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

ITS Japan
Level 4 Mobility Service Project

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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

Chairman

President

Executive Director
Senior Vice President
Vice President

About 30 members

Administration Group

Strategic Planning Group

Market Promotion Group

International Affairs Group

Government and External Affairs Group

Automated Driving Project Group

Integrated Mobility Service Project Group
Board of Director Companies

DENSO  FUJITSU  HITACHI  HONDA
JTEKT  MITSUBISHI ELECTRIC  NEC  NISSAN  OKI
Panasonic  SUMITOMO ELECTRIC  TOSHIBA  TOYOTA
AISIN  Clarion  IBM  IHI  ISUZU  KDDI  MAZDA
MITSUBISHI MOTORS  NTT  OMRON  PIONEER  SUBARU
SUZUKI  YAZAKI  ARI B  DRM  HID O
JAF  JAMA  JAPIA  JARI  UTMS JAPAN
Positioning among related Organizations

Private sector

 Industries
 Manufactures:
 Automobiles
 Electronics
 Infrastructure
 Service providers:
 Communications
 Telematics
 Associations:
 Automobile
 Electronics
 Auto parts

 Academia
 Engineering:
 Civil
 Traffic
 Mechanical
 Electrical
 Information
 Social science

 Organizations
 ITS operators
 Local promoters

 Users
 General public
 User association

 Government

 Cabinet Secretariat
 Cabinet Office

 National Police Agency
 Ministry of Internal Affairs and Communications
 Ministry of Economy, Trade and Industry
 Ministry of Land, Infrastructure, Transport and Tourism
International Cooperation
ADV classification and issues

ADV : Automated Driving Vehicle
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

Sources: Pictures from Internet
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

- **Level 0**: No Driving Automation
  - Driver performs part or all of the DDT
  - Sustained lateral and longitudinal vehicle motion control
  - OEDR
  - DDT fallback
  - ODD

- **Level 1**: Driver Assistance
  - The performance by the driver of the entire DDT, even when enhanced by active safety systems

- **Level 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
  - Driver and System
  - Driver
  - Driver
  - Limited

- **Level 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 responsive to ADS-issued requests to intervene, as well as to DDT performance-relevant system failures in other vehicle systems, and will respond appropriately

- **Level 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

- **Level 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

**Levels 1, 2**: DAS
DAS: Driving Assist System

**Levels 3, 4, 5**: ADS
ADS: Automated Driving System
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

![Diagram showing levels of automation and control systems](image)

- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

① Vehicle can switch on & off between levels.
② Level 4 dedicated Vehicle always at Level 4, with unlimited use area.

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

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**Dream car with various functions**

- **Driverless**
- **Ride as a passenger**
- **You can Drive**

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**Level 5**
- Always Level 4

**Level 4**
- Switch on & off

**Level 3**
- Varying Levels

**Level 2**

**Level 1**

**Level 0**
- Limited
- Use area
- Unlimited
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

- Level 5
  - Always Level 4 under exclusive environments

- Level 4
- Level 3
- Level 2
- Level 1
- Level 0

②CAV2, CAV3

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

Limited <-> Use area <-> Unlimited
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
3. Introduce Level 4 Mobility/Logistics ADV without Control Systems: CAV3
4. Expand Use area at Level 4

Full Driving Automation

Our Interest

CAR OEM
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
Current Topic: Level 4 Mobility Service Deployment

- Technical Challenges
  - Infrastructure design
  - Road design
  - City design

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

Global Collaboration for quicker Deployment
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

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

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

SIP Project
Cabinet Office
1. Tokyo
2. Okinawa

Truck Platooning
METI/MLIT
1. Shin Tomei
Operational Issue: Cost

- Driver Labor cost is very critical

![Pie chart showing cost distribution: Labor 57%, Fuel 8%, Others 35%]

Operational Issue: Drivers

- Bus Drivers decreasing significantly

Decreasing younger drivers

Decreasing year by year

Source: [http://www.bus.or.jp/about/pdf/h29_nba_brochure.pdf](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
Operational Issue: Cost Balance

- Driver Cost and Level 4 ADV Cost are Critical

Positive

Potential

Driver Cost

Value to the Society

Negative

Level 4

Vehicle Cost

Other Cost ex. Infrastructures, Operator

- Infrastructures, Operator
Different use conditions

Operation Sites

- Urban Shopping area
- Resort area
- Residential 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
Various requirements result excessive design for limited local use
Discussion Points

Service Car Projects
Operation area is limited

Short Travel Distance
First Mile/Last Mile
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

Local Rules

New Vehicle Type

TOKYO
20-20
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