ARCADE Joint CAD Network Stakeholder workshop :
International R & I Projects in Japan

ITS Japan
Level 4 Mobility Service Project

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ITS Japan Automated Driving Project Team

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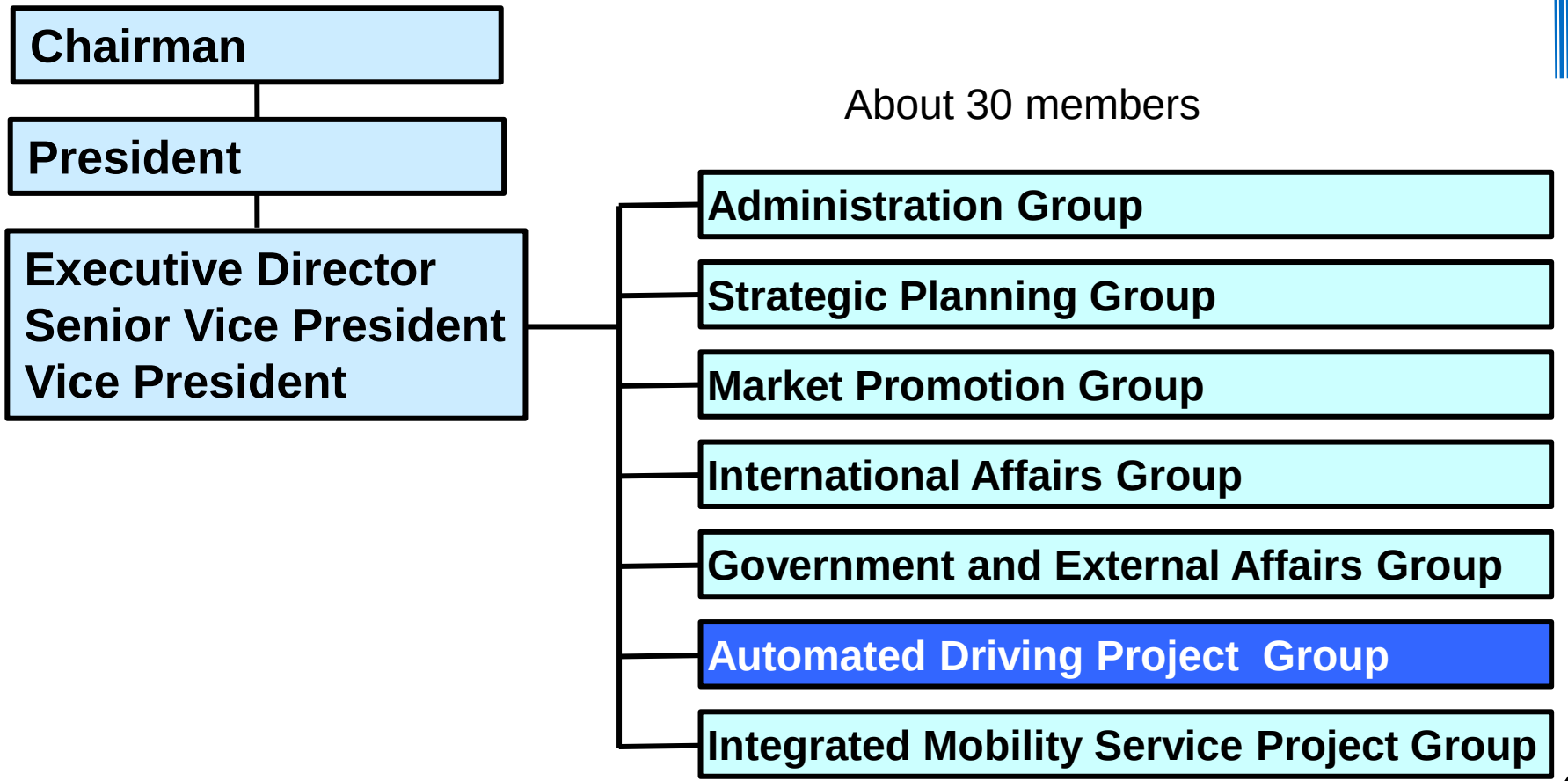
ITS Japan

Roles

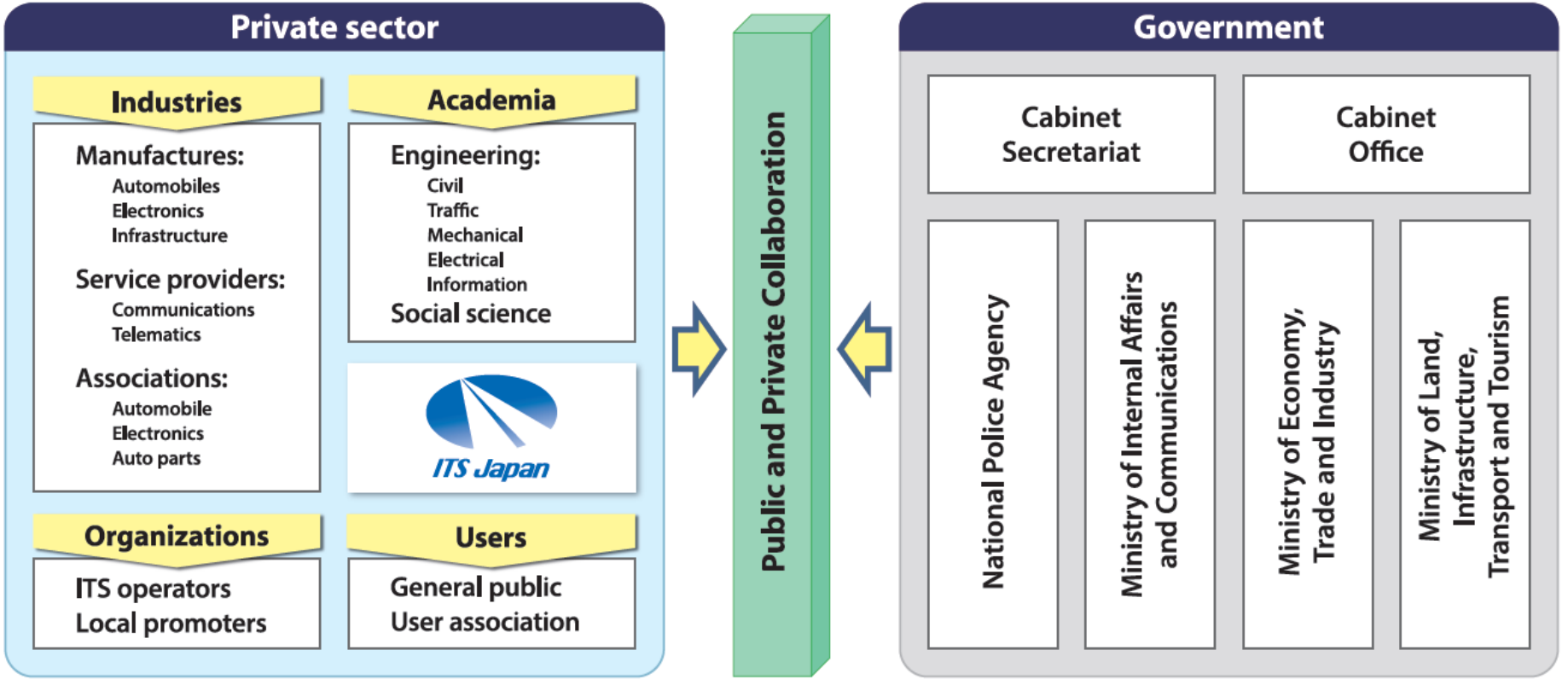
- Promoting ITS R&D and deployment
- ITS World Congress Asia-Pacific area contact
- Asia-Pacific ITS Forum Secretariat
- Liaison among ITS-related public and private organizations and academia
- Supporting ITS-related standardization activities

Organization



Board of Director Companies

Positioning among related Organizations



International Cooperation

ADV classification and issues

ADV : Automated Driving Vehicle

ADVs under development

1. **Owner car**: Privately owned private driving vehicle
2. **Shared Mobility**: Vehicle owned by a business operator
3. **Truck Platooning**: Trucks traveling in a row

Owner car

Shared Mobility

Truck Platooning

Sources: Pictures from Internet

ADV : Automated Driving Vehicle

ADV Classification

1. Drive by yourself : Owner Car

- Driving Automation

2. Ride as a Passenger/Deliver goods : Service Car

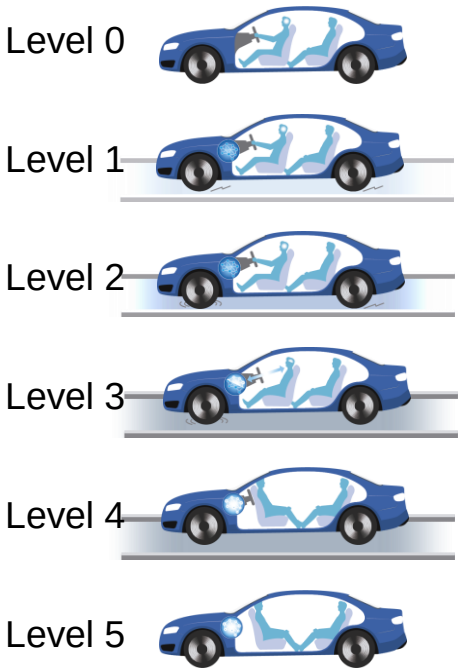
- Transport Automation

Levels of Driving Automation

■ SAE J3016 September, 2016

Level 1, 2 : DAS
DAS: Driving Assist System

Level 3, 4, 5 : ADS
ADS: Automated Driving System



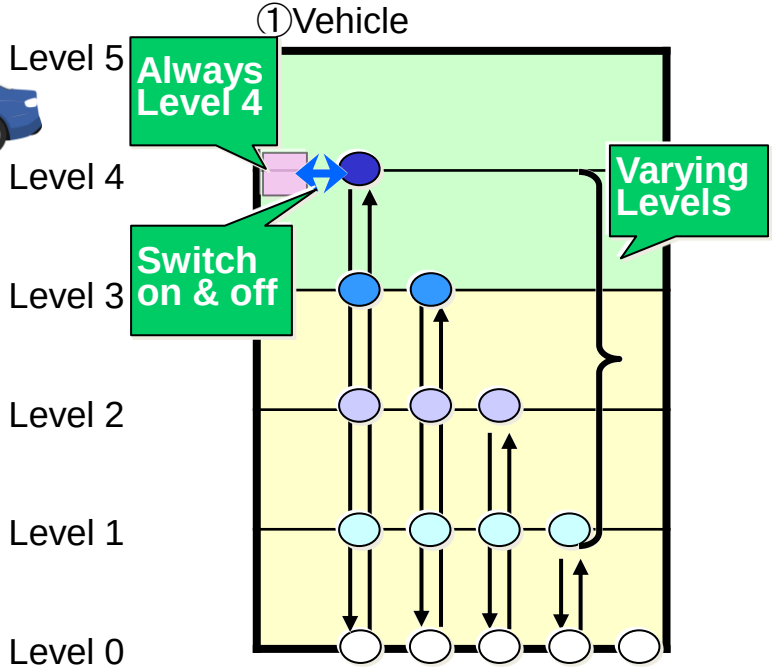
Level	Name	Narrative definition	DDT: Sustained lateral and longitudinal vehicle motion control	DDT: OEDR	DDT fallback	ODD
Driver performs part or all of the *DDT*						
0	No Driving Automation	The performance by the *driver* of the entire *DDT*, even when enhanced by *active safety systems*.	*Driver*	*Driver*	*Driver*	n/a
1	Driver Assistance	The *sustained* and *ODD*-specific execution by a *driving automation system* of either the *lateral* or the *longitudinal vehicle motion control* subtask of the DDT (but not both simultaneously) with the expectation that the *driver* performs the remainder of the *DDT*.	*Driver* and *System*	*Driver*	*Driver*	Limited
2	Partial Driving Automation	The *sustained* and *ODD*-specific execution by a *driving automation system* of both the *lateral* and *longitudinal vehicle motion control* subtasks of the *DDT* with the expectation that the *driver* completes the *OEDR* subtask and *supervises* the *driving automation system*.	**System**	*Driver*	*Driver*	Limited
ADS ("*System*") performs the entire *DDT* (while engaged)						
3	Conditional Driving Automation	The *sustained* and *ODD*-specific performance by an *ADS* of the entire DDT with the expectation that the *DDT fallback-ready user* is *receptive* to *ADS*-issued *requests to intervene*, as well as to *DDT performance-relevant system failures* in other *vehicle* systems, and will respond appropriately.	*System*	**System**	*Fallback-ready user (becomes the driver during fallback)*	Limited
4	High Driving Automation	The *sustained* and *ODD*-specific performance by an *ADS* of the entire *DDT* and *DDT fallback* without any expectation that a *user* will respond to a *request to intervene*.	*System*	*System*	**System**	Limited
5	Full Driving Automation	The *sustained* and unconditional (i.e., not *ODD*-specific) performance by an *ADS* of the entire *DDT* and *DDT fallback* without any expectation that a *user* will respond to a *request to intervene*.	*System*	*System*	*System*	**Unlimited**

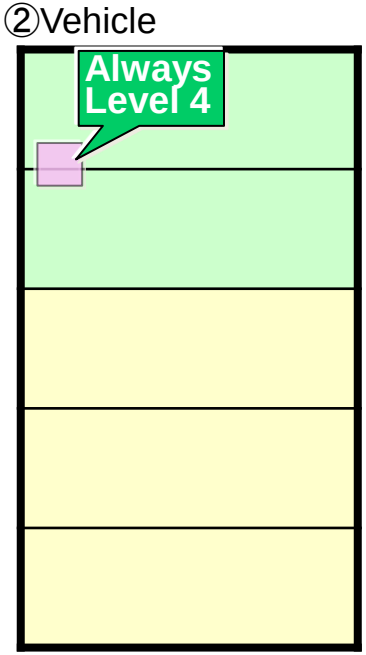
High Driving Automation：Level 4

■ Two Types of Level 4 Vehicles

① Can be driven at Level 0 to 3 with control systems

② **Level 4 dedicated Vehicle**

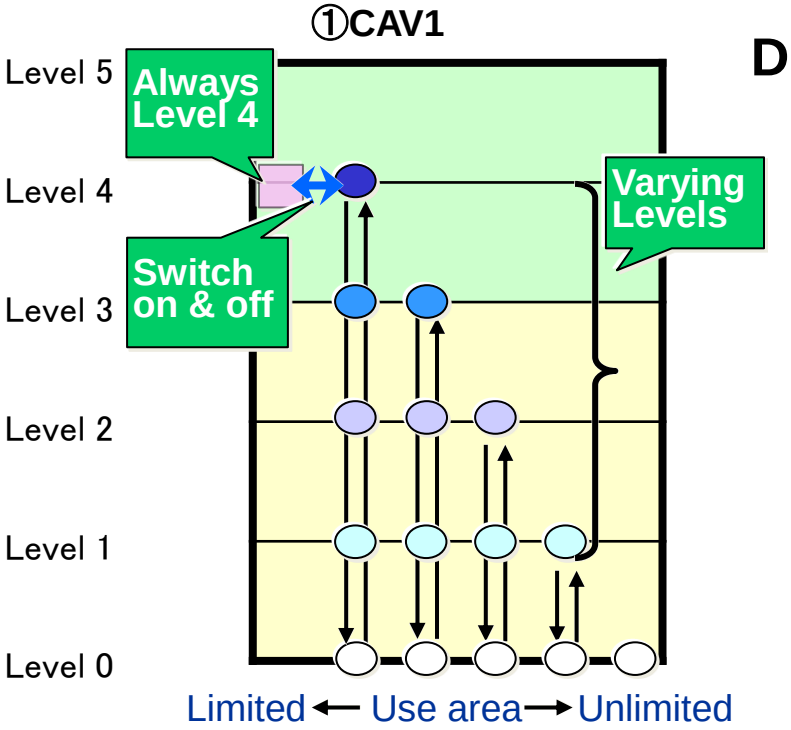




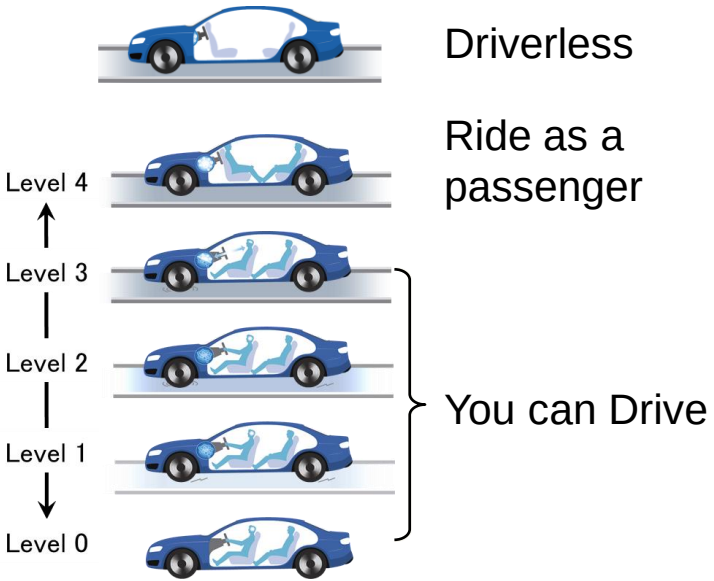
No Control System for Level 4 dedicated Vehicle

Owner Car

- **CAV1: Level 4 ADV with control systems that can be driven at Level 0 to 3**



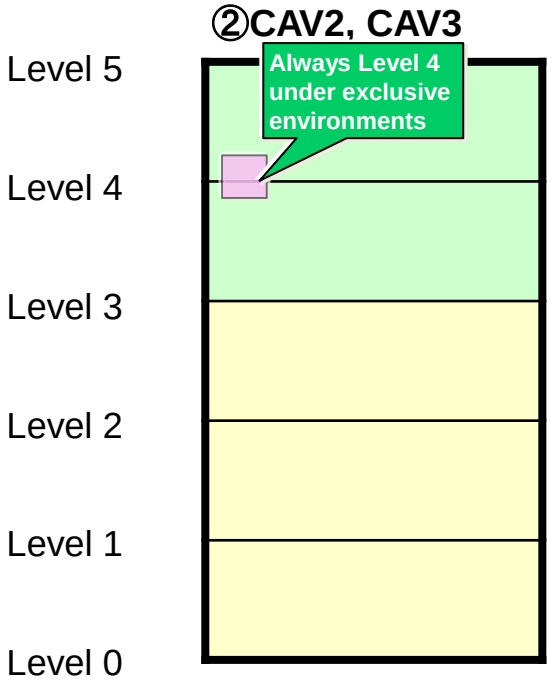
Dream car with various functions



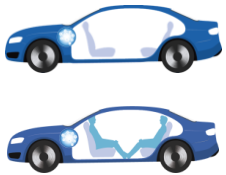
Service Car

■ Level 4 ADV without control systems

- CAV2：Owner car derived Level 4 ADV
- CAV3：Shared Mobility derived Transport/Logistics Service Level 4 ADV

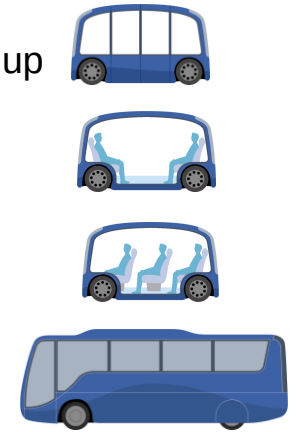


CAV2



- Personal use
- Driverless pick up
- High Speed
- Long Distance
- Taxi
- Limousine
- Rental car
- Shared car

CAV3

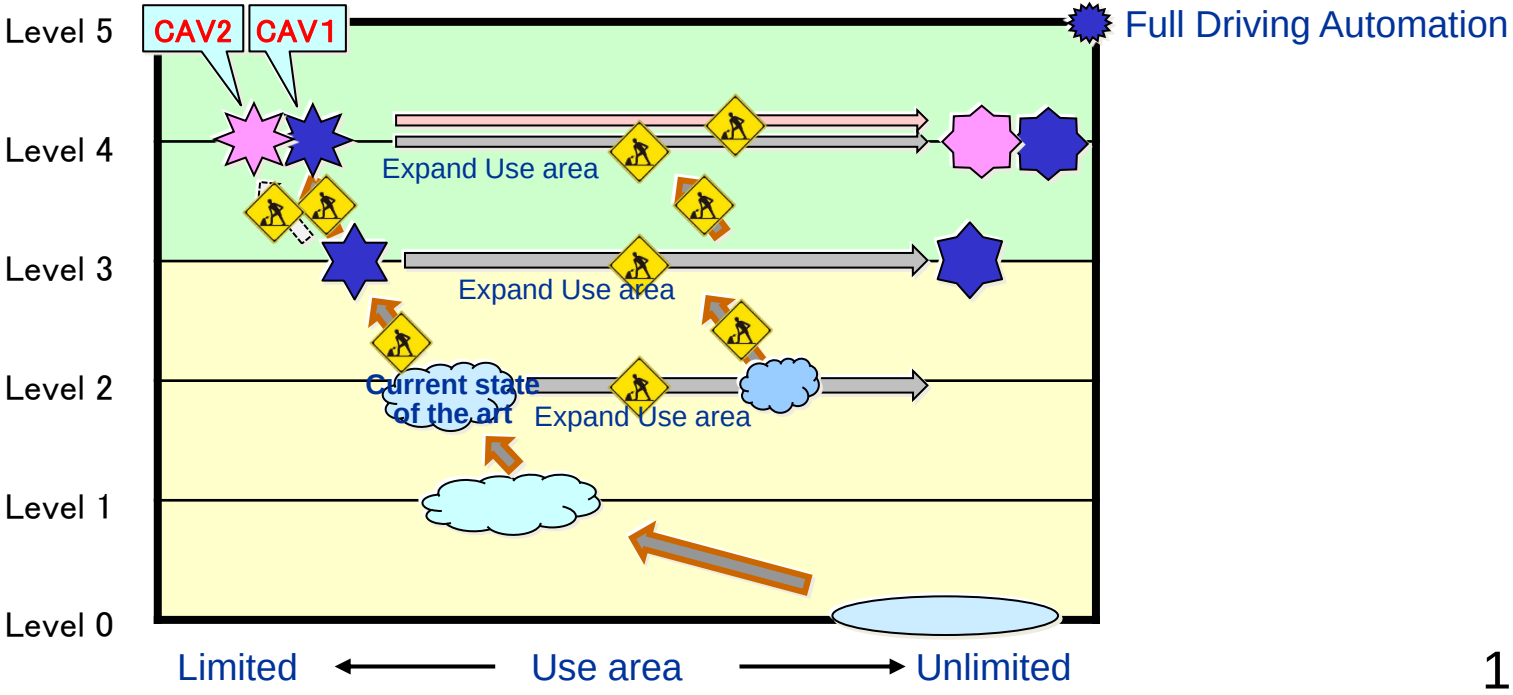


- Business use
- Driverless pick up
- Low speed
- Short distance
- Logistics
- High Speed
- Long distance
- Large bus
- Large Truck

Challenges at Evolution Path：CAV1, CAV2

■ Three Major Challenges

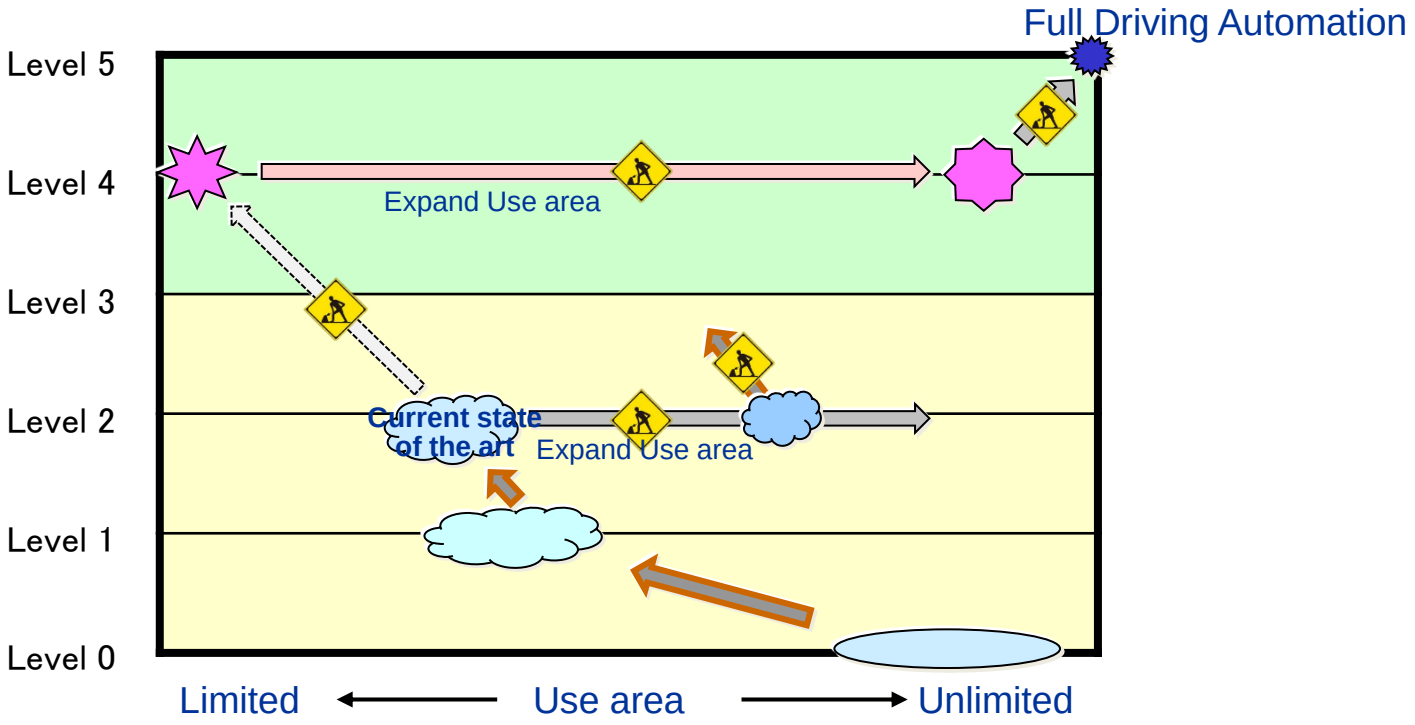
1. Progress to different Level：Level 2→Level 3, Level 3→Level 4
2. Introduce New Level 4 exclusive ADV
3. Expand Use area：Level 3(CAV1), Level 4(CAV1, CAV2)



Challenges at Evolution Path：CAV3

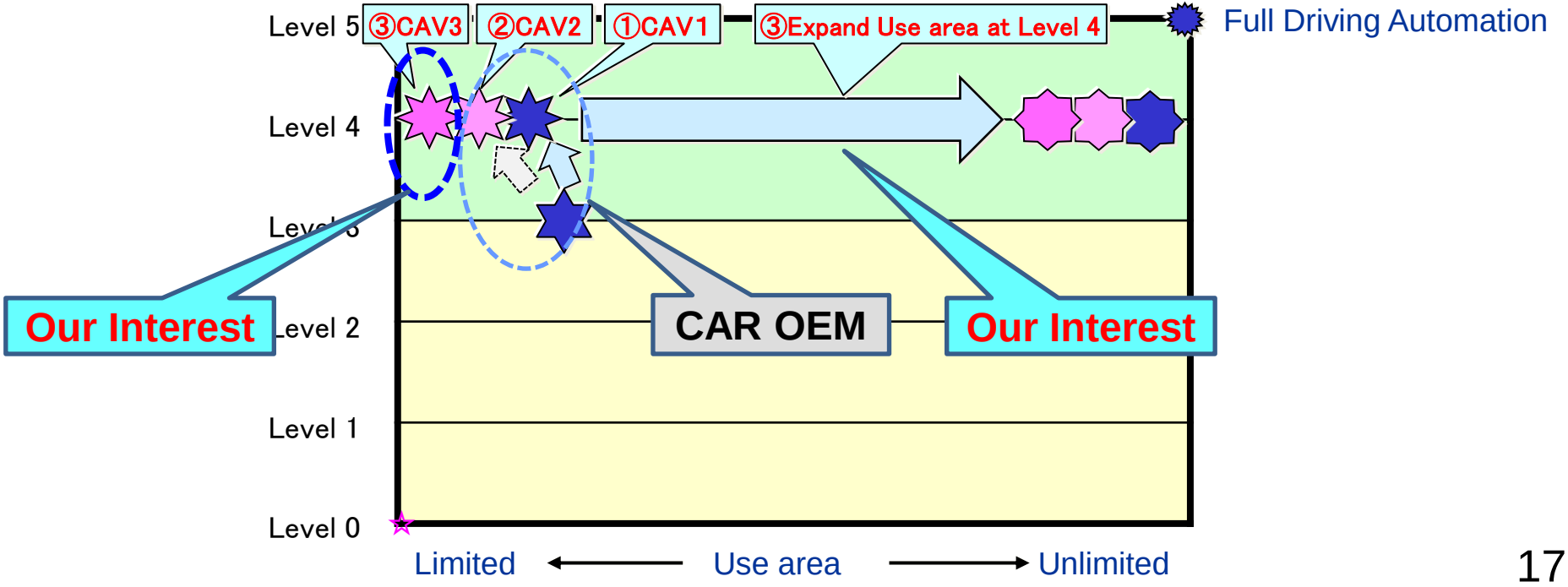
■ Two Major Challenges

1. Introduce New Level 4 exclusive ADV
2. Expand Use area



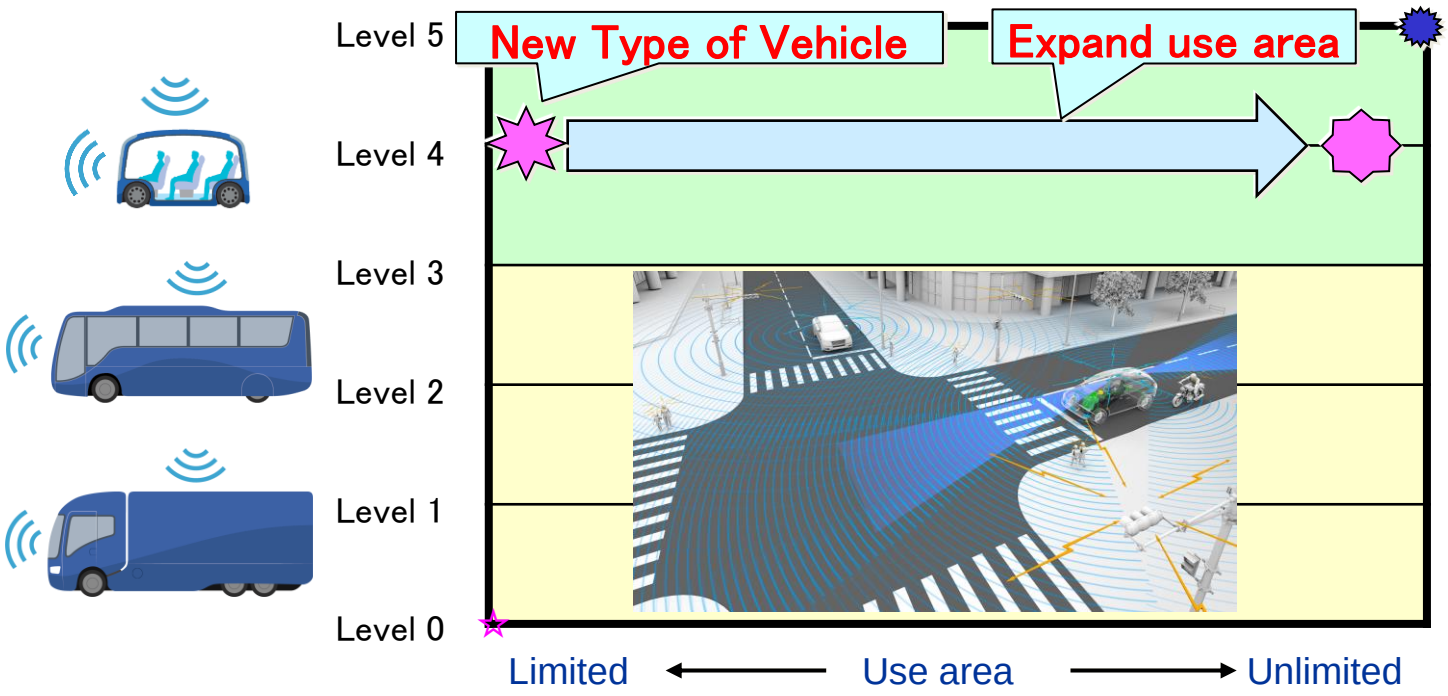
Four Selected Challenges

① Introduce Level 4 ADV with control systems that can be driven at Level 0 to 3:CAV1
② Introduce Level 4 ADV without Control Systems: CAV2
③Introduce Level 4 Mobility/Logistics ADV without Control Systems: CAV3
④Expand Use area at Level 4



Challenges for Level 4 ADV

- Introduce New Types of Vehicles
- Expand use areas



ITS Japan
Automated Driving Research Activity

■ Create business opportunities to the global market

Industry-Academia Collaboration Activity

Kitami Institute of Technology
165 Koen-cho kitami, Hokkaido 090-8507, JAPAN

JRC Japan Radio Co., Ltd.

東京大学 THE UNIVERSITY OF TOKYO

JTEKT JTEKT CORPORATION

TOHOKU UNIVERSITY
CREATING GLOBAL EXCELLENCE

NTT空間情報

OMRON

PASCO
Surveying the Earth to Create the Future

HIDO 一般財団法人 道路新産業開発機構
Highway Industry Development Organization

SB Drive

JARTIC 公益財団法人 日本道路交通情報センター

TOSHIBA

ITS Japan Automated Driving Research Project

■ Current Topic :Level 4 Mobility Service Deployment

- ➢ Technical Challenges
  - ✓ Infrastructure design
  - ✓ Road design
  - ✓ City design

Current Main Project

- ➢ Non Technical Challenges
  - ✓ Policies, Regulations, Traffic Rules
  - ✓ International Harmonization

◆ Global Collaboration for quicker Deployment

Action for SIP-adus Workshop 2018

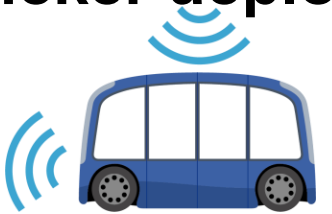
- Automated Driving Vehicle Developments are global trend

however

- Different types of ADVs
- Different Challenges for each ADV to Deploy

therefore

- Classified ADVs
- Clarified Challenges for each ADV
- Proposed global collaboration for quicker deployment



What we learned from SIP-adus Workshop 2018

- **Level 4 Shuttle Service, CAV3, is high priority**
- **Local deployment is realistic at the early stage**
- **Global Collaboration promotes deployment**

- **26 participants**
  - Japan
  - USA
  - Germany
  - UK
  - Finland
  - The Netherlands
  - Sweden
  - Belgium

Study from FOTs in Japan

Service Car Projects

FOTs in Japan as of February 2019

ITS Japan

Automated Driving Services at Roadside Stations
MLIT/Cabinet Office SIP

1	Akita
2	Kumamoto
3	Hokkaido
4	Nagano
5	Fukuoka

Automated Driving Services
MLIT/Cabinet Office SIP

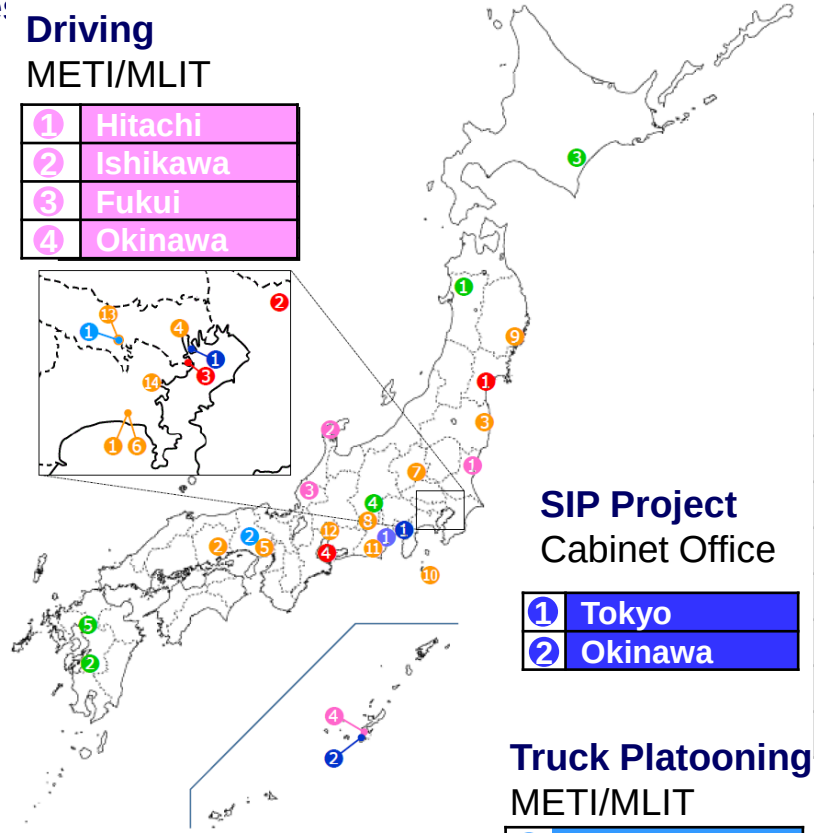
1	Tokyo
2	Hyogo

National Strategic Special Zone Project
Cabinet Office

1	Miyagi
2	Narita
3	Haneda
4	Aichi

Last-Mile Automated Driving
METI/MLIT

1	Hitachi
2	Ishikawa
3	Fukui
4	Okinawa



SIP Project
Cabinet Office

1	Tokyo
2	Okinawa

Truck Platooning
METI/MLIT

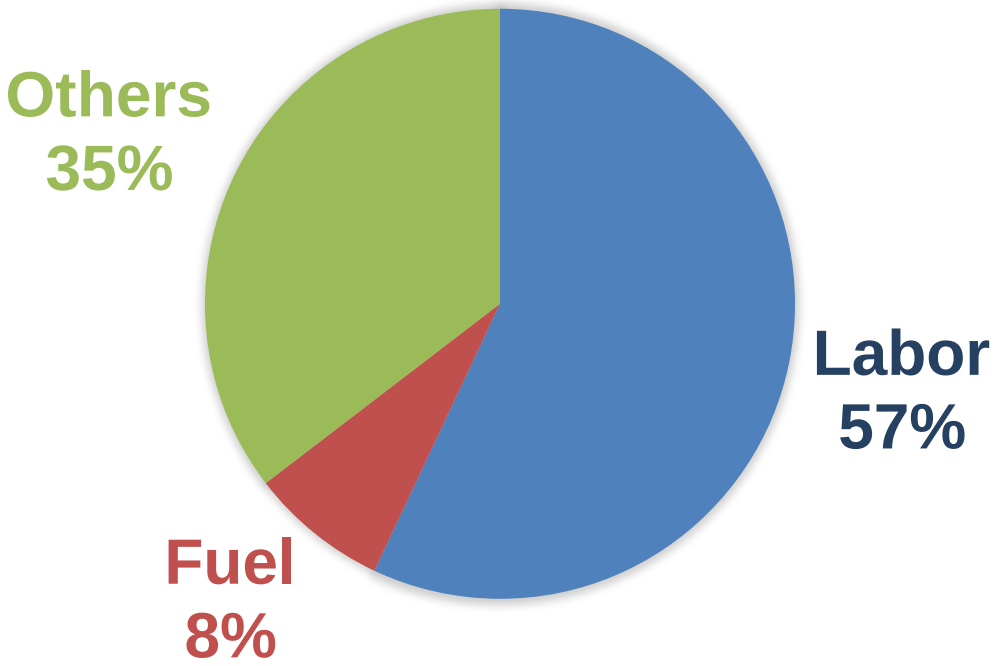
1	Shin Tomei

Local Government Private Company
University Project

1	Kanagawa
2	Okayama
3	Fukushima
4	Tokyo
5	Hyogo
6	Kanagawa
7	Gunma
8	Nagano
9	Iwate
10	Tokyo
11	Shizuoka
12	Aichi
13	Tokyo
14	Kanagawa

Operational Issue : Cost

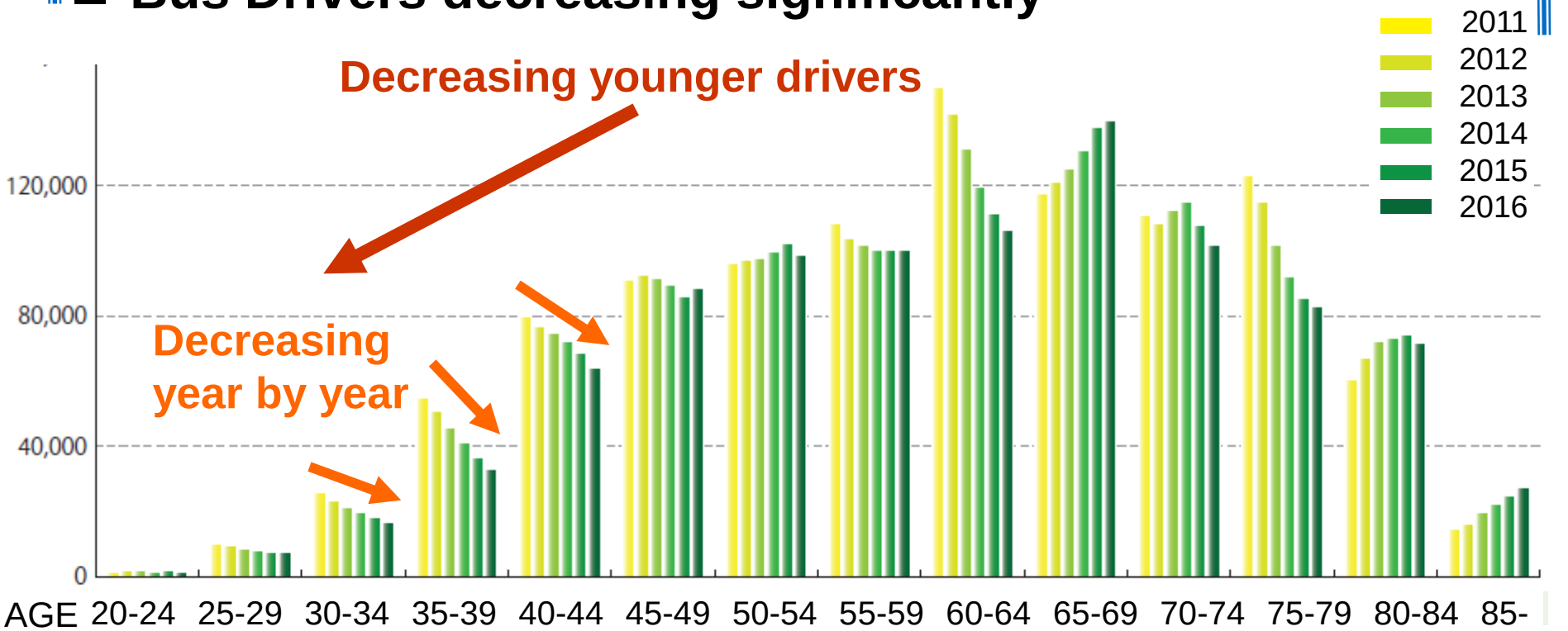
- **Driver Labor cost is very critical**



Source: http://www.mlit.go.jp/common/001262574.pdf

Operational Issue : Drivers

- **Bus Drivers decreasing significantly**



Source:http://www.bus.or.jp/about/pdf/h29_nba_brochure.pdf

Operational Issue : Cost Balance

■ Level 4 has potential cost advantage

Note: Rounded image from the rough estimate by Bus Operator

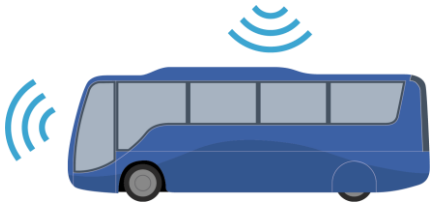
Positive

Potential

Base Line

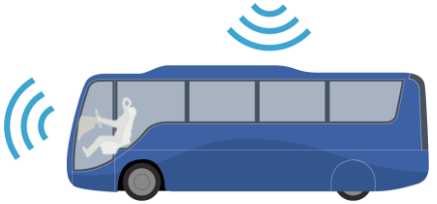
Vehicle Cost

Negative



Level 4

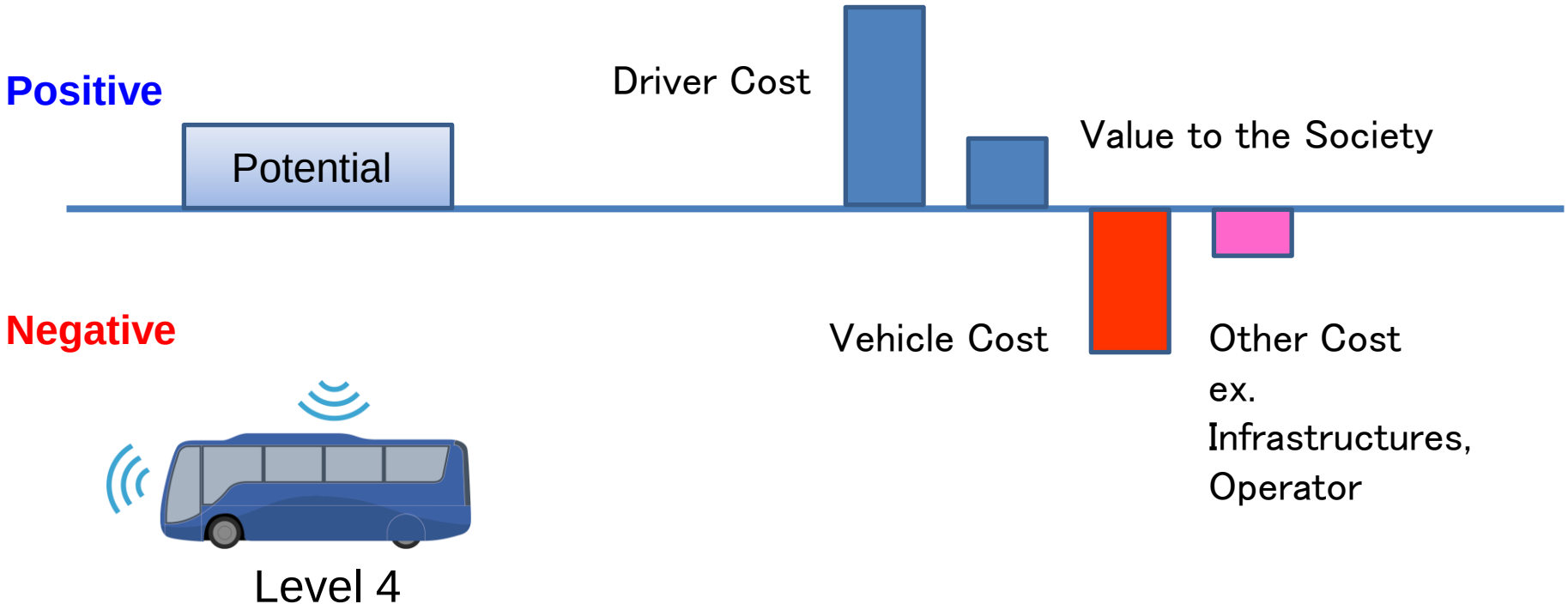
Level 0



Level 3

Operational Issue : Cost Balance

■ **Driver Cost and Level 4 ADV Cost are Critical**



Different use conditions

■ Operation Sites

Urban Shopping area

Residential area

Resort area

Rural area

Different use conditions

■ Road Conditions

Designated road

Slow easy resort route

Less traffic

Semi Designated road

Electromagnetic Guidance

Remote Operator

Different use conditions

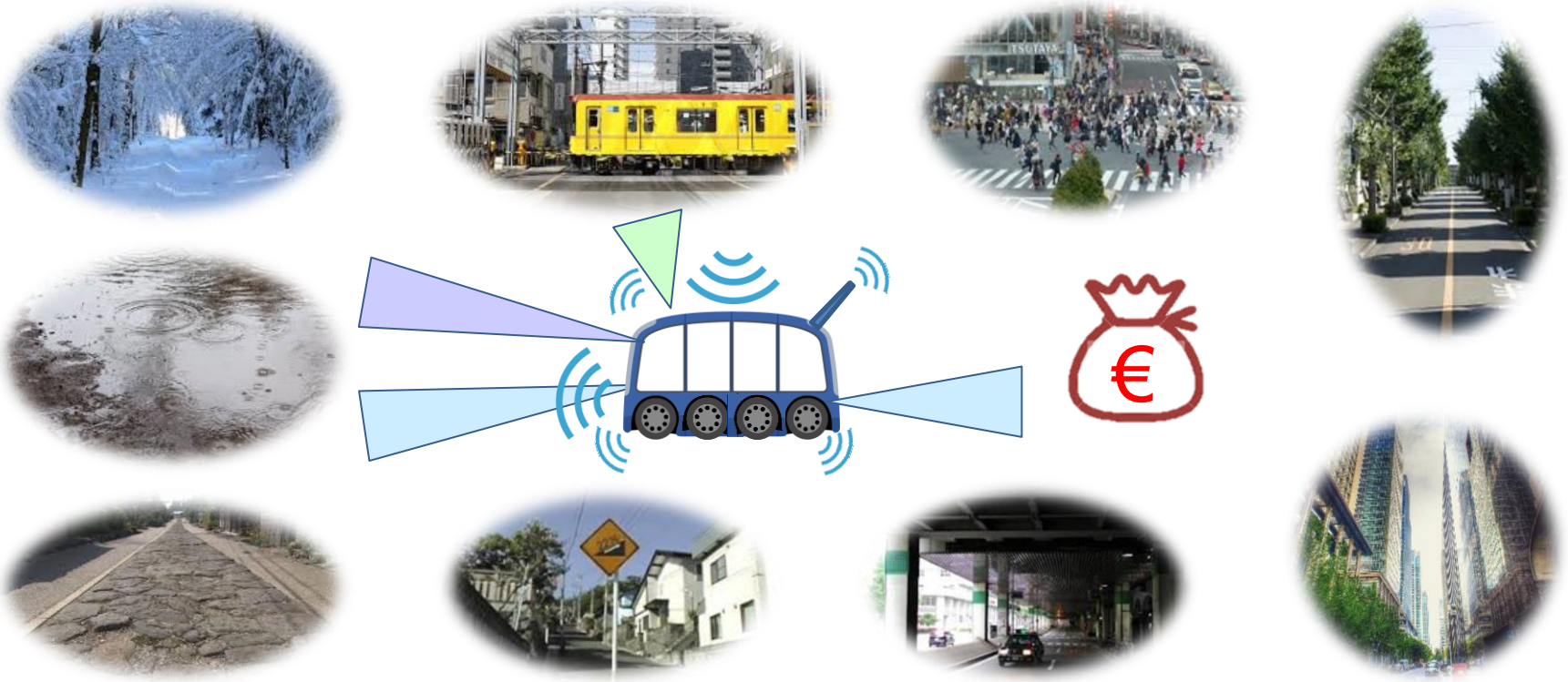
■ Weather Conditions

Always Fine

Cold and Snow

ADV Design

- **Various requirements result excessive design for limited local use**



Discussion Points

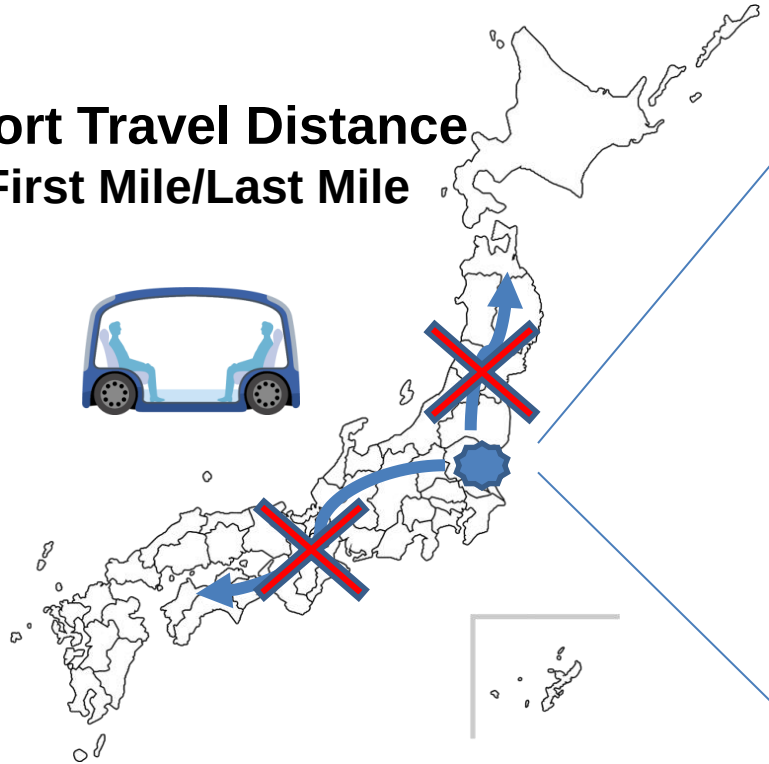
Service Car Projects

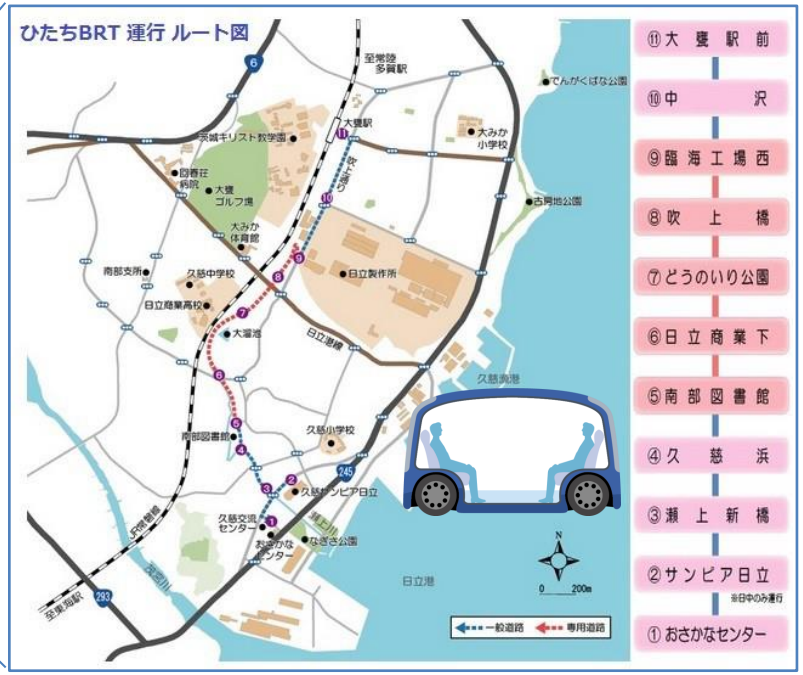
Operation area

■ Operation area is limited

Short Travel Distance

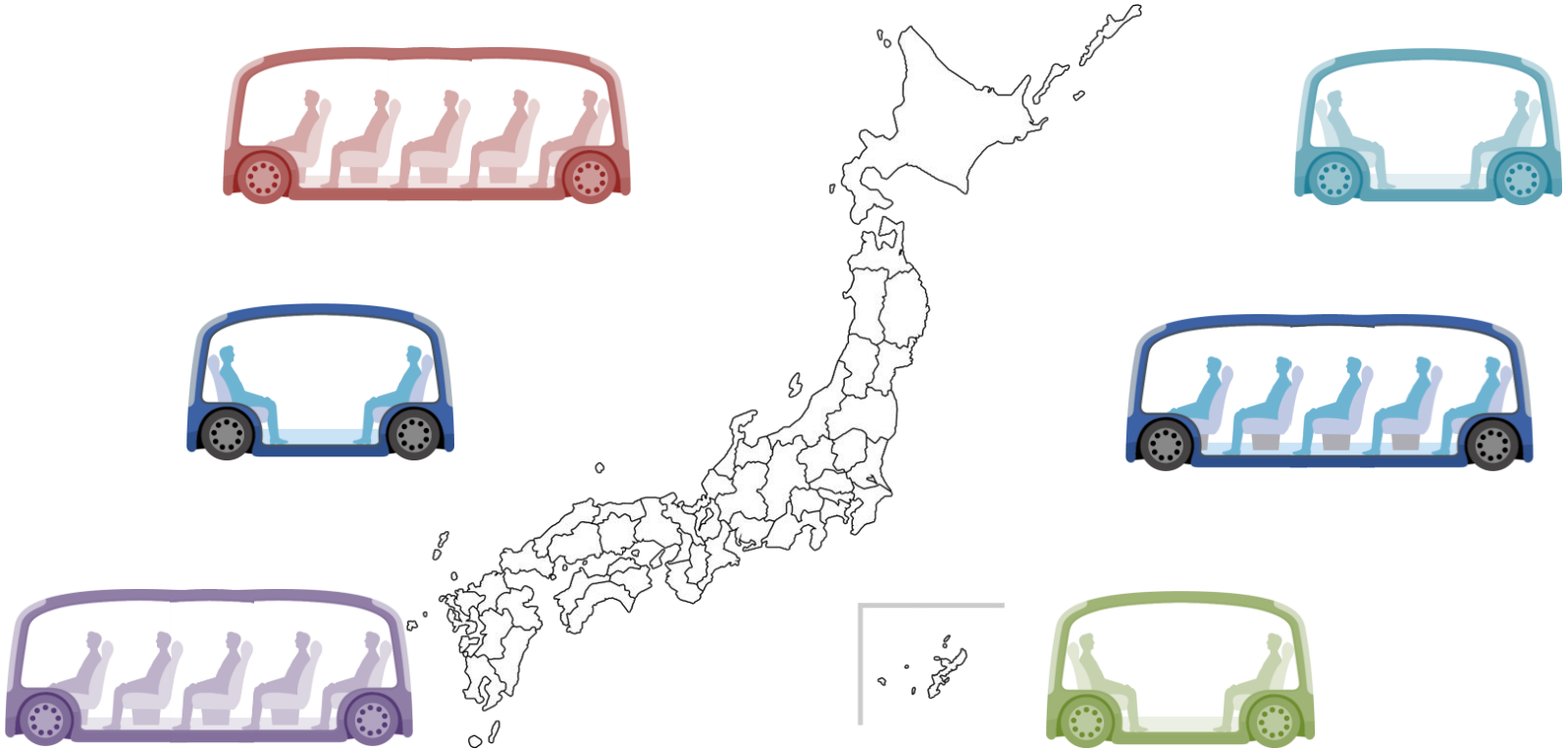
First Mile/Last Mile





ADV Design

■ Suitable Design for Service Area



Cooperation with other road users

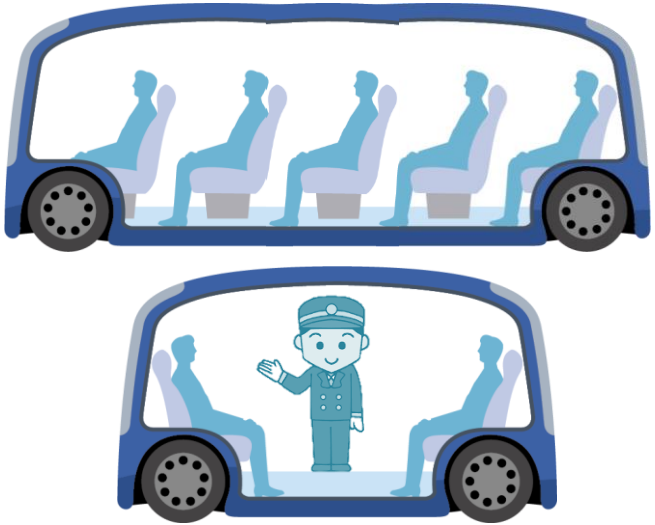
- Public Acceptance
- Suitable operating conditions

Policy and Regulation

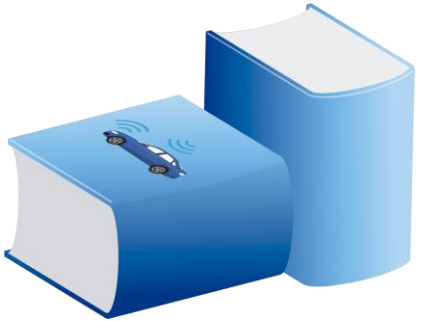
■ New Regulations

- ➢ Vehicle Type approval
- ➢ Road Traffic Laws, - - -
- ➢ Operational Rules

New License plate



New Vehicle Type



Local Rules

Conclusion

- Safety is the Priority
- Deliver benefits by ADV for People and Society quickly
- Resolve the issues with Global Cooperation
  - Introduce Necessary New Policies and Regulations
  - Grow ADV Technologies

END