

Advanced Technology (Vehicle)

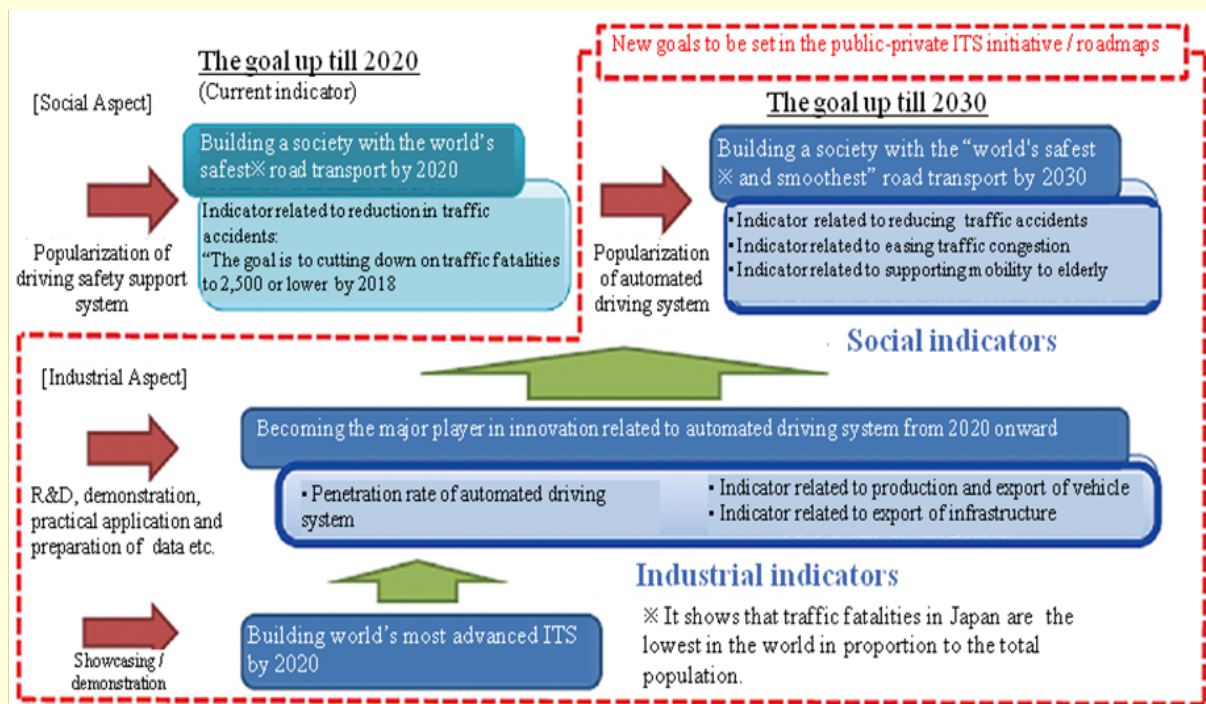
Public Private ITS Initiative/ Roadmaps 2016

Public private ITS initiative/ roadmaps (Hereinafter, referred to as roadmaps) is the national strategy document indicating Japan's policies on ITS (Intelligent Transport Systems) and automated driving adopted by the IT Strategic Headquarters.

Originally, the roadmaps were formulated in June 2014. However, because of the rapid progress in technology and industries in this field, revision is repeated every year in a form based on latest situation. Latest version is the "Public private ITS initiative/ roadmaps 2016" which was formulated in May 2016.

In these roadmaps, "Build and maintain the world's best ITS and thereby contribute to its people and the world" has been mentioned consistently. For this, the private sector, relevant ministries and agencies have come together and indicate the direction in which efforts should be taken and its specific work schedule. Moreover, a goal is set to build "World's safest and smoothest" road transport society by 2030 as shown in figure 1 as the purpose to build the ITS which is best in the world.

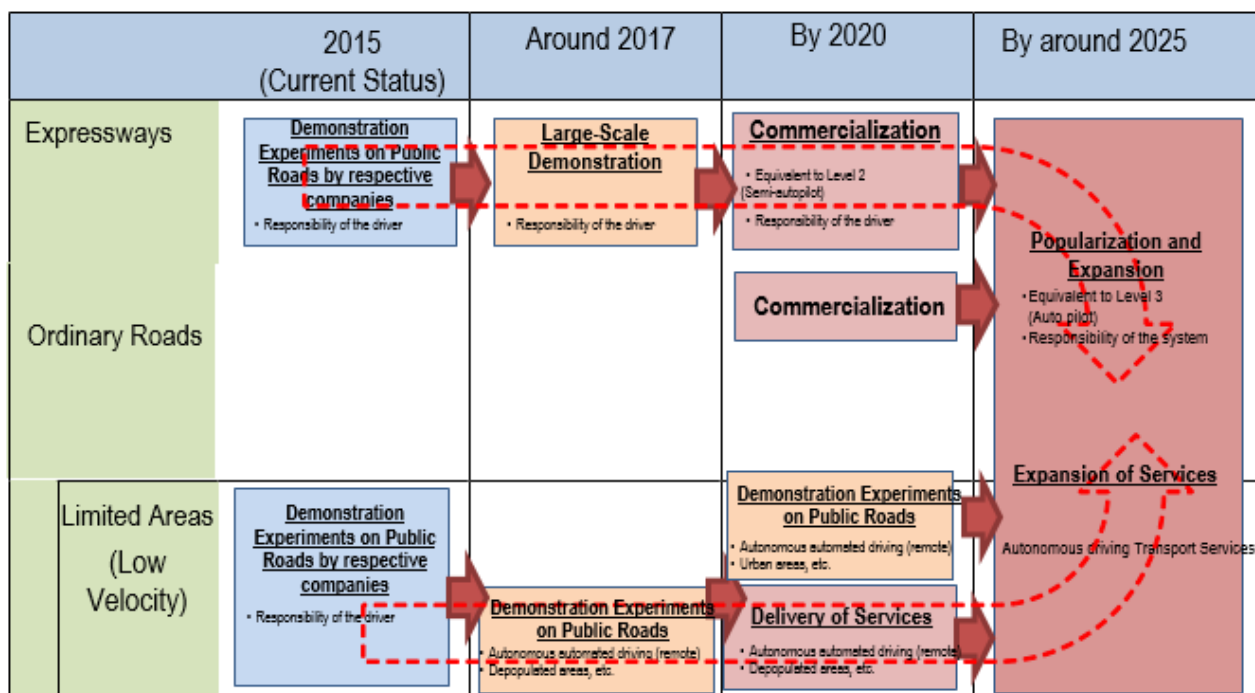
[Figure 1] Society and Important Goals Indicator for the Target



In the 2nd public-private dialogue on the future investment held in November 2015, Prime Minister Abe announced that "We will realize transport services for the 2020 Tokyo Olympic and Paralympic Games and automated driving on highways via unmanned autonomous driving systems. To achieve this, we will develop the required systems and infrastructure, including the implementation of demonstrations by 2017." Based on this, the roadmap (Image) for realization of these two automatic driving systems is shown in figure 2. Along with that, its specific process is clarified.

Further, commercialization and the expected time for implementation of the service of the automatic driving system is set as shown in table 1 with clarifying the level definition related to automated driving, and the system other than these two automated driving system mentioned above.

[Figure 2] The Entire Roadmap Focusing on Two Automatic Travelling Systems (Image)



[Table 1] Expected Time for Commercialization and Service implementation of the Automatic Travelling System

Levels	Technologies Expected to be Realized (Examples)	Expected Time of Commercialization
Level 2	• Follow-up and tracking systems (e.g. ACC+LKA)	Commercialized
	• Automated lane change	In 2017
	• Semi-autopilot	By 2020
Level 3	• Auto pilot	In 2020
Remote, Dedicated Space	• Unmanned autonomous driving Transport Services	Limited areas By 2020
Level 4	• Fully Automated Driving Systems (non-remote)	In 2025

“Semi-automated pilot”
 · A system having automatic travelling mode function (From entrance ramp way to exit ramp way, merging, lane change, lane/ vehicle maintenance, branching) on expressway.
 · There is a principle driver responsibility in automatic travelling mode also. However, there is a function for notifying travelling situation from system.

“Autopilot”
 · A system having automatic travelling mode function on expressway – under certain conditions
 · There is a principle system responsibility in the automatic travelling mode also. However, driver support is available upon request from system.

(Note 1) It is assumed that the expected time of realization will be reviewed in future on the basis of the domestic and international industry and technology trends, including the development trend of automatic travelling system in overseas.
 (Note 2) For “Autopilot” of level 3 and fully-automated travelling system (Non-remote) of level 4, in order to make the commercialization by private enterprises possible, government sets it as time expected for efforts to achieve goal.

On the other hand, the situation in technologies and industries including ITS and automated driving systems have been changing rapidly even after the development of public private ITS initiative/ roadmaps 2016. Even under such an environment, further revision of roadmaps is studied aiming at being the center of the world for the construction of the world's most advanced ITS and the innovation relevant to automated driving.

[Government Homepage Publisher]

The document of the “Public-Private ITS Initiative/Roadmaps 2016” is available on the following homepage.
http://www.kantei.go.jp/jp/singi/it2/kettei/pdf/20160520/2016_roadmap.pdf.

Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving System

Automated driving system was selected as one of the 10 tasks (Currently 11 tasks) of Cross-ministerial Strategic Innovation Promotion Program (SIP) which was an initiative for the tasks important for the Japanese economy and industrial competitiveness, which was socially essential. It was selected in the Council for Science, Technology and Innovation (at that time) on September 13, 2013. In SIP, for the promotion of the measures for handling each problem, a program director (PD) with strong leadership qualities has been appointed and across the sector efforts in cooperation with the government ministries and agencies, and continuous research and development anticipating from basic research up to the practical application and commercialization are considered to be the characteristics.

There are 3 major targets in the automated driving system for the realization of the automatic operation of the car. They are

- Safety assurance and reduction in congestion in road traffic
- Realization and dissemination of automated driving system
- Realization of advanced public bus system which is suitable for elderly people/ people having traffic restrictions

The research and development area on which each car manufacturer or part maker should take efforts considering common problems, is identified as a cooperation area. Efforts are being taken as a 5-year plan from FY 2014 for social implementation. On the other hand, the areas where necessity of the relative standardization is less and each company is already engaged in fierce development competition are regarded as the competition areas and are cut from the cooperation area.

In the automated driving system, "Recognition", "Judgment", "Operation" which was so far performed by drivers, will be finally performed by all the machines. Therefore the efforts for the research and development of a dynamic map which is necessary map for the automatic operation, the security of the communication, HMI (Human Machine Interface) deciding the way of exchanging information of the vehicle and the driver with surrounding pedestrian and around the vehicle, the simulation technology, the basic technology of the data server are promoted. At the same time, the industrial-academic-governmental efforts for reducing the accidents of pedestrians and bicycles, etc., and the efforts contributing in to the next-generation public transport of the city, are also promoted as cooperation areas.

Technology Required in Automated Driving System

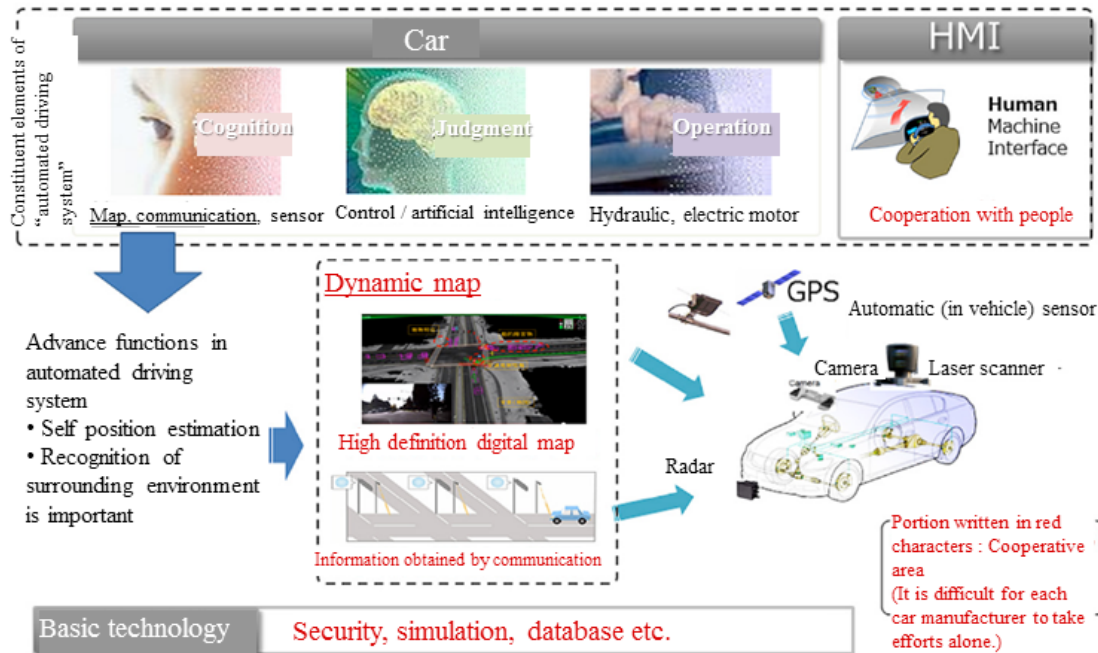


Figure 1 Technology Required in Automated Driving System

With respect to the achievement of research and development up till now, a Large-scale Demonstration Test^① is being carried out in the vicinity of Kanto from September 2017 together with the domestic and foreign automobile manufacturers and part manufacturers and the universities in order to realize the early implementation of automated driving system, with focus on 5 themes which are "Dynamic map", "HMI", "Information security", "Reduction in accidents of the pedestrians" and "Next-generation urban transportation", taking Tokyo Olympic and Paralympic Games 2020 into account.

Large-scale Demonstration Test (November 15, 2016)
[http : //www8.cao.go.jp/cstp/kaisaiannai/20161115sipadus.pdf](http://www8.cao.go.jp/cstp/kaisaiannai/20161115sipadus.pdf)

Large-scale demonstration test

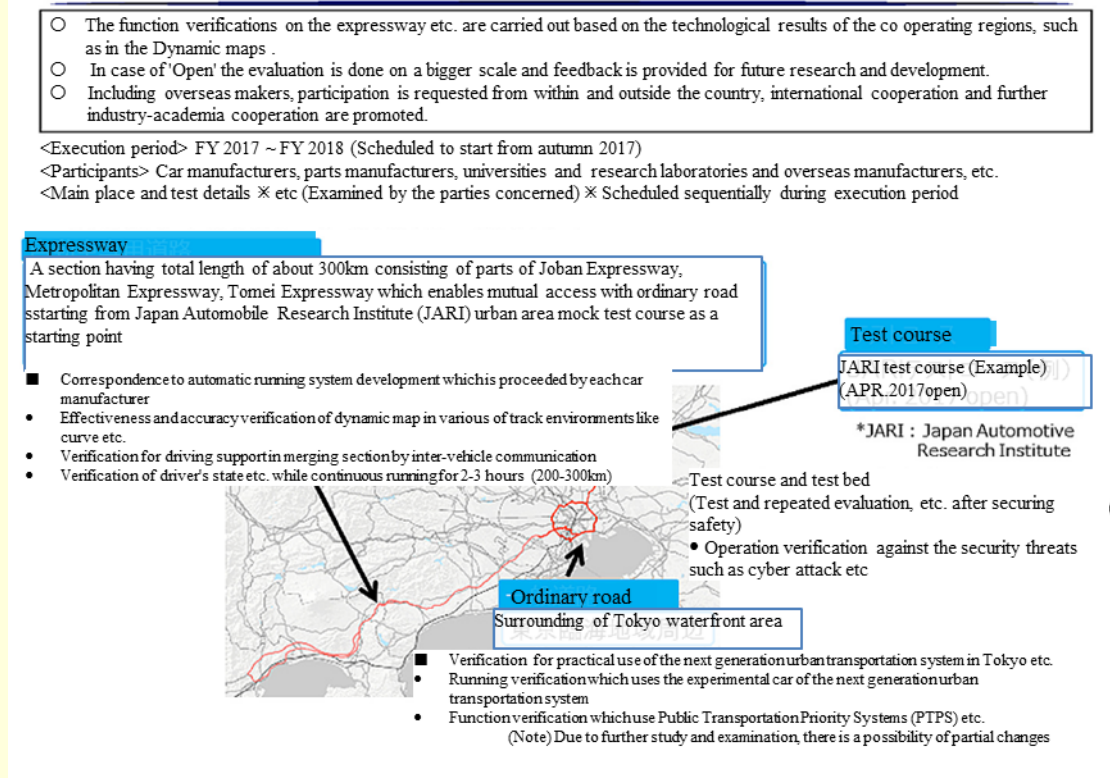



Figure 2 Outline of large-scale demonstration test

Prior to this, in March 2017, demonstration experiment of automatic driving bus was carried out in Okinawa . Technology verification, such as correct arrival control technology, which stops the bus at the bus stop with almost no gap was examined. Since the current fiscal year, with the use of automated driving technology, experiments will be demonstrated on actual vehicles including public roads to activate the local community and improve the traffic environment and to put into practice a public transport bus which will be friendly to everyone. Furthermore, in order to spread the automatic driving technology, to enable the Japanese automobile industry to take international leadership and to increase the acceptability of society, the demands of the general citizens are accepted and media meetings and a dialog with citizens are every year at the international meetings held in Tokyo to increase the understanding.

Demonstration Experiment of Automatic Driving Bus in Okinawa (December 26, 2016, February 17, 2017)
http://www8.cao.go.jp/cstp/kaisaiannai/sip_okinawa.pdf
http://www.sip-adus.jp/wp/wp-content/uploads/topic17027_sip_okinawa2.pdf


Demonstration Experiment of Automatic Driving Bus in Okinawa in Year 2016



~Main Verification Content~
 <Verification of automatic driving technology>
 ◇ Conformity control
 ◇ Lane keeping control, acceleration control
 ◇ Obstacle recognition, lane change control

 <Verification of operation information system>
 ◇ Vehicle Monitoring system
 ◇ Passenger response system

Implement ation period	March 20, 2017 (Monday) ~ April 2 (Sunday)
Place etc.	Around the Okinawa Prefecture Nanjo City "Ozama Shanshan beach" ○ Public road (general vehicle and pedestrians are also passing) ○ Round trip; traveling route of 2 km approximately [Total distance covered about 300 km, total demonstration models about 160 people]
Bus vehicle	Small buses were modified by assuming the utilization of automatic driving technology in local community buses ※ ※Capacity 19 people (35seater vehicles was remodeled for experiment)
Trustee	Advanced Smart Mobility Co. Ltd. , SB Drive Corp.



High precision GPS antenna

Wireless communication antenna

Rider (the surrounding is detected by emitting laser beam)

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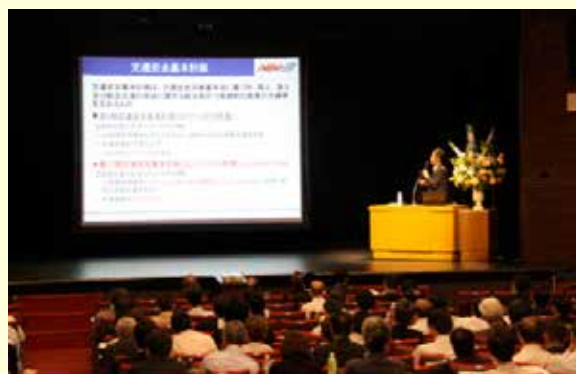
Figure 3 Demonstration Experiment of Automatic Driving Bus in Okinawa

Development and Dissemination of Advanced Safety Vehicles

J Promotion plan for advanced safety vehicles (ASV)

The Ministry of Land, Infrastructure, Transport and Tourism and industry-academic-government have been working together to promote ASV promotion plan since 1991 with a view to promote the development, implementation and dissemination of advanced safety vehicles (ASV).

In FY 2016, the performance debriefing session for the 5th ASV promotion plan (Planning period: FY 2011 ~ 2015) was conducted and the result of formulating the guidelines for the driver abnormality response system and next generation communication use type safe driving support system was summarized. The 6th ASV promotion plan (Planning period: FY 2016-2020) was newly established and dissemination of ASV technology which was put to practical use has been really promoted and examination of the technical requirements for the development of response system in case of driver's abnormal situations such as evacuation to road shoulder was started.



5th ASV promotion plan result debriefing session
(May 20, 2016)

K Trend of Automotive Assessment (Addition of automatic brake for pedestrians to the prevention safety performance evaluation)

The Ministry of Land, Infrastructure, Transport, Tourism carries out evaluation of vehicle safety performance from a fair and neutral standpoint in cooperation with the National Agency for Automotive Safety and Victims' Aid (NASVA), and promotes the selection of safe vehicles by users and the development of vehicles with high safety performance by manufacturers through the publication of its results.

In addition to the past vehicle assessment focused on collision safety performance, which assess performance, such as the protection of crews when vehicles collides, the Ministry has started to evaluate and publish prevention safety technology aimed to prevent accidents using advanced safety technologies since FY 2014. Concretely, the Ministry has newly started the evaluation of safety performance of collision damage mitigation brake (called as automatic brake) and lane departure warning system in FY 2014, and rear view field information provision device (called as rear camera) in FY 2015.

In addition to this, the evaluation of safety performance of collision damage mitigation brake for the pedestrian has also been newly started as a response to the pedestrians who occupy the highest ratio in number of fatalities due to the traffic accidents FY 2016.

As a result of evaluation, the scores per device are displayed and comprehensive evaluation is published in various pamphlets and on the homepage (<http://www.nasva.go.jp/>).



(Various pamphlets)

(Image of prevention safety performance evaluation)

From now on, in order to further reduce the number of casualties in traffic accidents and realize the world's safest road transport, it is necessary to increase the sophistication of prevention safety technology, to increase the sophistication and reliability of prevention safety technology and thus, the assessment of prevention safety performance will play a very important role. The automobile assessment will sequentially expand performance evaluation of advanced safety technologies which have an effect of high reduction in accidents and promote the development and dissemination of automobiles with high safety performance from now on.

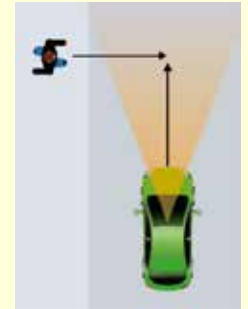
~ Image of Assessment Test of Prevention Safety Performance ~

Damage Mitigation Brake (For pedestrians crossing the road)

Test method

Make the car at a speed of at 10 km/h to 60 km/h approach the target simulating a pedestrian crossing a road, and check the operation status of the collision warning and collision damage mitigation brake. Specifically, conduct a test assuming two kinds of traffic environments, that is, a case where a pedestrian crosses a road with a good line of sight and a case where a pedestrian crosses a road from behind a parked vehicle.

In the evaluation, the operation timing of the collision warning and the collision avoidance situation due to the operation of the collision damage mitigation brake (in the case of collision, the speed reduction amount at the time of collision) are checked and a score is given.



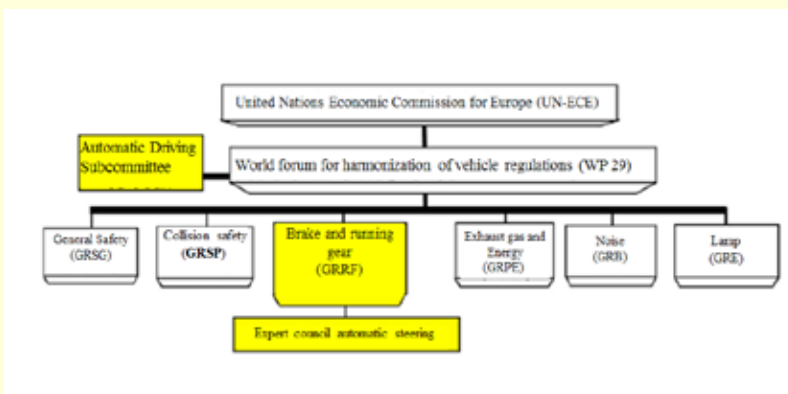
Automated Driving System

• “Status of Development of International Standards for Automated Driving System”

The Ministry of Land, Infrastructure, Transport and Tourism promotes international harmonization activities regarding vehicle safety and environment standards in the “World Forum for Harmonization of Vehicle Regulations (WP29)” in the United Nations, and as an environmental consideration for realization of automated driving system the Ministry is working by considering the study parameter of Automated Driving System Strategy Headquarters of the Ministry of Land, Infrastructure, Transport and Tourism.

In "Subcommittee on Automated Driving" established under WP29, Japan and UK have served as co-chair of the subcommittee and lead international discussions regarding the cyber security guideline for automated driven car.

In the "Expert Council on Automated Steering" established under "Working Party on Brakes and Running Gear (GRRF)" (Chair: UK, Deputy chair: Japan)" under the control of WP29, Japan and Germany have served as co-chair the expert council and lead discussions on formulating international standards on systems to automatically maintain and change the lanes on expressway roads.



Japan leading discussion on automatic traveling system as the deputy chair in the Expert Council on Automatic Steering in April 2016

• " Participation in International Discussions towards the realization of Fully Automated Driving"

In February 2016, it was approved at the Inland Transport Committee of the Economic Commission for Europe under the United Nations Economic and Social Council that Japan would become an official member of the "Working Party on Road Traffic Safety" (WP1) that discusses the consistency between automated driving and international treaties. The National Police Agency aims at early realization of fully automated driving through the participation in the WP1 in cooperation with the Ministry of Foreign Affairs and participates in international discussions.

- **"Guidelines for Public Road Testing of Automated Driving Systems"**

The National Police Agency has been discussing various issues including the legal system concerning the realization of automated driving system with experts since October 2015. The NPA drew up and published the "Guidelines for Public Road Testing of Automated Driving Systems" that indicate the matters to bear in mind from a standpoint of ensuring safe and smooth traffic, with an aim to contribute to the proper and safe implementation of demonstration testing on public roads in May, 2016.

The public road testing of automated driving system can be carried out under a current Road Traffic Act if the following conditions are fulfilled;

- The vehicle used for public road testing should comply with the requirements of the Safety Regulations for Road Vehicles (No.67 of ordinance of the Ministry of Transport of 1951).
- While driving the test vehicle, the driver should always monitor the surrounding traffic as well as the vehicle's condition, and in the event of an emergency he/she should operate the vehicle as necessary in order to ensure safety and prevent damage to others;
- The test vehicle should be driven in compliance with the relevant laws including the Road Traffic Act (Act No. 105 of 1960).