. AEBS using milli-wave or camera functioning well at middle speed range. This category aims at a higher level of safety. Combination with FCWS and assist braking system, combination of multi detectors, image detecting system with high resolution and coloring dual camera raises more safety. Considering the tests have many aspects in speeds and scenarios making a valiant effort should be important for stable controls and indispensable for forthcoming AEBS (car to pedestrian) tests. I believe that many manufacturers and suppliers cooporate to develop these technologies.

AEBS Test result

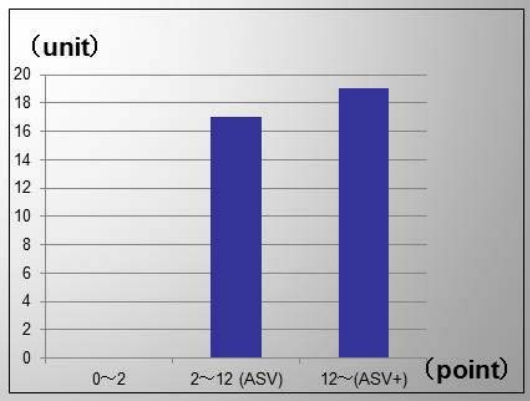
• Device features

Device	Feature
Millimeter-wave Radar	-detects the position of person or running vehicle, speed, and relative speed by irradiating a short wavelength radio wave -detection distance is relatively long
Laser Radar	-detect the distance to the obstacle based on the reflection from the device -detection distance is relatively short
Camera	-detect obstacles by analyzing the images

• Unit/AEBS points



• Unit/ASV points



6. Forthcoming events

We are implementing for introduction of rear view monitoring test in fiscal year of 2015 and AEBS (car to pedestrian) tests and evaluations in fiscal year of 2016 in respect of needs from end users and victims of the traffic accident according to our roadmap. We have already started after setting up procedures and evaluation methods for around view camera with the research on accident data and simulations. Also for AEBS (car to pedestrian) tests, we need to determine procedures and evaluation methods with the making of test scenarios meeting real accident data and allocation of the points based on the reduction effects of accidents in 2015. Having been considering Japan's present circumstances, it is the key issue how we can focus to link with the assessment with increasing number of accidents that is often very severely involved by elderly people and accidents at night. We have been discussing many points at Task Force and Working Group under JNCAP steering committee.

7. Conclusion

We will have 30 to 40 models be tested in fiscal year of 2015 as manufactures became conscious of putting safer and innovative technology on the market. We need to maintain this trend continuously. NCAP operation bears a big power on its cooperation with the Japanese nation, industries, government and academics. And end users and manufactures need to take the results of NCAP assessments seriously moer than ever before. For those accounts we need more substantial work on test procedures and evaluation methods, also we regard international cooperation important to share experience and knowledge.