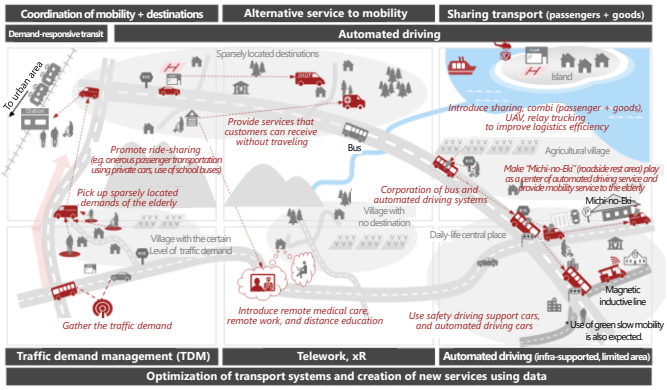
2-7 Recent ITS Research and Developments

Research Associate, The University of Tokyo
Azusa Toriumi
Professor, The University of Tokyo
Takashi Oguchi

"Public-Private ITS Initiative/Roadmaps" was first established in 2014 and have been updated every year by the IT Strategic Headquarters, describing the medium- and long-term goals of ITS developments which private companies and relevant ministries should address together. Their main targets are to develop and deploy safety driving support and automated driving systems, and to utilize various kinds of big data for transport. Furthermore, R&D of automated driving systems have been promoted as one of the Strategic Innovation Promotion Programs in the Cabinet Office since 2014, called as "SIP-adus". The second phase of SIP-adus started in 2018; currently field operational tests (FOTs) in the Tokyo Waterfront Area have been conducted since 2019.

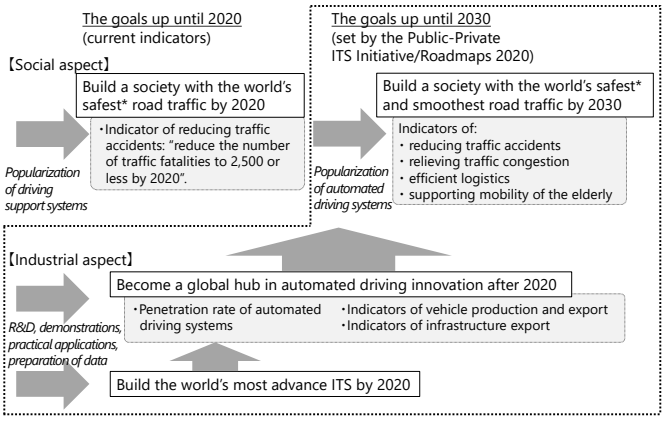
☐ "Public-Private ITS Initiative/Roadmaps 2020" delivers the visions for 2030 for the ITS development in rural areas, urban areas with private cars as major means of transport, and urban areas with public transport as major means of transport, based on their different mobility needs and problems. It also declares the goals on social and industrial aspects to realize the visions.

Figure 1 Vision of 2030 in Rural Areas



Source: Public-Private ITS Initiative/Roadmaps 2020 (translated by the authors)

Figure 2 Goals and Key Indicators

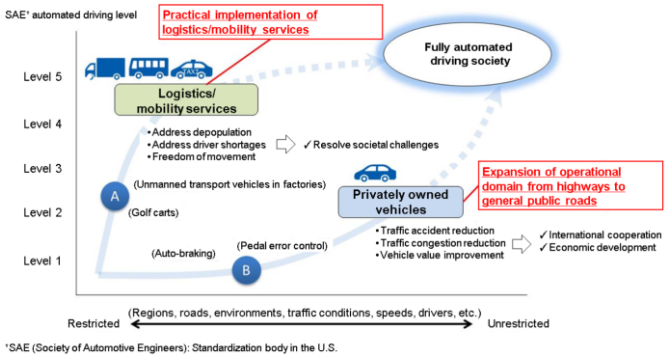


* To have the smallest number of traffic fatalities per population in the world.

Source: Public-Private ITS Initiative/Roadmaps 2020 (translated by the authors)

Figure 3 Two Approaches towards a Fully Automated Driving Society

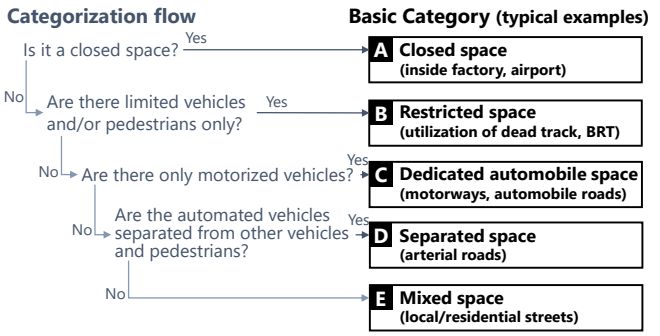
■ The aims of the second phase of SIP-adus, which started in 2018, are to implement logistics and mobility services using automated driving technologies in practice, and to expand the operational domain of automated driving systems from highways to general public roads. R&D are in progress from the two approaches: realizing "automation" of driving tasks under the limited conditions (for logistics and mobility services) and applying more sophisticated technologies for driving systems to deal with "various environments" (for private cars).



Source: SIP-adus

Figure 4 Driving Conditions for Automated Vehicles

■ Driving conditions of automated vehicles are determined by five basic categories and additional supplemental factors according to the Panel on Business Strategies for Automated Driving (METI and MLIT).



* Categories of A~E represent basic differences of their conditions, but other factors, typically shown below as the additional factors, also affects actual driving conditions. Therefore, A~E do not necessarily mean relative difficulties in realizing automated driving.

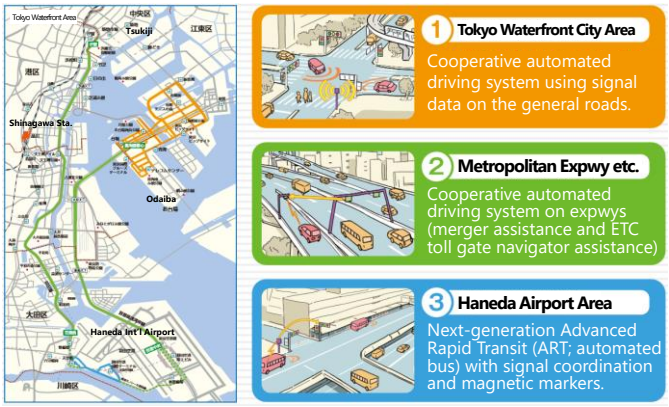
Additional major factors			
Speed	**Topography**	**Road**	
Automated driving speed (low/mid/high)	Area type (urban/ mountainous/...), Gradient, Curvature	Number of lanes, Presence of sidewalks, Pavement marking, Surface conditions (dry/wet/snow...)	
Environment	**Traffic condition**	**Time of day**	
Weather, Disaster impact, Lighting	Traffic volume, Congestion On-street parking volume, Obstacles on the road	Day-time/night-time	

Source: MLIT (translated and partially modified by the authors)

☐ FOTs in the Tokyo Waterfront Area were started in October 2019 in the second phase of SIP-adus. Validation of automated driving technologies based on the high-precision 3D map data (static information) as well as expressway merging conditions, traffic congestion, and traffic signal control information (dynamic and semi-dynamic information) will be done step by step.

Figure 5 FOTs in the Tokyo Waterfront Area

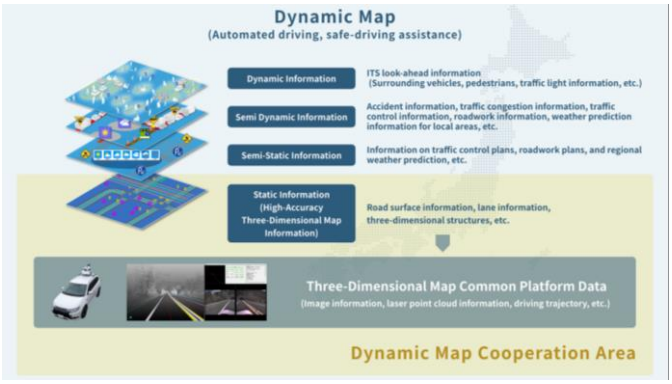
■ 29 organizations, including automobile manufacturers, suppliers, and universities in Japan and other countries take part in the FOTs.



Source: SIP-adus (translated by the authors)

Figure 6 Development of High-Precision 3D Map Data

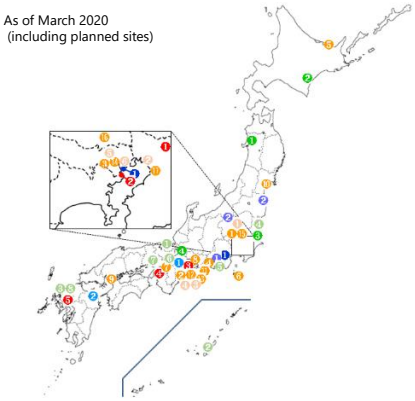
■ Initial preparation of the data for 29,205 km of the expressways and highways across Japan was completed in 2019. The data are now used for highly accuracy navigation, ADAS and automated driving applications.



Source: Dynamic Map Platform Co., Ltd.

Figure 7 FOTs of Automated Driving in Japan

■ FOTs are planned/under execution by relevant ministries, local municipalities, private companies, universities, etc., for different purposes such as technology validation, mobility services in depopulated and aging mountainous villages, mobility services for a last one-mile, improving logistics efficiency, etc.



Automated driving service around Michi-no-Eki (MLIT/SIP)
1Kamikoani, Akita 2Taiki, Hokkaido 3Hitachiota, Ibaraki 4Higashiomi, Shiga

Smart mobility challenge (METI & MLIT) 1Otsu, Shiga 2Oita, Oita

SIP projects (Cabinet Office) 1Tokyo Waterfront Area

Automated driving for last one-mile (MLIT & METI)
1Eiheiji, Fukui 2Kitadani, Okinawa

Automated middle-size bus (MLIT & METI)
3 8Kitakyushu and Kanda, Fukuoka 4Hitachi, Ibaraki 5Yokohama, Kanagawa 6Otsu, Shiga 7Mita, Hyogo

Truck platooning (MLIT & METI)
1Shi-Tomei Expwy (E1A) 2Joshin-etsu Expwy (E18) and Joban Expwy (E6)

Automated driving inside restricted area of an airport (MLIT)
1Narita airport 2Haneda airport 3Chubu airport 4Kansai airport 5Saga airport

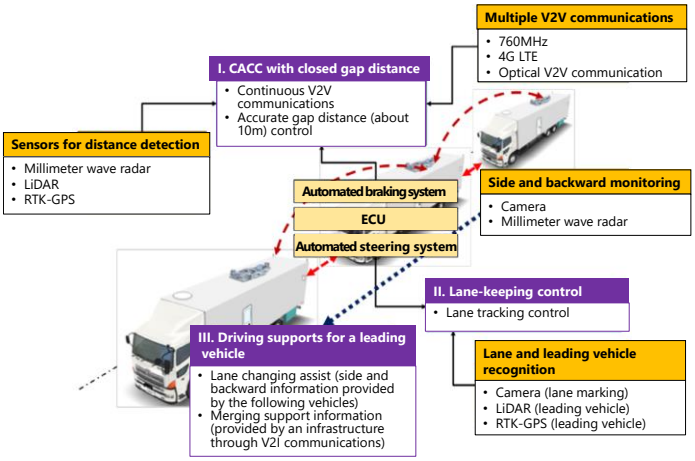
Smart city (MLIT)
1Utsunomiya, Tochigi 2Kashiwa, Chiba 3Shimoda, Shizuoka 4Kasugai, Aichi 5Chiyoda, Tokyo 6Koto, Tokyo

Major FOTs done by local municipalities, private organizations, and universities
1Kiryu, Gunma 2Kuwana, Mie 3Minato, Tokyo 4Iwata, Shizuoka 5Shari, Hokkaido 6Hachijo-island, Tokyo 7Sakai, Osaka 8Nagakute, Aichi 9Hiroshima, Hiroshima 10JR Kesennuma line 11Matsuzaki, Shimoda, and Fukuroi, Shizuoka 12Tobishima, Aichi 13Minamichita, Aichi 14Chuo and Chiyoda, Tokyo 15Maebashi, Gunma 16Kawaguchi, Saitama 17Chiba, Chiba

Source: Public-Private ITS Initiative/Roadmaps 2020 (modified and translated by the authors)

Figure 8 Truck Platooning on Expressways

■ Driverless truck platooning systems have been tested in the actual field, Shin-Tomei Expressway (E1A), since 2019.



Source: METI (translated by the authors)

Figure 9 Public-private Cooperative Platform for Smart Cities

■ A platform for smart cities, which incorporate AI and IoT technologies into urban development, was established by ministries, local municipalities, private companies, research institutes, etc.

Source: Public-private cooperative platform for smart cities