Study of Socioeconomic Impact of Automated Driving on Reducing Traffic Accidents and on Others

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Cabinet Office

Objective of Study

Research and development plan for Second Phase of Cross-Ministerial Strategic Innovation Promotion Program — Innovation of Automated Driving for Universal Services (System and Service Expansion)

Commercial development and increased diffusion of automated driving (AD) vehicles will help to reduce traffic accidents, alleviate traffic congestion, ensure mobility for vulnerable road users, resolve the driver shortage and reduce costs in logistics and transport services, and resolve other social problems. The aim is to achieve a society in which everyone is able to enjoy a high-quality life.

Quantification and monetary valuation of impact (benefits and potential risks)

Focus on differences in impact caused by governmental policies and/or manufactures' launching methods

→ Basic references for fostering social acceptance

→ Use in corporate management and policymaking

Study Items

(1) Relevance of AD to SDGs

(2) Simulation of AD vehicle diffusion

(3) Effect on road transport

i. Estimation of effectiveness in reducing traffic accidents
ii. Estimation of reduction of traffic congestion and reduction of CO_2 emissions

(4) Effect on traffic services sector

i. Ensuring mobility for vulnerable road users and in depopulated areas and other locations with poor access to transport
ii. Reduction of costs and resolution of driver shortage in logistics and transport services
iii. Change in ownership and usage of vehicle, and the structure of consumers' choice

(5) Effect on industry and society

i. Effect on whole automobile industry due to change in vehicle ownership structure and other effects
ii. Contribution to growth of the total factor productivity of the Japanese economy

(6) Research activities with international cooperation

(7) Convening of Advisory Committee

Implementation system

Mobility Innovation Collaborative Research Organization, The University of Tokyo (UTmobI)

③ ii . Estimation of reduction of traffic congestion and reduction of CO2 emissions
④ ii . Reduction of costs and resolution of driver shortage in logistics and transport services
⑥ Formation of organization for international cooperation
⑦ Convening of Advisory Committee

Institute for Technology, Enterprise and Competitiveness (ITEC) , Doshisha University

① Relevance of AD to SDGs
② Simulation of AD vehicle diffusion
③ i . Estimation of effectiveness in reducing traffic accidents
④iii . Change in ownership and usage of vehicle, and the structure of consumers' choice
⑤ i . Effect on whole automobile industry due to change in vehicle ownership structure and other effects
ii . Contribution to growth of the total factor productivity of the Japanese economy
⑥ Formation of organization for international cooperation
⑦ Convening of Advisory Committee

Tottori University（subcontractor）

④ i . Ensuring mobility for vulnerable road users and in depopulated areas and other locations with poor access to transport

Kagawa University（subcontractor）

② Simulation of AD vehicle diffusion
④iii . Change in ownership and usage of vehicle, and the structure of consumers' choice
⑥ Formation of organization for international cooperation

Schedule of Major Items

FY2018 and FY2019

- Relevance of AD to SDGs
- Simulation of AD vehicle diffusion
- Estimation of reduction of traffic congestion and reduction of CO2 emissions
- Estimation of driver shortage in logistics
- Study on AD's impact in depopulated areas
- Germany-Japan joint research

FY2020

- Estimation of effectiveness in reducing traffic accidents
- Simulation of AD vehicle diffusion considering change in ownership and usage of vehicle, and the structure of consumers' choice
- Effect on whole automobile industry
- Study on AD's impact in logistics sector
- Germany-Japan joint research

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Objectives of AD diffusion simulation

- Simulation results are used as common data for various impact assessments such as traffic congestion and CO2 emission

- Evaluate the impact of the following factors on market diffusion of AD vehicles:
  - ✓Policy measures（economic incentives, mandatory installation of automated-driving devices, introduction of new types of driver licenses with relaxed conditions on license holders)
  - ✓OEM’s strategy for launching products (when to launch into markets, at what price)
  - ✓Enhancement of societal acceptance

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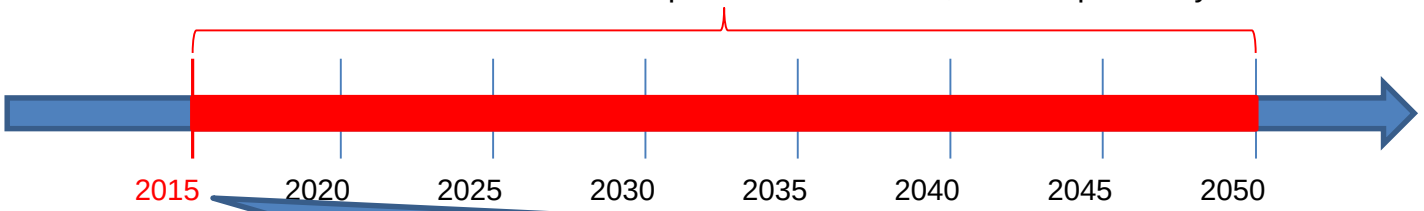
Outline of AD diffusion simulation

1. Categories of vehicles and vehicle-based services

Category in this study	Outline of method for determining results	Outputs
Privately owned vehicle	• Use results of online surveys to model consumer's technology-related choices • Incorporate results from the study *(4)-iii. Change in ownership and usage of vehicle, and the structure of consumers' choice* to model the transition from privately owned vehicle to mobility services	Numbers of vehicle owned Numbers of new vehicle registrations Traffic volumes
Mobility services		
Logistics services	Use results from the study *(4)- ii. Reduction of costs and resolution of driver shortage in logistics and transport services*	

2. Temporal extent of simulations

Simulation period: 2015 - 2050, data output at 5-year intervals



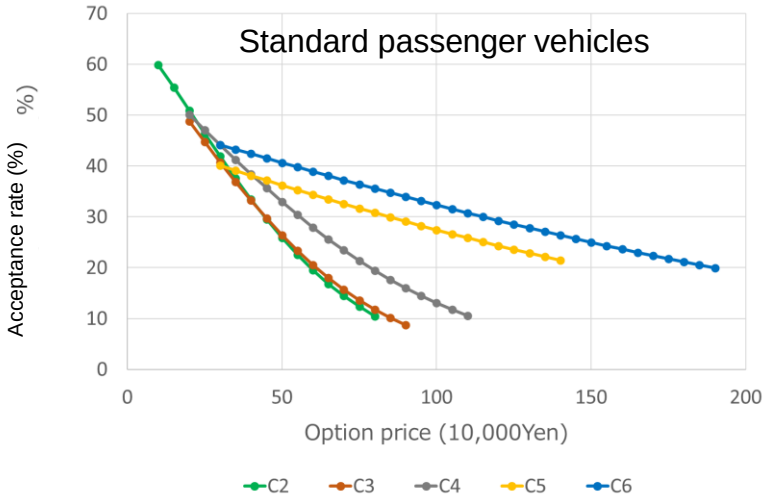
2015 is the most recent year for which basic data are available for statistics including the Road Traffic Census

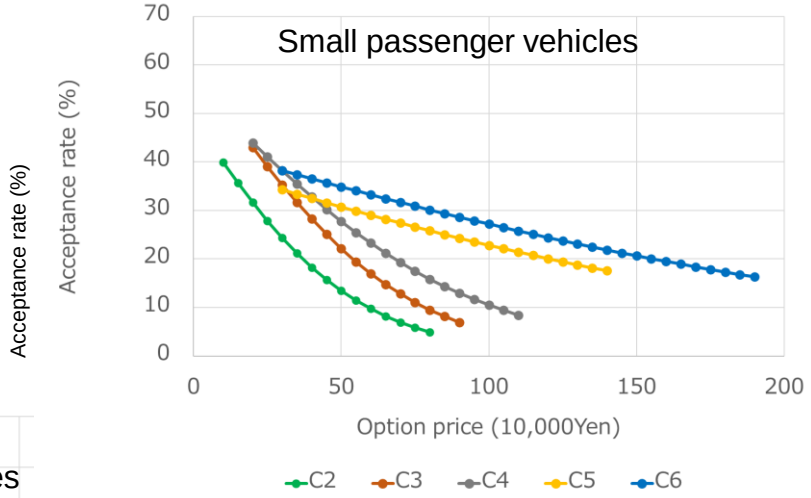
Categories of AD vehicles considered in this study

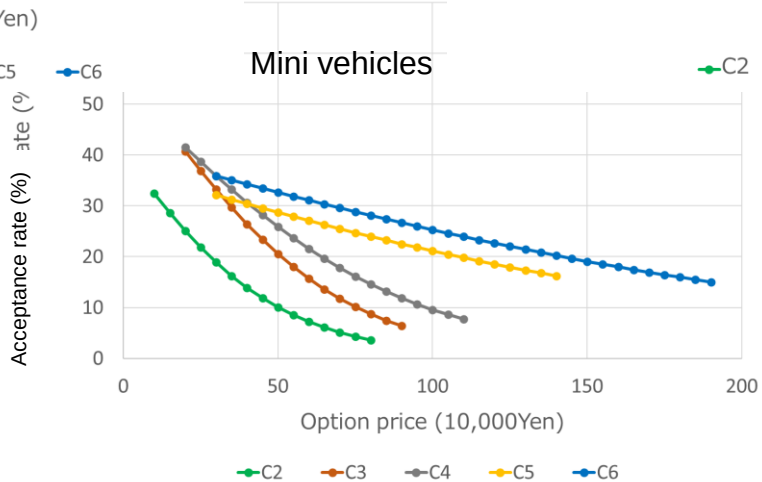
Category	Highways	General roads	Compatible technologies
C0	SAE Lv.0	SAE Lv.0	No driving-support devices
C1	SAE Lv.1 Driver assistance	SAE Lv.1	・Collision-damage-reducing brakes ・Acceleration limiters for accidental accelerations (due to driver error) ・Lane-departure warning system ・Car distance warning system
C2	SAE Lv.2 Partial automation	SAE Lv.1	In addition to C1: ・On highway, lane keeping systems (LKAS) + adaptive cruise control (ACC) applicable to all vehicle speed regimes, including low-speed motion and stopping ・Automatic lane changing on highway
C3	SAE Lv.3 Conditional automation	SAE Lv.2	In addition to C2: ・Lv.3 on highways ・Lv.2 on general roads
C4	SAE Lv.4 High automation	SAE Lv.3 on major arteries and thoroughfares	In addition to C3: ・Lv.4 on highways ・Lv.3 on major general roads
C5	SAE Lv.4 High automation	SAE Lv.4 on major arteries and thoroughfares	In addition to C4: ・Lv.4 on major general roads
C6	SAE Lv.5 Fill automation		

Acceptance curves for various categories of AD vehicles

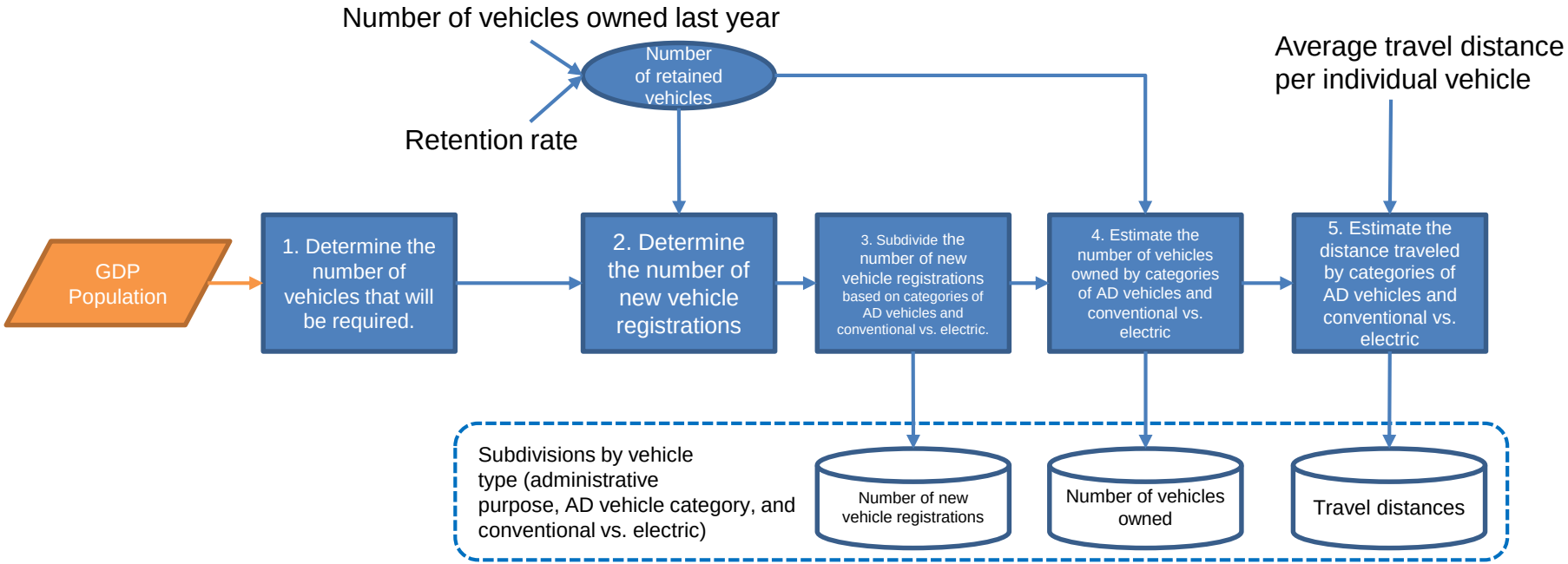
Acceptance curves for each self-driving vehicle category are constructed based on individual responses to online surveys.



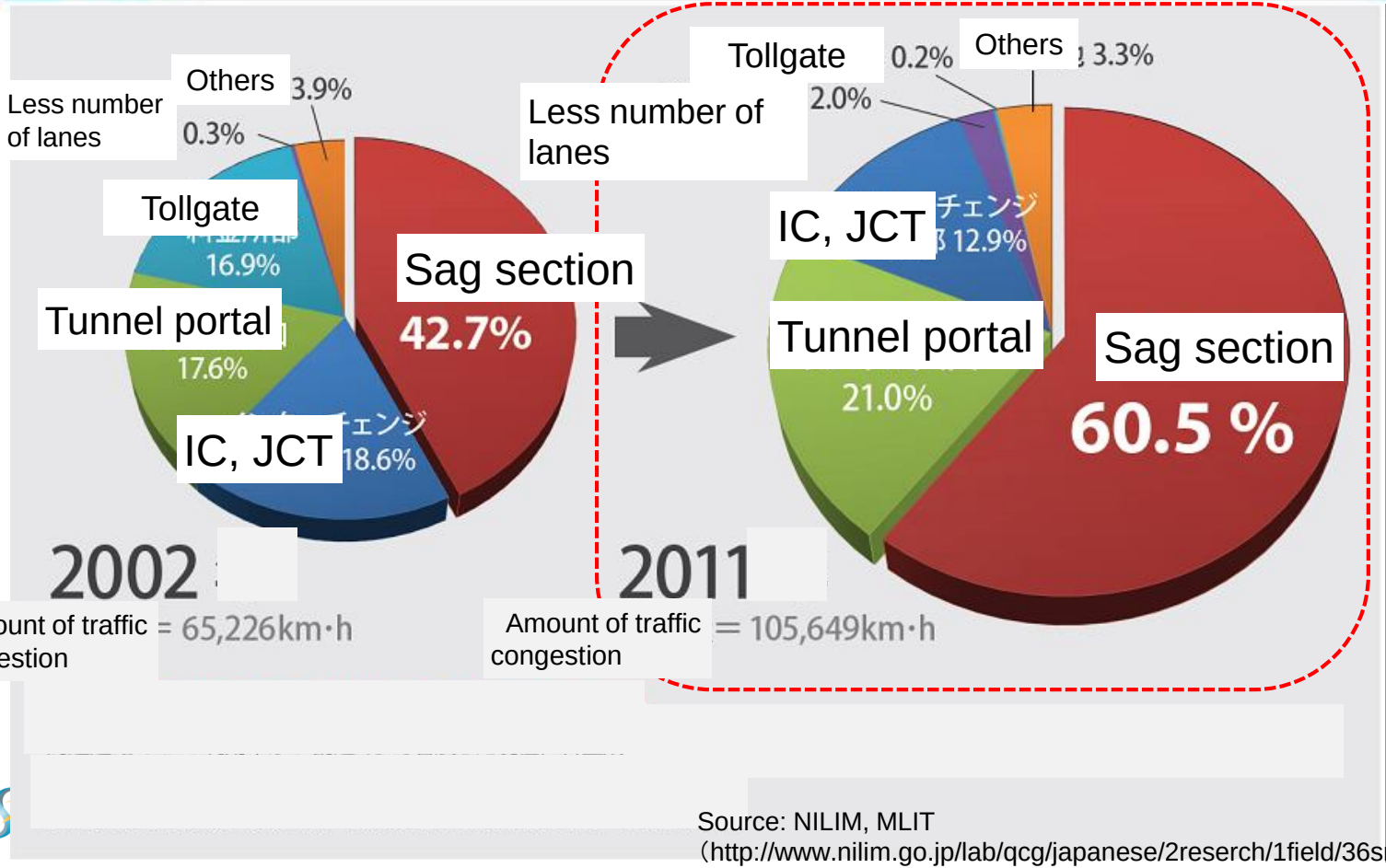




Flowchart for AD vehicles market-diffusion simulations (owner cars)



Basic Idea of estimation of traffic congestion reduction by AD introduction



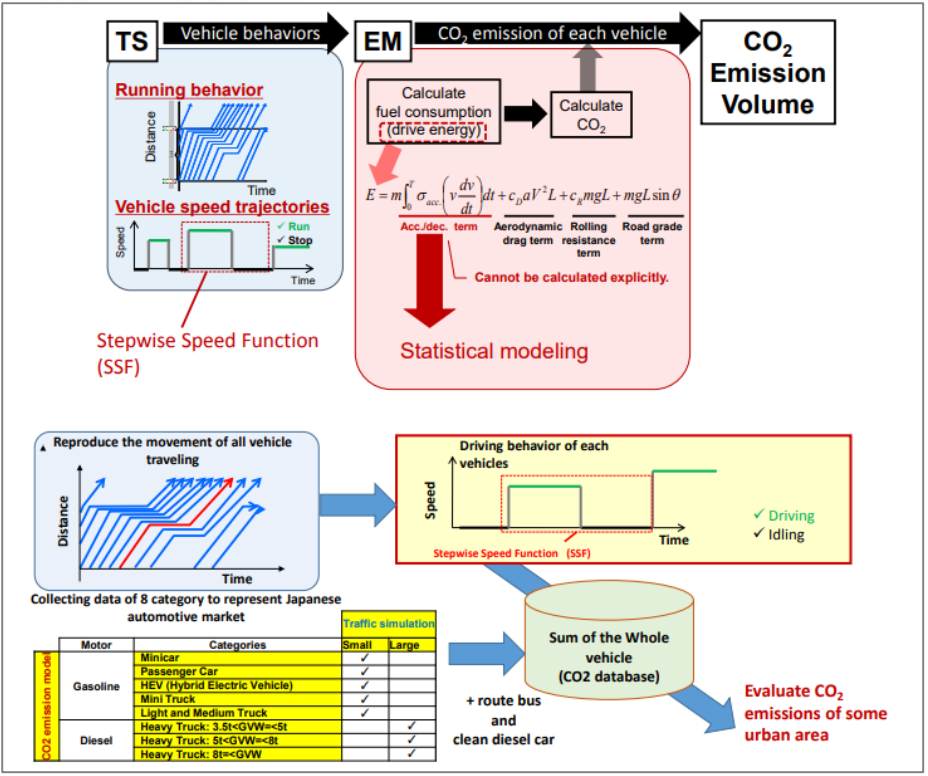
Source: NILIM, MLIT
（http://www.nilim.go.jp/lab/qcg/japanese/2reserch/1field/36smoothingsag/）

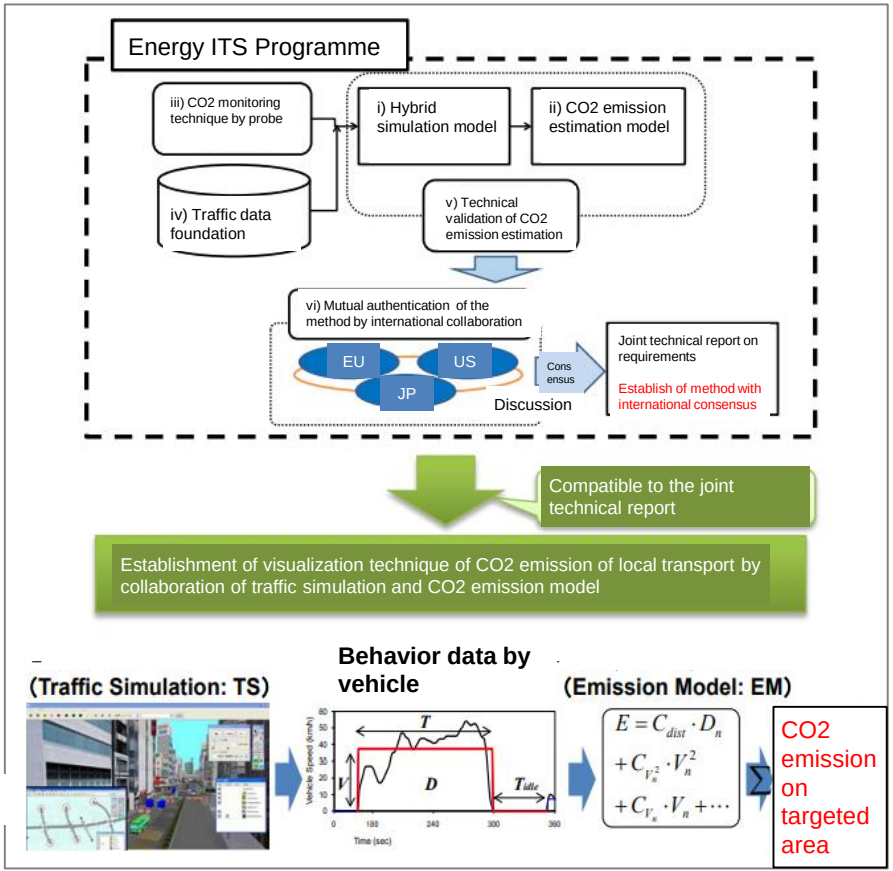
Estimation of reduction of traffic congestion by AD introduction

- Traffic simulation is carried out on two representing sections, a section with three-lane expressway and a section with two-lane expressway, along sags with frequent heavy traffic jams, for several AD diffusion-rate cases.

- Traffic congestion reduction by AD introduction nationwide is estimated on top30 sections with sag traffic jam.

Estimation of reduction of CO2 emissions by AD introduction





Source: SIP-adus programme report (FY2018)

Thank you