Outline of a project "Urban surface Streets Management for smart mobility (USM)"

Dr. **OGUCHI, Takashi** 大口　敬

http://www.iis.u-tokyo.ac.jp/~takog/

Professor in Department of Human and Social Systems,
in Advanced Mobility Research Center (**ITS Center**), and
Deputy Director Institute of Industrial Science (**IIS**), [Deputy Director]
Director Mobility Innovation Collaborative Research Organization **(UTmobI)**
(Educational duty) in Dep. of Civil Engineering, Graduate School of Engineering

the University of Tokyo (UTokyo)

Self Introduction

Including affiliations and Laboratory

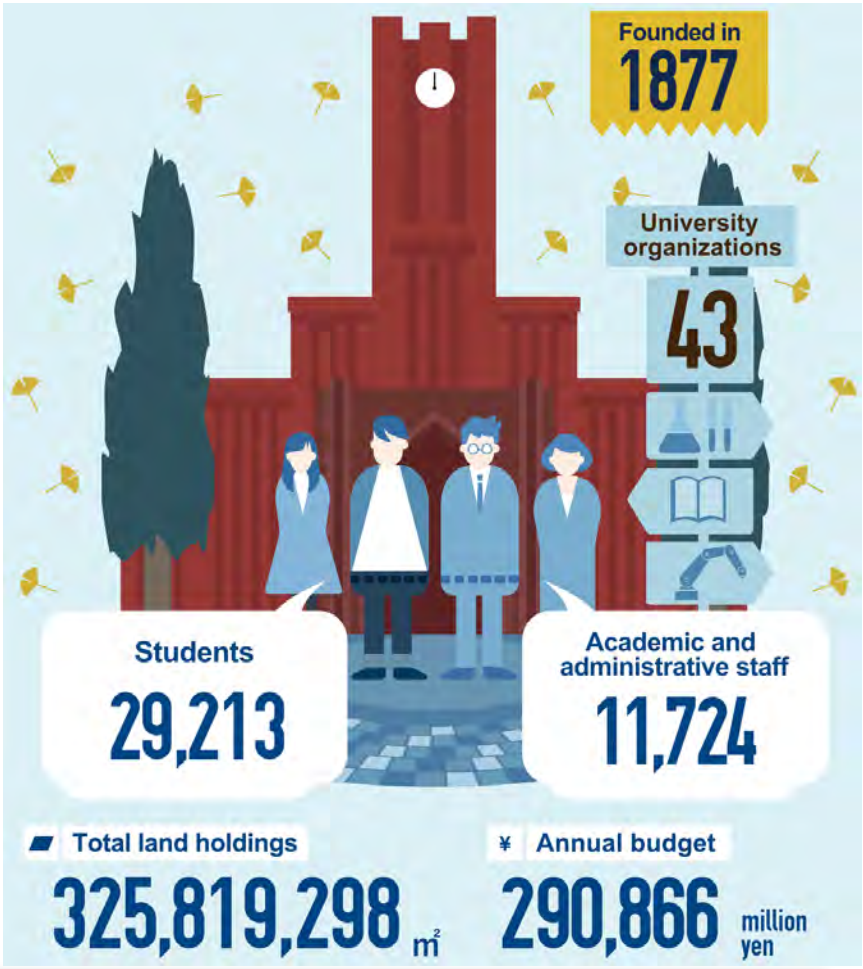
the University of Tokyo (**UTokyo**)

東京大学 THE UNIVERSITY OF TOKYO

https://www.u-tokyo.ac.jp/

as of December 2024

- 10 Faculties
- 15 Graduate Schools (incl. Graduate School of Engineering; **SOE**)
- 11 Affiliated Institutes (incl. Institute of Industrial Science; **IIS**)
- 15 University-wide Centers (incl. Center for Spatial Information Science; **CSIS**)
- 20 Integrated Research Systems (incl. Mobility Innovation Collaborative Research Organization; **UTMobI**)
- …



Institute of Industrial Science (**IIS**)

http://www.iis.u-tokyo.ac.jp/en/

70 Full Professors
37 Assoc. Professors
9 Lecturers
} 116 PIs + 12 Proj. PIs

11Project Profs., 7 Proj. APs., 5 Proj. Ls.

5 Visiting Profs.

2 Platforms (**LEAP** & **DLX**)

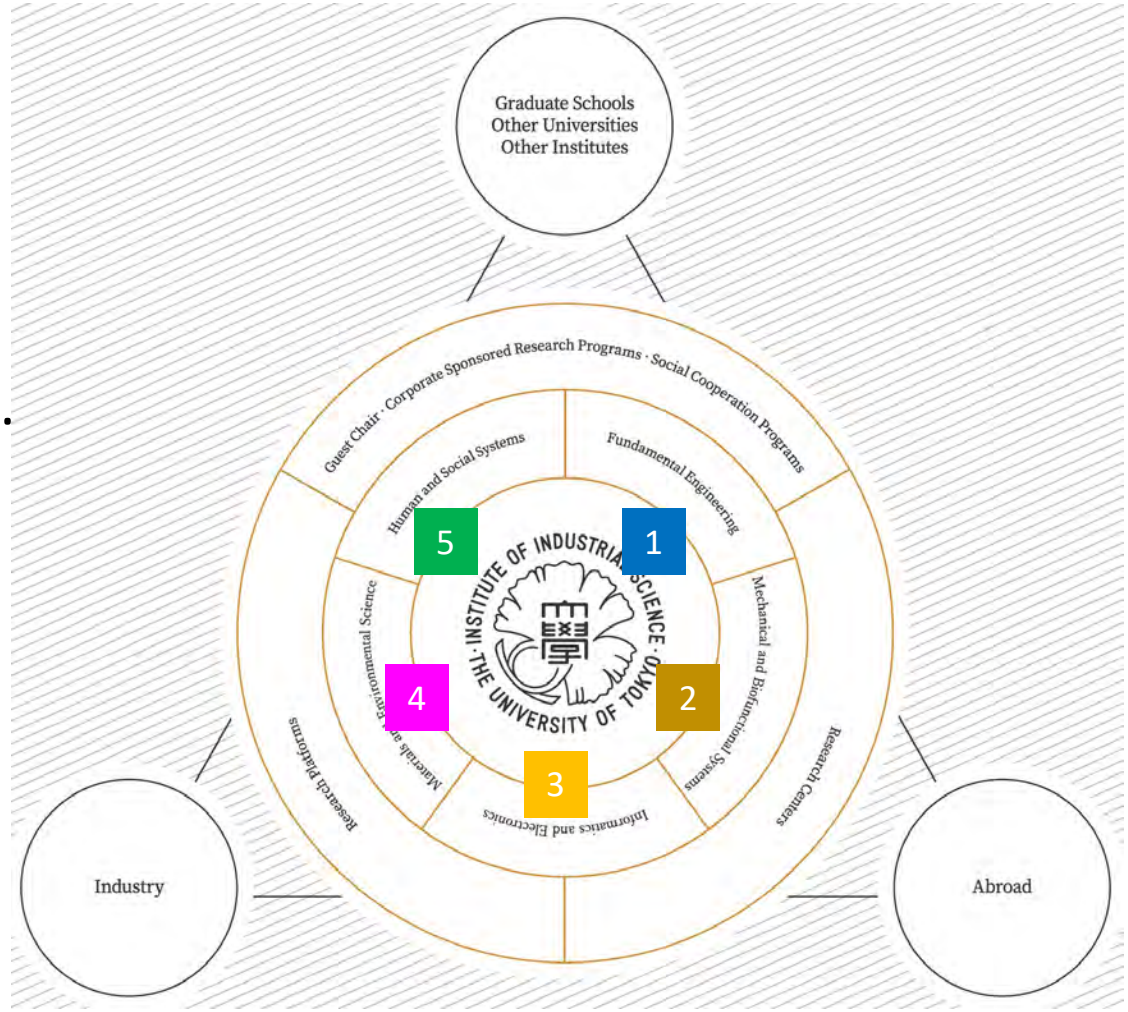
2 Coperate Sponsored Res. Progs.

6 Social Cooperation Progs. =(**USM**)

2 UTokyo IIS Research Centers, and

11 IIS Research Center = (**ITS Center**)

(as of April, 2025)

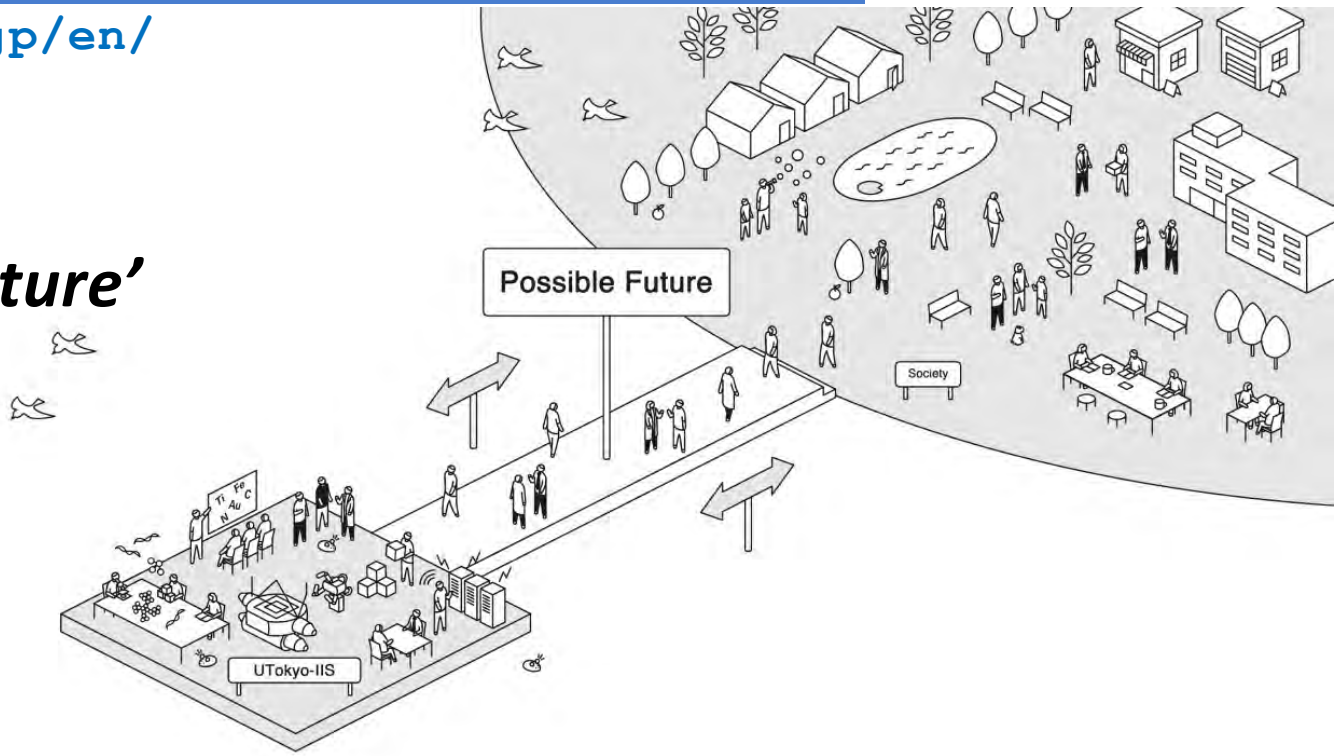


Institute of Industrial Science (**IIS**)

http://www.iis.u-tokyo.ac.jp/en/

Slogan / Statement

'Institute for a Possible Future'



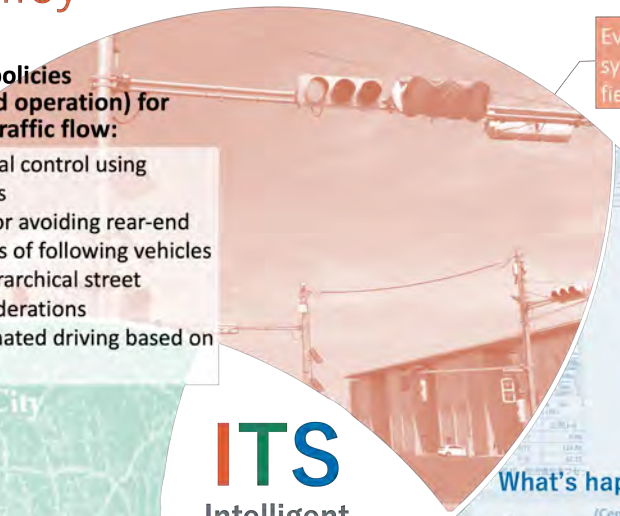
In 2021, we formulated a slogan and statement to convey the 'character' of the Institute of Industrial Science of the University of Tokyo. We aim to increase the number of links between society on one side and our research and organization—which are often seen as difficult to understand—on the other. We want to make our slogan and statement function and circulate like communication tools. From a place that 'looks kind of rigid' to a research institute where 'something exciting is going to happen!'

Innovative policy

How to manage road traffic?

Studies on road management policies (including planning, design, and operation) for more safe and efficient urban traffic flow:

- Proposal of adaptive traffic signal control using reinforcement learning methods
- Proposal of a braking strategy for avoiding rear-end collisions considering the drivers of following vehicles
- Theoretical development of hierarchical street network with multimodal considerations
- Social implementation of automated driving based on technological change forecasts



Evaluation of the proposed systems at Kashiwa ITS R&D field

Large-scale traffic simulation in the whole Tokyo Metro network

ITS
Intelligent Transport Systems

Science

What's happening in road traffic?

Development of basic theories and analysis of various kinds of observed data to understand road traffic:

- Development of fundamental theory on traffic signal coordination
- Analysis of secular change of traffic performance of interurban expressways
- Impacts of weather conditions on motorway traffic performance
- Analysis of the effects of separation structures between pedestrian spaces and roadways
- Evaluating the impact of bulb-out crosswalk through field experiments

Technology

How to assess road management policies?

Development of traffic simulation models, open data utilization, and so forth, to assess road management policies:

- Operational evaluation for three-ring expressways in the Tokyo Metro area
- Quality management strategy for network traffic safety
- A study on evaluation methods for urban streets from a pedestrian perspective
- Origin–destination prediction via knowledge-enhanced hybrid learning
- Multi-country survey on legislation, enforcement, and education for traffic safety
- Simulation analysis of public transit priority signal control and its impact on various road users

Dr. Takashi Oguchi

Speciallity in

Traffic Management and Control

Oguchi LAB Traffic ENGINEERING GROUP established in Apr. 2011

ITS Center THE UNIVERSITY OF TOKYO

Institute of Industrial Science, The University of Tokyo

東京大学 THE UNIVERSITY OF TOKYO

mobi

Oguchi Lab Members; Reseach Staffs

Professor

Oguchi Takashi

[add. appoits.]

USM

DTUM

DWPT

Proj. Assoc. Professor

Toriumi Azusa

USM

Inf. AD

Research Associate

Sahachaiseree Somporn

3DTraffic

Proj. Research Assoc.

Ikeya Fuma

USM

Alt. Int.

Proj. Research Assoc.

Toyama Yurie

MIAJ

Proj. Researcher

Hasegawa Yu

DTUM

CooL4

Proj. Researcher

Umeda Manabu

MIAJ

CooL4

Proj. Researcher

Yamada Yoshiko

UTmobI

KW

DTUM

Collaborative Faculty

Hiraiwa Yozo

AssociateProfessor

[add. appoits.]

USM

DWPT

KW = working in **UTokyo-IIS** in Kashiwa Campus

USM — Urban Street Management Project [Social Cooperation Program in IIS] (w/Oriental Consultants Co., Ltd.)

Inf. AD — Infrastructure for Automated Driving [trial & experiment in Kashiwa] (sponsored by MLIT)

3DTraffic — Data Driven Dynamic Transport Management [**esp. in Signal Control**] (sponsored by JICA & JST)

Alt. Int. — Alternative Intersections Project (sponsored by MLIT)

UTmobI — Mobility Innovation collaborative research organization (in UTokyo)

DTUM — Data-Informed Transit and Urban Management [Social Cooperation Program in UTmobI] by HHHD

MIAJ — Mobility Innovation Alliance Japan [supported by SIP 3rd phase Smart Mobility Platform establishment]

CooL4 — Cooperative Level 4 Automated Driving [under METI Project "RoAD to the L4"]

DWPT — Mob. Inf. Strategy for Decarbonization

Oguchi Lab Members; Students & Secretaries

Ph.D Cadidates

Doctoral Course Student

Xing Zeren

(visiting Hong Kong)

Doctoral Course Student

Chiba Tomoki

Doctoral Course Student

Wang Yiyang

Master Students

Master's Course Student

Sasaki Tatsuya

Master's Course Student

Nagasawa Kaito

(visiting ENPC, France)

Master's Course Student

Lancelot Tatsumi

Master's Course Student

Hatakenaka Hibiki

Master's Course Student

Kondo Yoshio

Master's Course Student

Deguchi Kei

Visiting Students

Special Research Student

Zhu Junyu

(from Tongji U.)

Special Research Student

Lin Yuzhu

(from Beijing Jaoton U.)

Special Research Student

Yin Kaitai

(from Tongji U.)

Secretaries

Secretary

Saeki Maki

サエキ マキ

Secretary

Asahara Noriko

アサハラ ノリコ

Secretary

Shimizu Kayo

シミズ カヨ

Secretary

Morimoto Kiyoko

モリモト キヨコ

Secretary

Kurokawa Shoko

クロカワ ショウコ

KW

Harmonic Mobility Research Center (ITS Center)

Institute of Industrial Science, The University of Tokyo

Harmonic Mobility Research Center aims to realise a sustainable future society by promoting the 'harmony' of diverse technologies and systems related to advanced mobility, such as automated driving, cooperative systems, traffic control, data linkage and electrification technologies. The center will not only integrate diverse modes of transport, infrastructures and technologies, but also lead the next generation of mobility society by promoting innovative research that integrates a wide range of academic fields, including data utilisation, AI and consideration of social and ethical perspectives.
The Center aims to the **Harmony** with **Technology**, **People**, **Society**, and **Environment**.

Director: Kimihiko Nakano (Dep. of Mech. and Biofunctional Systems)
In April 2025, **ITS center** was reformed with thirteen PI members (Professors, Associate Professors, a Project Associate Professor) among all the five Dep. in **IIS**. The center also forms nucleus of the **"Mobility Innovation Collaborative Research Organization in UTokyo (UTmobI) "** started in Jul. 2018.

History

Apr. 2003: "Sustainable ITS", Industry-Academia cooperative project starts
Mar. 2005: "Cooperative Research Center for Advanced Mobility" (starts Abbrev.**ITS center**)
Apr. 2009: Upgrade to "Advanced Mobility Research Center"
Apr. 2014 "Next-generation Mobility Research Center" (2nd stage from 2019)
Apr. 2025 "Harmonic Mobility Center"

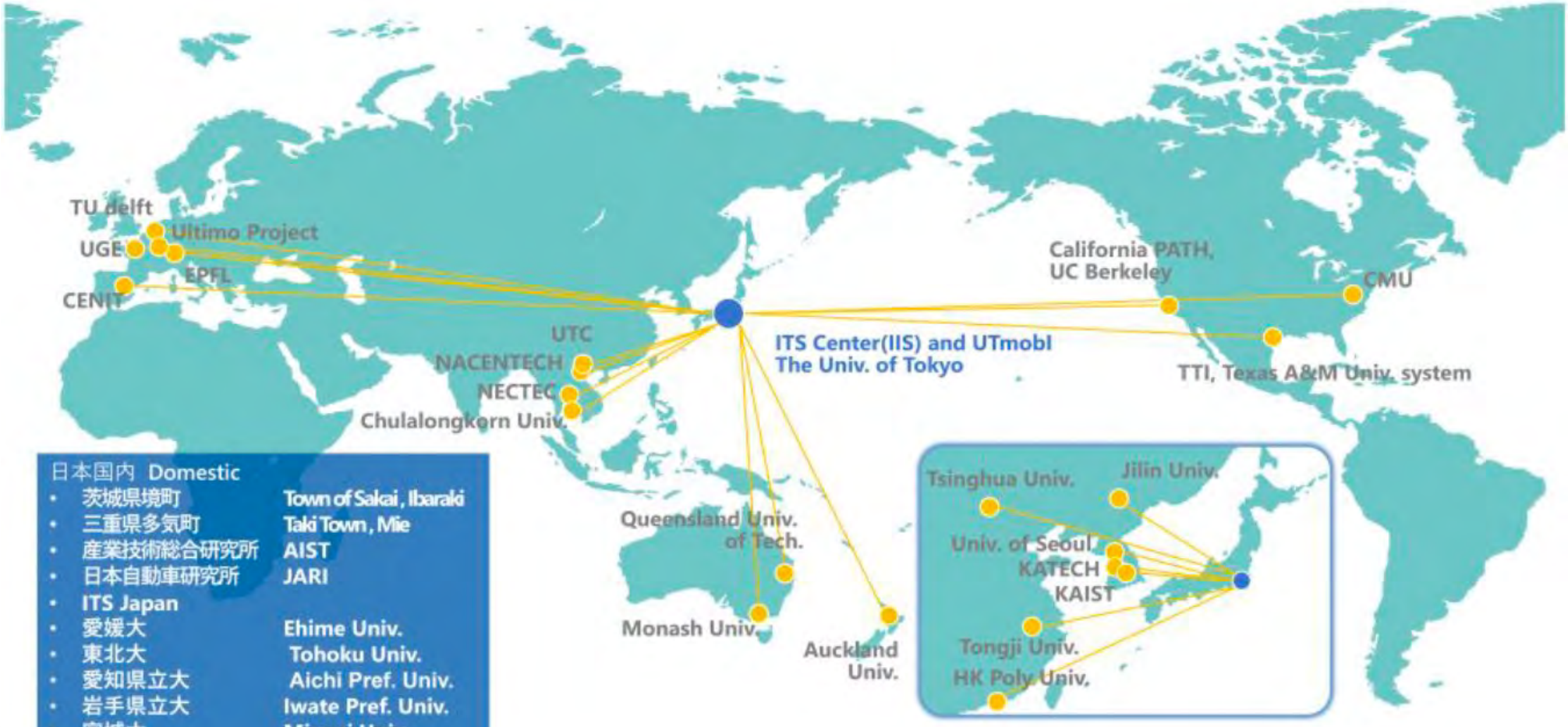
https://www.its.iis.u-tokyo.ac.jp/en/

Harmonic Mobility Research Center (ITS Center)

ITS Center THE UNIVERSITY OF TOKYO

Institute of Industrial Science, The University of Tokyo

- Achievement about MOU



日本国内 Domestic

茨城県境町	Town of Sakai, Ibaraki
三重県多気町	Taki Town, Mie
産業技術総合研究所	AIST
日本自動車研究所	JARI
ITS Japan	
愛媛大	Ehime Univ.
東北大	Tohoku Univ.
愛知県立大	Aichi Pref. Univ.
岩手県立大	Iwate Pref. Univ.
宮城大	Miyagi Univ.
高知工科大	Kochi Univ. of Tech.

Harmonic Mobility Research Center (ITS Center)

ITS Center THE UNIVERSITY OF TOKYO

Institute of Industrial Science, The University of Tokyo

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ITS Japan
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Corporate Legal Adviser

UEMURA, Tamaki *
Project Academic Support Specialist
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1 Fundamental Eng. 2 Mech. & Biofunc. 3 Info. & Electronics 4 Materials & Env. 5 Human & Social Sys.

UTokyo-IIS Kashiwa Campus

Institute of Industrial Science, The University of Tokyo

(former)

Chiba Experimental Station of IIS

- in Nishi-Chiba Campus (~Mar., 2017)
- moved to Kashiwa Campus (Apr. 2017~)

- "**Large-scale Experiment and Advanced-analysis Platform (LEAP)**" starts from Apr. 2020 in spite of abolition of **Chiba Experimental Station.**

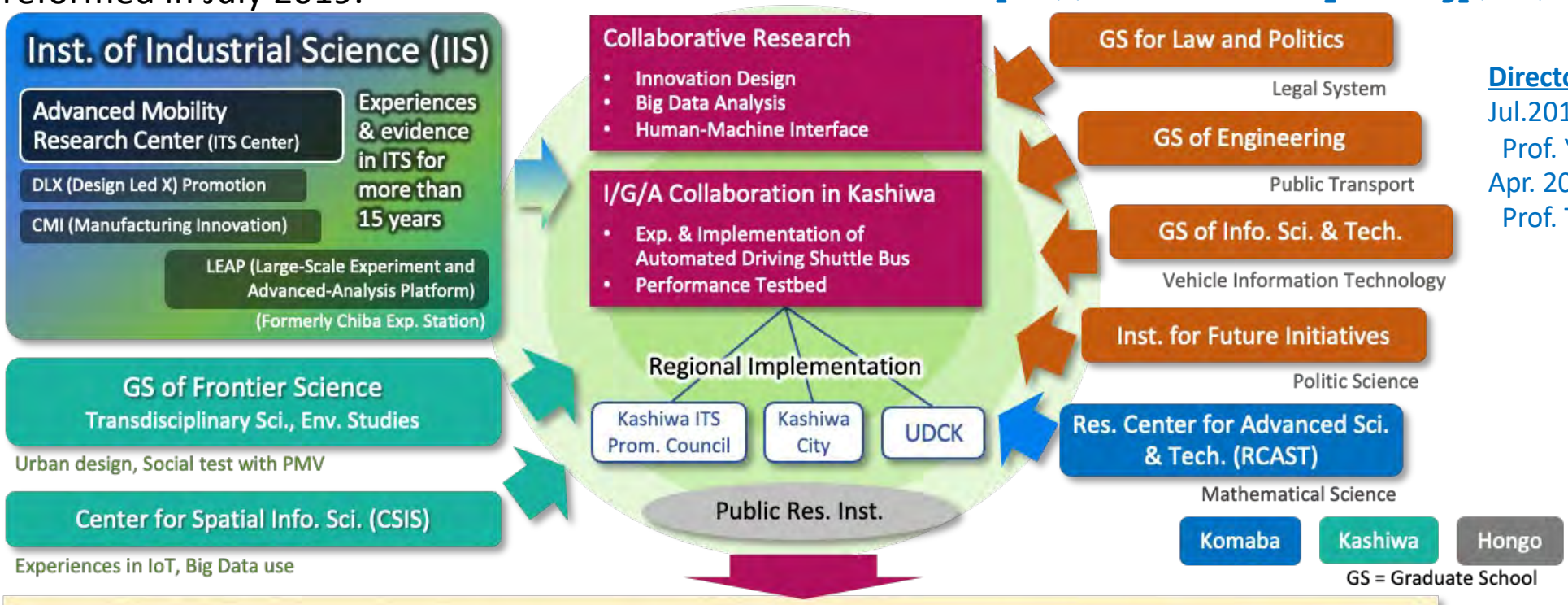
ITS R&R Experimenta Field (in **IIS** of Kashiwa Campus)

Institute of Industrial Science,
The University of Tokyo

UTmobI (one of **UTokyo** University level cross-faculty organization)

Establish the "**Mobility Innovation Collaborative Research Organization**" in **UTokyo** (**UTmobI**) in July 2018, reformed in July 2019.

https://utmobi.u-tokyo.ac.jp/en/home-en/



Director:
Jul.2018 – Mar.2025
Prof. Yoshihiro Suda
Apr. 2025 –
Prof. Takashi Oguchi

- Intra/International Promotion of mobility innovation based on the experience at Kashiwa-area using the academic promotion council.
- Nurturing Young Persons & Social Return Activity for promoting mobility innovation (Ideathon, Hackathon)

Academic research model collaborated with real society beyond simple social return activity

Systematic knowledge to innovate mobility and promotion for regional implementation

Mobility Innovation Alliance Japan

MIAJ

https://mobilityinnovationalliance.org

Considering after the **termination of SIP-adus from Apr. 2023**;

Established in July 2022 as an **indipendent organization**

Towards mobility innovation, the Alliance addresses to;

- **Formulate** **cross-sectoral** academic activities for mobility innovation
- Study & make **proposal** on **cross-ministerial** policy & social infrastructure
- Create **collaboration opportunities** bridging diverse **researchers, industries & public sectors**
- Promote international activities **through** ***international workshop in Japan***
- **Integrate** **technologies & societal changes** for mobility innovation
- **Foster** **young researchers** & **start ups**

History of SIP

- R&D funding scheme started in FY2014 -

History of SIP: **SIP-adus** (1st phase)

SIP (Cross-Ministerial Strategic Innovation Promotion Program)

- **Intensive R&D program**
- promote 5-years R&D (**FY2014-2018: 1st phase**)
- enhancing cross-ministerial cooperation
  - ➔ **CAO, CAS, NPA, MIC, METI, MLIT(RB, RTB)**
- **11 themes** are selected

Issues	Themes
Energy	Innovative combustion technology
	Next-generation power electronics
	Innovative structural materials
	Energy carrier
	Next-generation ocean resources development tech.
Next-Genera-tion Infra-structures	***Automated Driving System***
	Maintenance/upgrading/management of infra.
	Preventing and mitigating disasters
	Cyber-Security for Critical Infrastructure
Local Resources	Creating next-gen. agriculture, forestry and fisheries
	Innovative design/manufacturing technologies

SIP-adus (Automated Driving for Universal Services)

https://en.sip-adus.go.jp

Program Director(PD)

Seigo KUZUMAKI
Toyota Motor Corp.
CSTO(Chief Safety Technology Officer) Secretary

From FY2016

プログラムディレクター
渡邉 浩之
Hiroyuki Watanabe

(8 yrs. earlier) **DI&E cocept**

Target: 1) Reduction of Traffic Accident
2) Realization and diffusion of automated driving
3) ART relization at TOKYO 2020 Olympic games

➔ Followed by 2nd stage SIP-adus FY2018-2022

Levels of Driving Automation [SAE J3016]

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	**You <u>are</u> driving** whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			**You <u>are not</u> driving** when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			**These are automated driving features**		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering **OR** brake/ acceleration support to the driver	These features provide steering **AND** brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	

Once a 100 year's revolution (in 2010's): Automated Driving

Driving Automation / Vehicle Automation: innovation for once a century

au·ton·o·mous | ôˈtänəməs |

ORIGIN

early 19th century: from Greek ***autonomos*** 'having its own laws'+ -ous.

New Oxford American Dictionary

Technology Develpment (from 1950's)

Automated Vehicles (AV)/ Autoamted Driving (AD)

← X **Autonomous Car**

- **1994:** Dawn of ITS ... **AHS** (Automated Highway Systems)[**AHSRA**], California **PATH**...

・**2005:** Stanford Univ. awarded in DARPA grand-challenge → google car

http://www.itmedia.co.jp/news/articles/1208/08/news027.html

・**2013:** 20th World Congress on ITS in Tokyo, Japan

- **AD** technology development in car manufacturers in earnest

➔ **Expected to reduce the "three evils" of Road Transport plus to introduce new transport service/business**

CV: Connected Vehicle

→ (approx.) 2016: **CAD**: **Connected & Automated Driving**

CASE (Connected/Autonomous/Shared/Electric)・**MaaS** (Mobility as a Service)

➔ in Europe; **CCAM** (Connected, Cooperative Automated Mobility) 2021~

DI&E cocept 2022~

Two paths for technology progress of CADs

SIP-adus

List of study team's members [FY2016-2017 Project under SIP-adus 1st Stage]

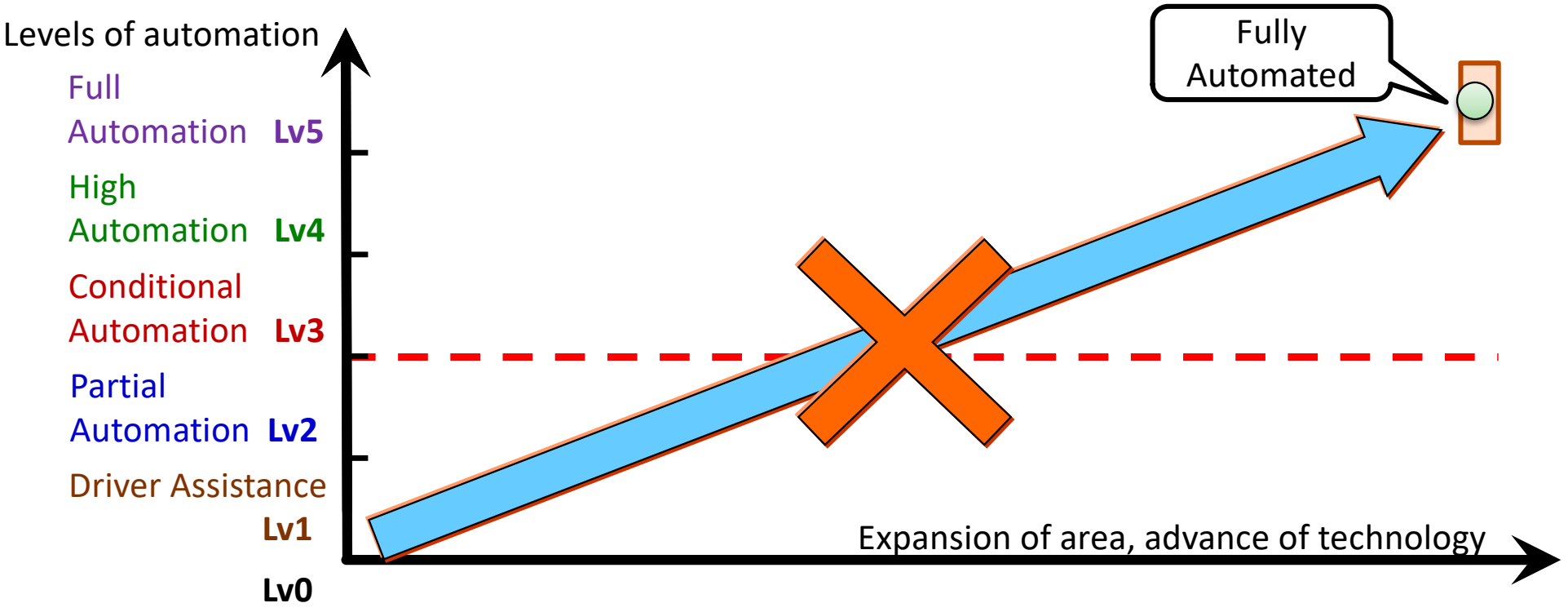
Name	Affiliation	Specialty
Masato Itohisa	Associate Professor, Faculty of Sociology, Hosei University	Technology management
Takeyoshi Imai	Professor, Graduate School of Law, Hosei University	Criminal law
Keisuke Uehara	Associate Professor, Faculty of Environment and Information Studies, Keio University	Information and communications
○ Takashi Oguchi	Professor and Deputy Director, Advanced Mobility Research Center, Institute of Industrial Science, The University of Tokyo	Traffic control engineering
Shusuke Kakiuchi	Faculty of Law, Graduate Schools of Law and Politics, The University of Tokyo	Civil procedure
Yuto Kitamura	Associate Professor, Graduate School of Education, The University of Tokyo	Education
Ryo Kurachi	Specially Appointed Associate Professor, Center for Embedded Computing Systems, Graduate School of Informatics, Nagoya University	Cybersecurity
Yasuhiro Shiomi	Associate Professor, Department of Environmental Systems Engineering, College of Science and Engineering, Ritsumeikan University	Traffic engineering
Naoki Suganuma	Associate Professor, Automated Driving Unit, Future Society Research Creation Core, Institute for Frontier Science Initiative, Kanazawa University	Robotics engineering
Akihiro Nakamura	Professor, Graduate School of International Management, Yokohama City University	Public economics
Pongsathorn Raksincharoensak	Associate Professor, Department of Mechanical Systems Engineering, Tokyo University of Agriculture and Technology	Mechanical dynamics control
Hiroaki Miyoshi	Professor, Graduate School of Policy and Management and Director, Institute for Technology, Enterprise and Competitiveness, Doshisha University	Technology and public policy
Akinori Morimoto	Professor, Department of Civil and Environmental Engineering, Faculty of Science and Engineering, Waseda University	Urban planning
Goro Yamazaki	Associate Professor, CO Design Center, Osaka University	Cultural anthropology

Modified based on Section II, chapter 6 in SIP-adus the 1st stage Report https://www.sip-adus.go.jp/file/Chapter2_s.pdf

Two paths for technology progress of CADs

SIP-adus

- Need oriented, social problem solving, dedicated & focused introduction



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Two paths for technology progress of CADs

SIP-adus

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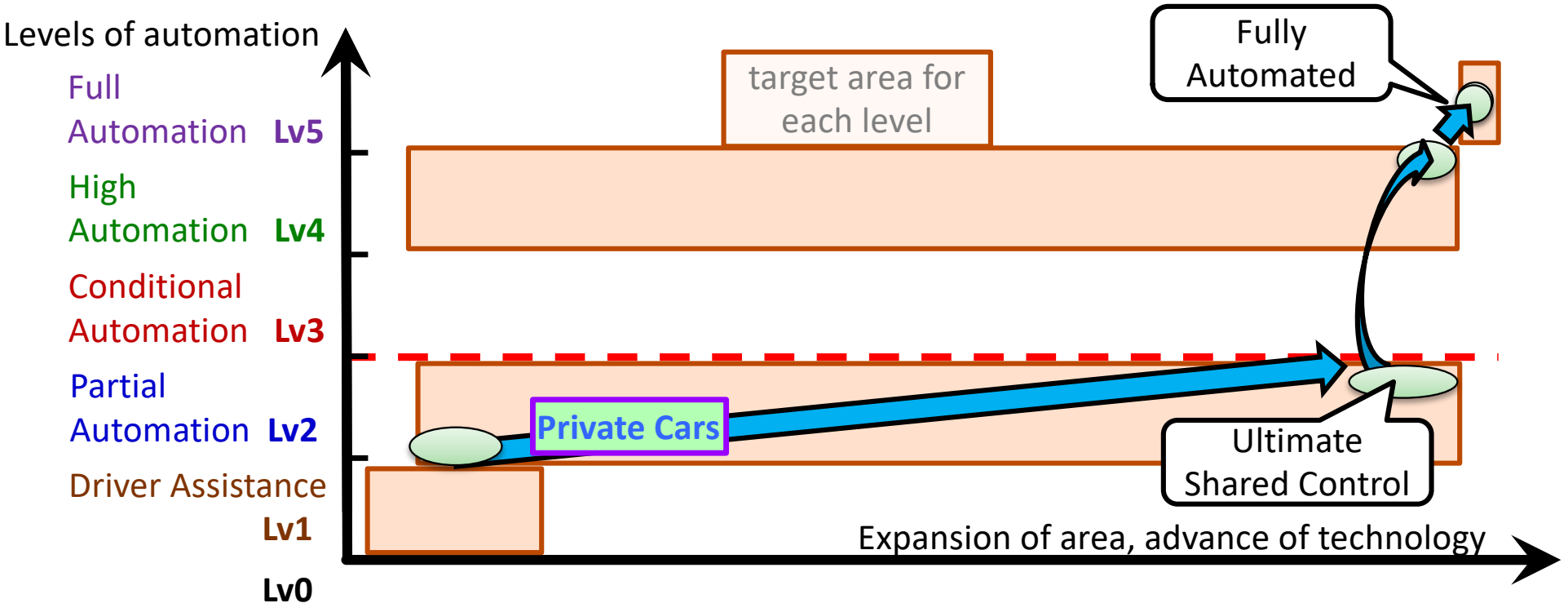

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Two paths for technology progress of CADs

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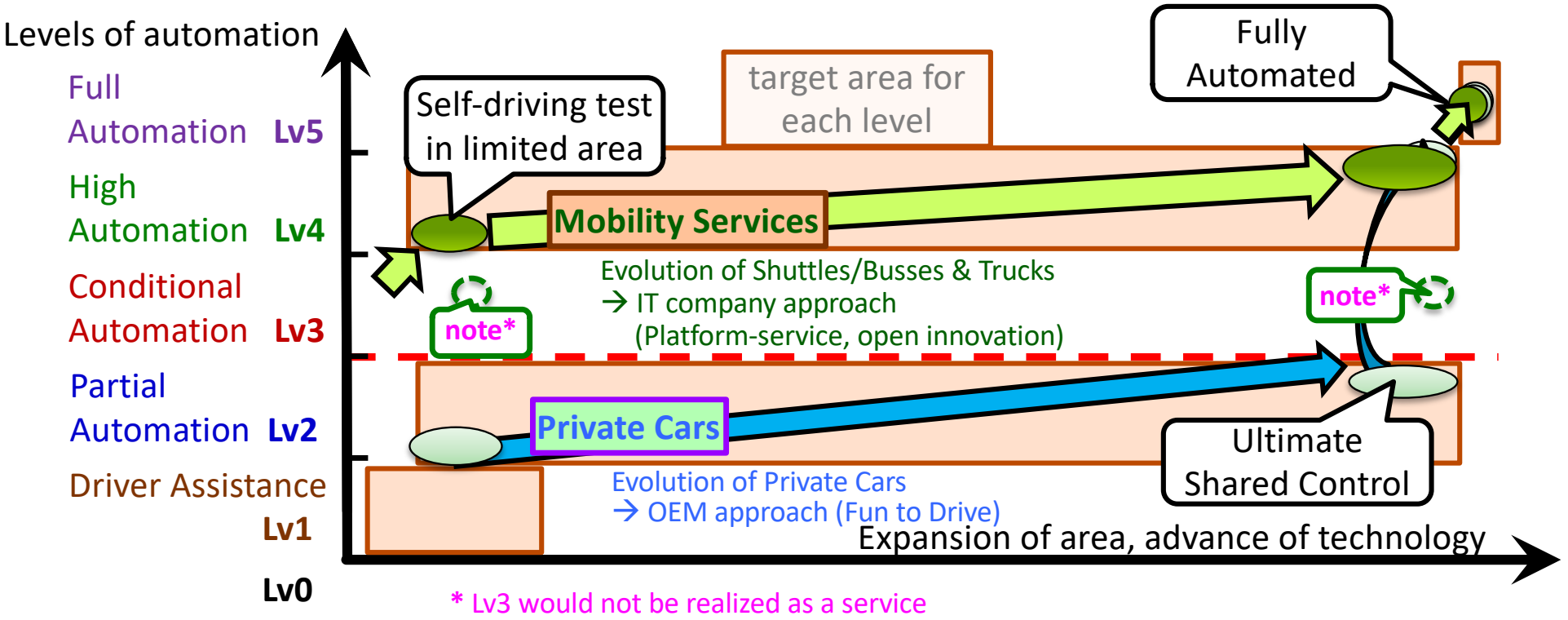


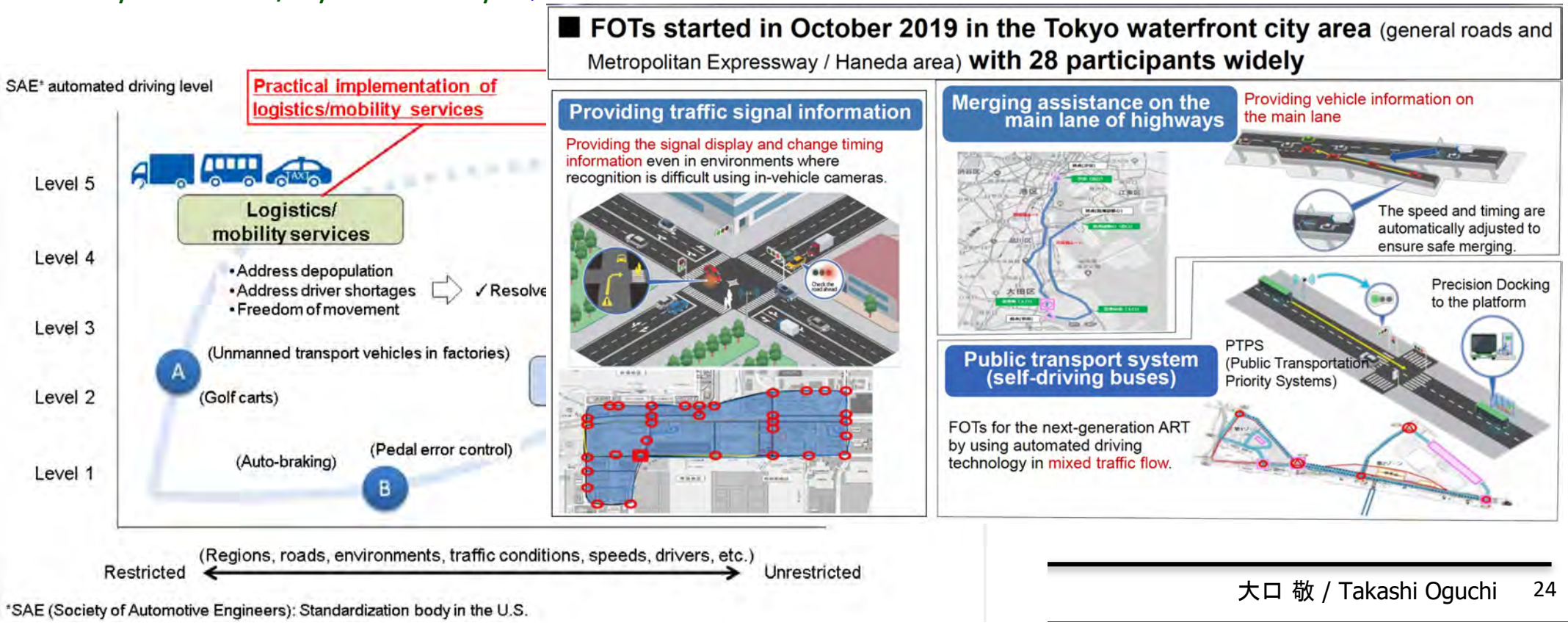
* Lv3 would not be realized as a service

Modified based on Section II, chapter 6 in SIP-adus the 1st stage Report https://www.sip-adus.go.jp/file/Chapter2_s.pdf

2nd Phase **SIP-adus** (Automated Driving for Universal Services)

FY2018-2022: 2nd Phase SIP-adus (terminates in Mar. 2023)

Features;
- Promote Field Operational Test
- Social acceptance
- Safety Assurance/ Cyber Security ↓ Overview



Brief summary of SIP-adus (Automated Driving for Universal Services)

SIP-adus 1st phase: FY2014-2018 8 yrs. earlier proposal of **DI&E cocept**

annual SIP-adus intn'l Workshop

- Promoted by car manufactureres (OEM); reduce traffic accidents
- Technology oriented (non-competitive area) ➔ Dynamic Map Platform **DMP Co., Ltd.**
- (Next-gen. urban transport: ART realization at TOKYO 2020)

SIP-adus 2nd phase: FY2018-2022 (until Mar. 2023)

- Public road environement for FOT: Tokyo Bay area & "Michi-no-Eki" (rural, local)
- Development & Standardization: V-Drive Technologies (**DIVP**R), Cyber Security, …
- Social Acceptance increase (e.g.: **M-BIC** (business competition among students)
- International cooperation: Safety Assurance, Cyber Security, Human Factors, Impact Assessment

SIP 3rd phase: FY2023-2027 → no program explicitly forcused on Automated Driving

- (Related Program) "**S**mart **M**obility **P**latform establishment"

– – ➔ **[RoAD to the L4** (METI) + α**]**

SiP

annual Monility Innovation Week

Outline of USM project and the supporting consortium activities under SIP 3rd phase program

Social Cooperation Program in IIS, UTokyo

URBAN SURFACE STREET MANAGEMENT

“Urban surface streets management for smart mobility” [**USM**]

https://www.usm.iis.u-tokyo.ac.jp/

Period: 16th October, 2024 – 31st March 2028

Goal:

- Society with **no mobility divide**
  - Safe, comport, and friendly for environment, people, and communities
  - All people, goods, and service can transport

DI&E cocept

Targets:

- **Comprehensive and systematic studies on theory and technologies for urban surface street management for smart mobility**.

Budget: about 110 million JPY (in total)

Institute of Industrial Science, The University of Tokyo

ORIENTAL CONSULTANTS ORICONSUL Global Consulting for Sustainable Development

SiP

R&D activity led by Oriental Consultants (under **SIP 3rd phase**) will be reported **in Session 5 (tomorrow)**

(SIP 3rd phase) Development of Smart Mobility Platform

PD: Dr. Haruo Ishida

Themes

https://sip3.nedo.go.jp/smartmobility/

1 Research and development of support for preemptive prevention of traffic accidents through proactive risk notification

2 Realization of a Smart Mobility Society using the Japan Mobility Dataspace

3 Realization of Shared Space through Digital Smart Mobility

4 Development of a mobility social experiment Digital Twin incorporating geospatial information and pseudo human flow data

5 Development of a new mobility oriented city with a concentration of places of exchange

6 Development of a technology and policy package for redesigning urban street transportation

7 Promoting international research collaboration and dissemination activities toward the Development of Smart Mobility Platform

8 Building smart districts with advanced mobility systems

9 Research and Development on local transportation community formulation and Human Resource Development Program with narrative approaches

10 Practical mobility redesign

11 Research and development of a general traffic signal information provision platform using V2N

12 Verification of welfare effects caused by mobility service profisions on community building and activities

13 Development of infrastructure and onboard sensor systems that utilize compact LiDAR technology to understand the actual situations of streets in living areas and busy districts

14 Economic and mathematical engineering study by market design for SMP construction

15 Social implementation of Smart Mobility Platform based on social acceptance and stakeholder coordination (~FY2024)

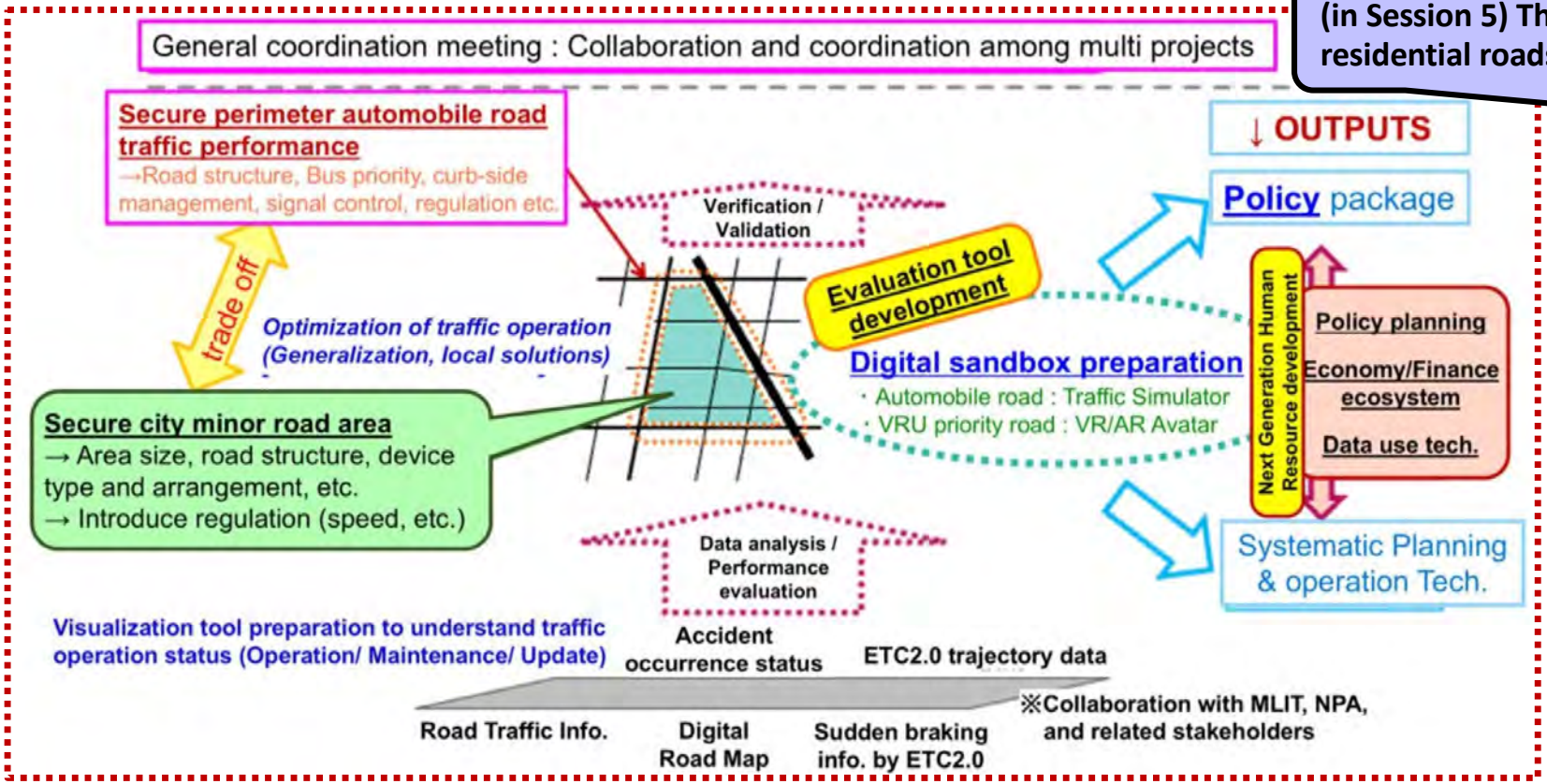
16 Proposals for improving regulations, systems, and business practices that streamline long distance transport by trucks and development of software for converting logistics information into digital

17 Cybernic Smart Mobility Contributing to Re-design of Vehicles and Infrastructure

(SIP 3rd phase) Development of Smart Mobility Platform

6 Development of a technology and policy package for redesigning urban street transportation

https://sip3.nedo.go.jp/smartmobility/en/theme/06/



(in Session 5) The challenge of redesigning residential roads (Mr. Y. Otubo)

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JICE 国土技術研究センター Japan Innovation Center of Civil Engineering

(subcontractors)
- Nagoya Univ. (Dr. M. Iryo)
- Fukuoka Univ. (Dr. S. Ono)

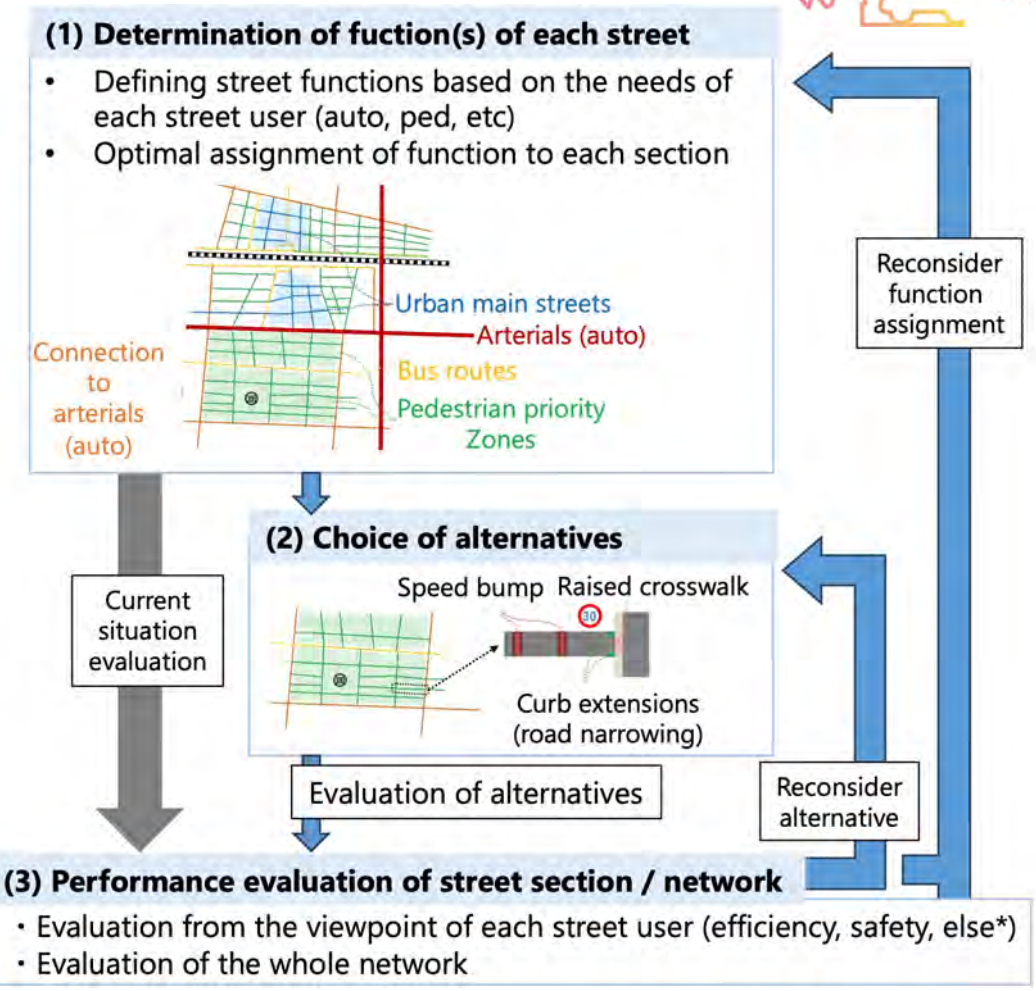
(cooperative conductor)
- Univ. of Tokyo

URBAN SURFACE STREET MANAGEMENT

Research for Urban Street Management [**USM**]

URBAN SURFACE STREET MANAGEMENT

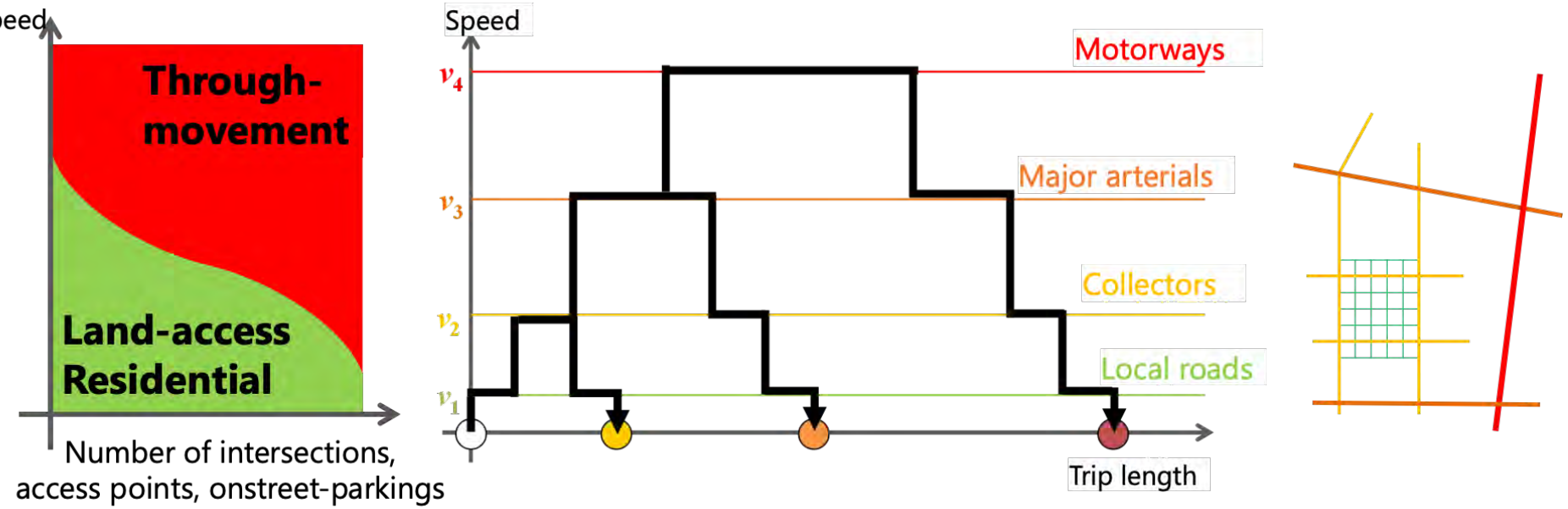
- Redefine **functions of streets** considering various street users (such as private cars, pedestrians, public transport, bicycles)
- **Optimal assignment of street function**(s) to each street section in a network
- **Choices of geometric design and operational methods** that realize the assigned function of each section
- **Performance evaluation** of each street section and the whole network from a viewpoint of each different street user



URBAN SURFACE STREET MANAGEMENT

Functionally Hierarchical Road Network Concept

- Fundamental of road network planning since 1960s (e.g., Buchanan report)
- Road function is divided into **Through-movement**, **Land-access, and Residential (stopping)**
- Roads of a network are hierarchically classified based on the trade-off between functions
- By separating different needs (functions) into different road sections, each road can be operated efficiently and safely.



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URBAN SURFACE STREET MANAGEMENT

Development of Urban Street Planning Theory

- Redefine street functions based on pedestrian's activities on the streets
- Check the **interactions between functions of pedestrians and those of automobiles**.
- Determine possible combinations of functions in one street segment, defining street class.

Choice improving/ deteriorating the function (example)

User	Function	Current needs	Current satisfaction level
Automobile	Through-movement	M	Low
	Land-access	M	Low
	Stopping	L	Low
Pedestrian	Through-movement	L	Moderate
	Promenade	S	Low
	Stopping for through-m	M	Low
	Land-access	L	Moderate
	Stopping for land-access	L	Low
	Boarding and alighting	L	Moderate
	Stopping for boarding	L	Low
	Non-mobility activities	S	Low

Simultaneously

Interaction deteriorates functions

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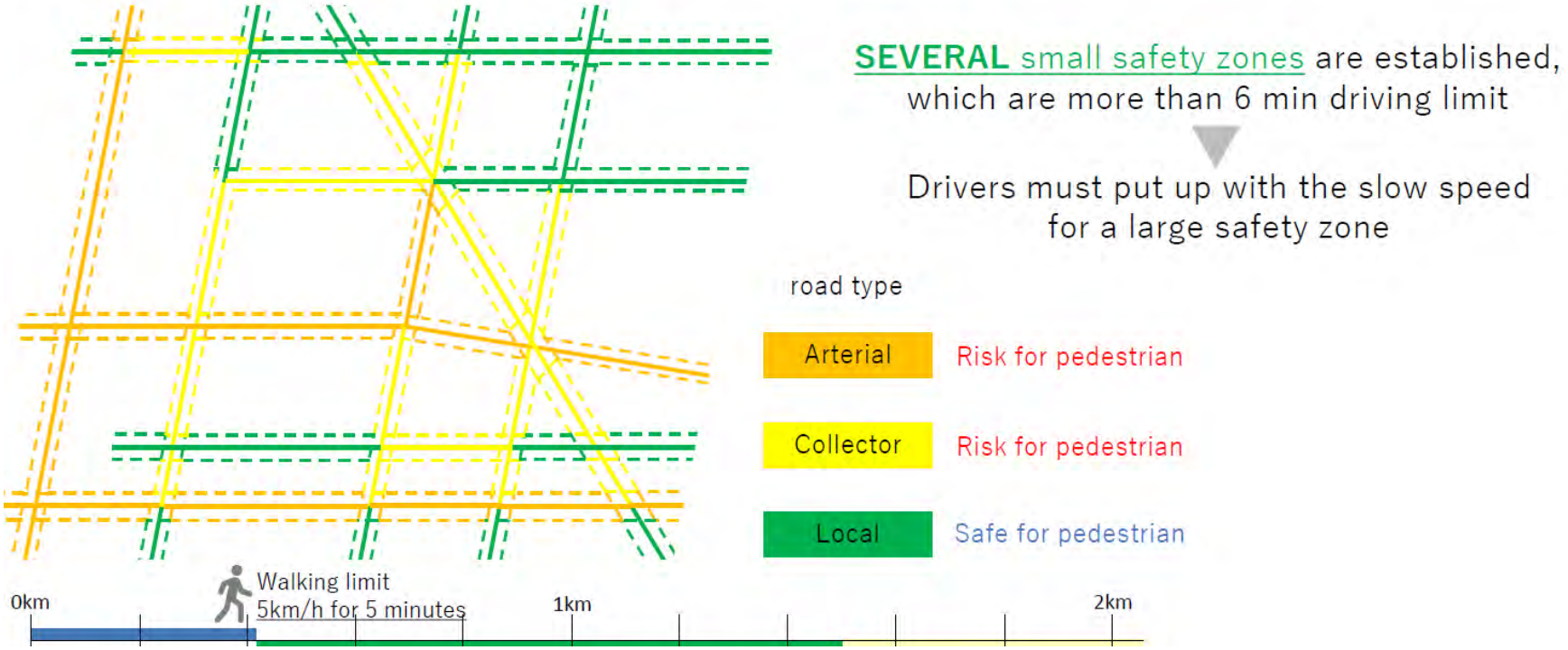
URBAN
SURFACE STREET
MANAGEMENT

street Hierarchy for Both Pedestrians and Automobiles

We develop the methodology using the Inverse Shortest Paths Problem to allocate street types that prioritize either pedestrians or automobiles within a network. This would support zoning to identify areas suitable for implementing pedestrian-priority policies, such as “Zone 30 Plus”.



END

This report partially includes the results of Cross-ministerial Strategic Innovation Promotion Program (SIP) 3rd Phase, “Development of Smart Mobility Platform” promoted by Council for Science, Technology and Innovation, Cabinet Office.
（Project Management Agency：New Energy and Industrial Technology Development Organization (NEDO) (Project Code JPNP23023))