Japan’s views on Automated Driving

Takashi NAONO
Director for the Coordination of Motor Vehicle Safety Measures
Road Transport Bureau
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Japan
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Our safety measures

1. 1991～ launching and exploiting ASV (Advanced Safety Vehicle) project

2. Regulation, including guidelines and regulations

3. New Car Assessment
The ASV Project

Since 1991, academia, industries, and government have been conducted the project more than 20 years to develop new advanced technologies of vehicles. Main actions are as follows:

Basic principles for ASV

- Driver Assistance
- Driver Acceptance
- Social Acceptance

Assumed reduction of accidents by new technologies

<table>
<thead>
<tr>
<th>Device</th>
<th>Number of fatalities of traffic accidents</th>
<th>Number of injuries of traffic accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEBS (alarm)</td>
<td>-291</td>
<td>-79,066</td>
</tr>
<tr>
<td>AEBS (control)</td>
<td>-350</td>
<td>-51,241</td>
</tr>
<tr>
<td>LDWS</td>
<td>-165</td>
<td>-4,838</td>
</tr>
<tr>
<td>Night vision</td>
<td>-239</td>
<td>-1,901</td>
</tr>
</tbody>
</table>

(A large scale) demonstration (2004, 2009, 2013)

2004: Verification Test for Communication-based systems
2009: Open Road Integrative Test for Communication-based systems
2013: Open Road Integrative Test for Communication-based systems
Communication-based systems - public road test in 2013

- Pedestrian existence alarm system
- Crossing collision prevention system
- Road-works vehicle information system
- Approaching emergency vehicle information system
40 (including target vehicles and campaign models) vehicles were demonstrated.
Communication-based systems
- public road integrative test in 2009
Communication-based systems
- open road verification in 2004
Guidelines for New Technologies and Development of Regulations

• Develop Technical Guidelines
  – Full Speed Range Adaptive Cruise Control System with Brake Control (in 1999)
  – Speed limitation system with brake control (in 1999)
  – Lane Keeping Assistance System (in 2000)
  – Nighttime frontal monitoring system (in 2002)
  – Advanced Emergency Braking System (in 2003)
  – Rear Parking Assistance System (in 2003)
  – Advanced Emergency Braking System for Low Speed (in 2009)

• Contribution to developing UN Regulation
  – Developed UN Regulation (R130) for LDWS (in 2013)
  – Developed UN Regulation (R131) for AEBS (in 2013)

• Contribution to developing UN Guideline
  – Common Understanding for ADAS: classified as information, warning, control
  – Warning Guidelines: adopted at 154th session of WP29, June, 2011, and have been taken into account when establishing new rules.
  – Control Principles: adopted at 159th session of WP29, June, 2013
Introducing Active Safety Technologies into New Car Assessment

- AEBS for vehicles and LDWS (2014～)
- AEBS for pedestrians (2016～)
- Night vision (2016～)

Road Map: Introduction of Preventive Safety Technology for JNCAP
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Japan Reconstruction Strategy (Cabinet decision June, 2013)

II. 3. Building infrastructure for future generation—Safe, Comfortable and Economical

② Enabling society to transport people and things safely and comfortably

To realize such society, national project should be worked on Driving Safety Support Devices and Systems by using Vehicle–Vehicle and Infrastructure–Vehicle Communication, etc. and by building Automated Driving System, Traffic congestion forecasting system, and Logistics System.

Development and Environmental Improvement needs for Driving Safety Support System and Automated Driving

Declaration of creating the world’s most advanced IT nation (June, 2013)

III.2. to live healthy and securely and comfortably in the safest and most disaster-resistant society.

(4) to realize the safest, environment concerned and economical road traffic in our society.

Science technology innovation integrated strategy (June, 2013)

C2.Ⅲ. Development of next generation infrastructure ahead of the world

To create communities through the development of the next generation infrastructure.

(3) Advanced Traffic System realization

Society where enables people and things to transport safely and comfortably

Traffic accidents decrease dramatically. Life without traffic accident.
## Roadmap for Development of Auto Pilot System

### <Scope>

(Aimed at driving on the same lane.)

<table>
<thead>
<tr>
<th>Traffic condition complication Level</th>
<th>System type</th>
<th>Frequent occasions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Fork, merging &amp; congestion point</td>
<td>Traffic hour</td>
</tr>
<tr>
<td>Low</td>
<td>Lane change, etc.</td>
<td>Lane keeping drive</td>
</tr>
</tbody>
</table>

**Goal:** Driving on main highway without changing lanes.

**Goal set out by the Government (Japan Revitalization Strategy):**
Making a test installation of Automated Driving System

**2013**

- Drivers' assists

**2015**

- Extend scope area of vehicles' assists (normally only driver monitoring, in emergency, driver takes controls)

**2020**

- All highways including joint/connected roads. Best driving during hours at areas where often congestions generate

**2030**

- High way main lane

### <main issues>

#### Vehicle side

- Driver system developed, commercialized (ACC, lane keeping assist, congested driving assist system, lane change assist system)

#### Road side

- Real time Information (real time information and changes of controlled area)

- Information of details of Road structure and data

**Sophisticated Driver Assistance System**

**Advanced Infrastructure Information**

Driver assistance by both vehicles and roads especially during congestions

**Combined Driver Assistance System (ACC + lane keeping assist)**
The Council defines driving with driver assistance system and full self-driving as automated driving.

Automated driving

- **Driving with driver assistance system** (Driver in the loop)
  - Individual system: collision mitigation, brakes, LKA, etc.
  - System Integration: ACC + LKA
  - [2] System Integration: ACC + LKA

- **Full self-driving** (Driver out of the loop)
  - [4] Full automation

Degree of participation in driving by vehicle (system) (Automation 100%)

Advancing
### Current situation on Automated Driving Technologies

<table>
<thead>
<tr>
<th>Type of Automated Driving</th>
<th>Manufacturers development situation</th>
<th>Under the current law (road transport vehicle act)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving with driver assistance system (Driver in the loop)</td>
<td>Aiming at advanced driver assistance technology</td>
<td>• no special procedures for driving on public road（※）</td>
</tr>
<tr>
<td>Full self-driving (Driver out of the loop)</td>
<td>Manufactures are not aiming at developing full self-driving. There is no test driving scheduled either.</td>
<td>• It changes role of human driver. • As technology advances, new laws on these technologies may be discussed.</td>
</tr>
</tbody>
</table>

（※）Vehicles with lane change assistance system and some automated driving technologies manufactured by Toyota, Honda, Nissan and other companies have already been registered and conducting fleet test on public road.  
（October, 2013）（July, 2013）（September, 2013）

(Reference)
1. Convention on Road Traffic (Geneva, 1949) provides that every vehicle has to have a driver and the driver always has to control the vehicle.
2. Concerning Google car in USA, test driving in some states is allowed under the condition that special trained driver is seated in driver's position. Operation without driver is not allowed.
3. NHTSA stated that it is too soon to reach conclusions about the feasibility of producing a vehicle that can safely operate in a fully automated (or “driverless”) mode.
4. UN ECE WP29 (World forum for harmonization of vehicle regulation) had made design principles for control systems of advanced driver assistance system. (Jun, 2013)
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• Driving with driver assistance system

Based on international discussions and mutual understandings, driver assistance system and other new technologies are worth supported and encouraged to become commercialized for the improvement safety.

• Full self-Driving (NHTSA, level4？)
  – We haven’t had a prospect of practical use of full self-driving so far and share NHTSA’s view that “it is too soon to reach conclusions about the feasibility of producing a vehicle that can safely operate in a fully automated (or “driverless”) mode”.
  – Based on the development of public acceptance, we think that the discussion may be started. Along with that, related existing laws should be amended at the same time.
• How Individual case should be treated?
  1. Driving without holding steering wheel • • • • • • Is it OK if a driver could override?
     Is it a part of corrective steering of R79?

2. Dead-man system • • • • Is it OK if a driver could override?

3. Remote controlled parking assist • • • R46 and R121; Vienna Convention needs to be amended?
Thank you for your attention.