５．　新規研修講義資料

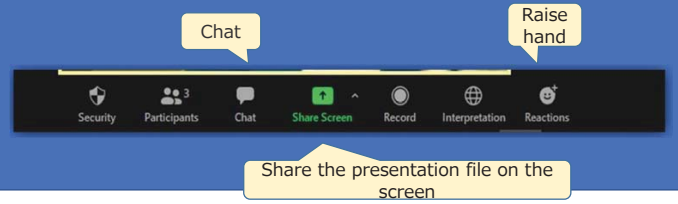
JICA Knowledge Co-Creation Program

Practical Technology on Intelligent Transport Systems (ITS)

November 15th, 2021
MIYAMOTO Ryo, JICA Tokyo
ITO Ryuichi, JICA Tokyo

Important Notice:

1. **Turn your video on and mute your microphone**. Unmute it only when you speak.
2. If you have any **comments** during the program, **write it in chat box (text message)**.
3. During the discussion session, you can also **raise your hand for questions/comments**.



Schedule of Today

8	Program	Presenter
17:00~17:30	Program Orientation	JICA, the University of Tokyo, Consultant Team
17:35~18:05	Lecture and Q&A: Introduction of JICA's Activities on ITS	JICA
18:15~19:15	Lecture and Q&A: Introduction to ITS Technology and Policy	Associate Professor. SUZUKI, the University of Tokyo
19:30~20:30	Country Report Presentation	Ms. Boukhames, Mr. Rezagui, Eman and Victoria

Presentation Order: Nov 15

Time	Program	Presenter
19:30~19:40	Country Report Presentation by Algeria	Ms. Boukhames
19:40~19:50	Country Report Presentation by Algeria	Mr. Rezagui
19:50~20:00	Country Report Presentation by Egypt	Eman
20:00~20:10	Country Report Presentation by Ghana	Victoria

Presentation Order: Nov 16

Time	Program	Presenter
18:40~18:50	Country Report Presentation by Nigeria	Adebayo
18:50~19:00	Country Report Presentation by Nigeria	Mr. Aruwa and Mr. Mosuro
19:00~19:10	Country Report Presentation by Rwanda	Gonzague
19:10~19:20	Country Report Presentation by Serbia	Olivera
19:20~19:30	Country Report Presentation by Thailand	Amp
19:30~19:40	Country Report Presentation by Uganda	Abel

Self Introduction

Introduction of Participants!

11 participants from 8 countries

Let's introduce yourself!

Introduce yourself in 1 minutes!

- ✓ Full Name and Nickname – How can we call you?
- ✓ Your current jobs in your organization? Your expertise?

We would like to know you more!!

Program Orientation

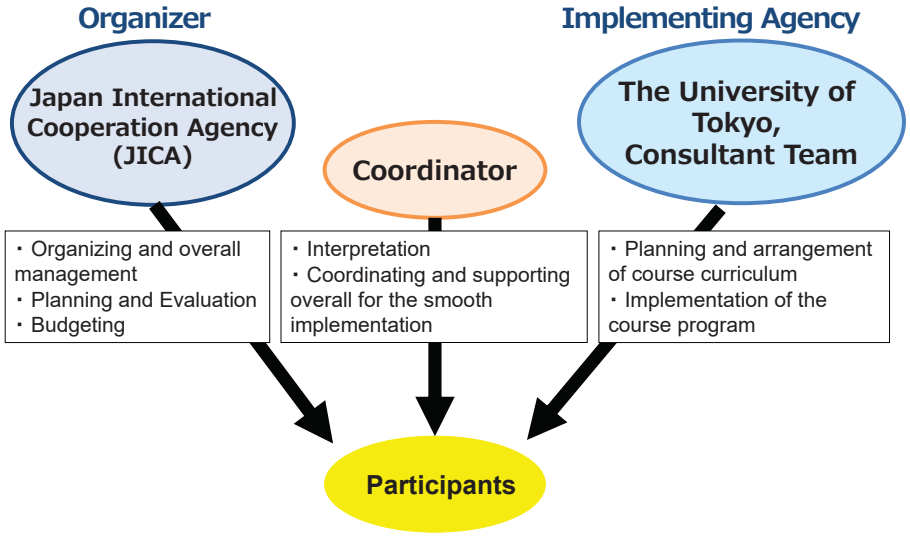
Contents

1. How the program is organized
2. Course information
   (1) Program Objectives
   (2) Schedule
3. Approach for Knowledge Co-Creation

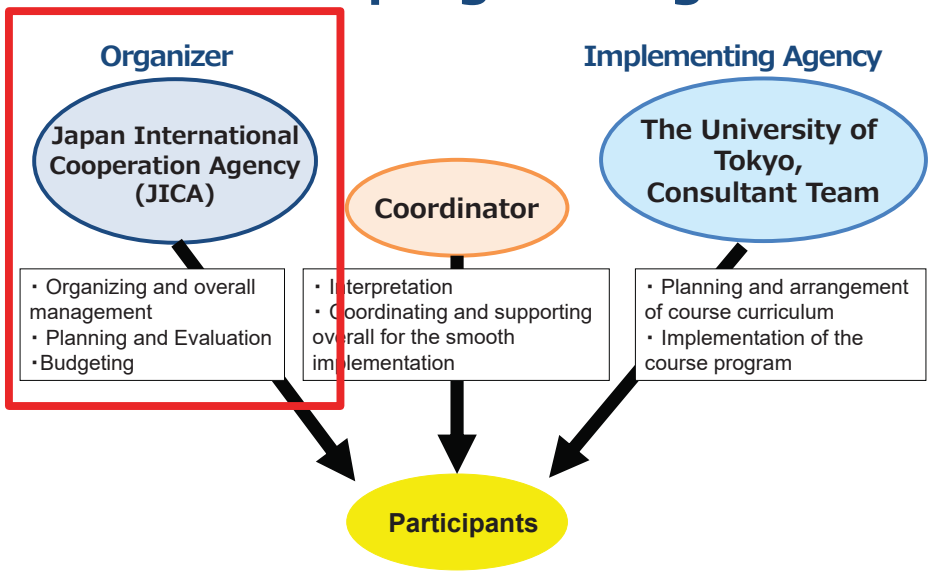
Contents

1. How the program is organized
2. Course information
   (1) Program Objectives
   (2) Schedule
3. Approach for Knowledge Co-Creation

How is this program organized?



How is this program organized?



Organizer:
Japan International Cooperation Agency (JICA)

Mr. MIYAMOTO Ryo
Mr. ITO Ryuichi

- ✓ Overall Management
- ✓ Planning, Evaluation & Monitoring

Personal Introduction…

[redacted]

You can call me

ITO

- ✓ Deputy Director
- ✓ Background: Int'l Law & Int'l Studies
- ✓ Contact: [redacted]

Personal Introduction…

[redacted]

You can call me

Ryo

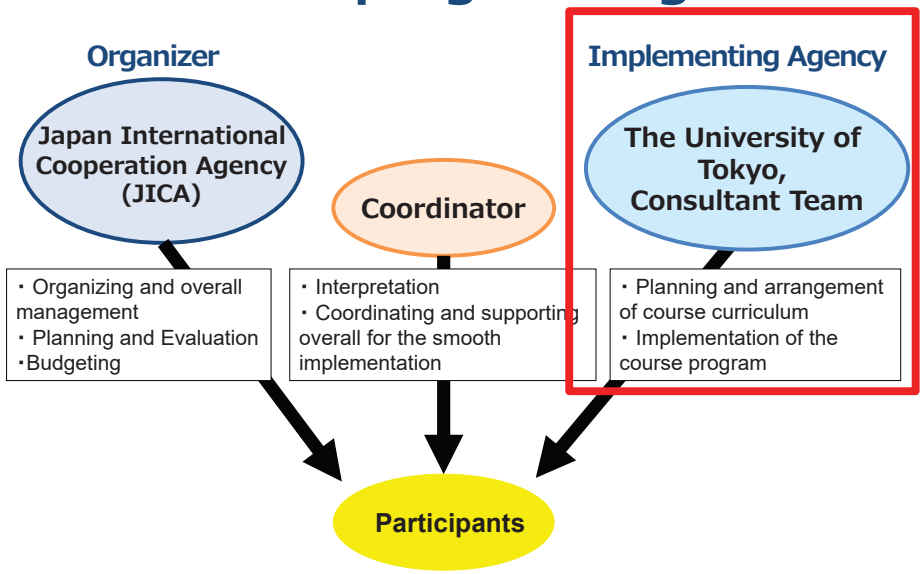
- ✓ Officer
- ✓ Background: Development Economics
- ✓ Contact: [redacted]

Japan International Cooperation Agency

Mr. KAWAHARA, Shuntaro
JICA Senior Advisor

Mr. KOIDE, Tsuyoshi
Transportation Group,
Infrastructure Management Department

How is this program organized?



Implementation Agency:
Advanced Mobility Research Center, the University of Tokyo

Dr. OGUCHI, Takashi
Professor in Mobility Innovation Collaborative Research Organization

Mr. SUZUKI, Shoichi
Associate Professor in Mobility Innovative Collaborative Research Organization

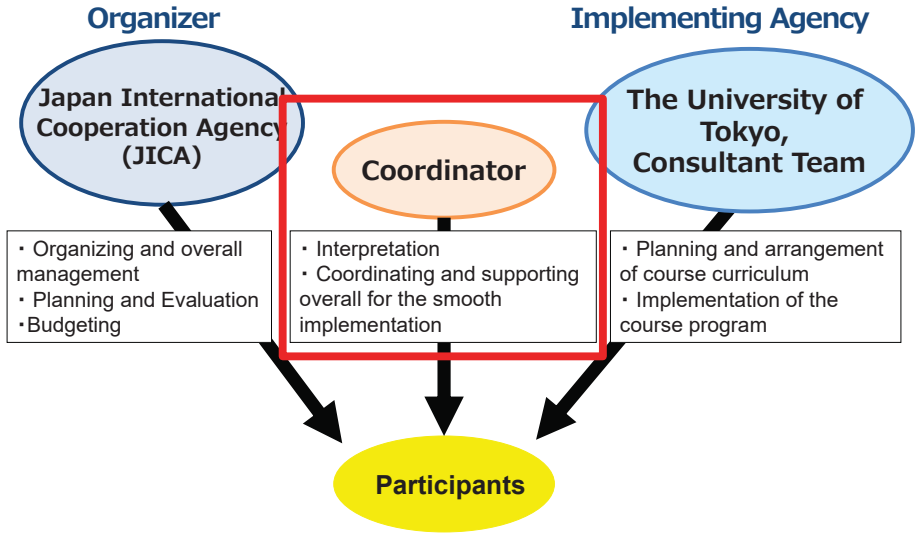
✓Overall management of course contents
✓Technical advice and cooperation

Implementation Agency:
Consultant Team

Mr. TOTANI, Hiroya
Mr. MOCHIZUKI, Atsushi
Mr. TSUJI, Hideo
Mr. ISEKI, Michio
Mr. UNO, Takumi
Mr. TSUBAKI, Koichi
Mr. YOSHIDA, Toshihiro

✓ Overall management of course contents
✓ Technical advice to the program

How is this program organized?



Coordinator

Ms. MINE Tomomi

[redacted]

- ✓ Daily operation and coordination
- ✓ Interpretation (English⇔Japanese)

Contents

Program Objective

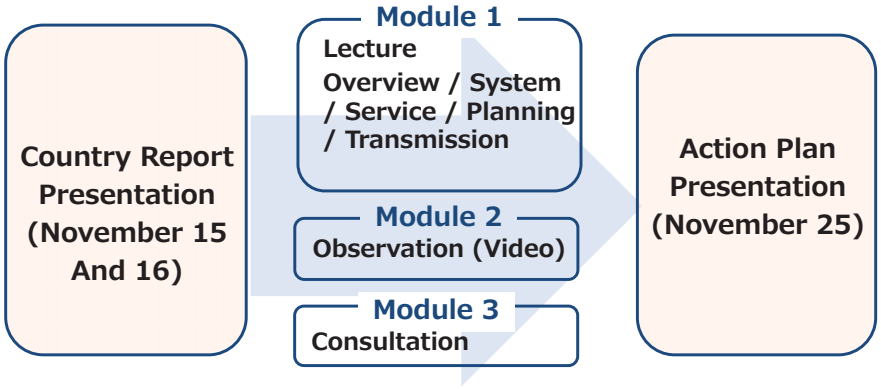
Overall Goal

Formulate a plan to introduce ITS to the participants' organization.

Course Objective

To acquire relevant knowledge to introduce ITS technology in their respective countries.

Program Contents



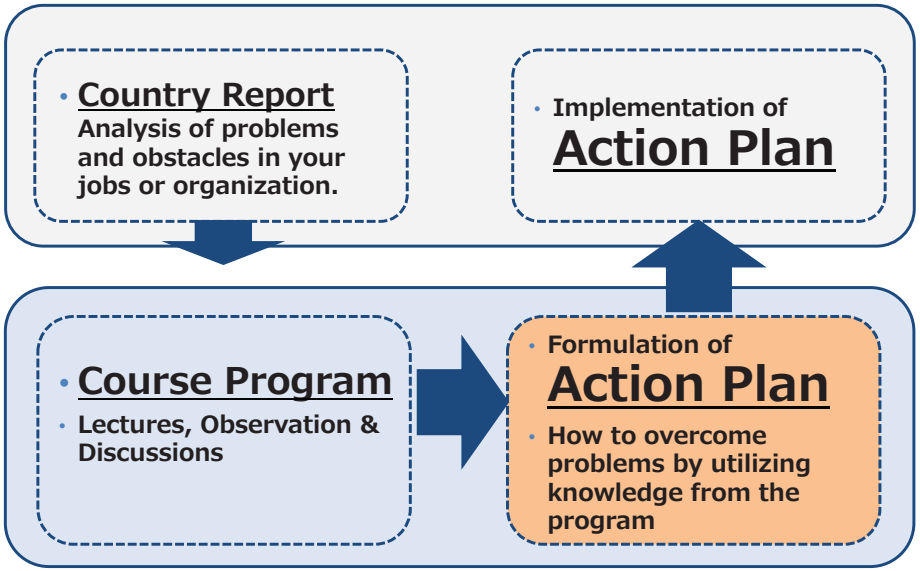
Country Presentation:

Contents to be included

1. To define the issues of ITS, traffic control, etc, that you face in the work. This will be your objectives of the participation in this program and should be led to the Action Plan which proposes the solution to the issues.
2. To share issues and backgrounds with other participants.

- Each country has **5 minutes** for presentation and **5 minutes** for Q&A.

Action Plan



Action Plan Presentation

✓ All the participants will present **Action Plan Presentation** (8 mins for presentation + 5 mins for Q&A) at the end of the program.

✓ Please include **Concrete Idea/Plan to apply your Learning to your country** to tackle the current issues/problems in your country.

Contents to be included

◆Your Learnings from this online program
◆How you would like to apply in your country

✓ **Share your Action Plan with your supervisors** after completion of the program.

Contents

What is Knowledge Co-Creation Program?

Until 2015

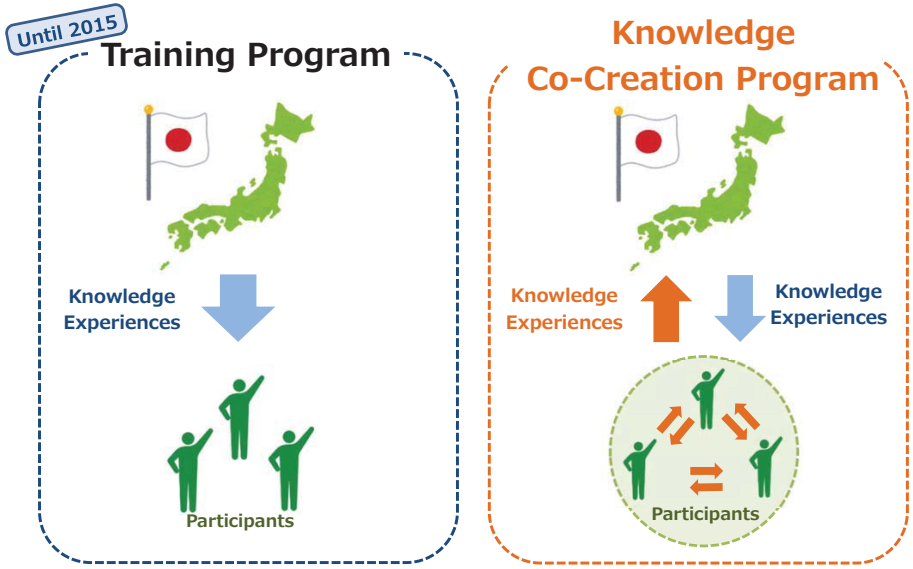
Training Program ⇒ Knowledge Co-Creation Program

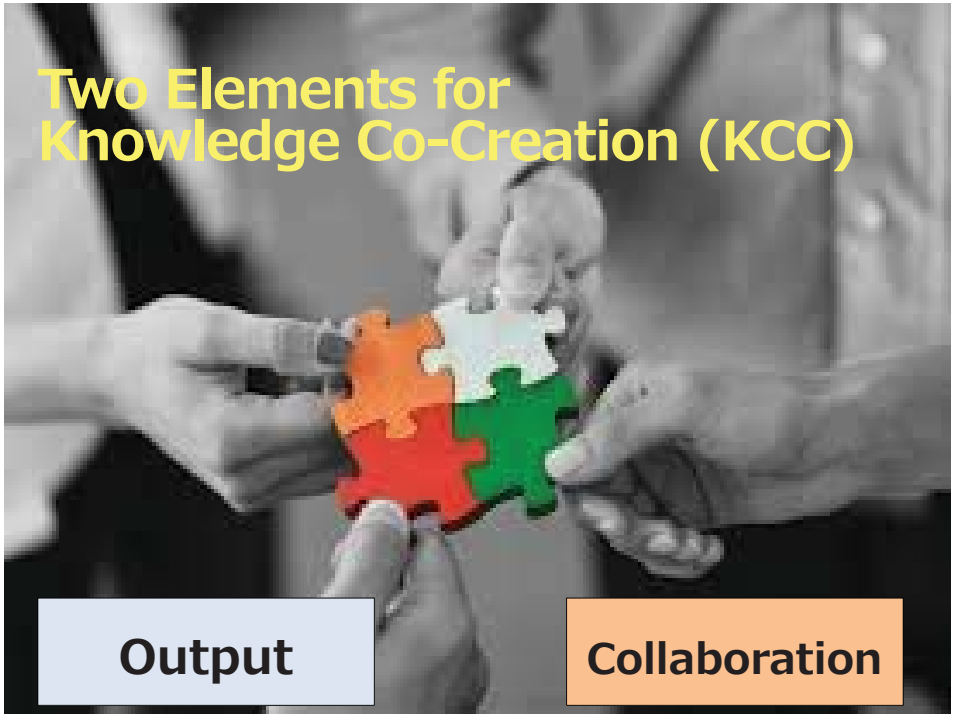
In the Development Cooperation Charter which was released by the Japanese Cabinet on February 2015, it is clearly pointed out that "In its development cooperation, Japan has maintained **the spirit of jointly creating things** that suit partner countries while respecting ownership, intentions and intrinsic characteristics of the country concerned based on a field-oriented approach through dialogue and collaboration.

It has also maintained the approach of building reciprocal relationships with developing countries in which **both sides learn from each other and grow and develop together.**"

We believe that this 'Knowledge Co-Creation Program' will **serve as a center of mutual learning process.**

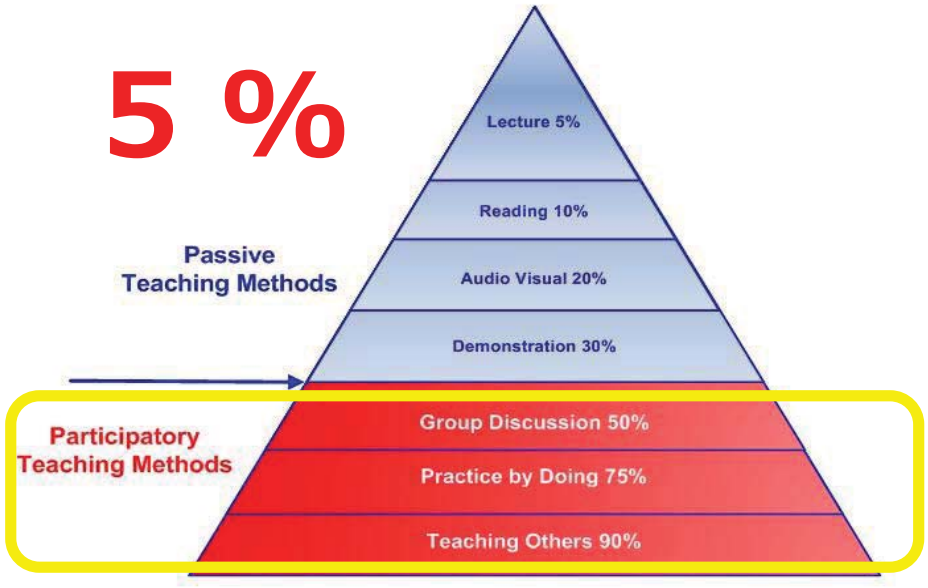
What is Knowledge Co-Creation Program?



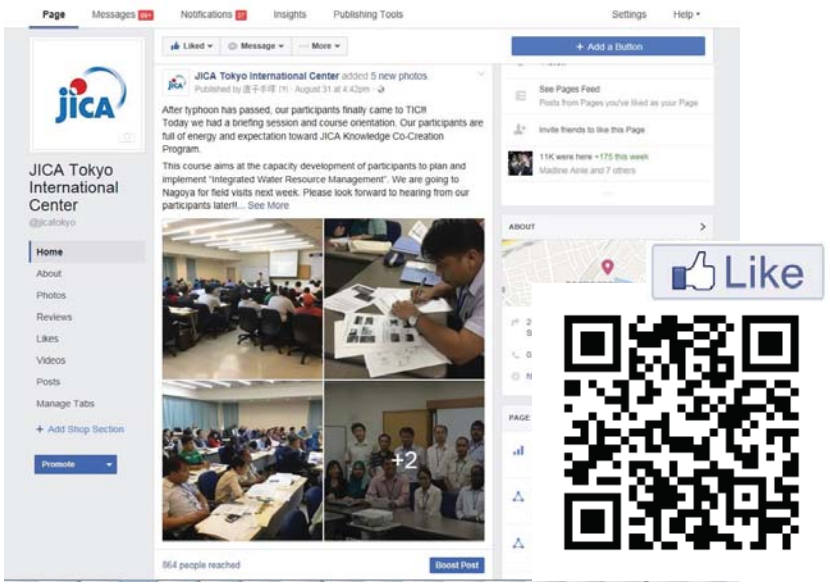


Average Learning Retention Rates

(Source : National Training Laboratories)



Please kindly acknowledge that some pictures taken in the program will be uploaded to JICA Tokyo's Facebook



Other Information

Introduction of JICA's cooperation on ITS

November 15, 2021

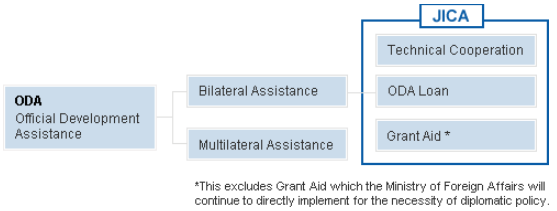
KOIDE Tsuyoshi
Infrastructure Management Dept.,
Japan International Cooperation Agency (JICA)

Contents

1. Introduction of JICA's approach to ITS

About JICA

ODA is broadly divided into bilateral aid, in which assistance is given directly to developing countries, and multilateral aid, which is provided through international organizations. JICA provides bilateral aid in the form of **Technical Cooperation**, Japanese **ODA Loan** and **Grant Aid**.



*This excludes Grant Aid which the Ministry of Foreign Affairs will continue to directly implement for the necessity of diplomatic policy.

Other Types of Assistance
・Citizen Participation (Volunteers, JICA Partnership Program)
・Emergency Disaster Relief

About ITS Development

Support “Your Effort for Sustainability”

Ownership

Strong leadership and ownership by Recipient countries

Growth Oriented

Infrastructure development and private sector development

Capacity Development

New knowledge into recipient countries’ system

ITS is just a tool. Our goal is not to introduce ITS but to support sustainable development using this tool.

Diversity of ITS Development

The strategies, masterplans, applications if ITS could differ country-to-country, city-to-city reflecting their traffic surroundings.

The Strategy of Country/City A

“Taylor-made Approach” is required.

The Strategy of Country/City B

The Strategy of Country/City C

The Strategy of JICA for ITS Introduction

Technical Cooperation

Master Plan
- Experts Dispatching
- Architecture
- Standardization
- Pilot Project

Organization / Capacity Development
- Experts Dispatching
- Technical Cooperation Projects
- Training Course

Grant Aid

Small Scale ITS Projects
- Preparatory Survey
- Installation
- Showcase
- Pilot Project

ODA Loans

ITS Projects
- Preparatory Survey
- Traffic Management
- Signal System
- Public Transport Information
- Toll Collection/ Pricing
- IC card/NFC/DSRC
- Probe Information
- Vehicle Control etc.

2. Examples of ITS Projects supported by JICA

2. Examples of ITS Projects supported by JICA

Solution Menu

1. ITS Master Plan Project
2. Traffic Control System for Expressway
3. Traffic Information Provision
4. Traffic Signal Control
5. Traffic Demand Management (Road Pricing)
6. Traffic Demand Management (Smart Parking)
7. Toll Collection ETC
8. Data collection and Provision (Floating Car Data)
9. Road Operation and Maintenance
10. ITS Seminar

No.1 ITS Master Plan Project
Mega Manila Region Highway Network ITS Integration Project

Project name: Mega Manila Region Highway Network ITS Integration Project

Study Area: The Mega Manila Region
(i.e., National Capital Region, Region III and Region IV-A).

Counterpart:

DPWH (Department of Public Works and Highways)

MMDA (Metropolitan Manila Development Authority)

Execution Period: From July 2012 to July 2013

Consultant: JICA Study Team (CTI, OC, MEX, MRI)

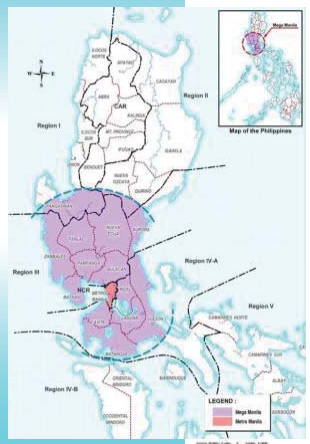
Background:

The government needs to urgently mitigate traffic congestion by maximizing utilization of existing transport facilities

- ➢All possible ITS Technologies to be implemented
- ➢Software Solutions

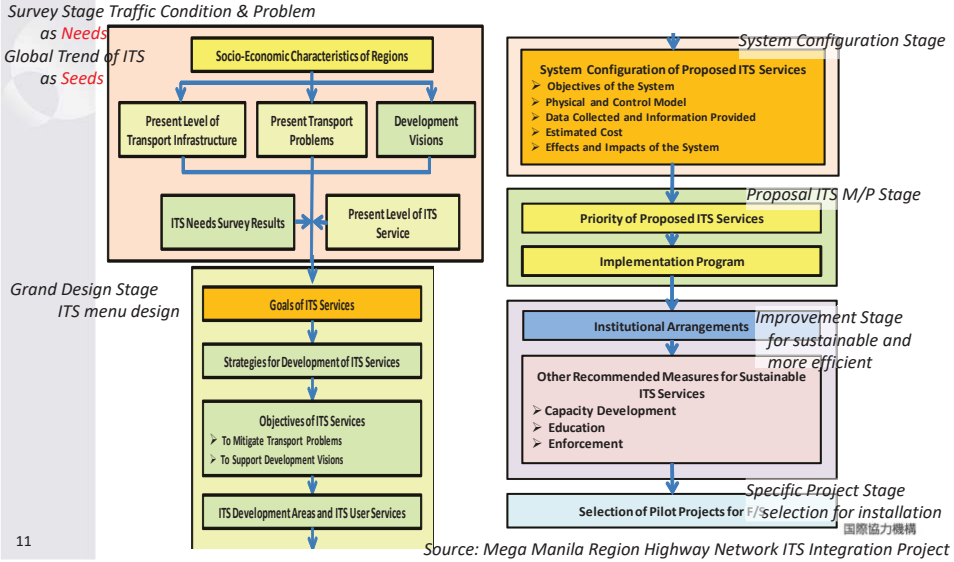
Objective of the study:

- To formulate master plan to introduce ITS in the Mega Manila Region
- To formulate short, medium, and long term ITS deployment plans



No.1 ITS Master Plan Project
Mega Manila Region Highway Network ITS Integration Project

Preparation for ITS Master Plan (Formulation Procedure)

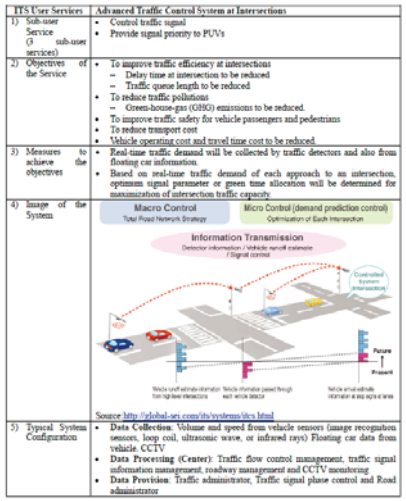


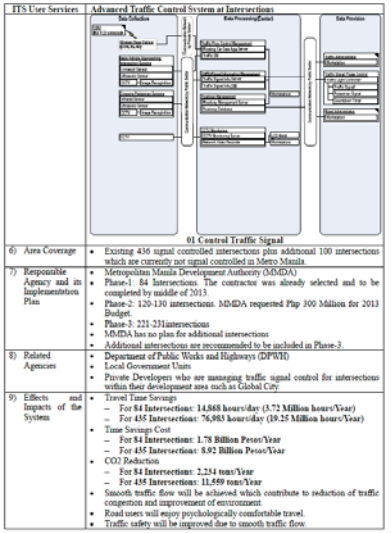
Source: Mega Manila Region Highway Network ITS Integration Project

No.1 ITS Master Plan Project
Mega Manila Region Highway Network ITS Integration Project

Establishment of ITS Master Plan - System Configuration

➢ Chart of ITS User Service (Sample)





Source: Mega Manila Region Highway Network ITS Integration Project

No.2 Traffic Control System for Expressway
The Project for Development of Traffic Control System for Expressway in Hanoi

Project name: The Project for Development of Traffic Control System for Expressway in Hanoi

Project Area: Hanoi
Ring Road No. 3 and (bypass road), National Higyway-1
(49 km between "*Phap Van* " and "*Vuc Von*")

Owner: Vietnam Expressway Corporation (Abbrev."VEC")

Schedule:【Bid day】4 Mar. 2013【Contract】 13 Mar. 2013

Contract Period: until 31 May 2014 (initial contract period until 15 Dec. 2013)

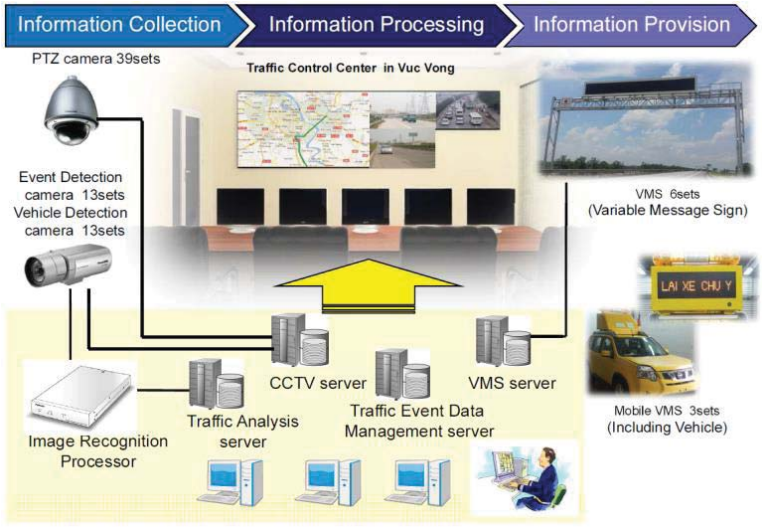
Contractor: Panasonic Corporation

Fund : Grant from JICA *Budget* : 527 million yen

Objective and Overview:
This Grant Aid Project was intended to support traffic control by collecting incident information by monitoring traffic by road-side detector, delivery of traffic information to road users by introduction of traffic control system along the priority sections on the expressways in the Hanoi metropolitan area.

System Configuration:
・Installation od roadside equipment (CCTV, Vehicle Detection, VMS), optical fiber cable, and data processing and conrol units in the traffic management center.

No.2 Traffic Control System for Expressway
The Project for Development of Traffic Control System for Expressway in Hanoi



No.2 Traffic Control System for Expressway
The Project for Development of Traffic Control System for Expressway in Hanoi


VMS （Length:Approx.10m）

Mobile VMS


Traffic Control Center

No.3 Traffic Information Provision
Implementation of Intelligent Transportation System in the City of Ahmedabad, India

Project name: Implementation of Intelligent Transportation System in the City of Ahmedabad, India

Project Area : Ahmedabad, India

Executing Organization : Zero-Sum ITS Solutions India Private Limited (service provider) / Ahmedabad Municipal Corporation / Ahmedabad Traffic Police

Fund: JICA Technical Cooperation to support private sector participation

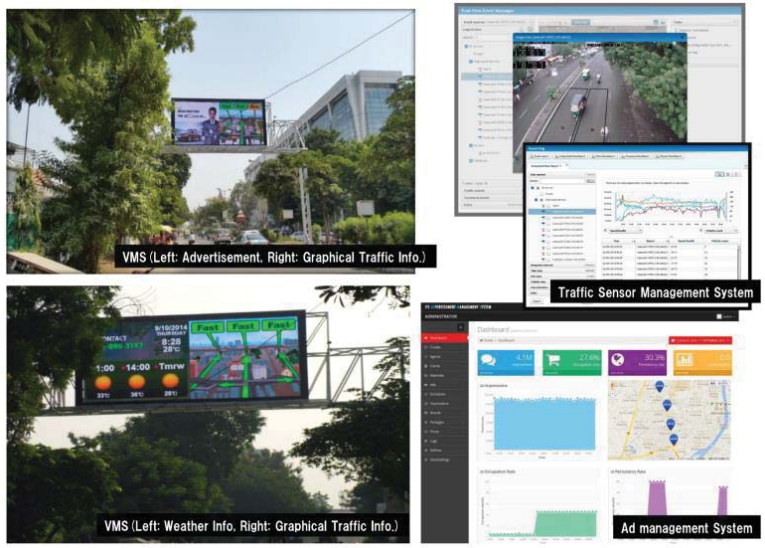
Initial Investment(JICA Fund) / Operating Costs: 100 million yen / PPP based advertisement fee

Execution Period: From November 2013 to June 2015

Objectives and Overview:
This project introduced ITS Solution, in which the real-time congestion information is transmitted to variable message sign boards and drivers' smart phones, utilizing traffic data collected by roadside camera sensors detecting traffic volume.
・Drivers can avoid congested routes by means of traffic information and the Ahmedabad Municipal Corporation can optimize usage of existing roads.
・Traffic Police officers can also send real-time information to variable message sign boards from its traffic control center when traffic incidents such as accidents occur.
・This project demonstrated that the sale of advertisement space on variable message sign boards covers the ITS Solution's maintenance cost.

No. 3 Traffic Information Provision

Implementation of Intelligent Transportation System in the City of Ahmedaba, India



Source: Zero-Sum, Ltd. Japan, Zero-Sum ITS Solutions India Pvt. Ltd.

No. 4 Traffic Signal Control

The Project for Development of Traffic Management System in Phnom Penh

Project name: The Project for Development of Traffic Management System in Phnom Penh

Project Area: Phnom Penh Capital City / Kingdom of Cambodia

Owner: The Kingdom of Cambodia Phnom Penh Capital City
Department of Public Works and Transport

Fund: Grants-in-aid project by JICA

Grant limit: 1.7 billion yen

Execution Period: From December 2015（On-going）

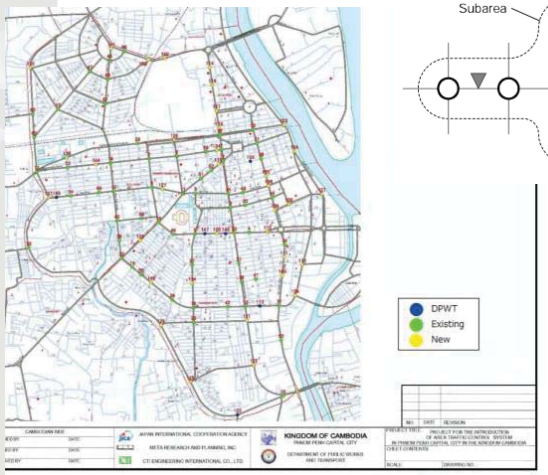
Cotractor: Sumitomo Electric Industries, Ltd. /Mitsubishi Corporation

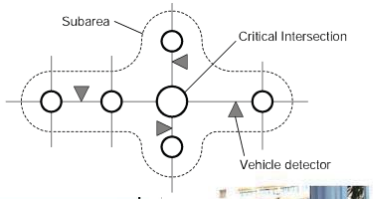
Objectives and Overview:
This Grant Aid Project is planned to mitigate traffic congestion by installing:
・New traffic signals and detectors at selected 100 intersections in Phnom Penh;
・Optical fiber cable for data transmission connecting signals and the traffic control center; and
・A central signal control unit at traffic control center.

Source: JICA THE PREPARATORY SURVEY FOR PROJECT OF DEVELOPMENT OF TRAFFIC MANAGEMENT SYSTEM IN PHNOM PENH PREPARATORY SURVEY REPORT

No.4 Traffic Signal Control

The Project for Development of Traffic Management System in Phnom Penh





Source: THE PREPARATORY SURVEY FOR PROJECT OF DEVELOPMENT OF TRAFFIC MANAGEMENT SYSTEM IN PHNOM PENH

Source: Sumitomo Electric Industries, Ltd

No.6 Traffic Demand Management (Smart Parking)

The Project on Traffic Demand Management of Historical Area in Istanbul

Project name: The Project on Traffic Demand Management of Historical Area in Istanbul

Study Area: Istanbul, Republic of Turkey

Counterpart: Directorate of Transportation Planning etc., Istanbul City Government

Scheme: Technical Cooperation (social experiment)

Execution Period: From January 2013 to February 2013

Consultant: Almec corporation, Padeco Co., Ltd.

Objectives and Overview:
"Reducing traffic congestion in the former Eminönü district" through increasing parking utilization around the area and enhancing access to the parking lots

・Introduction of parking information service by a website, cellular phones, and roadside information boards
(Five parking lots were targeted around the Vatan Street crossing the central area of Fatih Municipality, see Figure 1)
・ Operation of shuttle buses service connecting parking lots and sight seeing spots

Source: Traffic Demand Management of Historical Area in Istanbul (iSTDM) Final Report: Vol.1

No.6 Traffic Demand Management (Smart Parking)

The Project on Traffic Demand Management of Historical Area in Istanbul

Figure 1: Target Parking Lots of the Smart Parking System (SPS) Social Experiment

Figure 2: Basic Concept of the Smart Parking System (SPS)

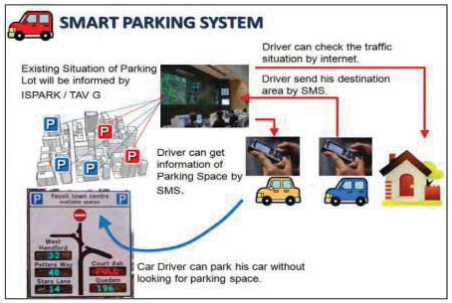


Figure 3: Parking Information Service by Cellular Phones

Figure 4: Parking Information Service by Information Boards

Source: Traffic Demand Management of Historical Area in Istanbul (iSTDM) Final Report: Vol.1

No.9 Highway structure monitoring and maintenance

Implementation of Bridge Monitoring System（BRIMOS）in Vietnam

Project name: Implementation of Bridge Monitoring System（BRIMOS）in Vietnam

Project Area: Can Tho, Vietnam

Owner: Ministry of Transportation

Manufacturer: NTT DATA Corporation

Objectives and Overview :

- The Cau Tho Bridge is a cable stayed bridge newly developed by Japanese yen loan in the Mekong Delta basin, where very soft soil is widely distributed.
- Many heavy cargo vehicles, some of which are overloaded, pass through the bridge.
- As the highway administrator is afraid of deterioration accelerated by overloaded cargo vehicles, it decided to equip the bridge with monitoring system call BRIMOS composed of various sensors to collect comprehensive data of: weather; traffic volume; and displacement and acceleration of various bridge members.
- The collected data are reviewed to check healthiness and safety of the bridge. And preventive maintenance plan of the bridge is to be prepared according to daily collected big data.

Source: NTT DATA Corporation http://www.nttdata.com/global/en/services/bds/case/casestudy-01.html

No.9 Highway strucure monitoring and maintenance

Implementation of Bridge Monitoring System（BRIMOS）in Vietnam

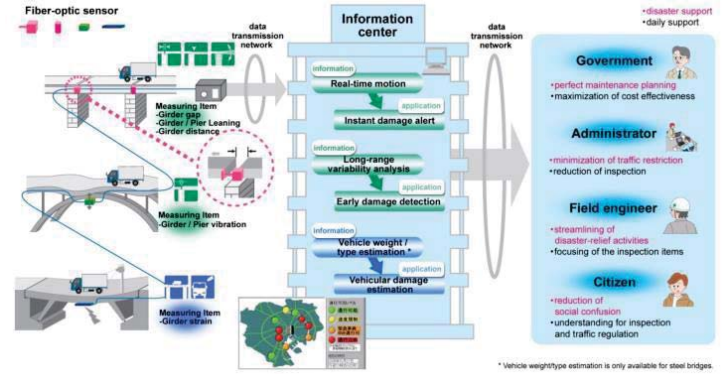


Fig.1. Automatic Real time Bridge Monitoring System

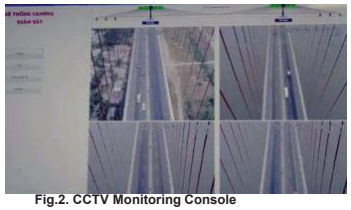


Fig.2. CCTV Monitoring Console

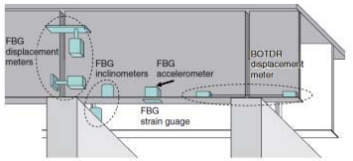


Fig. 3. Sensor attachment examples.

Source: NTT DATA http://www.nttdata.com/global/en/index.html

No.10 ITS Seminar

Seminar on ITS Menu based on Traffic Problem in Zambia

Overview:

・Based on the Urban Development Plan cooperated by JICA in 2009, development of Lusaka City is underway. Traffic congestion and traffic accident are gradually worse than ever. Therefore, JICA's consultant team were dispatched, review traffic situation and possibility of ITS, and held ITS seminar to introduce ITS technology and mitigate traffic issues.

Programs:

・Overview traffic problems in Lusaka City, Zambia

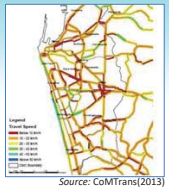
・Introduce: ITS to reduce traffic accident; coordinated traffic signal control; traffic monitoring and management such as information provision; and so on.

No.10 ITS Seminar

Seminar on Potential Needs and Promotion of ITS in Sri Lanka

Overview:

・JICA's consultants team tried to understand real traffic problems and the existing ITS development conditions in Sri Lanka. Also they found out the potential needs on ITS from Japanese Experts' viewpoints. Then JICA held ITS seminar to disseminate knowledge of ITS technologies etc.



Source: CoMTrans(2013)

Programs:

・Potential Needs on ITS
・Promotion of utilization of traffic and transportation Data
・ITS Solution to improve public transportation
・Effective provision of traffic information
・Promoting sage mobility through the cross-sector collaboration and so on



Thank you !

JICA Library
http://libopac.jica.go.jp/top/index.do?method=change&langMode=ENG

Introduction to ITS

Lecture & Q&A
Day2 Nov. 15, 2021

Dr./P.E.Jp SUZUKI Shoichi
Associate Professor, Institute of Industrial Science,
University of Tokyo

JICA Online Knowledge Co-Creation Program
"Practical Technology on Intelligent Transport Systems(ITS)"

Self introduction

Qualification & Education:
- Dr. Eng. Kyoto Univ.(2016)
- Professional Engineer of Japan (Road Eng.)(2014)
- M.Eng. (Civil Engineering), Kyoto Univ.(2000)

Professional Experience:
- 2021. University of Tokyo
- 2019. MLIT HQs (International Affairs Office, Road Bureau)
- 2018. MLIT Kyushu Regional Bureau
- 2016. MLIT Miyazaki Branch Office
- 2010. National Institute for Land and Infrastructure Management(ITS division)
- 2007. Ministry of Foreign Affairs (Embassy in Malaysia)
- 2000. Ministry of Construction (Reformed to MLIT in 2001)

Contents

Challenges

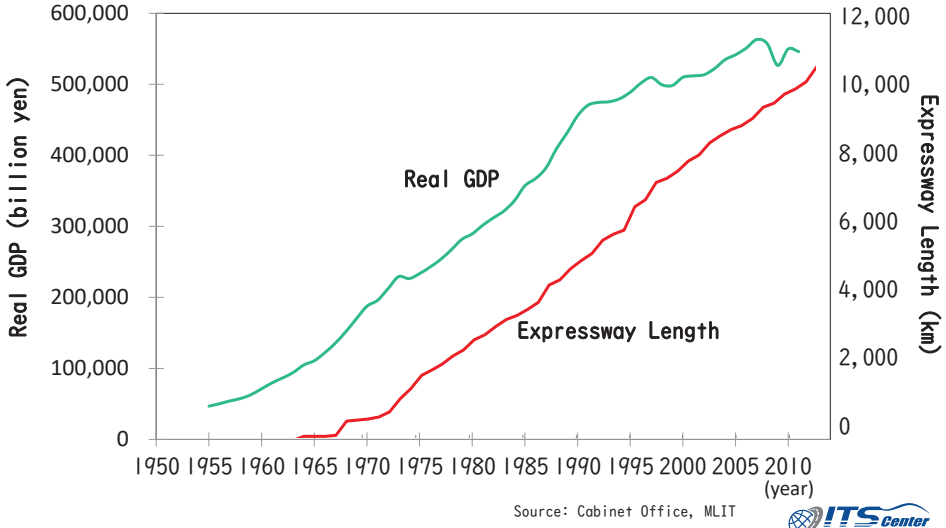
●Definition of ITS

'Intelligent Transport Systems' or 'ITS' means systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport;

Source :

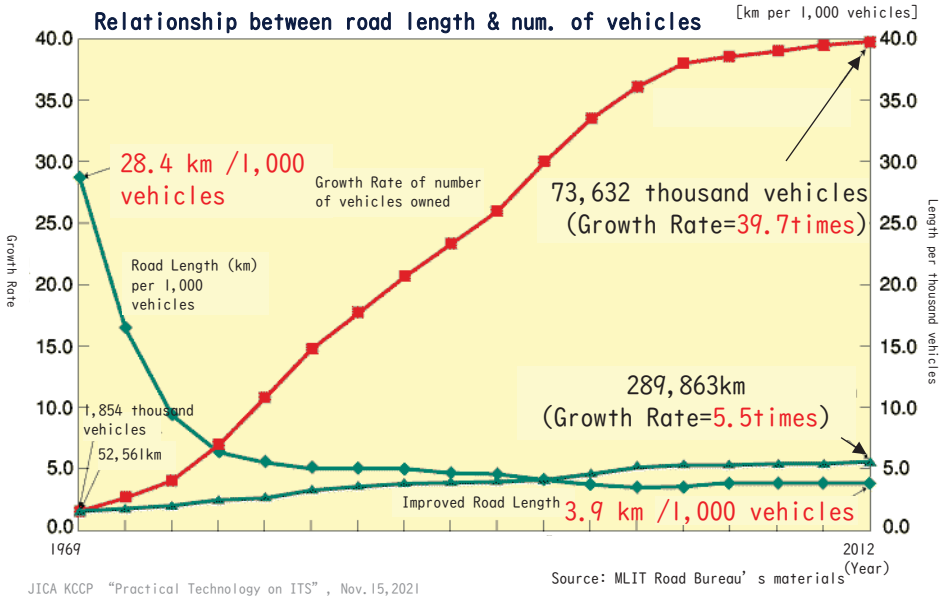
DIRECTIVE 2010/40/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport, Article 4 (1)

Relationship between real GDP and expressway length



Source: Cabinet Office, MLIT

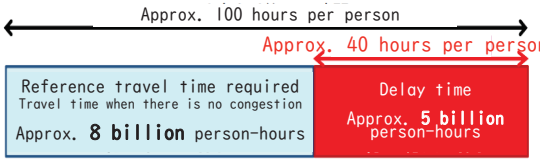
Relationship between road length & num. of vehicles



Source: MLIT Road Bureau's materials

- Situation of Traffic Congestion in Japan

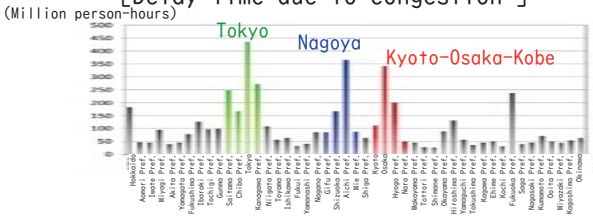
- Each person delays approx. **40 hours per year** due to traffic congestion. This is equivalent to approx. **40% of the time** spent in the vehicle.
- Congestion delay time is **concentrated in the metropolitan areas.**



Delay due to congestion in major cities in Europe and U.S. amounts to approx. **20% of travel time**

Source: TomTom Americas Traffic Index
TomTom European Traffic Index

[Delay time due to congestion]



- Congestion in urban area is worldwide challenges

Top10 Congested Cities in 2019

Rank	City	Country	Congestion Lv.
1	Bengaluru	India	71% (-)
2	Manila	Philippines	71% (-)
3	Bogota	Colombia	68% (↑5%p)
4	Mumbai	India	65% (0%p)
5	Pune	India	59% (-)
6	Moscow	Russia	59% (↑3%p)
7	Lima	Peru	57% (↓1%p)
8	New Delhi	India	56% (↓2%p)
9	Istanbul	Turkey	55% (↑2%p)
10	Jakarta	Indonesia	53% (0%p)

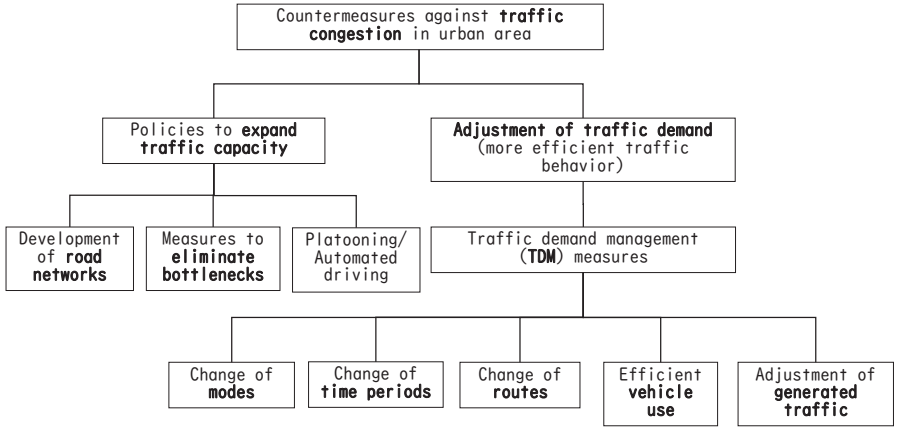
Ex.
It takes additional 21mins due to congestions in Bengaluru when you take 30mins-drive.

Source: TomTom Traffic Index 2019
https://www.tomtom.com/en_gb/traffic-index/ranking/

Challenges

Traffic congestion

●Countermeasures against Traffic Congestion



Challenges

Road safety

- The number of annual road traffic deaths = 1.35 million
- Road traffic injuries are now the leading killer of people aged 5-29 years.
- WHO predicts that road traffic injuries will rise to become the fifth leading cause of death by 2030

Source: Global status report on road safety 2018 (https://www.who.int/publications/i/item/9789241565684)

Challenges

Road safety

●Rates of road traffic death per population differ from regions.

Challenges

Road safety

- "Global Plan for the Decade of Action for Road Safety" (UN-WHO) set the target reducing fatalities and casualties by 50%

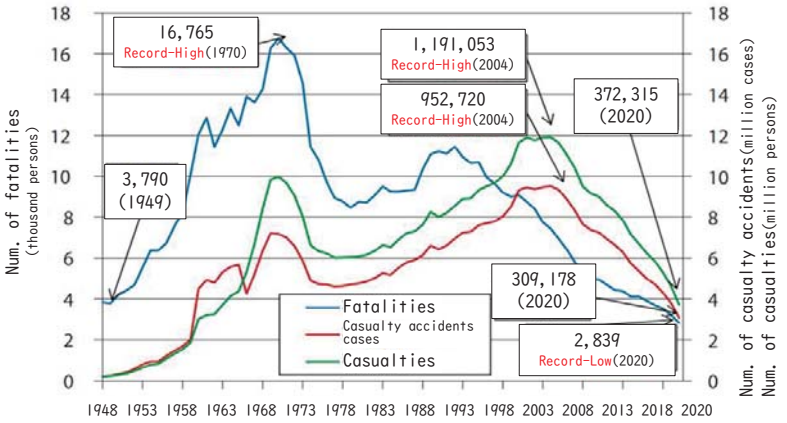
●5 pillars

① Road safety management
② Safer roads and mobility
③ Safer vehicles
④ Safer road users
⑤ Post-crash response

Challenges

Road safety

●Trend of casualty accidents and fatalities in Japan

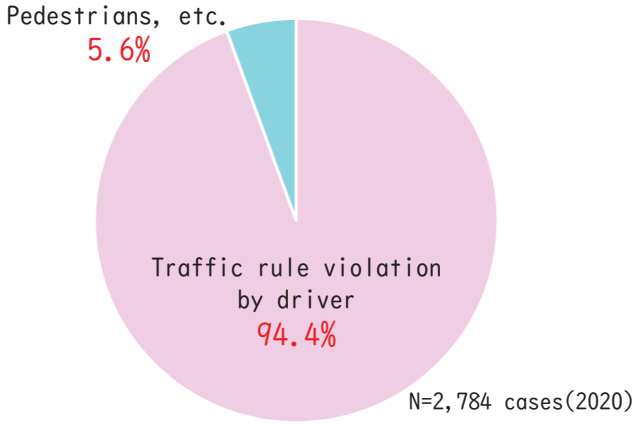


Source: MLIT website

Challenges

Road safety

Cause of fatal accidents

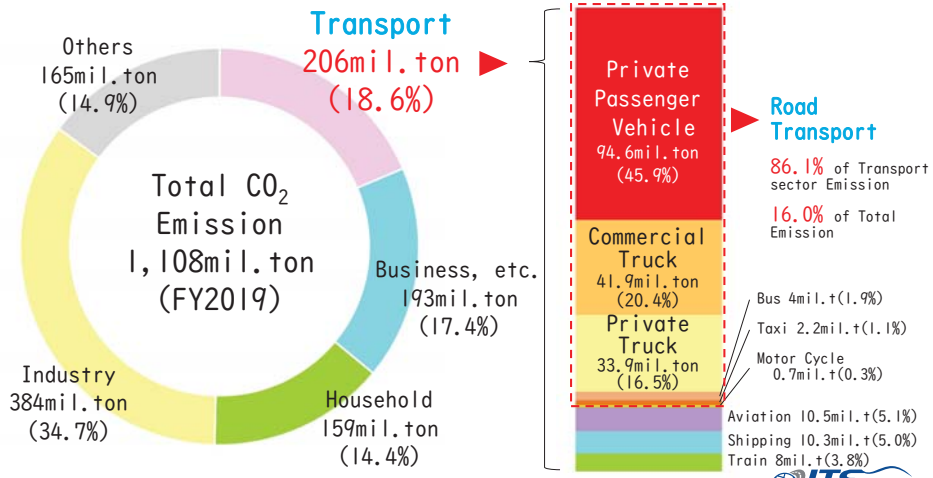


Source: MLIT website

Challenges

Carbon neutral

●16% of CO_2 emissions in Japan is from Road Transport



Challenges

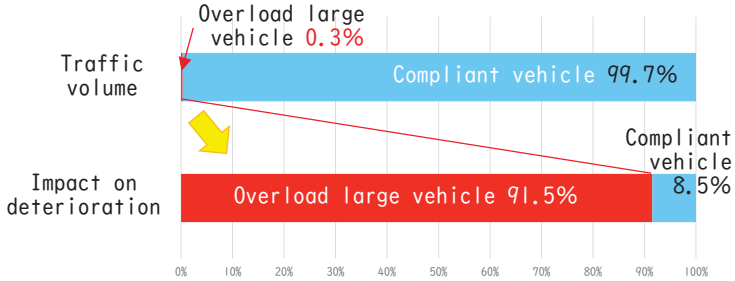
Carbon neutral

●Unit-CO_2 emission of private road transport is relatively high compared to other transport mode

●Modal mix/shift is necessary towards carbon neutral

Challenges

- The effect on the deterioration of RC floor slab of road bridges is proportional to the 12th power of weight.
- The impact of a 20-ton axle load vehicle is equivalent to about 4,000 vehicles with a 10-ton axle load.



Source: MLIT

Challenges

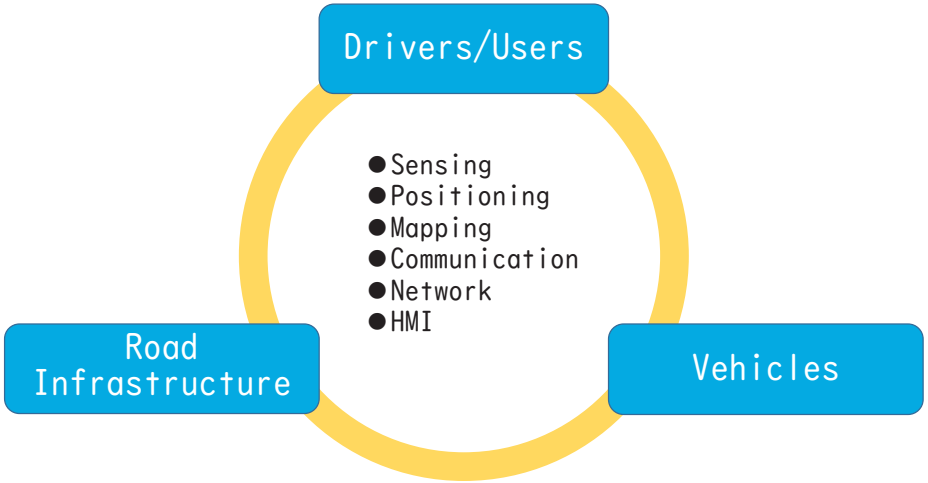
- The number of bridges older than 50 years will account for 43% of all bridges in 2023 and 67% in 2033, respectively in Japan.

Challenges

- Weigh Station
  - Drivers are told to pull over at "instruction stations," where vehicle weights and sizes are measured.
  - If the vehicle exceeds the size or weight limits, the drivers are ordered or warned to reduce the weight and size of the vehicle by splitting the cargo.

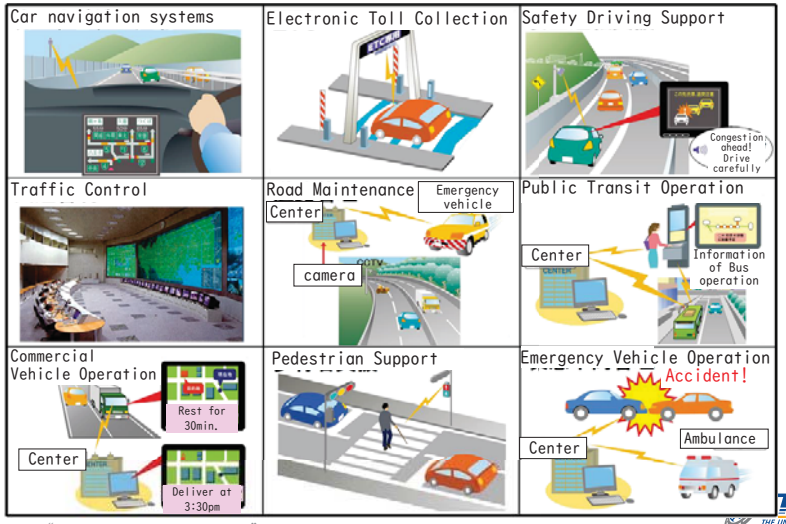
Contents

Fundamental technologies of ITS



Typical Applications

- 9 development fields in ITS in Japan (1996)



Source: MLIT materials

Contents

Points to note

Stakeholders

- Stakeholders/Role of public sectors/Cooperative & Competitive areas
  - Public & Private
  - Users, Operator, Manufacturers, Regulator, Third party
  - Ministries & Lows
  - Competitors & Collaborators
  - International & Internal standards/customs
- Ex. ETC service in Japan

Points to note

Jurisdiction

●List of relevant Ministries in Japan

Relevant Ministries		ITS-Related Policy	Governing Law, etc.
National Police Agency (NPA)		Traffic policy	**Road Traffic Law** Law established to prevent dangers on the road and ensure safe and smooth transport
Ministry of Internal Affairs and Communications (MIC)		ICT policy	**Radio Act** Law established to ensure fair and efficient use of radio waves and promote the public welfare
Ministry of Economy, Trade and Industry (METI)		Industrial policy	-
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	Road Bureau	Road operation policy	**Road Law**
	Road Transport Bureau	Vehicle safety policy	**Road Trucking Vehicle Law** Standards for Security of Road Transport Vehicles : Standards for ensuring vehicle safety and environmental preservation

Points to note

Regulation, etc.

●Regulation/Law and Standard

Convention/ Treaty
- e.g.) 1949 Geneva and 1968 Vienna Convention on Road Traffic
- Discussed by international organization (such as "United Nations Economic Commission for Europe (UNECE)")

Regulation / Law
- Driven by **government** (National/ Local)
- Enforceable
- e.g.)
  - Vehicle Safety Regulation → **Road Transportation Law**
  - Traffic control (incl. traffic signals, traffic signs) → **Road Traffic Law**
  - Road operation (Incl. toll collection) → **Road Law**

Standard
- Driven by **industry** (supported by government)
- Unenforceable
- Ex. of Standardization Organization;
  - **ISO** (International Standardization Organization)
  - **SAE** (Society of Automobile Engineering) [U.S.]
  - **CEN** (European Committee for Standardization) [Europe]
  - **ETSI** (European Telecommunications Standards Institute) [Europe]
  - **ARIB** (Association of Radio Industries and Businesses) [Japan]

Points to note

Vision, etc.

●Vision, Master plan, Architecture
- Ex. Public-Private ITS Initiative/Roadmaps 2020

Points to note

Funding & Products cycle

●Funding
- Capital cost vs Operational Cost
- Traffic volume forecast/maintenance cost/competitor
- Responsibility decomposition
- International vs internal procurement

●Products cycle of ITS components
- Road infrastructure
- Vehicle
- Devices
- Communication technologies & equipment

Summary

- **Challenges**
  - Traffic congestion
  - Road safety
  - Carbon neutral
  - Road maintenance

- **Technologies and applications of ITS**

- **Points to note for practical ITS implementation**
  - Stakeholders
  - Role of public sector(Policy, Jurisdiction, regulation)
  - Cooperative and competitive areas
  - Vision, Master plan, Architecture
  - Funding(capex & opex)
  - Products cycle

Fundamentals of Traffic Engineering & Traffic Management

Prof. Takashi OGUCHI

Institution of Industrial Science (**IIS**) &

Mobility Innovation Collaborative Research Organization (**UTmobI**)

the University of Tokyo (**UTokyo**)

2021年度巻末資料—188

Agenda

Self Introduction

1. Quiz
2. Traffic demand concentration
3. Traffic Flow fundamentals
4. Definition of "Traffic Congestion" and shock wave analysis
5. Traffic signal control; urban road network management
6. Example ITS measures

Institution: the University of Tokyo (**UTokyo**)

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

- 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**)
- ...

as of April, 2019

Institute of Industrial Science (**IIS**)

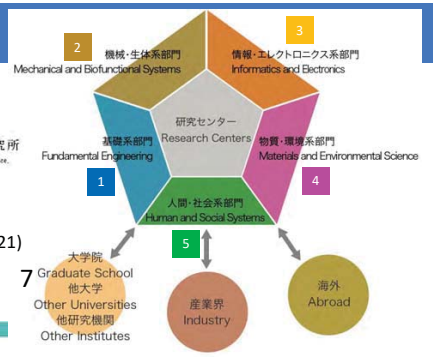
http://www.iis.u-tokyo.ac.jp/en/

62 Profs, 44 Assoc. Profs, Lecturers

37 Project PP/PAP/PL & 10 VP

(as of July 16, 2021)

3 UTokyo IIS Research Centers, and
7 IIS Research Centers (incl. ITS Center)



Advanced Mobility Research Center (**ITS Center**)

Human/Infra/Vehicles + Field-fusion + Gov./Ind./Aca. collabo + Mode fusion

Creation of Mobility Soc. with Soc. Innov.
Novel field for Soc. Implementation.

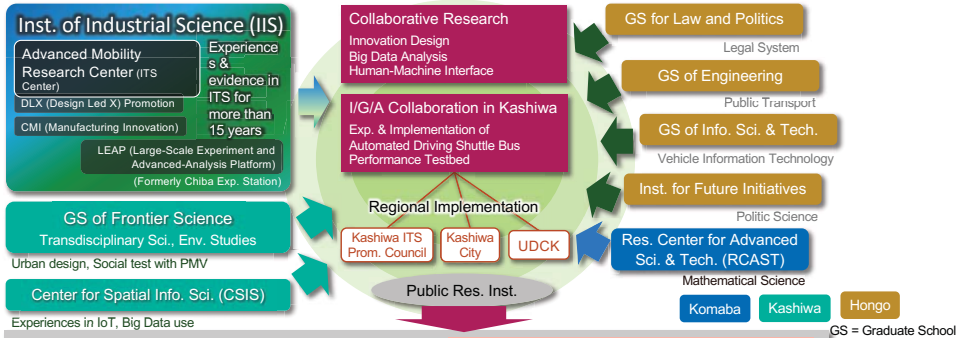
History
Apr. 2003 Sustanable ITS Project
Mar. 2005 ITS collaborative center
Apr. 2009 ITS Center established
Apr. 2014 ITS Center (2nd phase)
Apr. 2019 ITS Center (3rd phase)

Director: Prof. T. Oguchi (Human & Social Sys.)
3rd phase ITS Center was started in March 2014 to increase involvement of members in all Dep. of IIS, UToyo; 7 regular, 9 cooperating faculty memers and 2 visiting professors. In addition, the center leads the "Mobility Innovation Cooperative Research Center in UTokyo (**UTmobI**)" established in July 2018.

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

University level cross-faculty organization

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



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

ITS Center: Regular/Cooperating Members as of July 1, 2021

Name	Position	†	Speciality	
T. Oguchi	Director, Prof.	◎	Traffic Mang. & Control	5
K. Nakano	Deputy Director, Prof.	◎	Mech. Bio. Sys. Control	2
Y. Suda	**Director of UTmobI**, Prof.	◎	Dynamic Sys. & Control	2
M. Ogura	Prof.		Env. Catalyses & Mat. Sci.	4
S. Sakamoto	Prof.		Env. Acoustic Eng.	5
T. Shimura	Prof.		Nonlinear Optics & Info. Opt.	1
M. Takamiya	Prof.		Integrated Power Mang.	3
M. Toyoda	Prof.		Interactive Data Anls.	3
N. Yoshikawa	Prof.		Multi-scale Solid Mech.	1
T. Hiraoka	Project Prof.		Human-Machine Systems	2
H. Amano	Visiting Prof.	○	ADAS & Traff. Info. Sys.	5
M. Kamata	Visiting Prof.	○	Mobility & Automotive Eng.	2
S. Kamijo	Assoc. Prof.		Applied Multimedia Info. Proc.	3
S. Sugiura	Assoc. Prof.		Wireless Communication Network	3
S. Suzuki	Assoc. Prof.	◎	Transport Policy	5
Y. Honma	Assoc. Prof.		Urban Env. Math. Eng.	5
Y. Yamakawa	Assoc. Prof.	◎	High-speed Flexible Robotics	2
S. Ono	Prof. Assoc. Prof.	◎	Spaciotemporal Mob. Info.	2

Name	Position	†	Speciality
A. Toriumi	Res. Assoc.	◎	Traffic Eng.
K. Hata	Res. Assoc.		Power Electronics
M. Hirano	Res. Assoc.	◎	Hi-speed visual Info. Proc.
B. Yang	Res. Assoc.	◎	ADAS
J.-S. Gwak	Proj. Res. A.	◎	Human Factors
K. Shimono	Proj. Res. A.	◎	Mechanical Dynamics & Contrl.
S.-P. Lin	Proj. Res. A.	◎	Railway Sys. Eng. & Veh. Dyn.
T. Uchimura	Pr. Researcher	◎	Int'l Cooperation in AV Tech.
M. Umeda	Pr. Researcher	◎	Int'l Cooperation in AV Tech.
K. Kouno	Pr. Researcher	◎	Quasi-Electrostatic Eng.
Y. Hasegawa	Pr. Researcher	◎	PMV, Impact Assessment of AV
K. Iwasaki	Senior Coop.		Urban Planning
M. Satoh	Senior Coop.		Corperate Legal Advisor
T. Tanaka	Senior. Coop.		Industry-Academia Coop.
Name	**Position**	**†**	
S. Shiotani	Assis. Clerk	◎	
Y. Yamada	Assis. Clerk	◎	

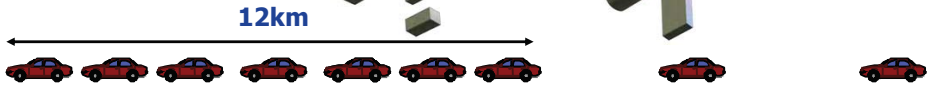
1 Fundamental Eng. 2 Mech. & Biofunc. 3 Info. & Electronics 4 Materials & Env. 5 Human & Social Sys.

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

Agenda

Self Introduction
1. Quiz
2. Traffic demand concentration
3. Traffic Flow fundamentals
4. Definition of "Traffic Congestion" and shock wave analysis
5. Traffic signal control; urban road network management
6. Example ITS measures

Quiz ! Part 1



- Assume recursive daily morning inbound urban expressway
- Congestion **starts at 7am** at the junction to inner core ring road
- **Until 9am**, the congestion forms **12km**

➔ Q. How much larger the traffic demand than the capacity during the two hours (**7am** to **9am**)?

Answer:

(a) twice

(b) 10 times

(c) 1.2 times

Quiz ! Part 2

- After **9am**, congestion **contiues** but the length is gradually **reduced until 1pm** when the congestion length comes to be **6 km** (half of the longest length).

➔ Q. How much amount of traffic demand **at 1 pm**?

Answer:

(a) Exceeding amount of demand is half of the capacity

(b) No change of demand because of contiuation of the congestion

(c) Demand is less than capacity during reducing the length

Agenda

Self Introduction

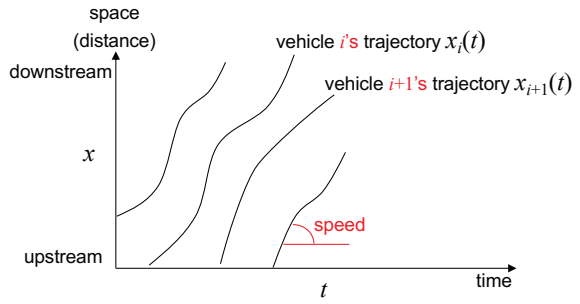
1. Quiz
2. Traffic demand concentration
3. Traffic Flow fundamentals
4. Definition of "Traffic Congestion" and shock wave analysis
5. Traffic signal control; urban road network management
6. Example ITS measures

2. Traffic flow concentration

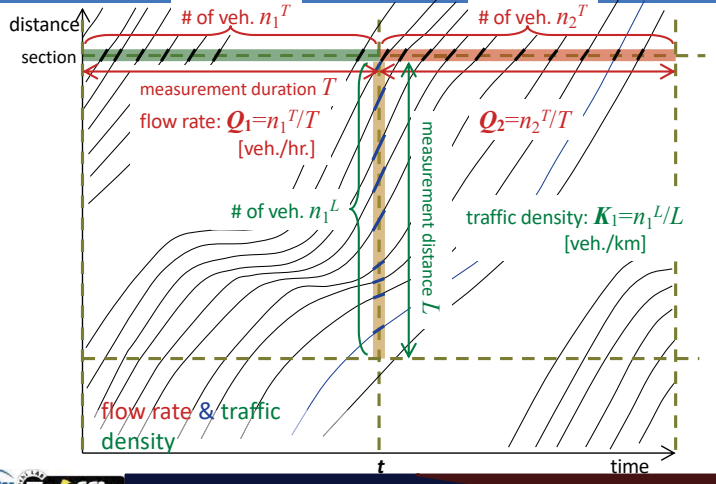
(in Bangkok, Thailand)

3.1 Time-Space Diagram

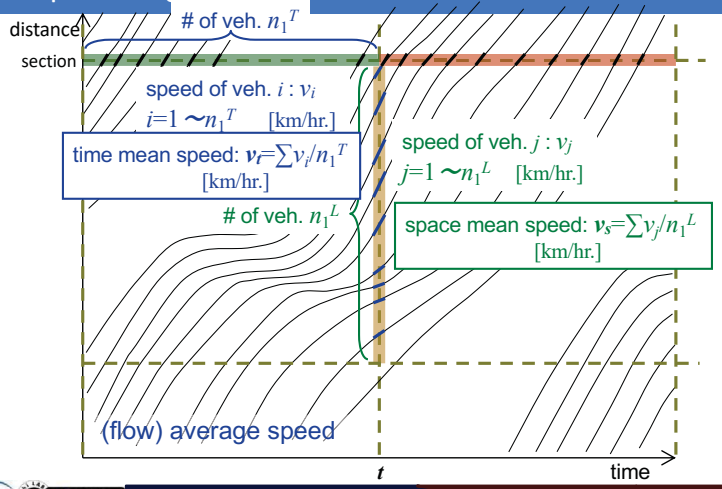
- To describe vehicle trajectories on two-dimensional (Time & Space) space
- A line shows time-dependent positions of a vehicle.



3.2 Time-Space Diagram and Basic Variables



3.2 Time-Space Diagram and Basic Variables



(Average) Speed

Time-mean speed (v_t) [km/h]

Arithmetic mean of passing vehicles' speed at a spot

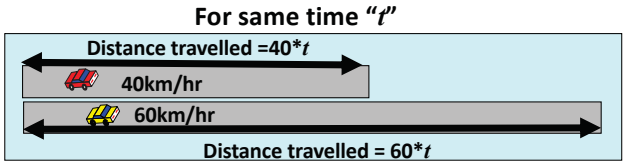
Space-mean speed (v_s) [km/h]

Arithmetic mean of vehicles' running speed at a moment

=(approx.) Harmonic mean of passing vehicles' speed at a spot

Time-mean Speed

Estimate average speed two vehicles, given they travel for equal time



$$\text{Average speed} = \frac{\text{Total Distance Travelled}}{\text{Total Time Taken}}$$

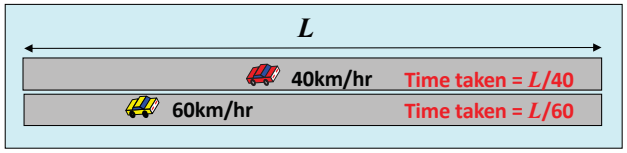
$$= \frac{40*t + 60*t}{2*t} = 50$$

(arithmetic mean)

Time-mean speed

Space-mean Speed

Estimate average speed of two vehicle when they travel equal distance.



$$\text{Average speed} = \frac{\text{Total Distance Travelled}}{\text{Total Time Taken}}$$

$$= \frac{2L}{L/40 + L/60} = \frac{1}{(1/40+1/60)/2} = 48$$

(harmonic mean)

Space-mean speed

Speed should not directly averaged!

TIPS

#	v_i [km/h]	$1/v_i$ [h/km]
1	20	0.05
2	15	0.0666...
3	50	0.02
4	10	0.1
5	50	0.02
6	70	0.01428...
7	25	0.04
8	10	0.1
9	65	0.01538...
10	55	0.01818...

$\sum v_i = 370$

(arithmetic-mean) $v_t = 370/10$

$= 37.0$ [km/h]

$\sum(1/v_i) = 0.4445...$

(harmonic-mean) $v_s = 1/(0.4445/10)$

$= 22.5$ [km/h]

average flow speed = v_s (not arithmetic-mean speed v_t)

= harmonic mean of each vehicle speed with spot observation

$$= 1/\left\{\frac{\sum_{i=1}^{n}\left[\frac{1}{v_i}\right]}{n}\right\}$$

whole avg. speed with divided section's speeds
total avg. speed with lane-by-lane avg. speeds
avg. speed with each sample probe speed

Speed should not directly averaged!

TIPS

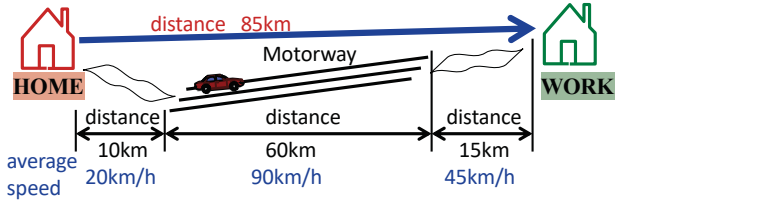
Example

total average speed $= \frac{85}{1.5} \fallingdotseq$ **56.7km/h**

harmonic mean

$=85 \div (10/20 + 60/90 + 15/45)$

$=1 \div (1/20 \times 10/85 + 1/90 \times 60/85 + 1/45 \times 15/85)$



$20 \times 10/85 + 90 \times 60/85 + 45 \times 15/85 = 73.8$km/h

arithmetic mean

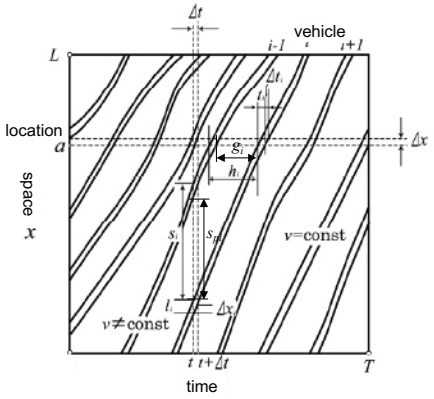
travel time: 30min. 40min. 20min.

Toal travel time : 1.5hr

3.2 Time-Space Diagram and Basic Variables

Microscopic Variables

spot variables	zone variables
obs. duration T	obs. zone length L
num of obs. veh. n^T	num of obs. veh. n^L
headway between veh i-1 & i	
time headway h_i	space headway s_i (=**spacing**)
clearance between veh i-1 & i	
time clearance g_i (=gap)	space clearance s_{pi}
occupancy of veh i	
occ. time t_i	occ. space l_i
speed of veh i	
spot speed $v_i=\Delta x/\Delta t_i$	pace $p_i=\Delta t/\Delta x_i$



Observation equipments

- Ultrasonic detector
  - Detector heads intermittently emit waves towards the ground.
  - Vehicles are detected by time difference of reflections.
  - speed also obtained by two sequential detectors, or by vehicle length

- Loop coil detector
  - A simple coil of wire embedded in the road's pavement
  - When a vehicle exists on it, metal mass changes the characteristics of the magnetic field, which is detected by electronic equipment.

2021年度巻末資料－193

3.2 Time-Space Diagram and Basic Variables

Flow (rate) (Q) [veh/h]

num. of passing vehicles at a spot per unit time

inverse value of average time headway

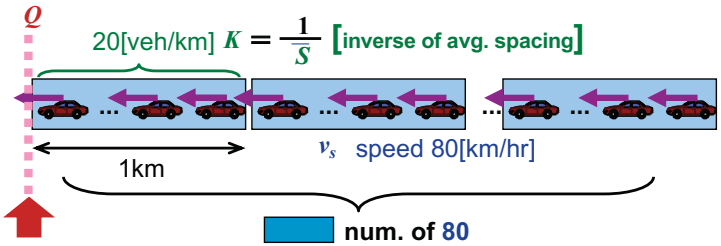
Density (K) [veh/km]

num. of running vehicles at a moment per unit distance

inverse value of average spacing

3.3 A Simple Flow-Density Model

1. Physical law: law of conservation of flow (mass)



volume (num. of veh's) passing in one hour [flow per unit time]
= 20[veh/km] * 80[km/hr]
= flow rate [veh/hr] = Density * (traffic) speed

$Q = K * v_s$ $\quad Q = K\,v_s$

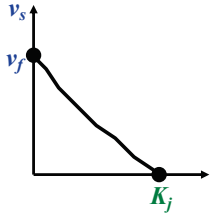
3.3 A Simple Flow-Density Model

2. empirical law: (ex.) relationship b/w K and v_s

case 1: free running

v_s = max. value [v_f:free speed]

K = 0



→ $Q = Kv_s$ then $Q = 0$ (Boundary condition 1)

density increase,
speed decrease
v_s is monotonous decrease function of K

case2: complete traffic jam

v_s = 0

K = max. value [K_j : saturated density]

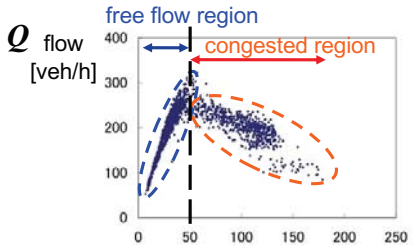
→ $Q = Kv_s$ then $Q = 0$ (Boundary condition 2)

3.3 A Simple Flow-Density Model

Relationship of Flow(Q), Density(K) & Speed(v_s) (space-mean speed)

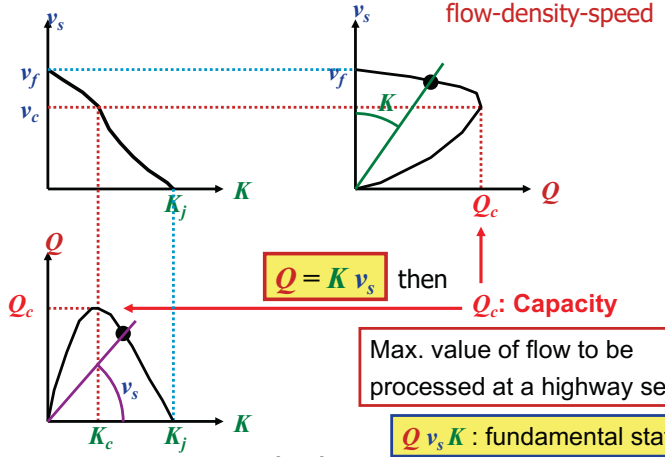
$$Q = K v_s$$

Relationship of flow Q – density K (= "Fundamental Diagram (FD)")



(at Metropolitan Expressway)

3.3 A Simple Flow-Density Model



$Q = K v_s$ then Q_c: Capacity

Max. value of flow to be processed at a highway section

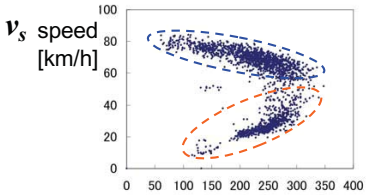
Q v_s K : fundamental state variables

Fundamental Diagram (FD)

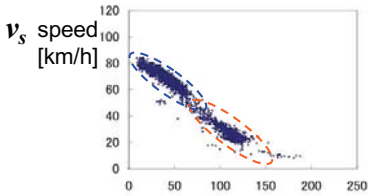
3.3 A Simple Flow-Density Model

(at Metropolitan Expressway)

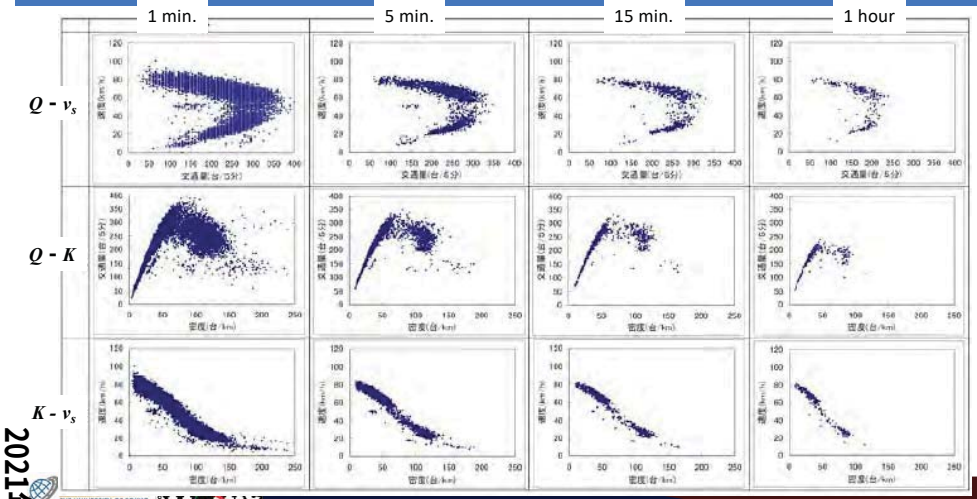
flow – speed Q - v_s



density – speed K - v_s



3.3 A Simple Flow-Density Model



2021年度巻末資料－195

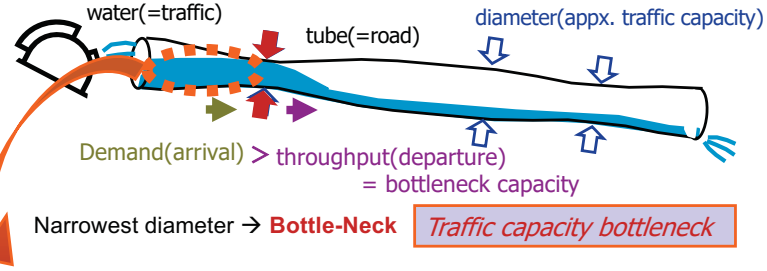
Agenda

Self Introduction

1. Quiz
2. Traffic demand concentration
3. Traffic Flow fundamentals
4. Definition of "Traffic Congestion" and shock wave analysis
5. Traffic signal control; urban road network management
6. Example ITS measures

4. Definition of "Traffic Congestion" and shock wave analysis

Concept of **Bottleneck**



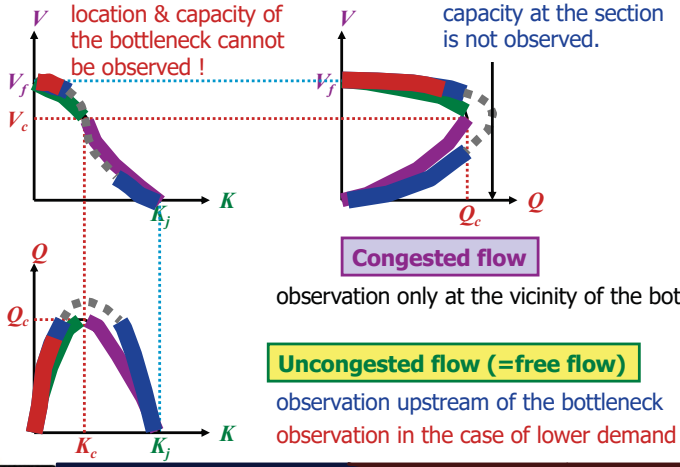
Narrowest diameter → **Bottle-Neck** *Traffic capacity bottleneck*

Unprocessed amount of water (traffic) should remain (spilled over) upstream of bottleneck

This is so called **"Traffic Congestion"**

Definition: flow condition (queue) at the upstream section of an bottleneck, when the demand traffic exceeding the traffic capacity of the bottleneck intends to pass through the bottleneck.

4. Definition of "Traffic Congestion" and shock wave analysis



Congested flow

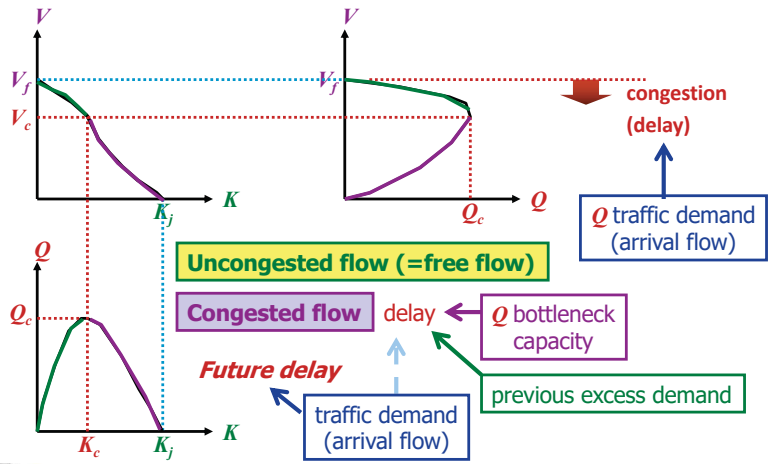
observation only at the vicinity of the bottleneck

Uncongested flow (=free flow)

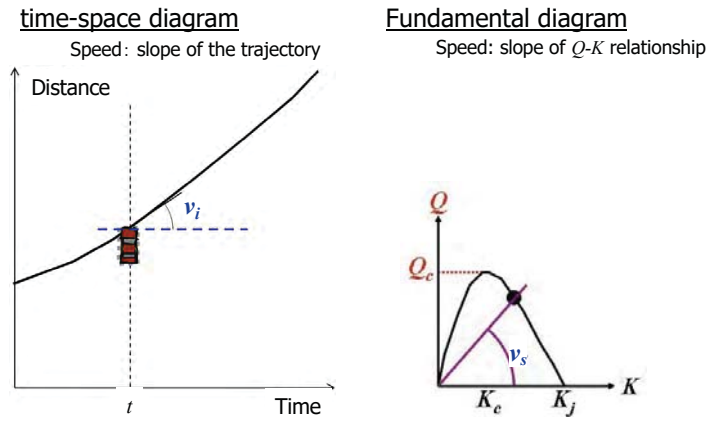
observation upstream of the bottleneck

observation in the case of lower demand

4. Definition of "Traffic Congestion" and shock wave analysis



4. Definition of "Traffic Congestion" and shock wave analysis



4. Definition of "Traffic Congestion" and shock wave analysis

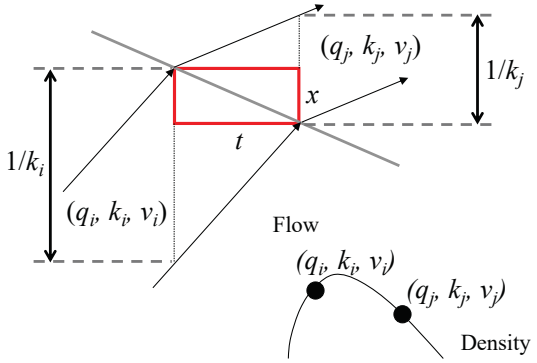
pick up two adjacent vehicles' trajectories covering two different regions

$$\frac{1}{k_i} - x = v_i t$$

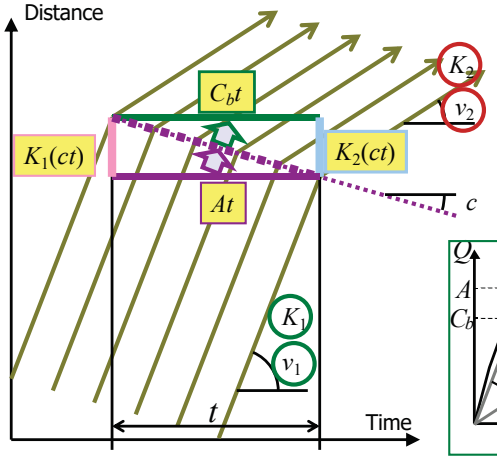
$$\frac{1}{k_j} - x = v_j t \quad \text{where,} \quad c = -\frac{x}{t}$$

$$\Rightarrow t = \frac{\frac{1}{k_i} - \frac{1}{k_j}}{v_i - v_j}, \quad x = \frac{\frac{v_i}{k_j} - \frac{v_j}{k_i}}{v_i - v_j}$$

$$\therefore \quad c = -\frac{x}{t} = \frac{q_i - q_j}{k_i - k_j}$$



4. Definition of "Traffic Congestion" and shock wave analysis

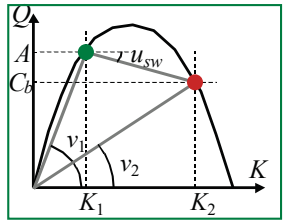


$Q_i = A$: arrival demand

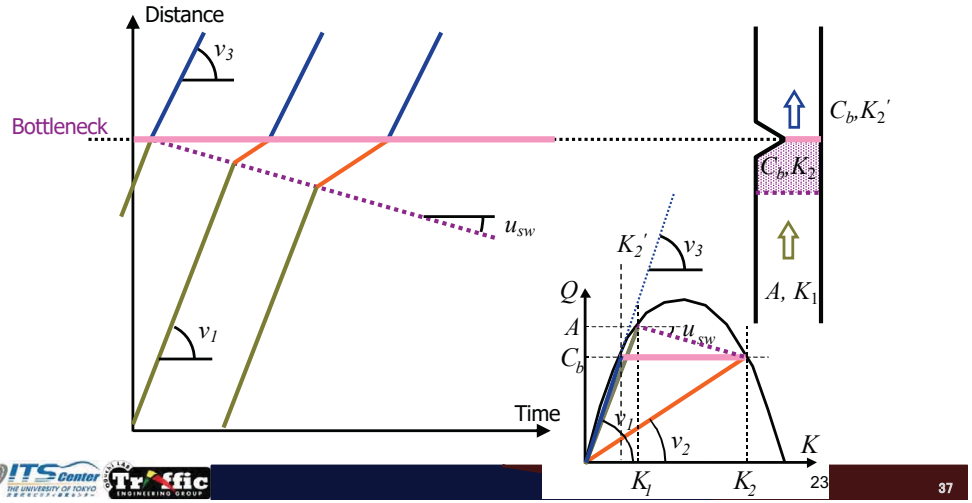
$Q_j = C_b$: bottleneck capacity

$$At + K_1(|c|t) = C_b t + K_2(|c|t)$$

$$\therefore c = \frac{A - C_b}{K_1 - K_2}$$

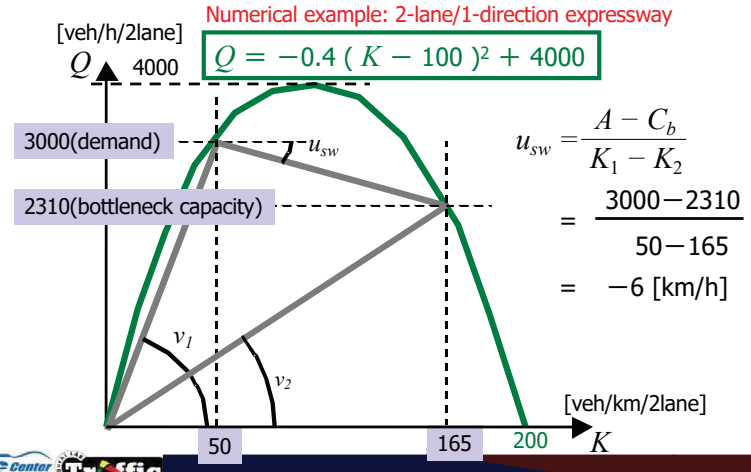


4. Definition of "Traffic Congestion" and shock wave analysis



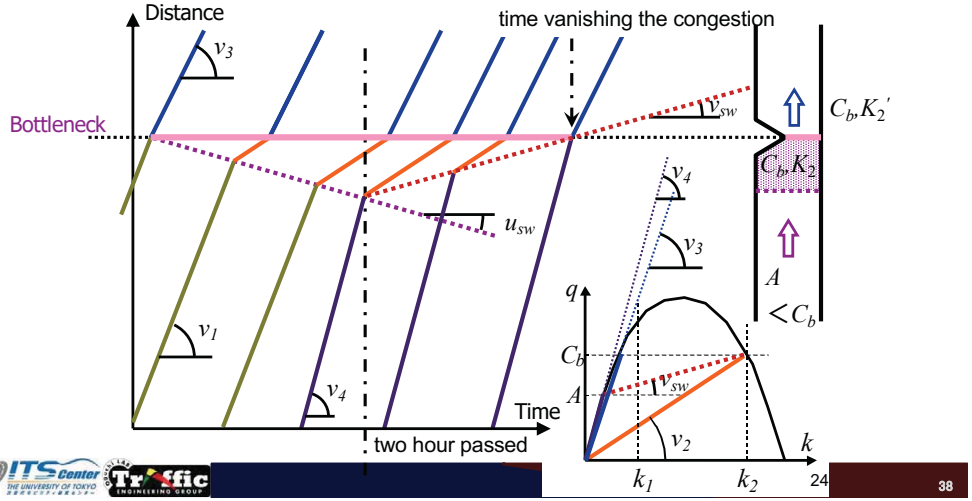
4. Definition of "Traffic Congestion" and shock wave analysis

Numerical example: 2-lane/1-direction expressway



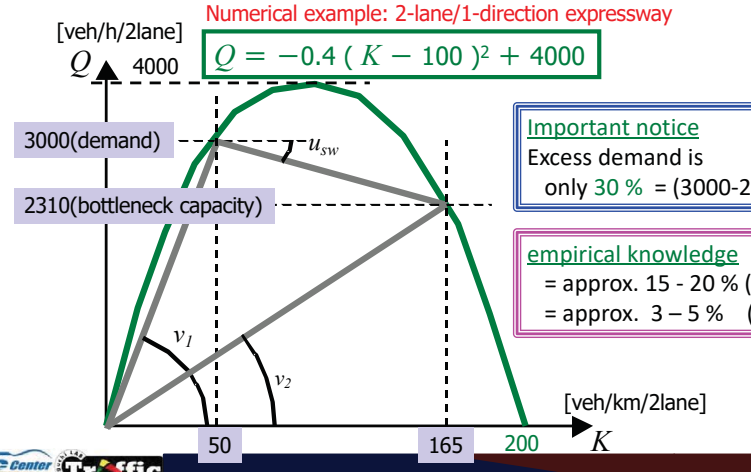
$$u_{sw} = \frac{A - C_b}{K_1 - K_2} = \frac{3000 - 2310}{50 - 165} = -6 \text{ [km/h]}$$

4. Definition of "Traffic Congestion" and shock wave analysis



4. Definition of "Traffic Congestion" and shock wave analysis

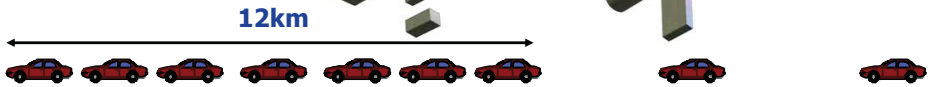
Numerical example: 2-lane/1-direction expressway



Important notice
Excess demand is
only 30 % = (3000-2310)/2310

empirical knowledge
= approx. 15 - 20 % (expressways)
= approx. 3 – 5 % (streets)

Quiz ! Part 1 Answer



- Assume recursive daily morning inbound urban expressway
- Congestion **starts at 7am** at the junction to inner core ring road
- **Until 9am**, the congestion forms **12km**

➔ Q. How much larger the traffic demand than the capacity during the two hours (**7am** to **9am**)?

Answer:

(a) twice

(b) 10 times

(c) 1.2 times

Quiz ! Part 2 Answer

- After **9am**, congestion **contiues** but the length is gradually **reduced until 1pm** when the congestion length comes to be **6 km** (half of the longest length).

➔ Q. How much amount of traffic demand **at 1 pm**?

Answer: **(a) Exceeding amount of demand is half of the capacity**

(b) No change of demand because of contiuation of the congestion

(c) Demand is less than capacity during reducing the length

4. Definition of "Traffic Congestion" and shock wave analysis

(Major/Typical) Causes of traffic congestion (in Japan)

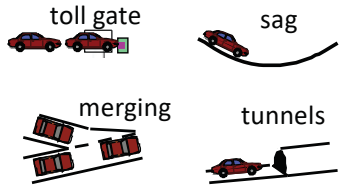
Recurrent bottlenecks (traffic demand concentration)

Motorway

- toll gate
- Sag, Tunnel
- Merging section

Surface street

- Intersection
- On-street parked vehicle



Incidents

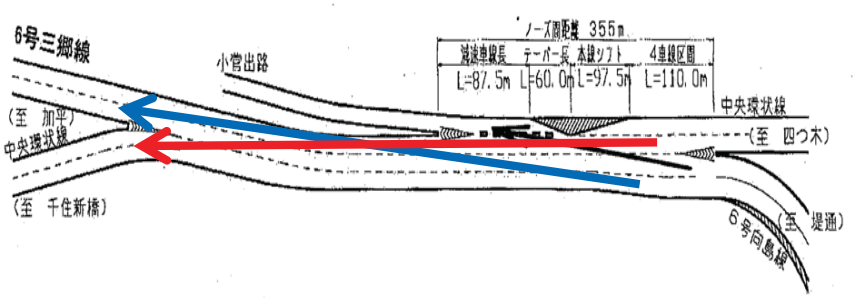
Traffic accident, stalled vehicle, fire, land slide, ...

4. Definition of "Traffic Congestion" and shock wave analysis

Merging (Weaving)

A section where traffic from different directions get together

If diverging shortly in the downstream, it is called “weaving” section.

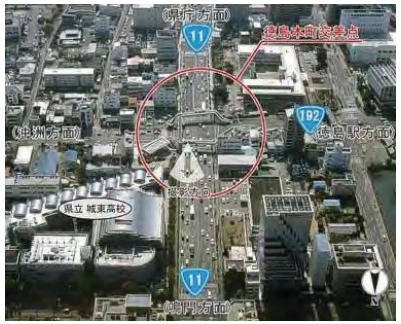


4. Definition of "Traffic Congestion" and shock wave analysis

Intersection

The bottleneck of surface street congestion is almost always at an intersection.

It needs to allocate (green time / priority) to different directions of traffic.



Agenda

Self Introduction

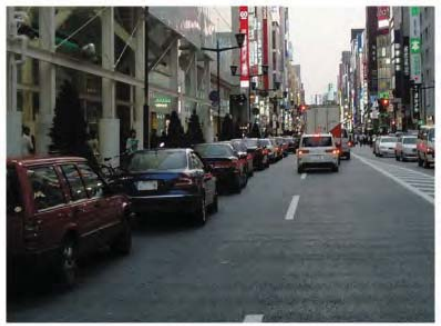
1. Quiz
2. Traffic demand concentration
3. Traffic Flow fundamentals
4. Definition of "Traffic Congestion" and shock wave analysis
5. Traffic signal control; urban road network management
6. Example ITS measures

4. Definition of "Traffic Congestion" and shock wave analysis

On-street parked vehicles

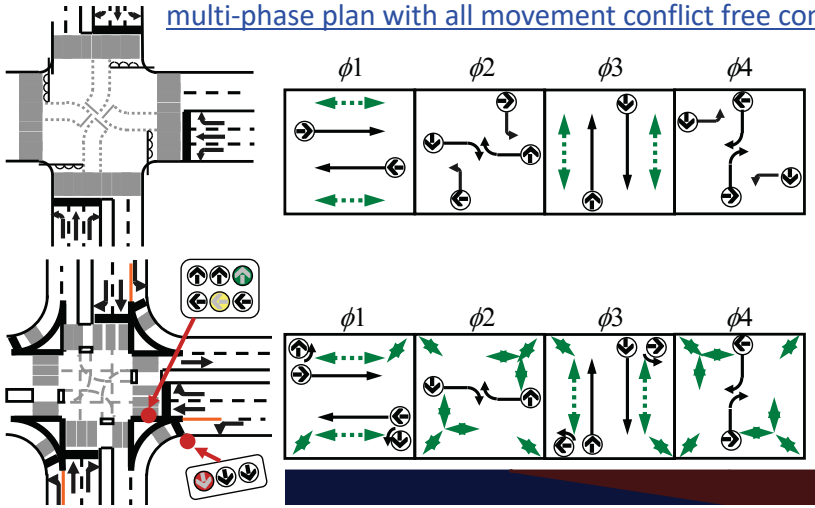
Occupy a certain width of the road and reduce the capacity considerably

Big influence if parked near an intersection



5. Traffic signal control; urban road network management

multi-phase plan with all movement conflict free concept



Signal control parameters

Cycle length: C [sec]

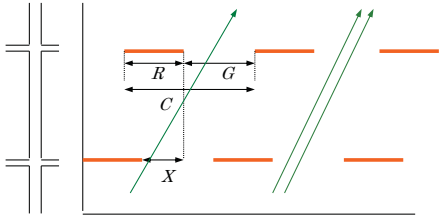
Time duration of one cycle of signal phases

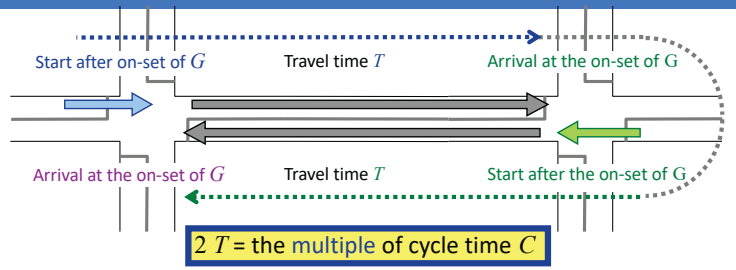
Green Split: g [%] (=G/C, G: effective green time [sec])

Time ratio of one phase out of the cycle time

Offset: x [%] (=X/C) or X [sec]

Time difference of green start between two adjacent intersections





2 T = the multiple of cycle time C

ex.) conditions: C = 60 [s], Travel sped = 30 [km/h] = 8.33 [m/s]

multiple =1 : T = 30 [s] → best coordination for the distance 250m

=2 : T = 60 [s] → 500m

=3 : T = 90 [s] → 750m

On the other hand, at the multiple of 0.5, 1.5, 2.5, 3.5...,

there is no way to coordinate for both directions

offset (signal coordination)

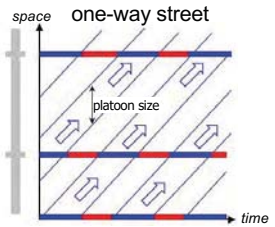
Cycle time have to be the same among coordinated intersections so that the coordination is kept.

one-way street:

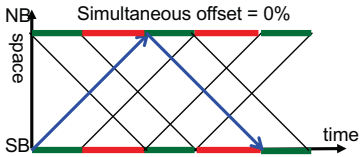
optimum offset = travel time between intersections

two-way street: optimum offset = ?

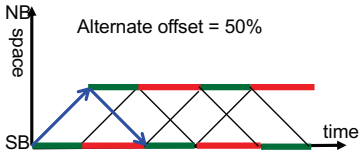
need to consider traffic in both direction



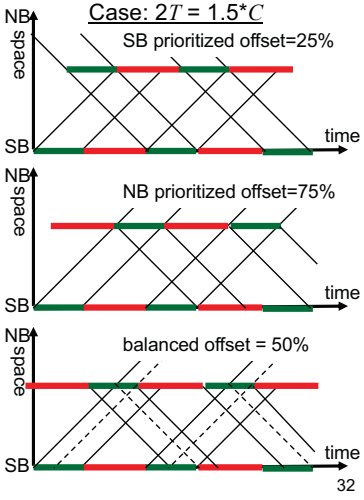
Case: 2T = 2C



Case: 2T = C

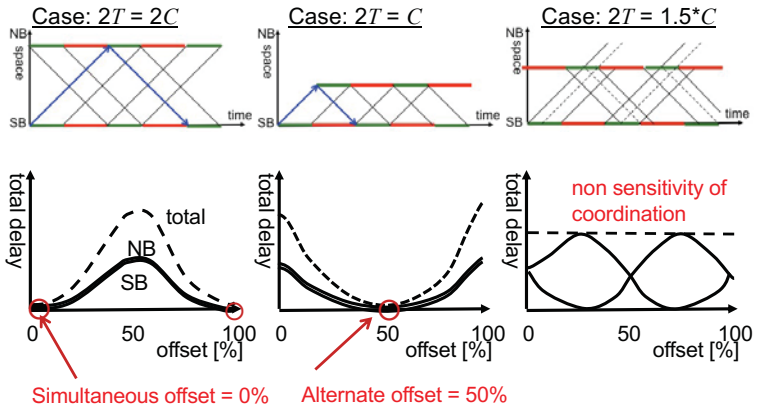


Case: 2T = 1.5*C



5. Traffic signal control; urban road network management

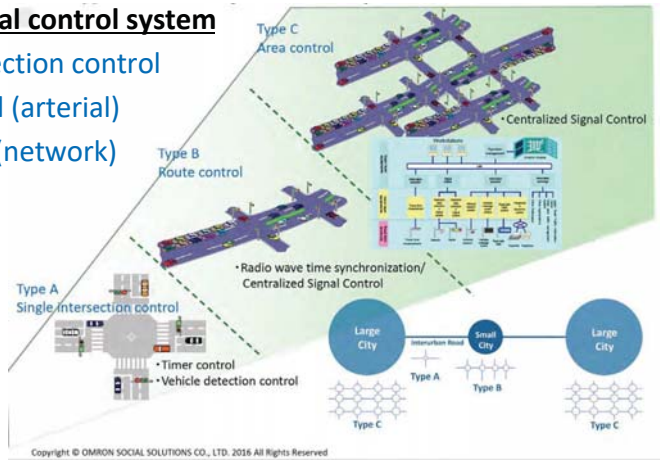
Offsets effects on signalized delay



5. Traffic signal control; urban road network management

Types of traffic signal control system

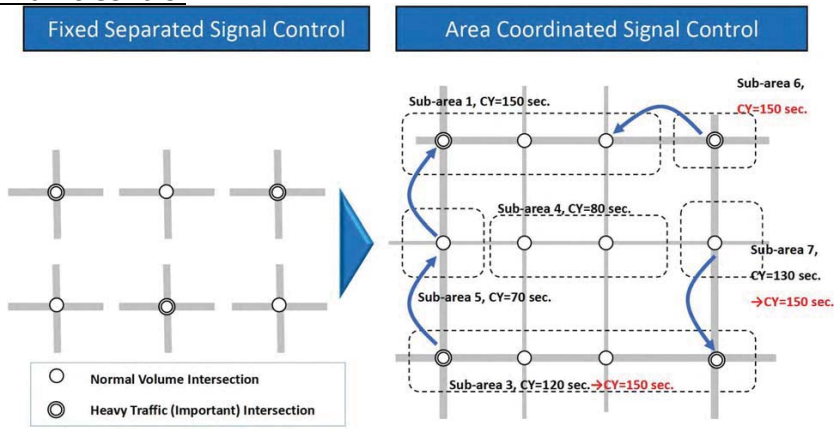
- **A**: Single intersection control
- **B**: Route control (arterial)
- **C**: Area control (network)



[source: JICA ITS KCCP material, 2019]

5. Traffic signal control; urban road network management

Area Traffic Control



[source: JICA ITS KCCP material, 2019]

5. Traffic signal control; urban road network management

Countermeasures for congestion alleviation

Capacity improvement

New road construction

Network missing-link connection (ring road etc.)

Road improvement

Grade separation at intersection

Addition of right-turn lane or bay

Demand management (temporal/spatial dispersion)

Staggered commuting (temporal dispersion)

detoured route guidance (spatial dispersion)

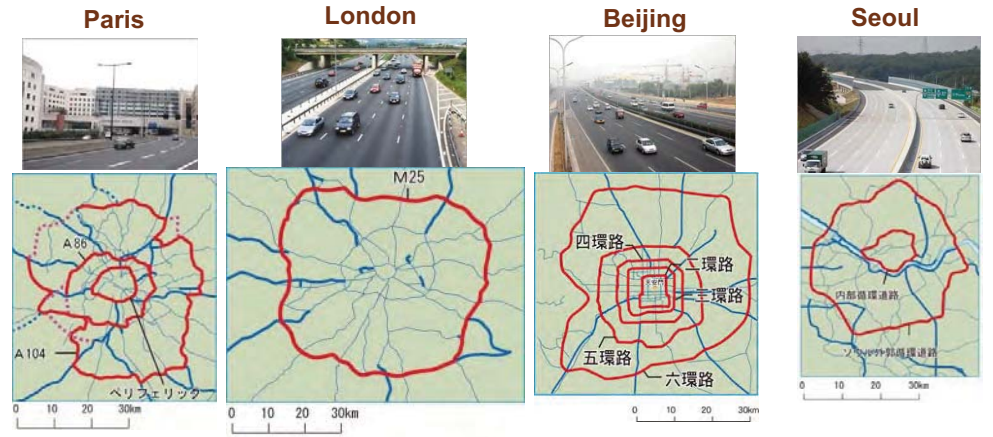
Modal shift

5. Traffic signal control; urban road network management

Points to introduce a measure against congestion

- Understand well the cause of the congestion
  - the ***location***, the ***nature***, and the ***capacity value*** of the bottleneck
  - NOTE!! : without knowledge about the bottleneck, nothing cannot be done effectively
- Lists the candidate measures to alleviate the congestion
  - don't exclude any possibilities without ITS
- Evaluate & compare the effectiveness of the alternative measures
  - including the cost-benefit analysis, short-term / long-term
- Select a proper measure

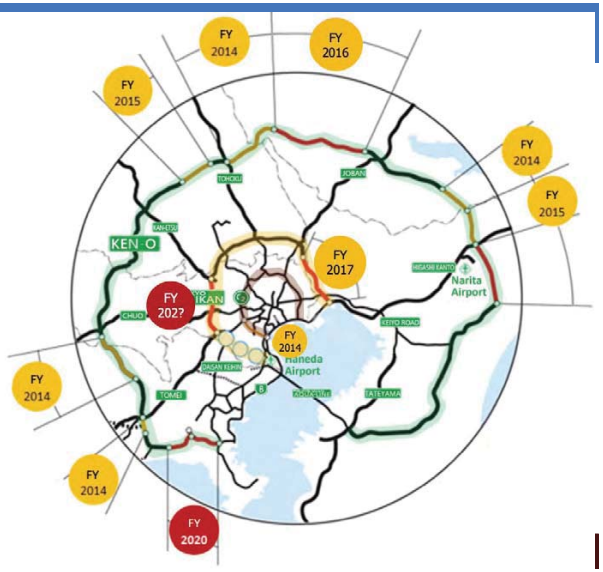
Situation in other cities



Paris	London	Beijing	Seoul
267/313 km	188/188 km	433/433 km	167/167 km
85%	100%	100%	100%

Ring road construction

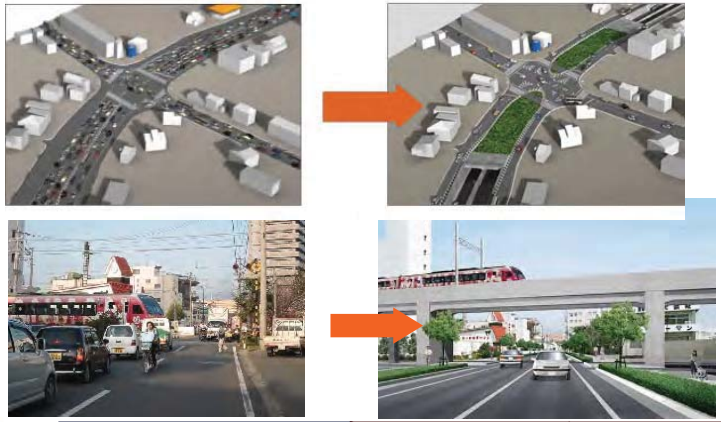
Tokyo Area



- open : 245/520

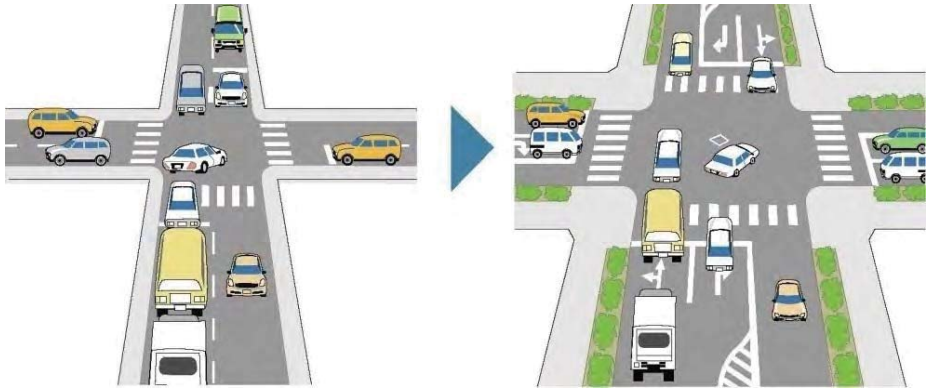
Intersection improvements

Grade separation



Intersection improvements (cont'd.)

Right-turn bay addition



2021年度巻末資料－203

Agenda

6. Example ITS measures

Typical functions

Advanced Traffic Management (ATM)

Increase the capacity of bottleneck intersections

Dynamic Traveler Information System

Disperse the concentrated demand at bottleneck to the shortest time routes (*from the shortest distance route*)

ETC (Electronic Toll Collection)

Increase the capacity of main line toll booths

Disperse demand by "dynamic congestion charging"

Advanced Public Transportation System

Disperse demand to other public transport mode

6. Example ITS measures

- **Route guidance**
  - Variable message sign (VMS), Picture map sign (PMS)
  - Guidance by charging (area charge, dynamic/congestion charging)
- **Travel demand management**
  - Ramp metering
  - Variable channelization: adjust the merging ratio at merging section
- **ATM: Active Traffic Management**
  - Variable Speed Limit by lanes
  - Hard shoulder running
- **Operation scheme after incidents**
  - Narrow lane operation after incidents (or at road works)
  - Incident management (Quick detection, effect estimation)

6. Example ITS measures

Advanced Traffic Management System

Dynamic Traveler Information System

ETC (Electronic Toll Collection)

Advanced Public Transportation System

Car navigation system & VICS (Vehicle Information & Communication System)

Basic Function of 'Car navigation system'

1) Digital map & its Display
→ avoiding to watch a paper map during driving

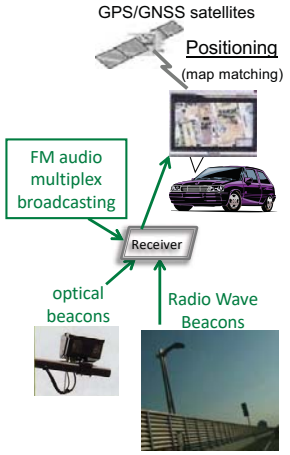
2) Position & Direction on the Display
- GPS/GNSS
- INS (Inertial Navigation System)
- Map matching technology

→ precise positioning, gospel for no sense of direction

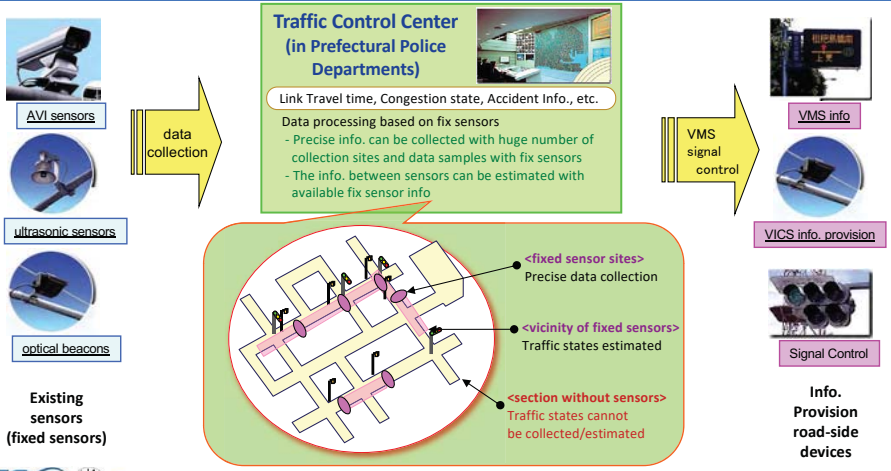
3) Route navigation function
- the shourtest route finding

[in addition] with VICS function:

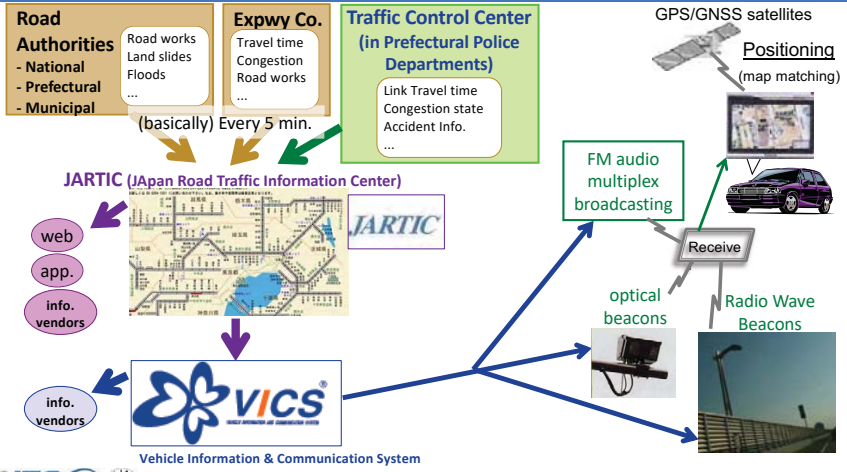
4) receiving/displaying traffic/road info.
5) dynamic (the fastest) route finding



Sensor Information Utilization via Traffic Control Center



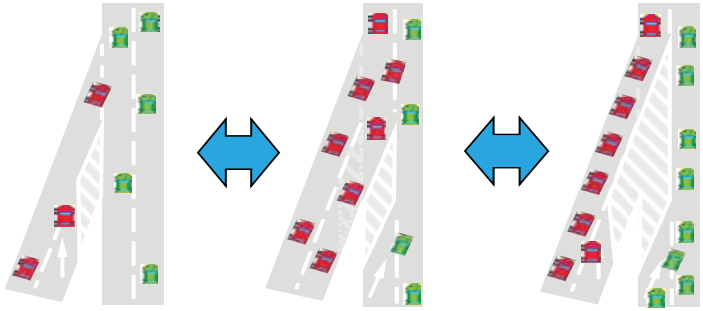
Data flow of traffic information



Variable message sign (VMS), Picture map sign (PMS)

Variable Channelization (Idea, under consideration & testing)

Dynamic lane operation change with the change of traffic states



Main line priority　　Merging flow priority　　Equal priority

→ ... to control the merging ratio

ATM: Active Traffic Management

[provided by] Paul Unwin - Senior Project Manager
Highways Agency – UK

ATM: Active Traffic Management

ATM: [Japanese case] temporal static increase of number of lanes

http://www.c-nexco.co.jp/corporate/pressroom/news_old/index.php?id=2294

Data-driven, Cyber-Physical-based, Intelligent Traffic Management

1) Rough prediction: Past Big Data + Data driven Prediction Model
day of week, time, Month, Season, Weather, Events, Incidents & Traffic Accidents, ...

2) Dynamic real time monitor: Network flow monitoring
Vehicle/Person Probe + Traffic Volume

3) Nowcast Simulator: w/o warming-up, super speed, near-future prediction
1) & 2) used as inputs

4) Near-future predicting flow control: Control by Ramp metering, Signal control,...
a little congestion acceptance, minimizing effect of congestion, early countermeasures

5) Quick incident response: quick detection & response, info. distribution
bottleneck capacity reduction, induce demand,...

References

Recommended text books for further study;

- A. D. May: "Traffic Flow Fundamentals", Prentice Hall, 464p., 1990.
- Carlos F. Daganzo: Fundamentals of Transportation and Traffic Operations, Pergamon, 1997.

Others;

- IATSS (International Association of Traffic and Safety Sciences) Ed.: "Traffic and Safety Sciences", Commemorative publication to mark the 40th anniversary of the founding of IATSS, 211p., 2015.
[freely available at http://www.iatss.or.jp/en/publication/commemorative-publication/]
- M. Koshi, M. Iwasaki and I. Ohkura: Some Findings and an Overview on Vehicular Flow Characteristics, Proc. of 8th ISTTT(Toronto), pp.403-426, 1981.
- T. Oguchi: The nature of occurrence of queued flow at capacity bottleneck of ordinary section, Traffic and Granular Flow '01, (Springer), pp.494-499, 2002.

ITS Planning and Important Considerations toward Implementation

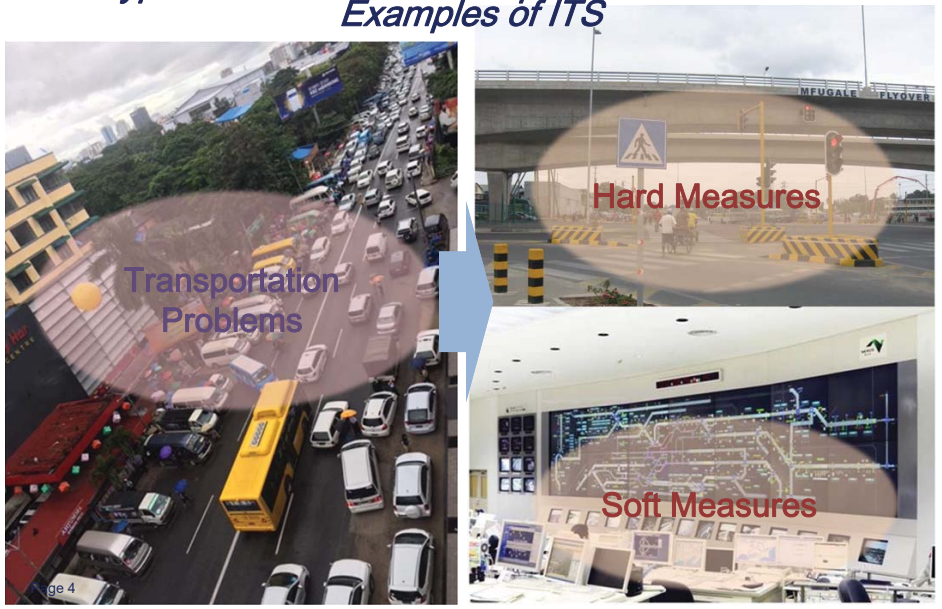
17th November, 2021

Consultant Team
(Nippon Koei and Hanshin Expressway JV)

Contents

Transportation Measures and ITS

Typical Measures in Transportation Sector and Examples of ITS



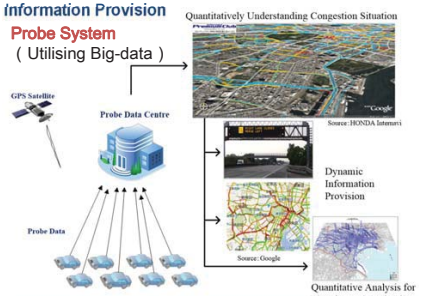
Typical Measures in Transportation Sector and Examples of ITS

Transportation Measures	Examples of ITS
■ Hard Measures	
● Increasing Infrastructure Capacity	
✓ Road Network, Bypass Road Development	
✓ Grade Separation Development	
✓ Public Transport Development, etc.	
	• *Planning by utilizing traffic data (identifying bottleneck location, understanding demand of movement, etc)*
● Enhancing Efficiency	
✓ Junction Improvement, Signal Improvement	
✓ Pavement Maintenance	
✓ Transport Hub Development, etc.	
	• *Introducing facilities, e.g. signals, parking system*
■ Soft Measures	
● Traffic Demand Management	
✓ Route/Time Alteration Encouragement	
✓ Transport Mode Alteration Encouragement, etc.	
	• *Providing traffic information (congestion, travel time, etc.)*
● Enhancing Efficiency	
✓ Public Transport Operation	
✓ Transport Usage Convenience (E-payment, etc.)	
	• *Bus operating system, bus location system*
	• *Smart card payment, etc*

Some Examples of ITS

Traffic Data Utilization for Planning and Traffic Information Provision

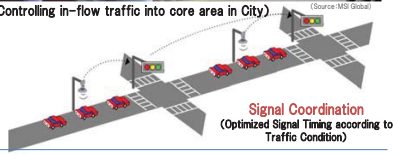
Probe System
(Utilising Big-data)



City Traffic Control

Electronic Road Pricing

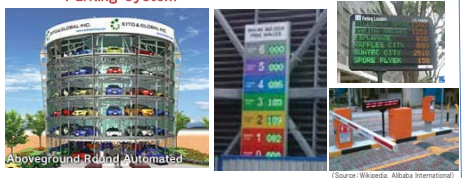
(Controlling in-flow traffic into core area in City)



Signal Coordination
(Optimized Signal Timing according to Traffic Condition)

Parking Management

Parking System



Multi-story Parking → Parking Availability and Fee Collection

ITS for Expressway

ETC

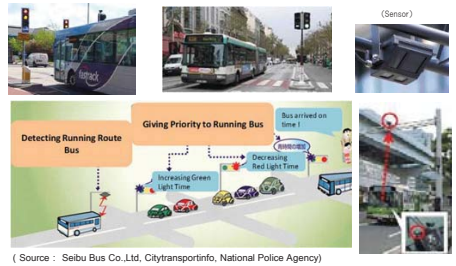
Highway Traffic Management System
(Ensuring Safety and Expressway Management)

Environment Road Pricing
(Guiding Traffic by Applying Different Toll Fee)
(Source: E-NEXCO, C-NEXCO, MEX)

Some Examples of ITS

ITS for Public Transport

BRT: Bus Rapid Transit
(Fare Collection, Information Provision, Control Center)

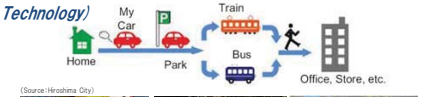


(Source : Seibu Bus Co.,Ltd, Citytransportinfo, National Police Agency)

Bus Priority System

Common Mobility Card
(Single Card Used for Different Transport)

ITS for Environment (Combination of Measures and Technology)



Special discount according to usage history to encourage park-and-ride

Park & Ride and Electric Vehicle

ITS Planning with Examples

Why is ITS Master Plan / ITS Planning needed?

Oh my god…what shall I do….

Increasing Congestion…

Many players…

Urban Sprawling…

Urban / road transport infrastructure development projects are going on…

Emerging Technologies….

We don't know much about ITS…

No money…..

Individual systems are being introduced….

ITS Master Plan (or ITS Planning) set out a road map to prepare a '<u>Mechanism</u>' to realize sustainable ITS to assist road and transport measures by addressing all above in an organized and integrated manner.

Preferable General Steps for Successful Introduction of ITS

Preliminary Survey

- Clarifying current condition and plans of ITS in entire region
- Identifying issues and requirement in the region
- Preliminary consideration of required policy
- Preliminary consideration of potential ITS Menus, and etc.

ITS Master Plan (or ITS Planning)

- Setting out ITS policy — In line with National / State Transport Policy
- Identifying ITS menus — Incorporating ITS World Trend
- Short, mid and long – term implementation plan
- Setting up required organisation
- Planning budgeting scheme, and etc

Project Implementation

- Design, procurement and installation <u>in line with ITS Master Plan Policy</u>
- Operating ITS under scheme <u>identified by ITS Master Plan</u>
- Carrying out capacity building programme <u>planned by ITS Master Plan</u>

General Flow for ITS Planning and Implementation

Reviewing on Current Conditions

Target Region	*Country and World*
Urban / Road Transport Plans	Related Policies in the Country
Road Transport Projects	Technology Direction in the Country
Existing ITS Planning / Introduced ITS	ITS Word Trend
ITS Stakeholders	

↓

Analyses and Setting Directions

- Analyzing and Identifying Issues
- Setting ITS Directions
- Identifying Required ITS Menus

↓

- Phasing (Short - Mid - Long Term)

↓

Implementation Planning (for Short and Mid Term)

Institutional Arrangement	Technical Investigation
Rough Cost Estimation	Analyses on Effect

↓

After Planning

- Feasibility Study
- Design and Procurement

Planning Stage

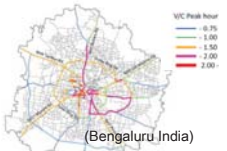
For Implementation

<Note>
- ✓ Left shown is a general flow.
- ✓ Thus, studies after planning i.e. Feasibility Study, Designing/Procurement can also be done together with planning.

Reviewing Current Condition and Identifying Issues (Example)

<Road Transport Condition / Plans>

(Chennai India)



(Bengaluru India)

Road Network Saturation (V/C)
(Traffic Survey Conducted)

Existing and Planned Road Network

<Existing ITS and Plans>

- Traffic Management Centre of Traffic Police
- Traffic signals are available but not working
- VMS are installed but only static message..

<ITS Stakeholders>

- Finding out Stakeholders in Transport Sector, not only ITS
- Finding out their roles as well

<Related Policies in the Country>

- NUTP (National Urban Transport Policy) Emphasizing Data Utilization in Transport Sector)
- Smart City Mission across Country

Smart City
MISSION TRANSFORM-NATION

<Tech. Directions in the Country>

- RFID Standard for ETC

FASTag

- Common Mobility Card Policy for Public Transport

<Tech. Trends in the World>

- R&D for Automated Vehicle
- Big Data, Emerging Sensing Technologies, etc.

Source: Final Report of the Master Plan Study on the Introduction of ITS in Bengaluru and Mysore in India, 2015, JICA and Final Report of Data Collection Survey for Chennai Metropolitan Region ITS in India, 2017, JICA

Identifying Issues (Example)

In Terms of System, Transport, Organization, etc. (Extracted)

System	- CCTVs are installed across metropolitan area - But there is no system to collect and utilize quantitative transport data - Traffic Management Centre of Traffic Police is established but the functions are limited to CCTV monitoring, etc.
Road Transport	- Roads in the core area of the city are saturated. - Metros are under construction, but transferring facility and information is not considered, etc.
Organization	- A lot of organizations are involved in the transport sector, but the coordination among them is not sufficiently done. - The individual systems are being introduced without harmonization, etc.

SWOT Analysis is Recommended (SWOT: Strength, Weakness, Opportunity, Threat)

<Strength> Controllable - Bus probe data available - High level transport decision making framework	<Weakness> Controllable - Absence of mechanism for utilisation of quantitative data on transport - Absence of cross-ministerial coordination
<Opportunity> Uncontrollable - Affordable technologies are increasingly emerging	<Threat> Uncontrollable - Increasing system risk by hackers - Natural disasters e.g. flood

Setting ITS Directions (Example)

Result of Issue Analysis

Setting ITS Sector Specific Objectives (Extracted)

Accessibility	Making Traffic Information Available for All Promoting People-centred mobility Improving Connectivity in the Region
Efficiency	Providing Integrated Traffic Information Service Contributing Efficient Road and Transport Management
Safety	Reducing Traffic Accident, Supporting for Traffic Vulnerable, etc.

Productivity, Environment, etc. as well (as deemed necessary)

Directions Set Out in Existing Transport Master Plan
(If this is the case)

Setting ITS Strategies

- *Quantitative Data Collection, Analysis, Storage, Utilization and Provision*
- *Integration and Utilization of Data and Information Available in Various Sources*
- *Centrally Coordinated Administrative Structure to Realise Proper Coordination*
- *Proper Decision Making on Urban Transport*
- *Proper Traffic Control and Management, Road Management, Traffic Demand Control*
- *Efficient Public Transport Connectivity*
- *ITS Promotion and Coordination with ITS National Policy*

Source: Final Report of the Master Plan Study on the Introduction of ITS in Bengaluru and Mysore in India, 2015, JICA

Identifying ITS Menus (Example)

ITS Strategies

Listing ITS Component Candidates by ITS Focus Area (Extracted)

ITS Focus Area	ITS Component Candidates
Quantitative Traffic Information	- Probe Data Collection - Highway Traffic Management System etc.
Traffic Management Assistance	- Traffic Monitoring System - Traffic Signal System etc.
Traffic Demand Management	- Electronic Road Pricing System - Toll Collection System etc.
Assisting Measures on Traffic Accidents and Safety	- Traffic Monitoring System - Traffic Accident Management System etc.

Others e.g. assisting public transport, inter-modal connectivity, etc.

Referring Existing or Planned ITS

Organizing or Omitting after listing candidates considering the existing or already planned ITS

Finalizing ITS Menus (Examples are shown on the subsequent slide)

Phasing (Example)

Phase	Years	Policies
Phase -1	Fist 5 Years	- To establish ITS Data Center - To introduce ITS components which can be implemented in short period - To set up cross-ministerial organizations for operation - To start operation of above introduced ITS - To start preparation of ITS components which require a relatively long period together with infrastructure development
Phase-2	Second 5 Years	- To expand and upgrade ITS components which are introduced in Phase-1 - To start operation of ITS components which started preparation in Phase-1 - To incorporate new technologies as applicable
Phase-3	After 10 Years	- To further upgrade functions, adopting new technologies

Source: Edited and Modified by JICA Consultant based on Final Report of the Master Plan Study on the Introduction of ITS in Bengaluru and Mysore in India, 2015, JICA

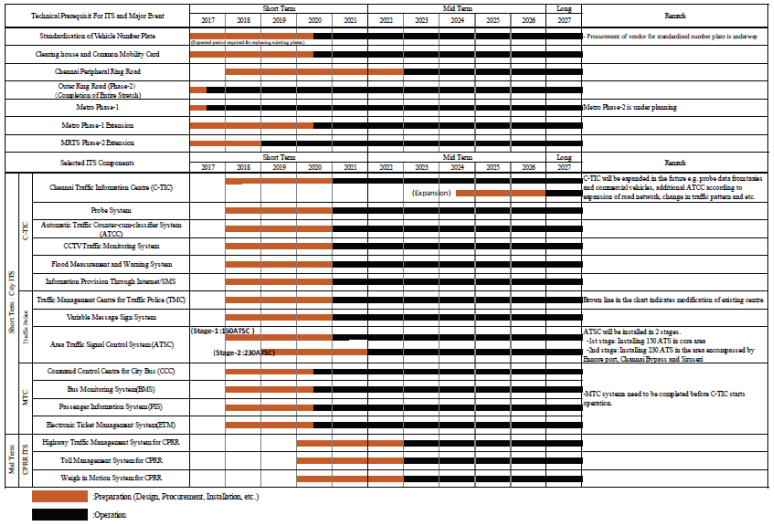
■ Some Tips for Setting Out Phasing Policy

✓ Preparing Basic Mechanism in terms of both Systems (e.g. data collection) and Organization in Phase 1

✓ Starting preparation of ITS which requires a large scale infrastructure development such as Highway ITS together with Highway development in Phase-1 and start operation in Phase-2

✓ Having flexibilities of incorporating emerging new technology as policy

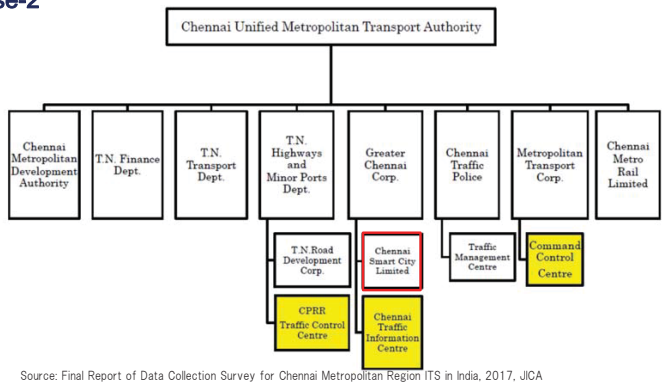
Image of Formulated Implementation Schedule (Example)



Source: Final Report of Data Collection Survey for Chennai Metropolitan Region ITS in India, 2017, JICA

Institutional Arrangement (Example)

Case-2



Source: Final Report of Data Collection Survey for Chennai Metropolitan Region ITS in India, 2017, JICA

- ✓ Three new centres are planned in this case, and they are assigned under the responsible agencies.
- ✓ Chennai Smart City Limited takes charges of coordination with the related agencies in this case. (Project Management Unit was established)

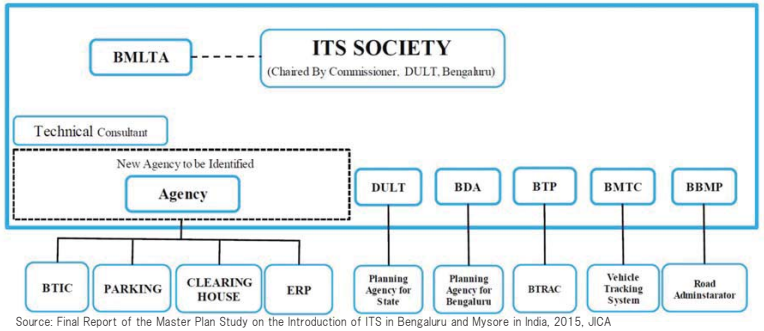
Implication of both cases

Institutional Arrangement for

- Tackling Cross-Cutting Issues in the Transport Sector
- Sustainable Promotion of ITS together with Road Transport Measures, etc.

Institutional Arrangement (Example)

Case-1



Source: Final Report of the Master Plan Study on the Introduction of ITS in Bengaluru and Mysore in India, 2015, JICA

- ✓ ITS Society: Newly set up constituted by senior members of related organizations in transport sector, and made legal body.
- ✓ BMLTA: Existing high-level decision making body on urban transport in Karnataka State formulated under Indian National Policy
- ✓ The related organizations work under the authority of ITS Society

Important Considerations toward Implementation of ITS

(Lessons Learned from Activities through Our Experiences)

- Importance of Coordination between Civil and ITS
- Important Points and Structure for Implementation
  - ✓ Basic Design, Contractor Procurement, Construction/Installation Management, Implementation Structure
- Jurisdictional Issues and Example of Solution
- Importance of Clarifying Demarcation of Related Organizations
  - ✓ Example of Previous JICA Study
  - ✓ Case Study: Solution for Issues Arising from Demarcation
- Some Other Important Tips
  - ✓ CCTV, Roadside Equipment
- Initiatives and Capability of Employer
- Advices on ITS Master Plan for Realizing ITS

Importance of Coordination between Civil and ITS

(In the case of Highway ITS)

There are still a number of other items that require coordination such as

- **Number of Toll Lanes at Interchanges (IC)**
  To be determined by estimated traffic volume at every IC at target year considering type of toll collection method, etc.
- **Locations and Spaces for Toll Plaza, Traffic Control Centre**
  To be determined by available land, highway operation requirement, layout of toll plaza and centre according to the required function and number of staff, etc
- **Spaces for Foundation of Poles and Gantries of ITS Equipment**
  To be designed on the main carriageway and on-ramp/off-ramp according to the required equipment and their wind-load, etc. considering visibility for drivers, appropriate sensing locations, etc.

The above listed are only limited examples. There are still many others !!

- *Operations of Highway and ITS are closely related and need to be considered/designed together*
- *Planning, Designing, Managing for Construction need to be done together*

Especially in the case of the project that Civil and ITS packages are separately procured. But even in the case of BOT that both portions belong to the Contractor's responsibility, they need to be critically aware of these. Otherwise, you may not gain proper asset !!

Examples of Issues of Coordination between Civil and ITS

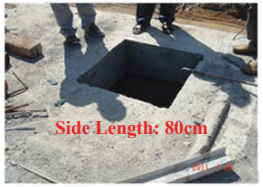

Space for OFC and Power Cable Duct


Duct for OFC


Duct for OFC


Absence of Duct Space


Absence of Duct Space

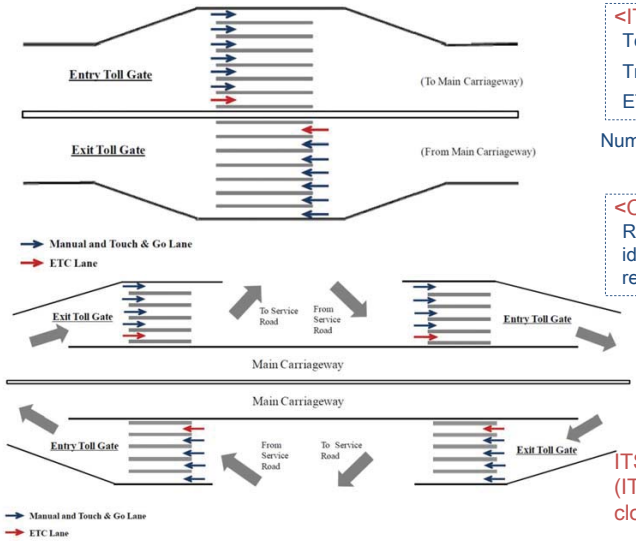


Narrow Space for Under Path for Casher at Toll Plaza


Duct Arrangement at Bridge

Source: Nippon Koei Co., Ltd.

Example: Number of Toll Lane at Interchange



<ITS Consideration>
Toll Collection Method
Traffic Demand
ETC Growth Prospect, etc

Number of Toll Lane Determined

<Civil>
Required Land Space is identified (Available land is required)

Furthermore, number of toll collector becomes clarified and required toll plaza building space is identified.

ITS, Civil and Operation (ITS and Highway) are closely related !!

Source: Final Report of the Master Plan Study on the Introduction of ITS in Bengaluru and Mysore in India, 2015, JICA

Important Points and Structure for Implementation

(Note: In the Case of FIDIC Yellow Book Based Project)

◆ **Importance of Basic Design: Level for Specifying Requirement**

ITS is generally procured in the form of 'Design Build' (Performance based Design) but how detail shall it specify the requirement ?

- ✓ If too detail: You may loose opportunity of the best fitted technology.
- ✓ If too high-level: You may not gain what you want.

Design Stage = Key Factor for Project

◆ **Importance of Contractor Procurement**

- ✓ Various enquiries from potential bidders need to be timely handled
- ✓ ITS bidding documents with proposed technologies need to be properly evaluated *Capability for Procuring the Contractor is Important*

◆ **Importance of Construction/Installation Management**

- ✓ Various systems are usually complicatedly inter-related
- ✓ Civil construction and ITS installation are closely related

Proper Management for Construction/Installation is Important

Important Points and Structure for Implementation (Cont'd)

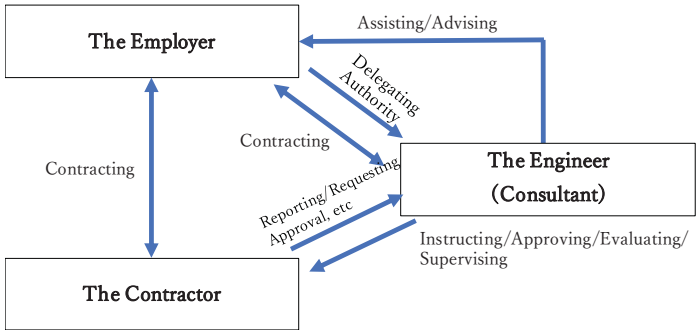
(Note: In the Case of FIDIC Yellow Book Based Project)

Roles of Three (3) Parties

	Consultant Procurement	Basic Design	Contractor Procurement	Installation / Construction
Employer	レ		レ	
Consultant		レ	Assistance	Suvervision
Contactor				レ

レ：Implementing Body

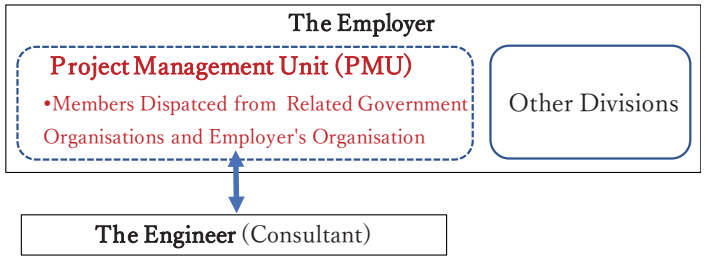
Relationship of Three (3) Parties



Source: Final Report of Preparatory Study for Chennai Peripheral Ring Road Development in India

Important Points and Structure for Implementation (Cont'd)

(Example) (Note: In the Case of FIDIC Yellow Book Based Project)



- ✓ The Employer directly contracts with the Engineer (Consultant).
- ✓ Various organizations are related in the ITS Project.
- ✓ Accordingly the close and continuous coordination is critical.

Therefore

- Project Management Unit (PMU) was established.
- Members are dispatched from the related organizations.
- The cross-organizational coordination is ensured under the responsibility of PMU.
- The Engineer (Consultant) works with the authority delegated from the Employer (PMU).

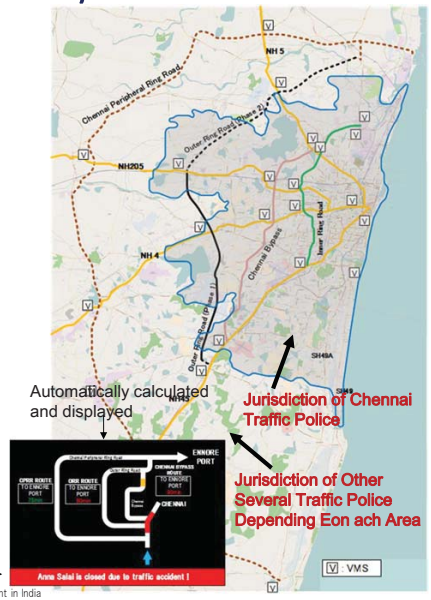
Source: Final Report of Preparatory Study for Chennai Peripheral Ring Road Development in India

Jurisdictional Issues and Example of Solution

- ✓ Variable Message Sign Boards (VMS) were planned across entire metropolitan area
- ✓ Information needs to be provided under the authority of Traffic Police
- ✓ But several different traffic police are involved across the entire target area

Therefore

- ITS centre and all VMS will belong to and be managed by a single organization
- Police personnel from all involved Traffic Police will station at ITS centre.
- The information will be provided under the responsibility of each Traffic Police.
- Maintenance of roadside equipment will be taken care by a single organization.
- All above arrangements were realized under the authority of PMU.



Source: Final Report of Preparatory Study for Chennai Peripheral Ring Road Development in India

Importance of Clarifying Demarcation of Related Organizations

(Example)

System	Subsystem	Project Phase			
		Procurement	Operation	Maintenance	Ownership
Traffic Information System	Traffic Information Center	Smart City Corporation	Smart City Corporation	Smart City Corporation	Smart City Corporation
	Probe System/Internet System				
	Traffic Detection System				
Traffic Control System	Traffic Management Center	Smart City Corporation	Traffic Police	Smart City Corporation	Traffic Police
	Signal System				
	CCTV System				
Bus System	Bus Management System	Smart City Corporation	Bus Operator	Smart City Corporation	Bus Operator
	Bus Location System				

Source: Edited by JICA Study Team based on Final Report of Preparatory Study for Chennai Peripheral Ring Road Development in India

- Several organizations are involved in ITS project.
- Three systems are inter-related in the above example.
- It is important to clarify the roles of the related organization *by Project Phase* and have consensus.
- In the above example, it was agreed that Smart City Corporation, a counter-part of the project, takes responsibilities of the above shown together with Service Level Agreement Evaluation

Case Study: Solution for Issues Arising from Demarcation

(Example)

The coordination among the parties involved in planning is concerned when two systems are integrated in the near future……

The parties carrying out operation knows the daily problems in detail but other parties have the budgets for system improvement……

System	Subsystem	Project Phase				
		Planning	Procurement	Operation	Maintenance	Ownership
Traffic Information System	Information Center	Planning Dept	City A	Traffic Police	City A	City A
	Probe System	Transport Operator	Transport Operator	Transport Operator	Transport Operator	Transport Operator
	Roadside System	Planning Dept	City A	Traffic Police	City A	City A
Traffic Control System	Control Center	City B	City B	Traffic Police	City B	City B
	Signal System	City B	City B	Traffic Police	City B	City B
	CCTV System	City B	City B	Traffic Police	City B	City B

Different party is involved in probe system though entire project phase and the Traffic Information System faces frequent system failure.

Measures for Example

- Measures by System and O&M
  (i) Re-locating the centres in the office building of Planning Department, (ii) All members in charge of operation and maintenance station in the centre
  Unifying Planning, Operation and Maintenance Activities
- Measures by Institutional Arrangement:
  (i) Establishing Working Group constituted by the organizations involved, (ii) Carrying out close and continuous discussions, (iii) Imposing compelling force on their activities by legislation
  Integrating Governing Structure

Some Other Important Tips

Planned at black-spots locations in addition to intersection

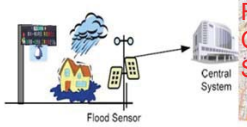
CCTVs for Monitoring Traffic at Site

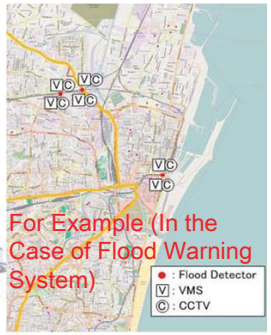
- ✓ CCTVs are generally installed at intersections in many cases in the developing countries.
- ✓ But other locations are also important to monitor.
- ✓ They include merging points and other black-spots.

Roadside Equipment Planning

- Considering (i) Regional Characteristics, and (ii) Road Network/Road Structure
- And yet, ITS is only one of the tools for transport measure

- ✓ Warning Systems planed only at under path structure in the city
- ✓ Improvement of entire drainage system is needed !





For Example (In the Case of Flood Warning System)

Initiatives and Capability of Employer

◆ **Strong Initiatives for Realizing ITS**

- ✓ ITS planning would be formulated supported by the consultants in many cases. But many things need to be continuously taken care toward implementation.
- ✓ A number of different organizations are usually involved in ITS and accordingly close and continuous coordination is inevitably required.
- ✓ Legislative measures e.g. amendment of the existing acts may be required in some cases.

Therefore, strong initiatives with unyielding spirit is vitally important

◆ **Capability of Employer in View of ITS Project Cost**

- ✓ A number of ITS projects experienced failures in many developing countries, and many of them are pointed out largely due to inadequate capability of the involved parties.
- ✓ The employer needs to be technically strong enough to properly evaluate the performance even in the case of BOT project.

Strengthening Technical Competency of Employer Leads to Cost Saving of ITS

Advices on ITS Master Plan for Realizing ITS

- ✓ Many things need arrangement depending on ITS component (act amendment, organization set up, etc.) even after ITS planning
- ✓ Thus it takes time to realize all
- ✓ Some of planned ITS may encounter unexpected situation (e.g. long delay of Highway ITS project due to land acquisition issue.)
- ✓ Technology advancement is vary rapid.

- ◆ **Better to have a broad direction having flexibility of Master Plan**
- ◆ **Recommended to periodically update Master Plan**
- ◆ **Advised to go for implementation of small scale pilot as soon as possible once the planning is done**

And Importantly

- ◆ **Somebody has to continuously take care of the Completed Master Plan**

Don't leave it in a bookshelf !!

Thank you

Funding and Maintaining ITS

17th November, 2021

Shuntaro KAWAHARA
Senior Advisor
Japan International Cooperation Agency

Points of my presentation

- Whatever authorities such as a road agency, a local government and/or traffic police are responsible, funding is a major issue for implementation and operation of traffic management facilities including ITS.
- Donor funds are useful for initial investment for ITS. However, operation and expansion of ITS network should be financed by local fund because donor funds are not lasting.
- Deployed ITS facilities are often deteriorated, obsoleted and/or not operational because of poor maintenance.
- I hope that my presentation becomes chance for participants to consider funding for ITS.
- Road Maintenance Fund can be a good fund source for ITS as many countries have the system. Private sector participation sometimes can be a option although user charges for ITS has difficulty.

Points of my presentation

- For example, Metro Manila Development Authority (MMDA) has developed present traffic management system by its own budget even though its function has some bottlenecks.



By Enforcer / Traffic Survey



By Traffic Signal System


By CCTV monitoring


By Social Media


By Drone

(Source: The Project for Comprehensive Traffic Management Plan for Metro Manila Interim Report 2, March 2021)

Contents

1. Category of Funding Source

Funding is a major issue of all kind of infrastructure development including ITS.

- Government Fund
  - General Fund
    - Tax revenue
    - Bond
  - Dedicated Fund
    - Fuel Tax, Fine, Users Charge
- Donor Funds
- Market Fund (PPP, Public Corporation)
  - Bond/Loan
  - Users Charge
  - Cross Subsidy

2. Cases of Funding Source

As fund for road improvement and maintenance can be major source for ITS implementation, I would like to review features of funding scheme for road in following countries.

① Japan
② United States
③ United Kingdom
④ France
⑤ Road Maintenance Fund in Kenya
⑥ Donor Funds

2. Cases of Funding Source ① Case in Japan

- ✓ Watkins Report says, “The roads in Japan are incredibly bad. No other industrial nation has so completely neglected its highway system.”
- ✓ Terrible Japanese road condition has been improved since mid 1950’s because of two major funding source, “Dedicated Fund” and “Toll Road system”

Source: Hagen, E. E, F. W. Herring, G. E. McLaughlin, W. Owen, H. M. Sapir, and R. J. Watkins (1956), *Report on Kobe-Nagoya Expressway Survey*, Ministry of Construction.

2. Cases of Funding Source ① Case in Japan

- ✓ Stable Fund, responding to traffic demand, not being influenced by economic fluctuations, is necessary.
- ✓ Beneficiaries bear cost of road improvement (User Charges).

1. Dedicated Taxes for Roads (General Roads)

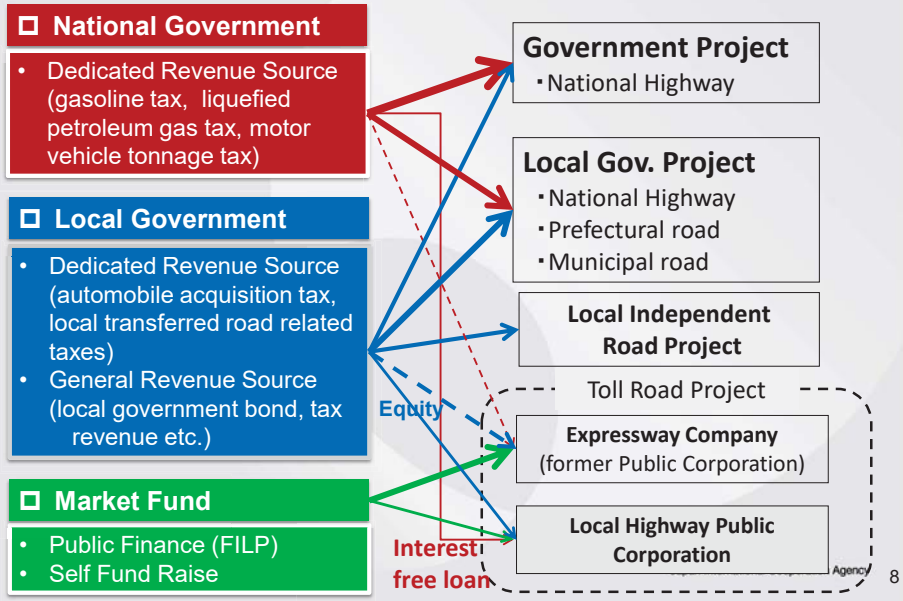
- Tax revenue of Gasoline Tax, Oil & Gas Tax, Diesel Tax, Tonnage Tax and Vehicle Purchase Tax used to be source of Road Dedicated Fund and appropriated for road development and O&M.
- “Temporary Measure Act for Financial Resources of Road Improvement” was enacted in 1953.
- Systematic link between the former dedicated tax revenue and road projects has been eliminated in 2009.

2. Toll Road System (Expressways)

- Expressways construction has been primarily funded by loans from financial market and government savings. The construction cost, O&M costs and interest are repaid with toll revenues.
- “Law Concerning Special Measures for Highway Construction” was enacted in 1952.

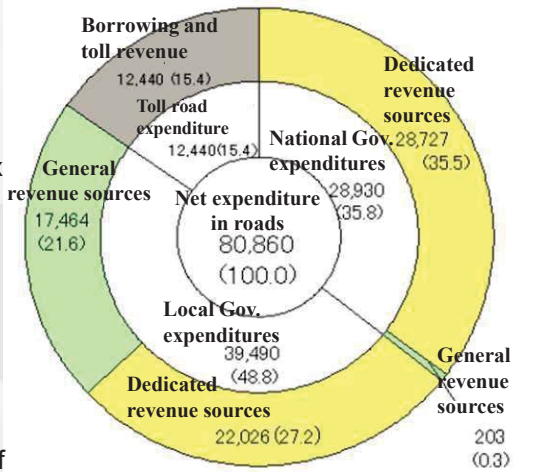
2. Cases of Funding Source ① Case in Japan

Japanese funding system for roads are complex because of cost sharing and subsidies.



2. Cases of Funding Source ① Case in Japan

- ✓ Funding source of road project used to consist of dedicated revenue source, general revenue sources and borrowing for toll road. General revenue sources mainly used to come from tax revenue and bond issuance by local governments.
- ✓ Feature of Japanese road improvement is cost sharing between central and local governments. Not only the Government provides subsidy, but also local governments bear 25–50% of cost of national highway improvement projects.



Composition of Revenue Sources for Road Projects in FY2007 (100 million yen) Source: MLIT

2. Cases of Funding Source ① Case in Japan

Traffic Safety Facilities Managed by Prefectural Police

- ✓ Traffic safety facilities such as traffic signage, pedestrian over bridge and signals are implemented and maintained by local government and prefectural polices.
- ✓ Since 1968, fines imposed on violation of traffic regulations have belonged to revenue of the Government, and been allocated to local governments as General Appropriation according to indicators, namely, occurrence of traffic accident, urban population, length of improved road.
- ✓ In addition, National Police Agency provides local governments with subsidy to implement advanced traffic signal systems.

2. Cases of Funding Source ① Case in Japan

Land Value Capture to cross-subsidize railway projects

In Japan, not a few railway companies used to acquire undeveloped lands, then develop them as railway ROW, housing and commercial lots, and sell them out to gain profits, which cross-subsidise railway business that can not fully recover capital investment.

2. Cases of Funding Source ① Case in Japan
Summary - Case in Japan -

- User charges has been powerful instrument for road and railway development.
- As for none tolled road development, dedicated road fund arising from road related levies such as fuel tax used to be major source.
- As for railways and toll roads, private and public corporations have developed and operated their networks by tariffs. Cross-subsidies arising from profitable segment and related business (property development around railway station) are indispensable.
- So called BOT scheme with project finance mechanism has been rarely applied in highway and railway sectors.

2. Cases of Funding Source ① Case in Japan
Summary - Case in Japan -

- ITS equipment funded by toll road operators such as Electronic Toll Collection (ETC) system and traffic monitoring system have been highly developed because of user charges.
- Bus and railway operation systems are developed by operators independently.
- Signal control systems have been developed by National Police Agency, and deployed with not road dedicated fund but budget of local governments and subsidies from National Police Agency.

2. Cases of Funding Source ② Case in USA

- USA has “Federal Highway Trust Fund” to support construction and maintenance of Federal-aid Highway. The sources of the Trust Fund come form revenue of Fuel Tax, Tire Tax and Heavy Vehicle Purchase Tax.
- Basic principle of “Highway Trust Fund” is “pay as you go”:
  - Users have to pay according to their usage of road;
  - Roads are improved according to the amount of the Trust Fund; and
  - Future revenue of the Fund cannot be a security of loan.
- Following rates of Federal-aid were set under SAFETEA-LU, 242 billion US$ of federal highway funding program 2005 -2009.

Program	Rate of federal support
Inter-states highway	90 %
Other national highway network	80 – 90 %
Land transport	80 – 90 %
Bridge	80 %
Mitigation to congestion & air polution	80 %
others	80 – 100 %

2. Cases of Funding Source ② Case in USA

Expanded usage of Highway Trust Fund in USA

- **In 1956**, “Federal-aid Highway Act” and “Highway Revenue Act” were enacted, and “**Federal Highway Trust Fund**” was established. Taxes revenue born by road users have been dedicated since then.
- **In 1960’s**, in addition to inter-states highways, more investment to urban road network were necessary to cope with urban congestion.
- **In 1970’s**, the amended Act enabled the Trust Fund to support **urban road**, **bus lane improvement**, **traffic management facilities , car parking** and **rehabilitation of inter-states highways**.
- **In 1980’s**, rate of **Fuel Tax was raised** from 4 to 9 cent/gal in order to secure fund to **improve Mass Transit** and **rehabilitate highways**.
- **In 1990’s**, **support for Mass Transit was strengthened** by legislating that rate of Fuel Tax would increase by 5 cent/gal, half of which was to be allotted to Mass Transit Program. At the end of the decade, **research development of ITS** started by means of the Trust Fund.

2. Cases of Funding Source ③ Case in UK

- UK has not had ridged dedicated fund for road compared to Japan and USA. Feature of its funding system is subsidy system.
- UK's history of dedicated fund:
  - In 1909, Road Improvement Fund, of which source were gasoline tax and car license tax, was established;
  - In 1920, New Road Improvement Fund, of which source were Vehicle Registration Tax, was established to provide subsidies;
  - In 1936, Trunk Road Act was enacted for Ministry of Transport to implement national road projects, and since then roads have been improved through general fund.
- PPP is also an UK's feature of infrastructure funding introduced since mid 1990's. And UK Government tend to put emphasis on maintenance of road and traffic demand control because of its budget constraint.

2. Cases of Funding Source ③ Case in UK

Local Government Funding for Transport

- In 1974, amended Local Administration Act introduced "Transport Supplementary Grant", where a local government would formulate "Transport Policies and Programme (TPP)" then Ministry of Transport would review it and decide amount of grant.
- In 2000, Transport Act replaced TPP for "Local Transport Plan", which is 5 year plan and enable local governments to incorporate long term strategy and secure stable funding.
- The Transport Act in 2000 also enabled local government to impose "road user charging" and "workplace parking levy" on vehicle users in order to suppress car usage as well as raise financial resources for improvement of transportation.
- For a long time, London is the only city to exercise this power with the establishment of the Congestion Charge. UK Government has now mandated a number of large cities to produce plans to tackle air pollution and some are seeking to implement charging or non-charging Clean Air Zones."

2. Cases of Funding Source ④ Case in France

- ✓ Roads have been developed by general fund and dedicated fund in France. There exist (existed) following dedicated fund.
- ✓ Toll road scheme has been also utilized in France.

Term	Name of Fund	Purpose	Source
1951-1981	Special Fund for Road Investment (FSIR)	Road	**22% of Fuel Tax** (Allotment rate to the Fund gradually decreased)
1982-1986	Special Fund for Large Project (FSGT)	Road, Public Transport, Energy Saving	**Loan & redemption by Fuel Tax (with additional rate)** (General fund for road decreased)
1990-	Fund for Capital Region Improvement (FARIF)	(Capital Region) Road, Public Transport, Housing	**Business Office Tax in Capital Region** (To compensate decreased allotment to national budget after Decentralization)
2003-	France Transport Infrastructure Financing Agency (AFITF)	Large Transport Infrastructure	**National Development Tax, Lease fee from expressway corporations** (General Fund→Dedicated Fund)

(As of 2009)

2. Cases of Funding Source ⑤ Case in Kenya

- Kenya, as well as many developing countries, has dedicated fund system for road development and maintenance.
- **Kenya Road Board (KRB)** was established by the KRB Act, 1999, and is responsible for the management of **Kenya Roads Board Fund (KRBF)**, of which sources come from **Road Maintenance Levy Fund (RMLF)** mainly comprising Fuel Levy and Transit Tolls.

COLLECTIONS of Road Dedicated Fund in Kenya (million KSHs)

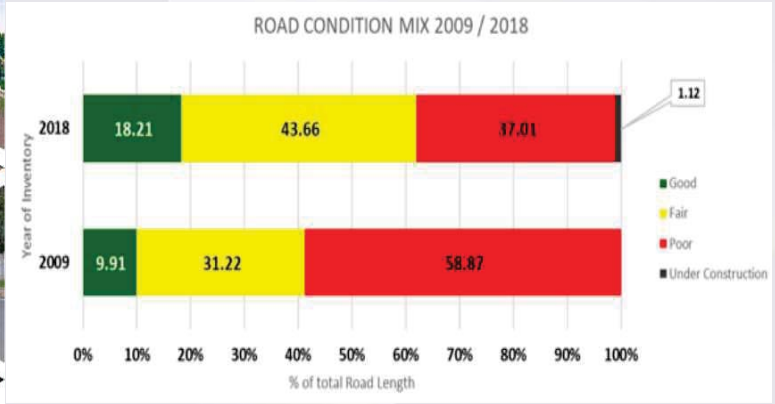
	Actual FY 2016/17	Est. FY 2017/18	Est. FY 2018/19	Est. FY 2019/20	Est. FY 2020/21	Est. FY 2019/20
Road Maintenance Levy Fund	55,321	53,184	55,824	58,587	63,933	56,578
Road Annuity Fund	13,792	10,290	10,805	11,345	12,326	12,542
Total Collections	69,114	63,474	66,629	69,931	76,259	69,120

Fuel levy collection process

Oil Marketers → Kenya Revenue Authority (KRA) → KRBF Bank Account at Central Bank of Kenya

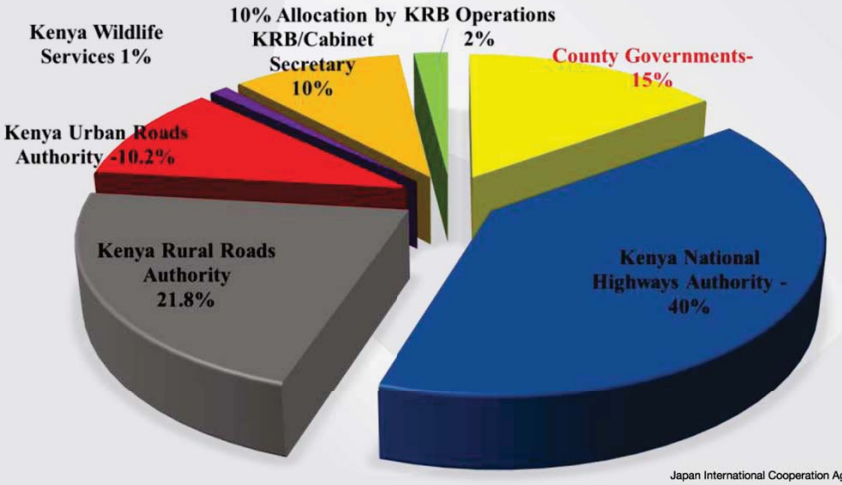
- Kenya Revenue Authority (KRA) collects Road Maintenance Levy (RML) upfront from the oil marketers.
- RML is charged on petrol and diesel only at the rate of 18 KSh per Liter. 3 KSh per Liter is channeled towards the **Road Annuity Fund** and the balance of 15 KSh per Liter is for the **Road Maintenance Levy Fund**.
- KRA retains agency collection fee of 2%, and remits the net collections to KRB on a weekly basis.

- Because of Kenya Road Board Fund, road condition in Kenya is being improved.



(Source: "Annual Public Road Programme 2021-2022", KRB)

The allocation of KRBF in FY2016/17 is as follows:



- Allocation criteria for FY2017/18 budgets amongst County Governments was based on 2nd Generation formula approved by the Senate 20th April 2016, in accordance with Article 217 and 218 of Constitution of Kenya.
- Parameters Percentage Weights are as follows:

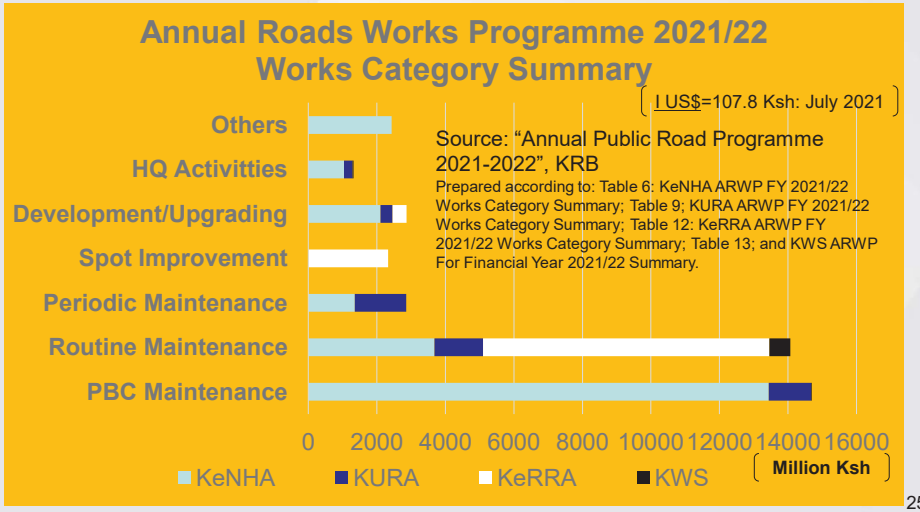
	Item	weight
1	Population	45%
2	Equal Share	26%
3	Poverty	18%
4	Land area	8%
5	Fiscal effort	2%
6	Development factor	1%
		100%

2. Cases of Funding Source ⑤ Case in Kenya

- Section 19 (4) of the KRB Act requires the Board to review individually the annual road programmes submitted by the road agencies and consolidate the Annual Roads Works Programmes (ARWPs) into Annual Public Roads Programme (APRP) which shall:
  a. Specify the amount allocated for the maintenance, rehabilitation and development of each class of roads;
  b. Match the cost of implementing the APRP with revenues collected or estimated to be collected by the Board and within the Fund; and
  c. Identify roads requiring maintenance, rehabilitation or development in order of priority, taking into account social and economic requirements of the country or any part thereof in which roads are located.

2. Cases of Funding Source ⑤ Case in Kenya

- The following graph shows KRBF allocation to the 4 road agencies according to APRP 2021/22.
- KRBF is mainly allocated for maintenance of roads.



2. Cases of Funding Source ⑤ Case in Kenya

- RMLF can be utilized including traffic management such as ITS.
- Head Quarters Activities of APRP include:
  - Emergency Works;
  - Axle Load Control;
  - Road Reserve, Corridor Management & Clearance;
  - **Intelligent Traffic Management System**;
  - Road Inventory and Condition Survey;
  - Bridge Maintenance System (BMS);
  - Traffic Census;
  - In-House Design;
  - Designs for NMT and Feasibility Studies;
  - Road Safety Campaigns;
  - Special Programmes & Environment Awareness;
  - Research and Innovation; and
  - Arbitration and Court Matters.

2. Cases of Funding Source ⑤ Case in countries with Road Fund

- World Bank has supported developing countries to establish Road Fund, dedicated fund for road maintenance. Road Fund is strong instrument and has possibility to facilitate ITS implementation and operation.
- However, Road Fund schemes in some countries have tight discipline of usage. Considering the discipline, relevant agency should design project scheme and/or revise the discipline.
- The points of the dicipline are:
  - Whether the fund can be used for installation of ITS (amount of fund is limited. Construction and installation are sometimes not eligible);
  - Whether the fund can be used for O&M of ITS; and
  - What agencies are eligible for the fund.

2. Cases of Funding Source ⑥ Case in Donor Funds

- Developing countries have opportunity to implement ITS through funds and technical assistances provided by Multilateral Development Banks, JICA and other donor agencies.
- JICA has cooperated: urban traffic management systems in Phnom Penh, Bengaluru, Chennai and Kampala; express way management system in Colombo, Hanoi, Delhi; and so on.

Traffic Management System in Phnom Penh funded by JICA

3. Innovative Fund Raise

- Public transport administrator and/or operator can relatively easily introduce ITS because of revenue of user charges.
  - Belgrade City, Serbia
- Private ITS service provider can raise fund by selling traffic big data and/or advertisement fee. Government agencies have possibility to work with Private ITS service provider.
  - Toyota Tsusho Nexty Electronics in Thailand
  - Utilization of information provided by Google and Waze.
  - Zero-Sum model in Ahmedabad, India

  (PPP model generating revenue by advertisement fee)
- Congestion Charge can raise fund by charging users on urban roads.
  - Singapore, London, Stockholm
- Government agency can lease space and equipment of ITS facilities so as to raise fund.
  - National Police Agency, Japan tries to utilize traffic signal equipment as a 5G communication devices.

3. Innovative Fund Raise (Belgrade City, Serbia)

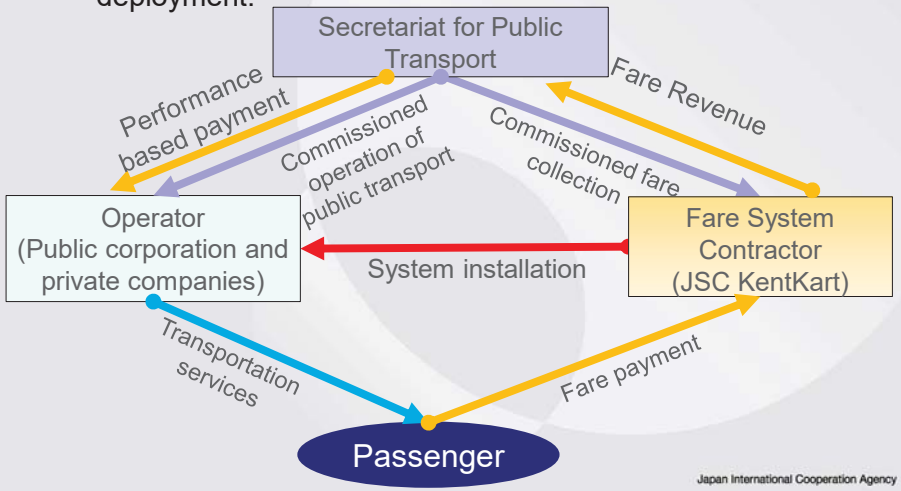
- Secretariat for Public Transport (SfPT) of Belgrade City introduced electronic common fare collection system with IC cards in 2012 under the contract with JSC Kentkart.
- All operators of public transport equip with the system.

3. Innovative Fund Raise (Belgrade City, Serbia)

- JSC Kentkart also provides SfPT with a system supporting operation of the public transport, under which location of trams and buses are monitored by attached GPS.
- JSC Kentkart stations its staff at the operation center of SfPT to support SfPT staff.

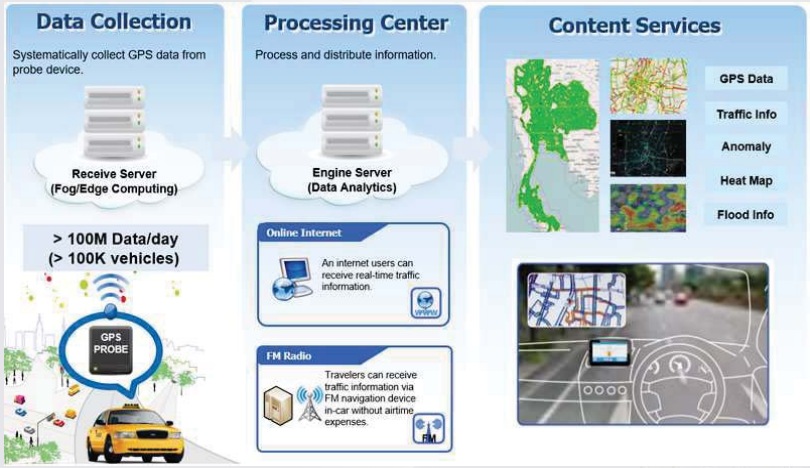
3. Innovative Fund Raise (Belgrade City, Serbia)

- Under the Belgrade system, ITS service provider is also responsible for fare collection.
- Fare revenue of public transport can be source for ITS deployment.



3. Innovative Fund Raise (Toyota Tsusho Nexty Electronics in Thailand)

- Toyota Tsusho Nexty Electronics is doing traffic data collection, analysis and provision business in Bangkok. It collect data through taxi prove system.



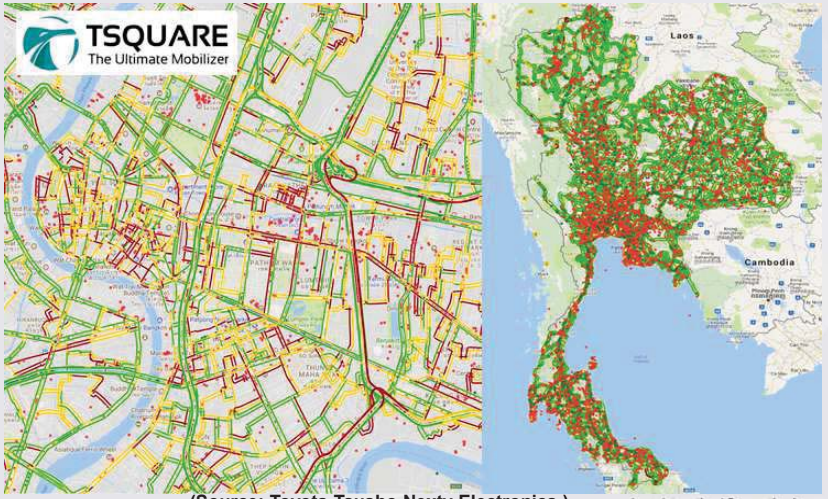
(Source: Toyota Tsusho Nexty Electronics)

3. Innovative Fund Raise (Toyota Tsusho Nexty Electronics in Thailand)

(Source: Toyota Tsusho Nexty Electronics)

3. Innovative Fund Raise (Toyota Tsusho Nexty Electronics in Thailand)

Congestion observed through floating car data



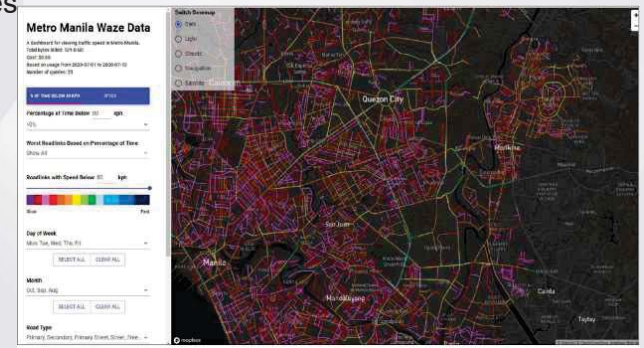
(Source: Toyota Tsusho Nexty Electronics)

3. Innovative Fund Raise
(Toyota Tsusho Nexty Electronics in Thailand)

- The company operates on pure commercial basis, and can raise enough profit without government support.
- The larger data volume is, the more profitable it becomes. The company has huge data, however, their service fee is too expensive for government agencies to utilize for public use.
- However, this case suggests possibility of self-sustainable ITS service provision considering value of traffic big data.
- There are two possibilities theoretically:
  i. Public entity provides people with free ITS service and sells traffic big data to business sector. Sales can cross-subsidies ITS service provision. One of challenge is uncertainty of market data price.
  ii. Private company handling traffic big data provides people with free ITS service according to an agreement with a government agency. Challenges are whether private sector needs cooperation with public sector or not, and whether public sector has authority to approve and/or intervene data business.

3. Innovative Fund Raise
(Utilization of Waze data to analyze traffic situation)

- Metro Manila Development Authority (MMDA) has an MOU called Connected Citizens Program on data exchange with Waze, a traffic navigation company with 2.4 million active users in the Philippines.
- By utilizing Waze data, MMDA can use not only for real-time operation but also analysis of travel speed under various situation, and identify bottlenecks. In addition, it is useful to assess the impact of countermeasures against traffic congestion.



Interface of visualization tool of Waze travel speed data developed by for JICA experts (Source: JICA experts)

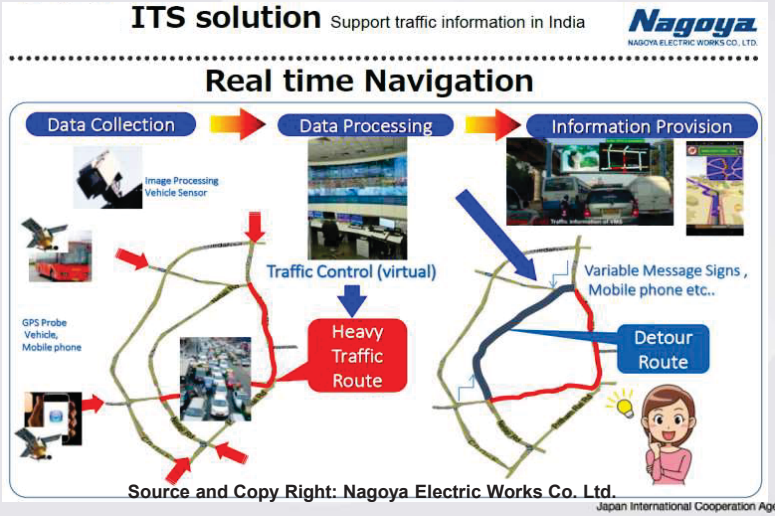
3. Innovative Fund Raise
(Utilization of Waze data to analyze traffic situation)

- Government institute of Costa Rica analyze traffic situation by utilizing Waze traffic data

Degree of road congestion in San Jose, Costa Rica
(Source: presentation material of the Government of Costa Rica prepared according to Waze traffic data 2018)

3. Innovative Fund Raise
(Zero-Sum ITS in India)

- ✓ In Ahmedabad, India, a PPP concessionaire provides citizens with traffic information service through ITS.



Source and Copy Right: Nagoya Electric Works Co. Ltd.

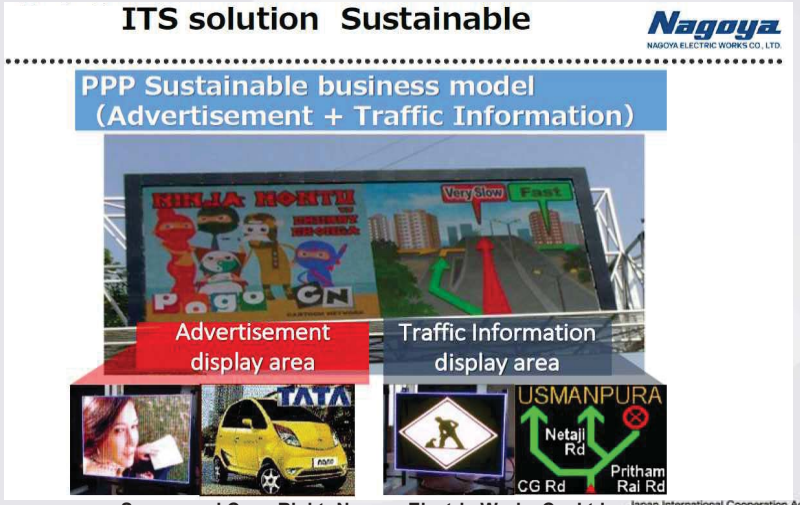
3. Innovative Fund Raise (Zero-Sum ITS in India)

JICA supported the SPC to conduct social experiment in India.

Source and Copy Right: Nagoya Electric Works Co. Ltd.

3. Innovative Fund Raise (Zero-Sum ITS in India)

The SPC gains fees for advertisement and recover cost of ITS service provision and initial investment.



Source and Copy Right: Nagoya Electric Works Co. Ltd.

3. Innovative Fund Raise (Congestion Charge)

- Congestion Charge, which is one measures for “Traffic Demand Management” aiming to decrease traffic volume in a certain area by charging the area, can raise fund by charging users on none access controlled road.
- Singapore, London and Stockholm are famous cities introducing the policy.

Stockholm Case

- Swedish Transport Agency explains, “This is being done not only to improve accessibility and the environment, but also to help develop the infrastructure.”

Charged Area of Stockholm
(Source: Swedish Transport Agency)

3. Innovative Fund Raise (Congestion Charge in Singapore)

ALS 1975-1998

- During ALS phase 1975 – 1998, average annual gross revenue was 6.8 million S$, average annual operating cost was 0.6 million S$, and initial implementation cost (ex. check box construction and public relation) was 0.5 million S$.
- Before starting ALS, large scale preparation amounting to 6 million S$ was implemented, which consisted of such as installation of new LRT, bus service improvement and suburban housing development for the poor living in city center subject to ALS. Net revenue of ALS recovered these investments in a few years.

(Source: HIDO Study)

ALS (Area Licensing Scheme) (1975-1998)
(Source: Land Transport Authority, Singapore)

3. Innovative Fund Raise
(Congestion Charge in Singapore)

ERP 1998- (Mitsubishi Heavy Industry, Japanese manufacturer, is the contractor)

- Initial investment for ERP was 1.97S$, half of which was used for purchase and installation of on-board units.
- ERP gross revenue were 125 million S$ (2008), 149 million S$ (2009) and 159 million S$ (2010). Operating cost, including salary for 30 operating staff and 35 maintenance staff, corresponds to approximately 20% of gross revenue.
- As there is no specific legislation regarding usage of net revenue of ERP, net revenue belongs to general account of the Government.

(Source: HIDO Study)

Electronic Road Pricing (ERP) (1998-) (Source: Land Transport Authority, Singapore)

3. Innovative Fund Raise
(Congestion Charge in London)

Net revenue of Congestion Charge is below the expected amount 200 million £/year because of less traffic volume than predicted one, and utilized for transport improvement. As the cordon area decreased, revenue by ERP also decreased.

Year	Revenue	Expenditure	Net income
02/03	18.5	76.8	-58.3
03/04	186.7	141.4	45.3
04/05	218.1	125.1	93.0
05/06	254.1	147.8	106.3
06/07	252.4	163.3	89.1
07/08	328.2	191.2	137.0
08/09	325.7	177.2	148.5
09/10	312.6	154.5	158.1
10/11	287.0	279.0	8.0
11/12	227.0	223.0	4.0
Total	2,410.3	1,679.3	731.0

3. Innovative Fund Raise
(Congestion Charge in London)

- Cost for ERP in FY 2007/2008 was 131 million £; gross revenue was 268 million £; and net revenue was 137million £, which was used as the table below. Bus network improvements was a major usage of the net revenue.

Application of congestion charging scheme revenues, financial year 2007/08. (£ million provisional).
(Source: "Central London Congestion Charging Impacts monitoring Sixth Annual Report", July 2008, Transport for London)

Bus network improvements	112
Support to London Boroughs for local transport improvements	2
Roads and bridges	13
Road safety	4
Environment	2
Walking and cycling	4
Total	**137**

4. Importance of Operation & Maintenance

- Traffic management facilities including ITS have been sometimes abandoned due to poor O&M.
- O&M, of which structure and cost must be clarified prior to implementation, is a crucial issues on ITS deployment.

Fig. Traffic Management Center in a South Asian Big City

Fig. Waste Signal Material Pilled up nearby the Center

Although PC can work, no traffic data are transmitted because of malfunction of roadside modules and communication cable.

4. Importance of Operation & Maintenance

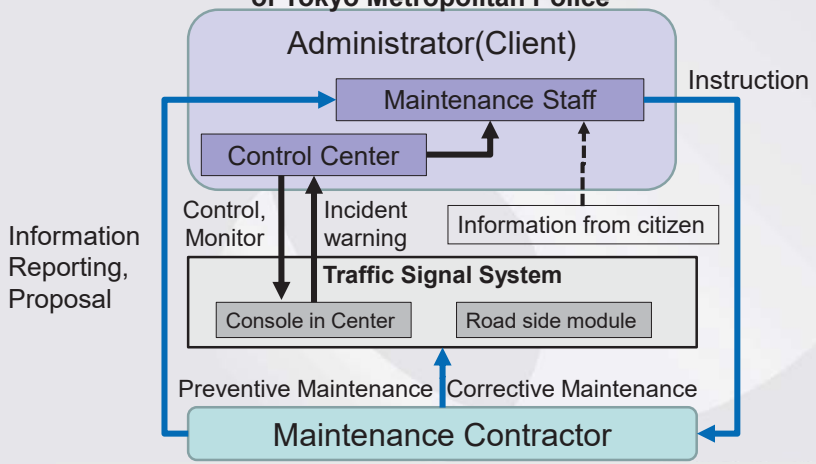
- ITS needs relatively high O&M expenditure compared to initial cost. High technical knowledge of manufacturer is sometimes necessary.
- Enough personnel and budget for O&M contracting should be secured.

	Road (except for ICT)	ITS Facility
Capital Cost (construction)	Relatively High (ODA is applicable)	Relatively Low (ODA is applicable)
O&M Cost	Relatively Low ODA applicable only initial stage	Relatively High ODA applicable only initial stage
Inspection	Necessary	Necessary
Maintenance Work	Cleaning, Pot Hole Repair	Cleaning, Replace Parts
System Update	No need in principle	Generally every 5-10 years
Commissioning	No need in principle	Necessary in case of expansion/updating system
Lease Fee Communication Fee	No need in principle	Possible (for Cloud Server, Telecommunication line etc.)
Spare Parts	No need （repair work contracted out）	Pole, electronic parts

4. Importance of Operation & Maintenance

- For example, O&M of traffic signal systems in Japan rely on maintenance contractors.

Outline of O&M Structure on Traffic Signal System of Tokyo Metropolitan Police



（Source: Japan Traffic Management Technology Association

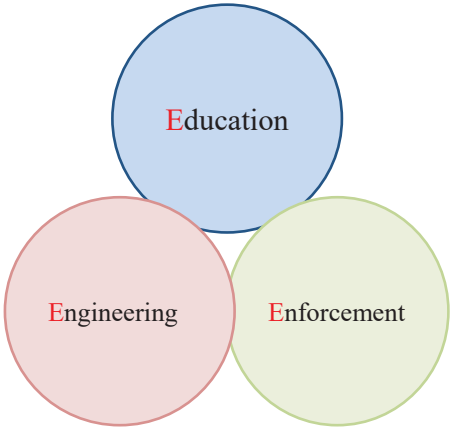
Thank you for your attention！

Traffic Management




November 18. 2021

3 E required for traffic management



3 E required for traffic management（1）

Education

Lifelong education from children to the elderly



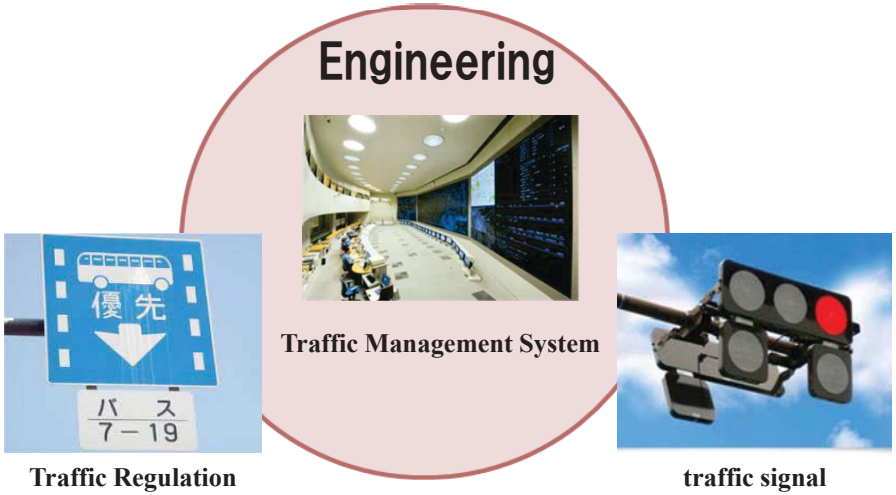
3 E required for traffic management（2）

Enforcement

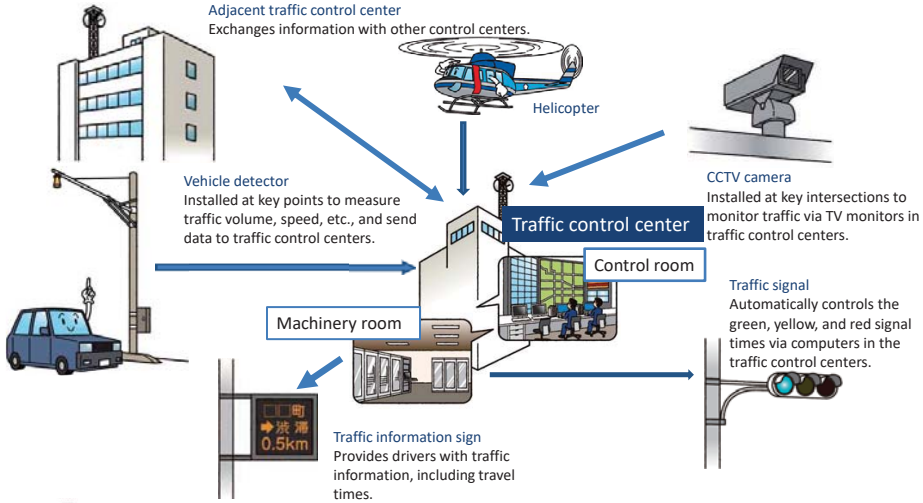
Traffic guidance and crackdown in according to the actual traffic situation


Crackdown to prevent traffic congestion　**Crackdown to prevent traffic accidents**

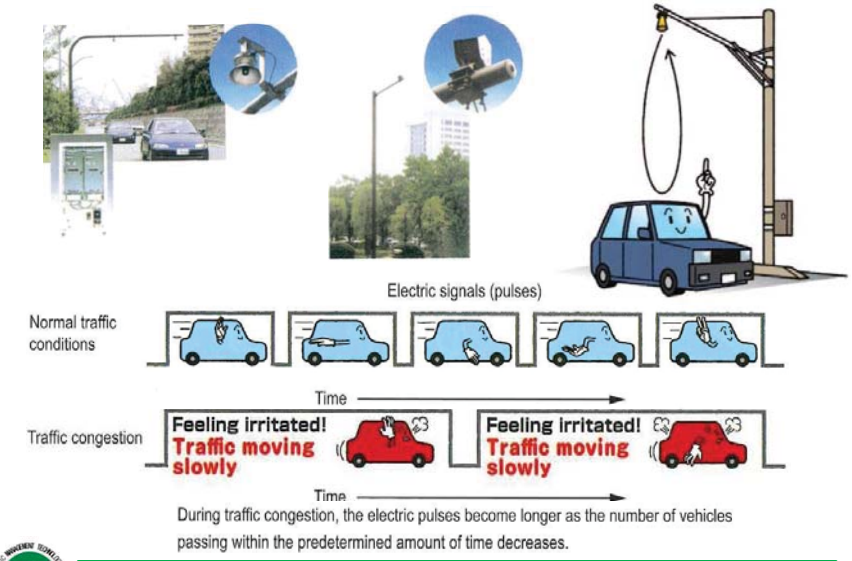
3 E required for traffic management（3）



Traffic Management System

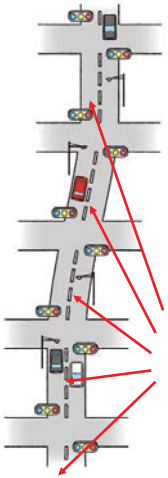


Collection and Analysis of Traffic Information



Supply of Traffic Information to Road Users

Traffic Signal Control



Signal control method in Japan : MODERATE(STREEM)

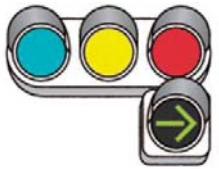
The important matter of signal system installation

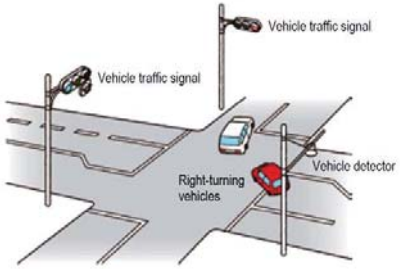
○ Signal control considering traffic volume, intersection shape, priority vehicles, etc .

(**Case Study**)

- Intersection with many right-turn vehicles : Installation of right turn lane and operation of right-turn-actuated signal
- Intersection with many pedestrians crossing in front of the station : Operation of signals separating pedestrians and vehicles
- Roads with many buses : Installation of bus priority lanes, operation of signals that prioritize buses

Example of Signal Control①
(Right-turn-actuated signal control system)

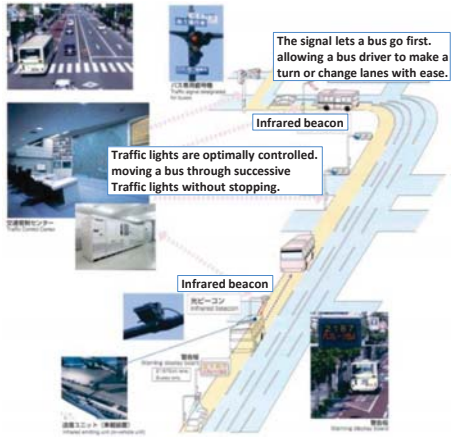




Elderly-actuated push-button box

Elderly-actuated pushbutton traffic signals are designed to extend the pedestrian green light time when the radio waves emitted from the pendants worn by senior citizens and physically disabled people are detected so as to ensure their safety.

Example of Signal Control②
(Public Bus transportation priority system etc.)



PTPS
(Public Transportation Priority Systems)

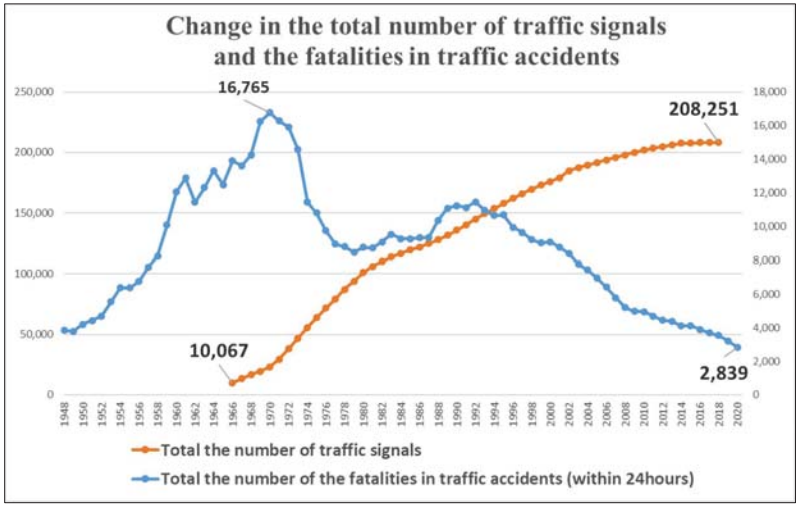
Public Transportation Priority Systems ensure the scheduled operation of buses and other public transport and encourage the use of public transport.
Based on vehicle ID information received from the on-board unit in the bus via infrared beacons, the Traffic Control Center extends the green or shortens the red light so that buses can pass intersections smoothly.
There is a case in which the implementation of PTPS reduced bus operational hours by 13%.

Measure against blackout of traffic signal

Prevent traffic accidents and traffic congestions by operating signals even during blackout

If traffic signals switch off during a power cut caused by an event such as a natural disaster (e.g., an earthquake or lightning strike), a power facility failure, a power distribution system malfunction, or a planned power outage, there will be an increased risk of accidents due to the chaotic traffic situation. In the event of a power outage, police officers usually try to regulate and lead the traffic by themselves, but there is no way to do during a large-scale outage. Therefore, to prepare for possible power outages, traffic signal power generators have been installed to supply temporarily emergency power during a power outage to traffic signals at the major intersections on main arterial roads.

Effect of Traffic Management system①



Effect of Traffic Management system②

Effect of New traffic signal control method（MODERATO) introduction (Metropolitan Police Department)

Traffic index	Old traffic signal control method (～1994)	New traffic signal control method (1995～)	Effect(%)
Total travel distance 【1,000veh/km】	(21，619)	21，619	—
Total travel time 【1,000veh/hour】	1，194	1，086	9．1
Congestion length-time 【km/hour】	448	343	28．0

JAPAN TRAFFIC MANAGEMENT TECHNOLOGY ASSOCIATION
https://www.tmt.or.jp/

2021年度巻末資料－233

Learn from Actual Practice

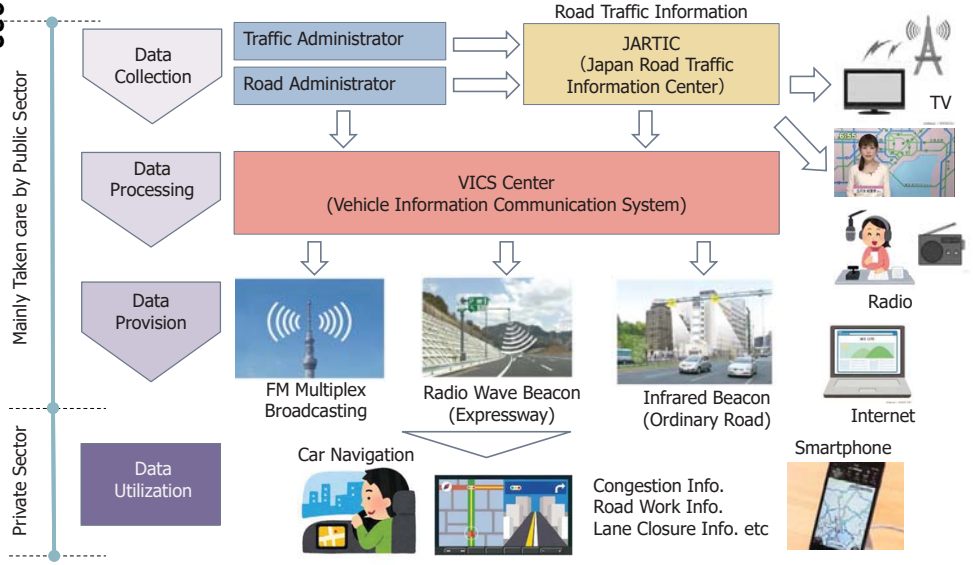
Traffic Information Provision

Consultant Team

Traffic Information Provision (Movie)

Traffic Information Provision

Entire Structure for Road Traffic Information Provision and Car Navigation in Japan



Thank You !

To the Next Theme

Traffic Information Provision (Supplement)

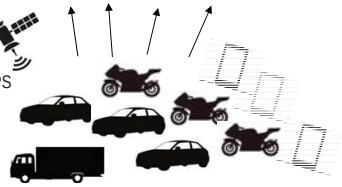
<Probe Data: GPS Based Data >

Time	Latitude	Longitude
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx
・・・	・・・	・・・
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx

Processing

Congestion Understanding

GPS



(GPS On-board Unit or Smartphone etc.)

Information Provision

Data Analysis

Traffic Information Provision (Supplement)

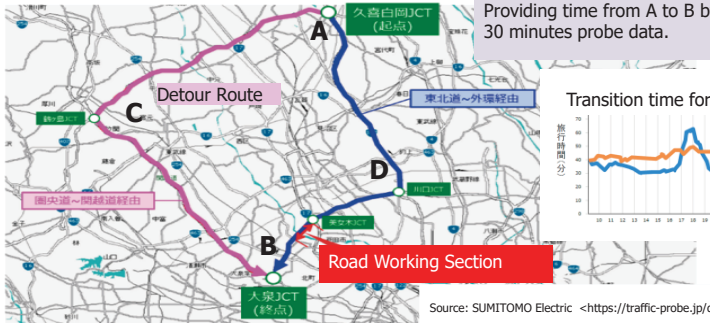
Data Utilization can be Possible by Data Accumulation

Ex. Probe Data can Solve Traffic Problems (On real-time for Wide Area)

・Provide the time to destination for multi routes as per user's requirement.

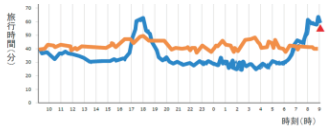
Showing Travel Time of Long Distance Trip

区間	ルート詳細	所要時間	順調時
久喜白岡JCT → 大泉JCT	A – D - B	60 minutes	35分
	A – C - B	45 minutes	45分



Providing time from A to B by calculating last 30 minutes probe data.

Transition time for each routes by hours



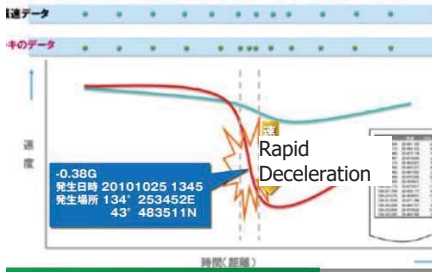
Source: SUMITOMO Electric <https://traffic-probe.jp/document/member_only.html>

Traffic Information Provision (Supplement)

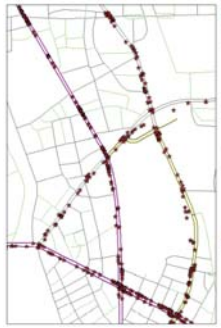
Data Utilization can be Possible by Data Accumulation

Ex. Probe Data can Solve Traffic Problems

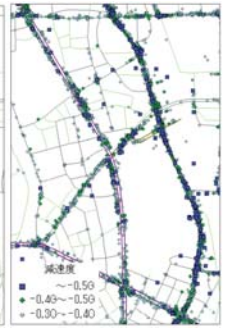
The point where sudden braking occurs frequently is a potentially black spot. If we can specify the location, we can carry out measures.



Sudden breaking point data



Accident occurring location



Sudden breaking location

Source:<http://www.trans.civil.nagoya-u.ac.jp/~yamamoto/presentation/IP06Spring.pdf>

Traffic Information Provision (Supplement)

Traffic Counter

GPS Device

Accident, Construction

Traffic Contorol Center

VICS Center

VMS

Car Navigation

Smart Phone App.

Bus Location System

Information Corner

Route Guide

Comfortable drive

Source : Consultant Team

Enhancement of Public Transport Service by ITS

Nov.17th , 2021
Atsushi MOCHIZUKI
Nippon Koei Co.,Ltd.

1. Roles of Public Transportation

https://i.imgur.com/kw8DaST.gif

✓ **Efficient Mobility**
✓ **Low CO2 Emission** …etc

But..

2. Issues on Public Transportation

Poor Service Level compared Private Transport

- Longer travel time (affected by traffic)
- Poor connectivity between modes
- Low comfort level
- Difficulty in understanding the routes and timetables …etc

3. Enhancement of PT's service by ITS

✓**Improvement and Management in fleet operation**

✓**Enhancement of passenger service**
- Information provision
- Integration of service (Search, Reservation, Transfer, Payment…)

✓**Utilization for Bus Operation Planning/improvement**

3. Enhancement of PT's service by ITS

Fleet Operation Data (Location etc) | Passenger's Flow Data | Passenger's Payment (Transaction) Data ..etc

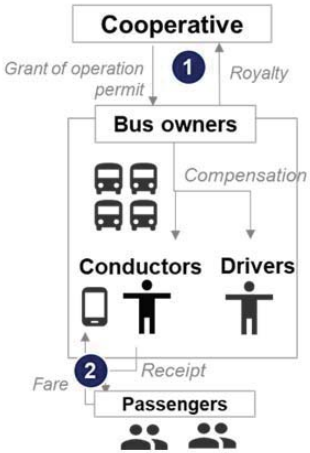
✓**Improvement and Management in fleet operation**

✓**Enhancement of passenger service**
- Information provision
- Integration of service (Search, Reservation, Transfer, Payment…)

✓**Utilization for Bus Operation Planning/improvement**

4. Example of Fleet Management ~ Matatu, Kenya ~

Developed by "Data Integrated Limited (DIL)"
Invested by "Toyota Tsusho Corporation"



1 Services provided to cooperative and owners


Transport information image

Fleet management
- Transport information of busses belong to cooperative.
- Profit information of each busses

2 Services provided to passengers


Cashless payment by a smartphone.

Cashless payment system
- Booking, monitoring transport information and payment through an application for smartphones.

https://www.toyota-tsusho.com/english/press/detail/201016_004698.html

5. Example of Information Provision ~ Bus Location System ~

Signage @ Bus Terminal

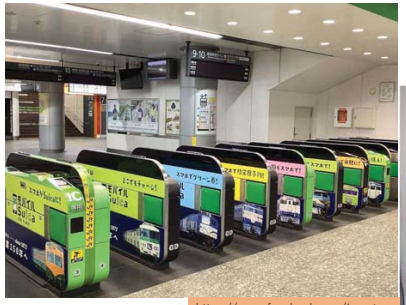
Signage @ Bus stop

Website / App

6. Example of Advanced Payment System

https://www.jreast.co.jp/suicamoney

https://corriente.top/post-23523/


https://www.facebook.com/jreast.yokohama.jp/posts/372080487672621

※交通系ICカード全国相互利用のシンボルマーク

PASMO manaca nimoca

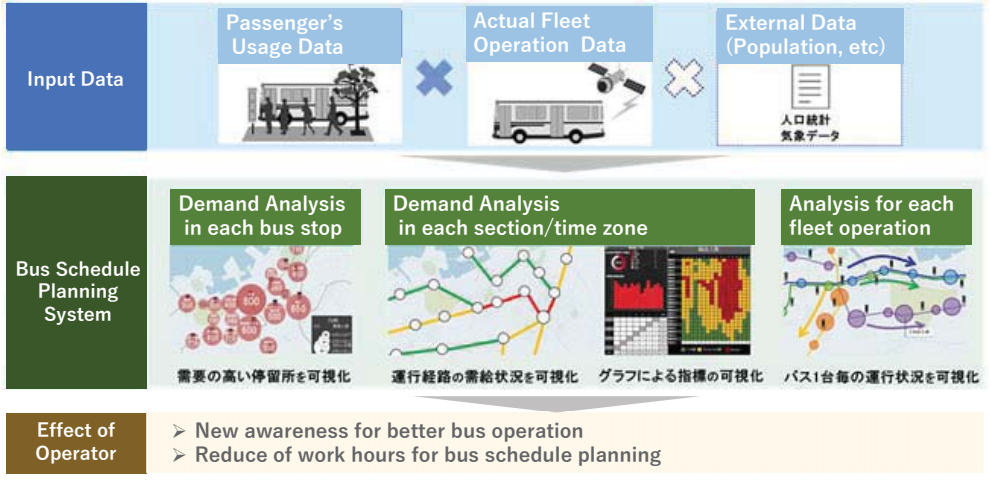
Contactless IC card (common in various mode, region)

7. Example of “MaaS” (Mobility as a Service)

Let’s watch Movie!

BGM provided by : Music-Note.jp http://www.music-note.jp/
株式会社ピクセル http://pixel-co.com/

8. Example of Utilization for Bus Operation Planning



2018 Asea Pacific Forum / https://www.hitachi.co.jp/New/cnews/month/2018/04/0424.html

8. Summary

✓ Collaboration between Operators/Stakeholders

✓ Utilization of Data/Information

✓ Integration of System and Service

..are the Key for success!

1. COVID-19 Impact on Transportation in Japan

Sdvvhqjhuv#wudlq#kvdjh#sdwkuq#bqdd|vlv#urp #F#Fdug#Elj0gdwd#MU#Idvw,

Major Hub Station Passengers Decrease

compared “before-COVID19 (January 2020)” in peak hours(7am – 10am)

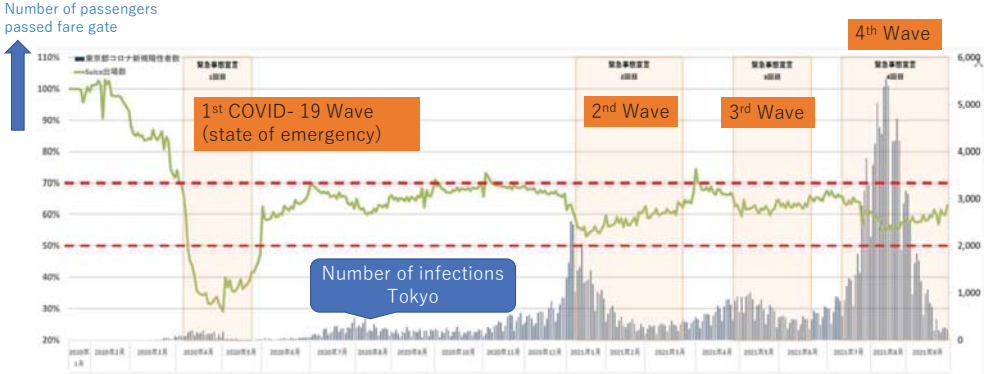
山手線の主要駅に通勤するお客さまの数について、**2020年1月**と、**2021年1月**と**2021年7月**における朝通勤時間帯の利用状況をそれぞれ比較（朝7時～10時の間に改札出場）

(Source) https://www.jreast.co.jp/press/2021/20211104_ho04.pdf

1. COVID-19 Impact on Transportation in Japan

Sdvvhqjhuv#wudlq#kvdjh#sdwkuq#bqdd|vlv#urp #F#Fdug#Elj0gdwd#MU#Idvw,

Number of passengers passed fare gate



山手線全駅の平日朝7時～10時のSuica（定期券、チャージ利用）改札出場数合計（**2020年1月20日から2021年9月30日**まで,土日祝,お盆,GW,年末年始除く）**コロナ前の2020年1月20日**を100%として指数化

(Source) https://www.jreast.co.jp/press/2021/20211104_ho04.pdf

2. Transportation Trend with COVID-19

+4 ,Wudiilf#Ghp dqg

- ✓ Medical Field
- ✓ Delivery (Online shopping..)
- :

- ✓ Commuting
- ✓ Business Trip
- ✓ Tourism
- :

+5 ,P rgdd#Vsdw

- ✓ Mobility with Personal Space
- ✓ Open-air Mobility
- ✓ On-demand Mobility

- ✓ Crowded Mass Transit
- ✓ Mobility with possibility of contact with different persons

3. Basic Concept to cope with COVID-19 (in transportation field)

Physical Countermeasures

- ✓ Contactless / Automation
- ✓ Social Distancing
- ✓ Hygiene Management

Management

- ✓ Crowding Avoidance / Monitoring
- ✓ Demand Response
- ✓ Traceability / Verification of passengers (Vaccination, PCR negative etc)

4. Effort for COVID-19 Response
(Ex.1) Introduction of Fully Contactless Payment

P dqgdwru|#iru HWF2Fdvkdnvv#bw#Wrqœerrwk

Also Vehicle's data collected

(Source) https://www.mlit.go.jp/road/ir/yuryou/7pdf/1.pdf

Wudqvsruwdwrq#F#Fdug lq#P relb#Dss1

Also passenger's data collected

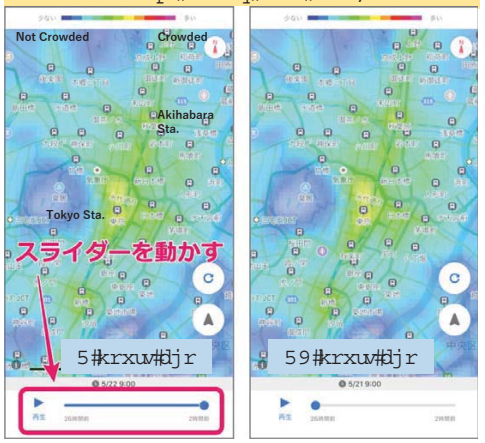
(Source) https://matsunosuke.jp/mobile-suica/

Dxwrqrp rxv#Exv# z lk#Idfldg#Uhfrjqlwrq

(Photo by Mochizuki)

5. (Ex.2) Crowding Avoidance / Monitoring

Furzglgj#Jdgdu
+urp #Shuvrq#Eorz#Gdwd,



https://about.yahoo.co.jp/pr/release/2020/05/25b/

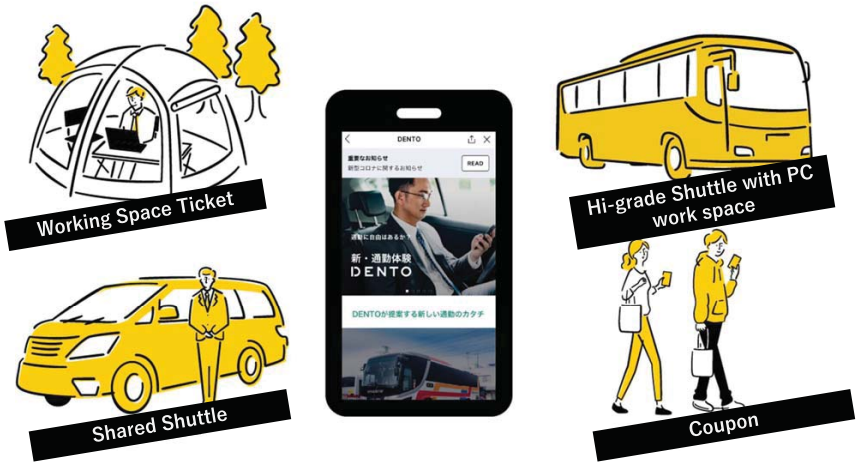
Furzglgj#Dyrlgdqfh#
Ydulxv#Prgh Urxwh#Vhdufk

https://about.yahoo.co.jp/pr/release/2020/06/09b/

Annex:

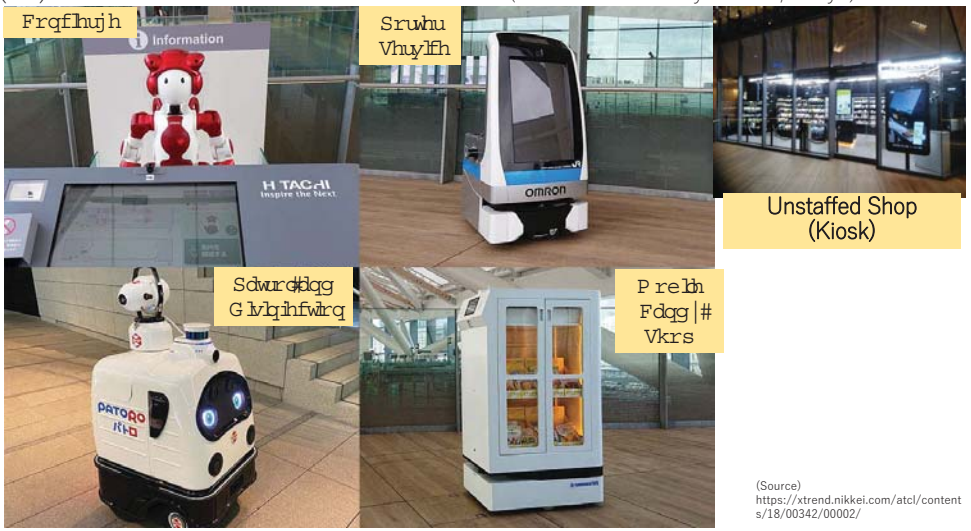
Examples of various COVID-19 countermeasures in Japan/The World

(Ex) With-COVID19 MaaS trial by Rail-operator (Tokyu Corporation)



(Source) https://www.tokyu-dento.jp/

(Ex) Automation Robots in the Station (Takanaka Gateway Station, Tokyo)



(Source) https://xtrend.nikkei.com/atcl/contents/18/00342/00002/

(Ex) Monitoring system in public facilities

※写真は入退室ゲートと組み合わせたイメージです。

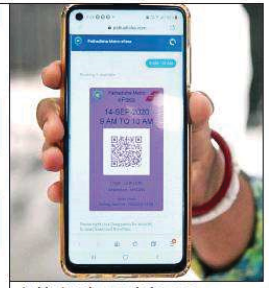
(Source) https://tsuzuki.jp/jigyo/ai/thermometer/

(Ex) Reservation and Passenger Control (Kolkata Metro, India)

Pic Amit Moulick

TWEAK IN ALGORITHM

- 20% increase in booking caps for the busy stations
- Increase at Dum Dum, M G Road, Esplanade, Kalighat, Mahanayak Uttam Kumar, Kavi Nazrul, Kavi Subhas
- The objective is to accommodate more genuine commuters
- On Monday, 53,000 passes were issued, but only 20,000 rode the Metro
- Many complained of not getting free slots
- Tweaks in booking slots have to be dynamic, based on footfall data analysis
- 400 people can ride an eight-coach train at a time
- There are 110 trips on north-south line daily
- There were 47,000 bookings on Thursday, but Only 26,000 riders
- Metro wants to accommodate 1 lakh passengers daily



A rider's colour-coded e-pass

(Source) https://timesofindia.indiatimes.com/city/kolkata/metro-hikes-e-pass-cap-at-busy-stns-cuts-limit-for-gitanjali-netaji-bhavan/articleshow/78176411.cms

(Ex) Control for Unvaccinated Passengers (Italy)

Travellers at Tiburtina train station in Rome: Italy's 'green pass' is an extension of the EU's digital Covid certificate. Photograph: Maria Laura Antonelli/AGF/Rex/Shutterstock

https://www.theguardian.com/world/2021/jul/22/italy-covid-19-green-pass-vaccinations-restrictions

(Ex) COVID-19 Response by Japanese Operator (Yokohama Seaside)

Dxwrqrp rxv#Gulylqj | Frqwdfwohvv2Dqqylud#Wlfnhw#Jdwh | FRYLG04<#SU#Dfwylwlhv#yhqwdwrq,

(Ex) Utilization of AI for Train/Passenger Flow Control (Demand response, Panama)

(Source) https://www.alstom.com/press-releases-news/2020/6/alstom-offers-artificial-intelligence-solution-ensure-passenger

Learn from Actual Practice

Parking Management and Service Utilizing IT

Consultant Team

Parking Management and Service Utilizing IT

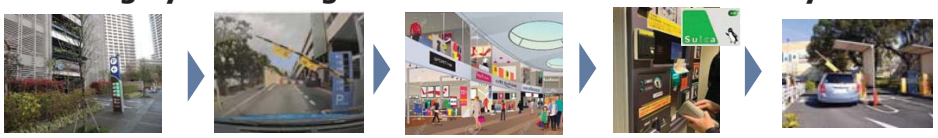
- ✓ Important to strategically develop parking lots and operate them efficiently
- ✓ Examples of parking measures: Enactment of obligation of parking lot preparation for buildings of a certain size as a measure for car storage, construction of street or off-street parking, etc.
- ✓ Comprehensive measures are important, e.g. parking construction according to parking demand, the setting of parking prohibited areas as part of traffic control, crackdown on illegally parked vehicles, and etc.
- ✓ In recent years, it has become possible to combine the parking service with other related services and provide a flexible parking fee discount service utilizing IT and electronic payment technology.
- ✓ Park-and-ride is one of the measures to curb the demand for automobile traffic to the central area of the city center, and effective measures can be taken by using a common payment method for public transportation and parking fee payment.
- ✓ These applications include car sharing services and MaaS nowadays.

Parking Management and Service Utilizing IT

Example

Movie

◆**Parking System Using License Plate Linked with POS System**



Parking Availability Information → Number Plate Reading at Entrance → Shopping → Parking Discount → Automatic Gate Open at Exit

- ✓ Grasping the number of parking spaces with a sensor for each parking space → Providing parking availability information to the users
- ✓ License plate reading at entrance → Automatic gate opening at the exit (Avoiding congestion at exit and enhancing convenience)
- ✓ By linking with POS System (Point of Sales System), parking fee discount according to the shopping amount, grasping whether or not payment is made based on car number link information, and automatic gate open

Source: Consultant Team

Parking Management and Service Utilizing IT

Supplementary Material

Parking Management and Service Utilizing IT　Supplement

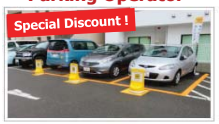
◆Collaboration between Parking Operators Offering Car Share Services and Railway Operators in Tourism Location

- ✓ A parking operator offers a car sharing service.
- ✓ By parking for a certain period of time at the parking facility provided by the parking operator, a discount service for nearby tourist facilities and/or places is offered.
- ✓ Further, it collaborates with a railway operator.
- ✓ A discount on the car sharing fee is offered by using IC-Card if the railway of the collaborating railway operator is used.

Railway Company

Travelling to the service target area using the railway

Parking Operator



Using the car share service offered by parking operator

(Driving in Tourism Place)

Enjoying driving in tourism place at discounted car share service fee

出典：Times Car Share for Miura Peninsula Tourism

Parking Management and Service Utilizing IT　Supplement

◆ Parking Fee Discount Service Linked with Public Transport Use (Park and Ride)

(Source: Times)

Parking in the Service Target Parking Lot

Using Public Transport

Settling Parking Fee

- ✓ Parking discount based on the use of public transportation using IC card
- ✓ Realized by collaboration between a public transport company and parking operator
- ✓ Parking → Using public transport with IC card → Parking discount based on usage record

◆Parking Lot Settlement as Part of ETC Multipurpose Use

- ✓ Utilizing on-board equipment and communication technology used for ETC in the country as a national standard for parking lots
- ✓ DSRC technology in Japan and RFID technology in Taiwan are used for parking lot settlement as part of ETC multipurpose use.

RFID Settlement in Taiwan

Source：Geovision

Parking Management and Service Utilizing IT　Supplement

◆Major Types of Parking

（1）Gate Type Parking

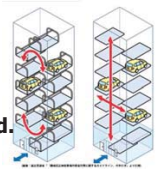
A system in which a gate bar is installed at the entrance and exit of the parking lot so that only parking lot users and registered / permitted vehicles can enter and exit. There are exit settlement type and prepayment type.

（2）Flap Type Parking

A type with flap plates installed in each parking space. It allows the parking car to exit by lowering the flap plate once the parking fee is paid and settled.

（3）Mechanical Parking Station

It mainly manages and operates from entrance to fee settlement in a multi-story car park. After entering and getting off at the warehousing berth, the vehicle is stored and a parking ticket is issued. After the settlement, the vehicle will be carried to the delivery berth and will participate.



By adopting electronic payments such as SUICA, more convenient use becomes possible.

Learn from Actual Practice

Transportation Hub and IC Card

Consultant Team

2021年度巻末資料－244

Transportation Hub and IC Card

- ✓ Various payments with one IC card:
  Payment for multiple different transportation modes such as bus, railway, car parking, etc. and payment for convenience stores, vending machines, etc.
- ✓ Transportation hub: Arranged in consideration of efficiency and convenience of mobility, flow and movement of people
- ✓ For example: Station square in front of railway station → Departure / arrival place of last mile transportation, e.g. bus, taxi, and temporary waiting pace of passenger car, parking lots, and etc. → Convenience stores near by → Access routes to the shopping area/business district in the vicinity

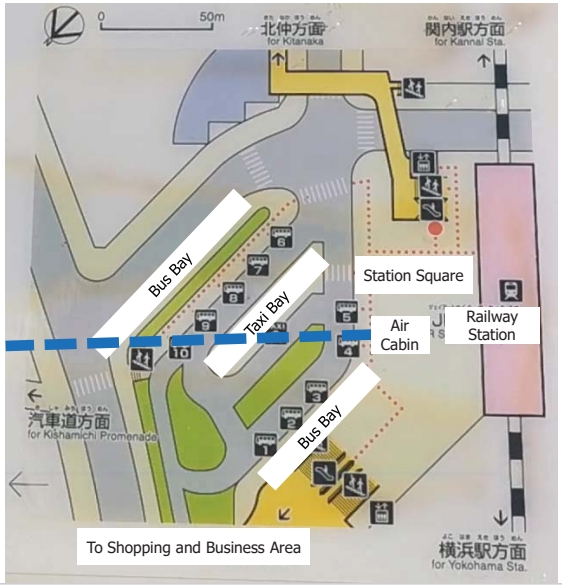
Physical and operational considerations and preparations at first

Then IT e.g. IC Card for further convenience and efficiency next

Transportation Hub and IC Card

Sakuragi-cho Station Area Map

Movie



Source: Picture of Area Map of Sakuragi-cho Station Taken and Edited by Consultant Team

Transportation Hub and IC Card *Common IC Card Payment*

Convenience Store (Inside the Station)

Source: JICA Consultant

Source: usedoor

Railway

Source: JICA Consultant

Source: @DIME

City Bus

Source: hiyosi.net

Source: ITMedia

Vending Machine

Source: JICA Consultant

Source: JICA Consultant

Air Cabin Ticket

Source: tantanquest.com

Source: Iko-yo.net

Source: SMBC

Source: DIAMOND Signal

Hanshin Expressway

Pursuing more advanced expressway service

At a glance of ITS on Japanese Urban Expressway

阪神高速道路株式会社

The Presenter

[redacted]

UNO Takumi
Assistant Manager
of the
International Business and Cooperation Office
[redacted]
(Traffic Operations Engineer certified by Japan Society of Traffic Engineers)

CONTENTS

Hanshin Expressway Network

History

Traffic in Osaka City in 1950s

From the 1950s to the 1960s, the Kansai (Osaka and Kobe) area experienced overpopulation as a result of Japan's economic growth, an unexpectedly rapid increase in the number of vehicles worsened road conditions in the Osaka-Kobe area, severely affecting economic activities and urban life.

History

The Hanshin Expressway Public Corporation as the administrative entity was established in May, 1962 with the funds from both the national, local governments and the World Bank.

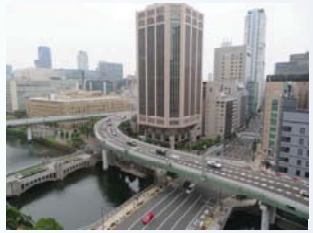
Public corporation establishment announcement reception (1962)

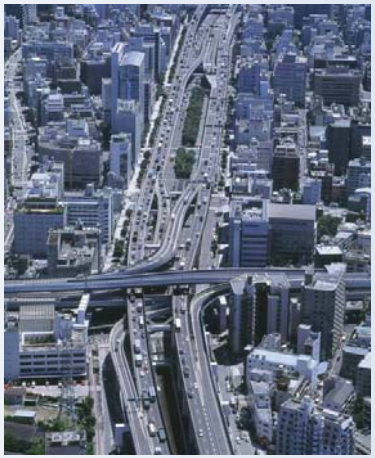
World Bank Loan Signing Ceremony

Connecting Ports and Airport

Hanshin Expressway

Viaduct network in the CBD

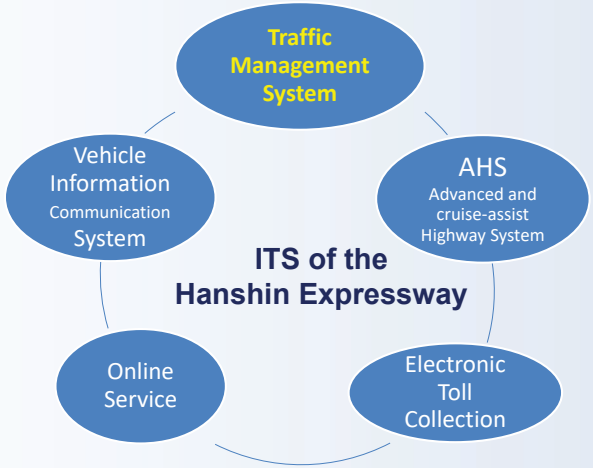




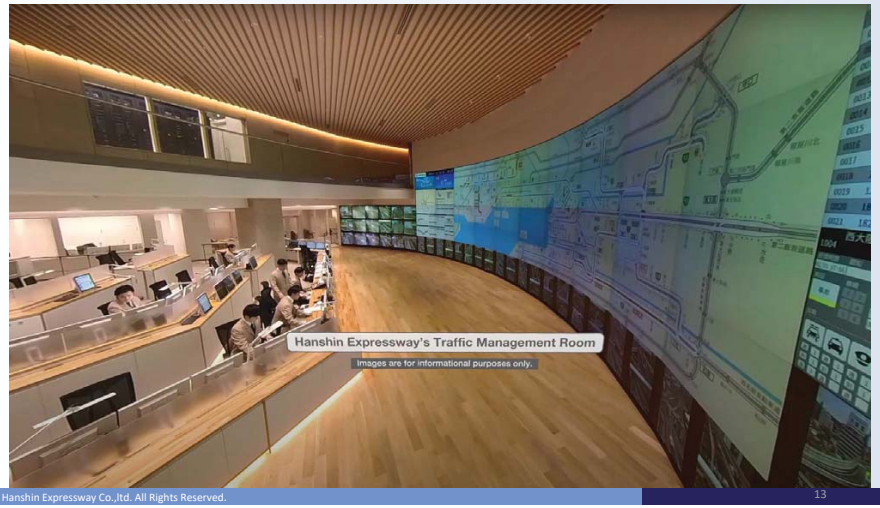
Hanshin Expressway

The Urban Expressway

Intelligent Traffic/Transport System in HEX



Intelligent Transportation System



Components of Traffic Management System

Traffic Management System

Data Collection

Ultrasonic Pulse

CCTVs

Data Analysis and Processing

Management Room

Information Provision and Service

Variable Message Signboard on the expressway

Variable Message Signboard at on-ramp

Data Collection

Vehicle Detector

TV Camera

AVI
(Automatic Vehicle Identifiers)

- Traffic conditions are mainly collected from vehicle detectors and TV camera.
- Vehicle detector ⇒ traffic volume, time occupancy
- TV camera ⇒ cause of congestion

Camera Image

Automated Accident Capturing

Traffic Management – Crew's Activity

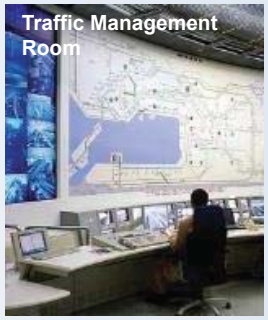
24 hours a day, 365 days a year

Well-trained staff patrol and control the traffic

Accidents Response

On-road Patrol & Debris Salvage

Overloaded Vehicle Crackdown



Information Provision and Service Communication between Road & Car

World's Cutting Edge Traffic Management Room

(360 Video: Maintenance Project Site Base)

https://www.youtube.com/embed/bKorxtf9d_o?rel=0&showinfo=0

Viewpoints (Traffic Management System)

Problem Identification

- In your Country, what is the problem/challenges that are expected to be solved by the power of ITS?
  - Reduce Traffic Congestion?
  - Reduce Traffic Incidents and Accidents?
  - Get more profit by collecting tolls?
  - Anything Else?

Data and Information Collection

- What is used to collect traffic data?
- (Traffic Counts, Speed, Incident…)
- What is your challenge/constraints about data and information collection?

Data Processing and Analysis

- Do you have automated traffic data processing system?
- What is your challenge about data and information collection?
- Do you have traffic management(control) room?
- If there, who has the responsibility of the management (control) work?

Viewpoints (Traffic Management System)

Data Provision and Service

- What is used to provide the traffic information to drivers?
- What is your challenge /constraints about data and information collection?

System Maintenance

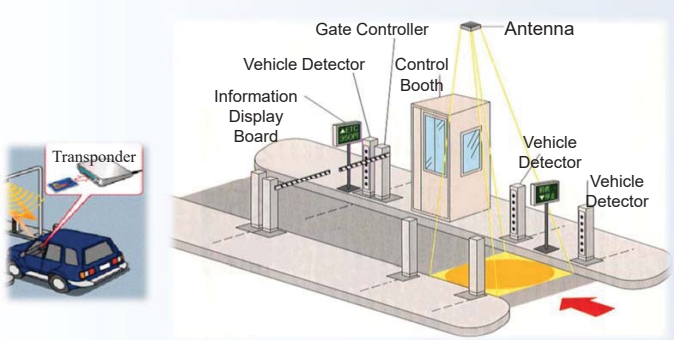
- Who maintains and repair traffic management system in your country?
- What is your challenge/constraints regarding system maintenance?

Private Service

- Is there traffic information service provided by the internet service (Google, Waze, Yahoo, etc..) popular in your country?
- What is the merit of traffic information service provided by the private sector?
- What is the demerit of it?
- How do you think about role assignment and collaboration between the system provided by the public side and private sector?

Hanshin Expressway

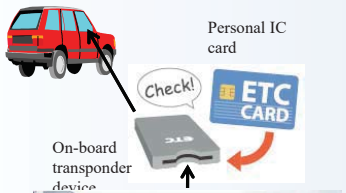
ETC System in Hanshin Expressway



ETC system at the Entrance / Mainline Toll Plaza

Free Flow ETC Antenna

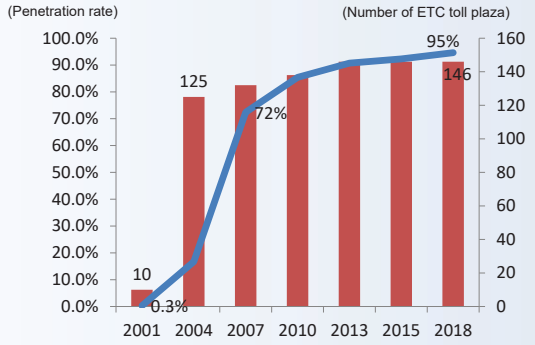
ETC System in the Hanshin Expressway



ETC service for Hanshin Expressway network started in July 23, 2001

Hanshin Expressway

Usage Share of Electronic Toll Collection



- ✓ ETC service on Hanshin Expressway started in 2001 (2006 for motorbikes).
- ✓ The share of the ETC toll payment has dramatically increased.

Hanshin Expressway

The History and Future of the Toll Payment Method of the Hanshin Expressway

1964 2001 2012 2025-2030

Manual Toll Collection — Start — End

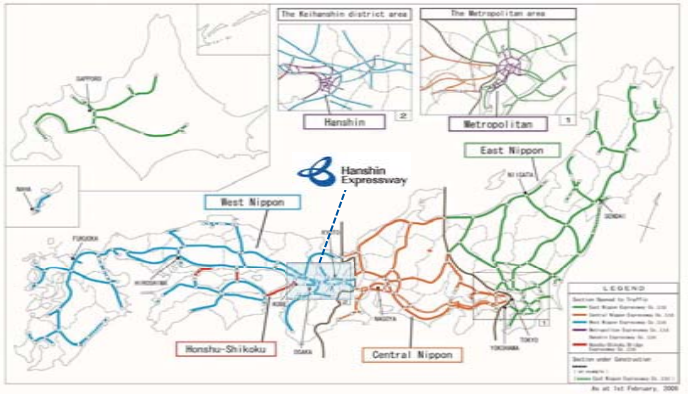
Electronic Toll Collection — Start — 100 % ETC

Unmanned Toll Payment Machine — Start — End

Cashless Payment — Not available on HEX

https://bukabank.com/cara-mendapatkan-kartu-e-toll-card-baru-lengkap/

Expressway Network In Japan



Inter-city Expressway

Inter-island Bridge

Honshu-Shikoku Bridge Expressway Company Limited

Urban Expressway

COVID-19 and Japanese Expressway

(This Photo was taken in during G20 Summit in Osaka)

COVID-19 measures in the expressway rest area

2020年10月30日

弊社が管理するサービスエリア・パーキングエリアの商業施設内では、NEXCO東日本 新型コロナウイルス感染予防ガイドラインに基づき、お客さまのご協力のもと、安心・安全のため、次のとおり新型コロナウイルス感染予防対策に取り組んでおります。

・テーブルやドアノブなど接触が多い箇所の定期的な消毒
・お客さま用消毒液の設置
・ソーシャルディスタンスの確保に向けた対策（レジ待ち間隔目印の表示等）
・従業員等の健康管理
・自動販売機(選択ボタン/返却レバー/つり銭取出し口/商品取り出し口等)への衛生対策施工(抗菌または抗ウイルス)の実施、および商品補充時のアルコール消毒

お客さまには、手洗いやマスクの着用、咳エチケットへのご協力をお願いしております。

お客さまにはご不便をお掛けいたしますが、ご理解・ご協力をお願いいたします。

東日本高速道路株式会社
ネクセリア東日本株式会社

Source: NEXCO East

https://4travel.jp/dm_shisetsu/11555680

COVID-19 measures in the expressway toll

SUN MON TUE WED THU FRI SAT

2020 5月

日	月	火	水	木	金	土
					1	×
×	×	×	×	7	8	×
×	11	12	13	14	15	×
×	18	19	20	21	22	×
×	25	26	27	28	29	×
×						

2020 6月

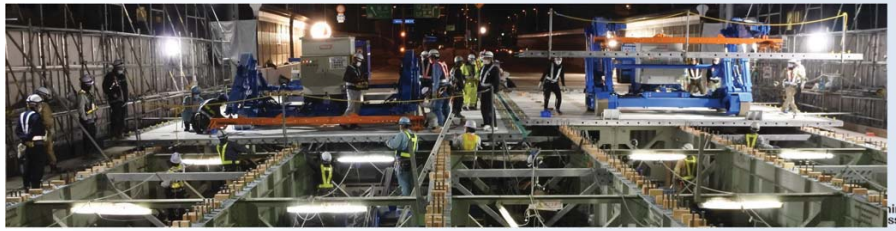
×	1	2	3	4	5	×
×	8	9	10	11	12	×
×						

×：適用除外日、×：適用除外日（今回発表）、■：適用日
※他の割引については変更ございません。

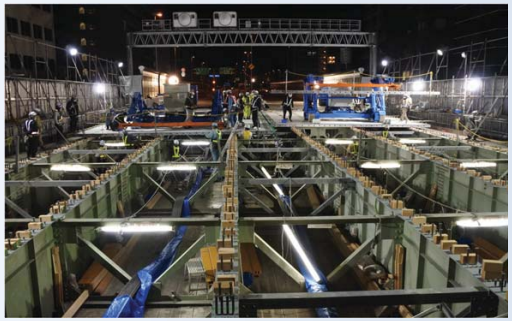
Cancellation of Holiday Toll Discount

Toll Plaza Staff wearing Mask

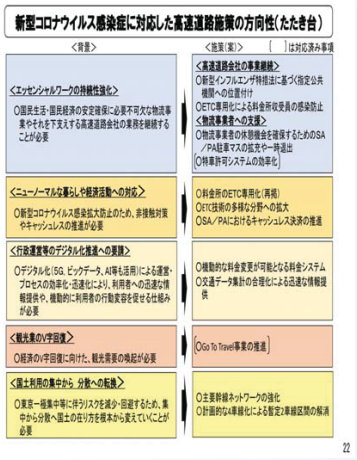
Source: NEXCO East



COVID-19 Countermeasures in the case of Total Urban Expressway Maintenance Project



Japanese Government's Future Vision of ITS

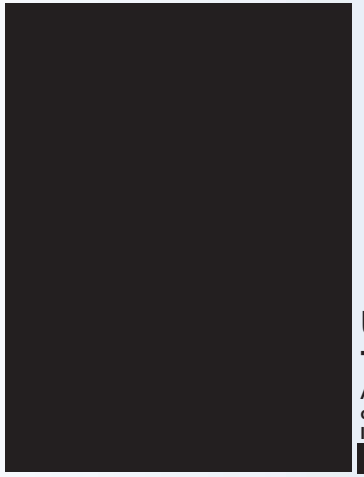


Direction of Expressway-related Policy to COVID-19 (By Ministry of Land Infrastructure Transport and Tourism)

Sustain Essential work (logistics and expressway business)	Continuous Expressway Business (e.g. 100% ETC Payment) Support Logistic Vehicles
Fit to "New-Normal" life and Economy	100% ETC Payment ETC application, Cashless Payment
Social Digitization (5G Big-data, AI…)	Dynamically Changeable Toll Improve Traffic Data Collection
Promote Tourism	(Tourism Promotion Campaign)
Widespread Land Use From Concentration to Tokyo	Enrich Artery Expressway Network Add more lanes (1 → 2 Lanes each)

Hanshin Expressway

Thank you!



UNO Takumi
Assistant Manager of the International Business and Cooperation Office
[redacted]

Viewpoints (Expressway Toll / Fare Payment)

- What kind of Payment Methods for Car Parking / Toll Road do you have in your country?
- Did the Payment system of Car Parking and Toll Road change after COVID-19?
- What do you think about **merit** of the cashless / contact less payment for car parking / toll road in your country?
- What do you think about **challenge** to introduce cashless / contact less payment for car parking / toll road in your country?

Hanshin Expressway

Environmentally Sustainable Urban Transport Planning

November 2021

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

CONTENTS

1. Who we are ?
-Company Overview-

Nagoya Electric Works Company Quick Snapshot

1-1.Company Overview

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

NAGOYA ELECTRIC WORKS CO., ltd

- Established 1958
- Capital :¥1,185million-（US$ 10million -） (*1USD=¥110)
- Net Sales: ¥19,363million （US$ 176million -）
- Nagoya Stock Exchange Second Section (Code:6797.n)
- Employees :446
- Office location: 11branch
- ISO9001 / ISO14001 Certificate

as of 2019.03

1-2.Company Overview

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

NAGOYA ELECTRIC WORKS CO., ltd

83.7%
US$ 147million

16.3%
US$ 29million

as of 2019.03

◆ Information Equipment Division

Traffic Center

VMS on Highway

MOBILE VMS

◆ FA-inspection equipment company

SOLDERING PASTE INSPECTOR

AUTOMATIC OPTICAL INSPECTOR

3D X-RAY INSPECTOR

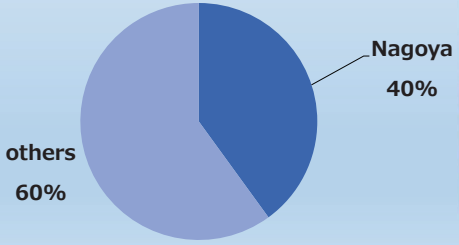
1-3.Company Overview

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

NAGOYA ELECTRIC WORKS CO., ltd

◆ Information Equipment Division

Japanese VMS Market share at Express Highway
(FY2018 Nagoya source)



Produce 1000 unit a year

Leading company of ITS system in Japan

1-4.Company Overview

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

One-Stop Solution

1-4. VMS system overview

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Control Center

VMS(Junction)

VMS(Highway)

Optical fiber Network

VMS(Toll gate)

Traffic sensor

Meteorological sensor

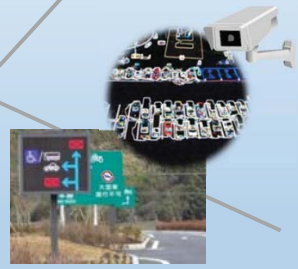


Image Processing parking Guide

1-5. Mobile VMS (Portable type other product)

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Product for
Traffic control of Construction site

Mobile Signal light ,
Mobile VMS

2. What we have ?

- Product Introduction -

Promotable overseas product

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

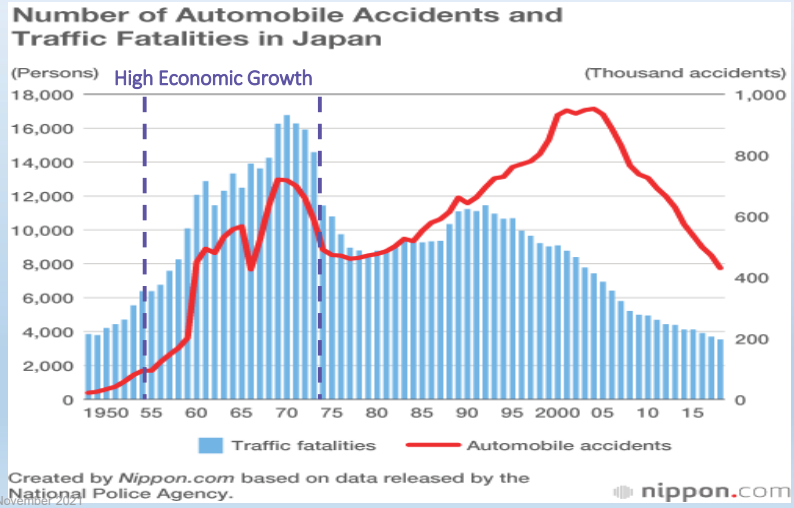
Introduction
Mobile VMS
(with Variable Message Sign)

Nagoya Electric Works Co., Ltd.

2-1 Mobile VMS

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Problems of traffic accidents by high economic growth



2-2. Mobile VMS

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Support safer regulation by providing the needed information at the required locations.

Construction Site

Accident Site

Disaster Site

Patrol Site
(Falling object etc.)

2-3. Example (1)

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Accident
Disaster

If, When there isn't
Road VMS.....

Traffic jam

Accident, Disaster?
I want the detour information!!

Delivers traffic information by Mobile VMS

Traffic flowing smoothly!!

2-4. Example (2)

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Emergency
(Terror, Dispute) etc.

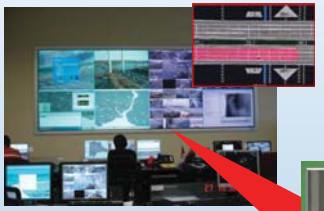
Delivers Evacuation information by Mobile VMS

Safety

2-5. Operation Traffic Management Vehicle

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

1.Accident generation



Traffic Control Room

2.Contact patrol

Patrolling

3.Rush to the accident site

4.Traffic support

2-6. Mobile VMS(Model:W-L012)

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Operation photo in Road administrator

November 2021

2-7. Mobile VMS(Model:W-L012)

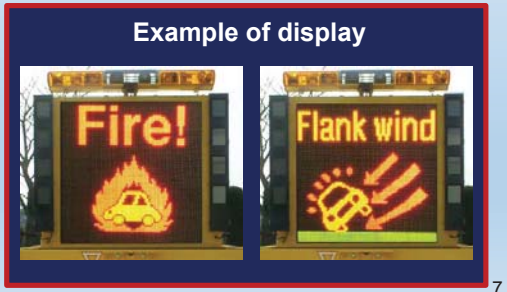
Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

November 2021

2-8. Mobile VMS (Model:TC-L008)

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Operation photo in Road administrator



November 2021

2-9. Solar power Mobile VMS

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

- Solar Power (No generator)
- Elevating function
- Low cost・Easy operation (Remote-control)

November 2021

Example overseas promotion

Overseas Business experience

Supply of Vehicles for O&M of Southern Expressway in Sri Lanka by Japan International Cooperation Agency

Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

■From 24th Feb. 2011 To 10th May. 2011

Maintenance Training for Mobile VMS in Bosnia and Herzegovina by Ministry of Foreign Affairs of Japan

Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

■Training from 26th Oct. 2019 to 1th Nov .2019

Supply of Vehicles for O&M of Southern Expressway in Sri Lanka by Japan International Cooperation Agency

Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

Operation photo in Road administrator

3. What we are doing ?

- challenge for traffic management in India -

Joint Venture Start up bisuness

3-1.Background of Project

Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

Traffic Congestion Negative Impact

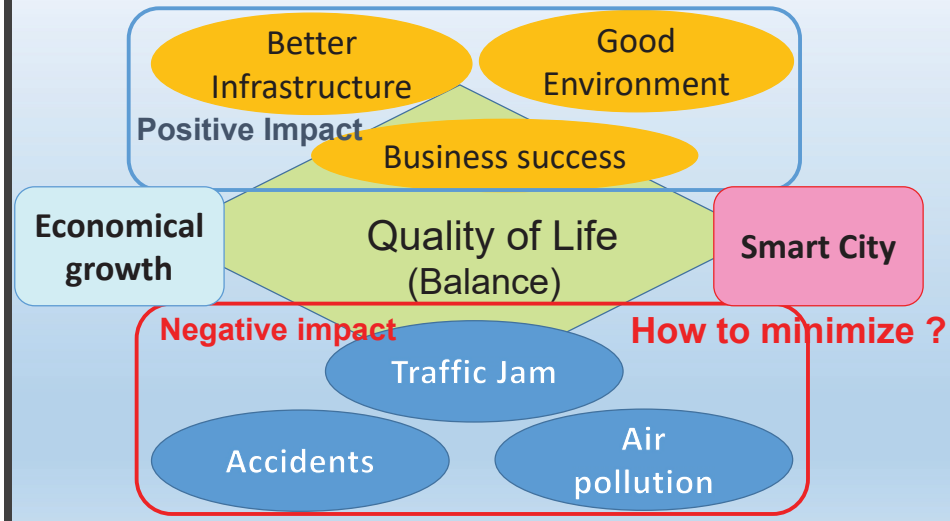
- Loss of Productive Labor Time
- Unnecessary Fuel Consumption
- Air Pollution
- Problems in Personal Health
- Increasing Accidental Risk

"Economic losses from congestion and poor roads alone are as high as $6 billion a year"

- Gajendra Haldea, an Adviser to the Federal Planning Commission (Businessweek.com "The Trouble With India")

3-2. Impact in Motorization

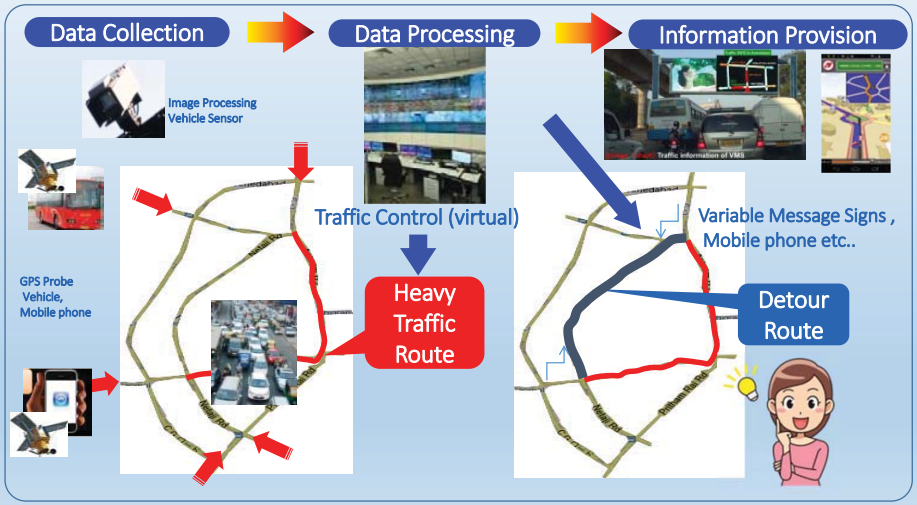
Nagoya NAGOYA ELECTRIC WORKS CO., LTD.



3-3. ITS solution Support traffic information in India

Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

Real time Navigation



3-4.ITS solution Sustainable

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

PPP Sustainable business model (Advertisement + Traffic Information)

3-5.SPC in India

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

- Nagoya Electric Works and Venture Company (Zero-Sum) have established SPC (Zero-Sum ITS) in India.
- SPC starts Ahmedabad ITS business since Oct.2014.

Zero-Sum ITS

4-6. ITS location

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

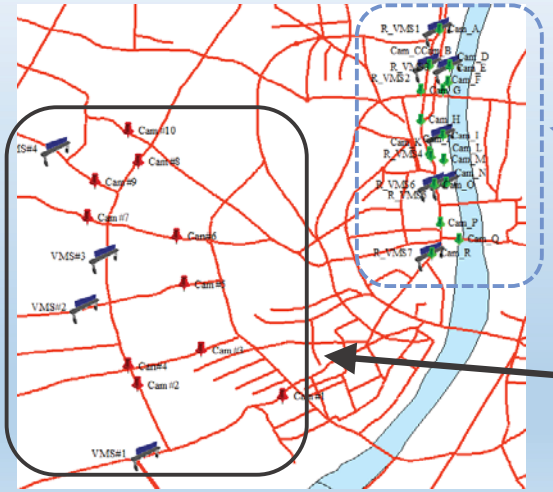
- 14 Traffic Monitoring Cameras + 4 Information Boards (VMS) in Ahmedabad city

3-7. Traffic Condition in VMS

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

3-8. New development

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.



River front (new development) 2016.1~

- VMS : 7
- Traffic cameras : 18

132 Feet Ring Road (under operation) 2014.10~

- VMS : 4
- Traffic cameras : 14

4. What we have learned?

- Indian – Japanese Joint R&D -

Government funded program “SATREPS” (4.2017 – 9.2022)

4-1. SATREPS program field

SATREPS SUSTAINABLE DEVELOPMENT GOALS Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

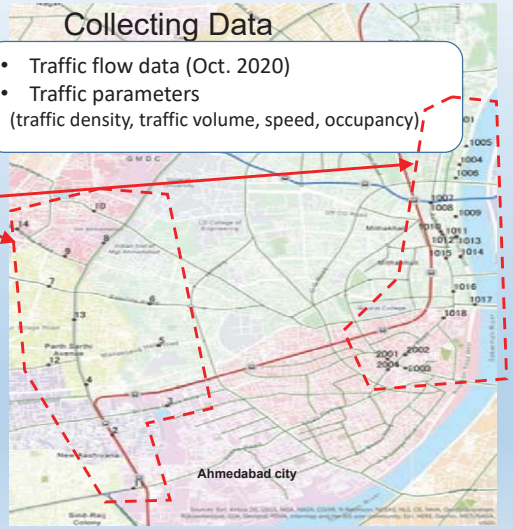
- How to collect traffic data ?

Installation CCTV

- Traffic monitoring camera
- Install major location 29
- Field (Ahmedabad city)

Collecting Data

- Traffic flow data (Oct. 2020)
- Traffic parameters (traffic density, traffic volume, speed, occupancy)

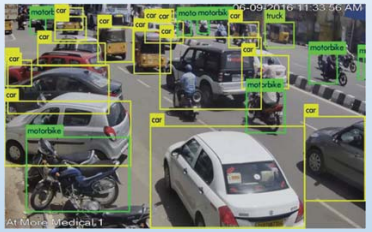


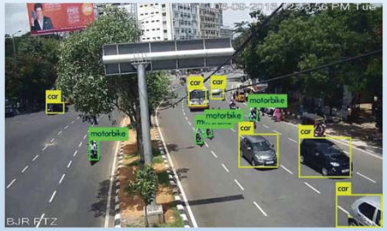
4-2. Traffic Sensing Technology Example

SATREPS SUSTAINABLE DEVELOPMENT GOALS Nagoya NAGOYA ELECTRIC WORKS CO., LTD.

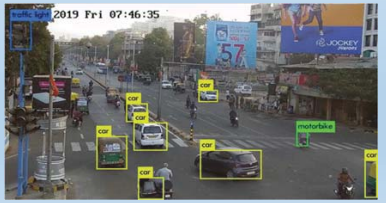
Challenge Difference traffic flow detection

HYD





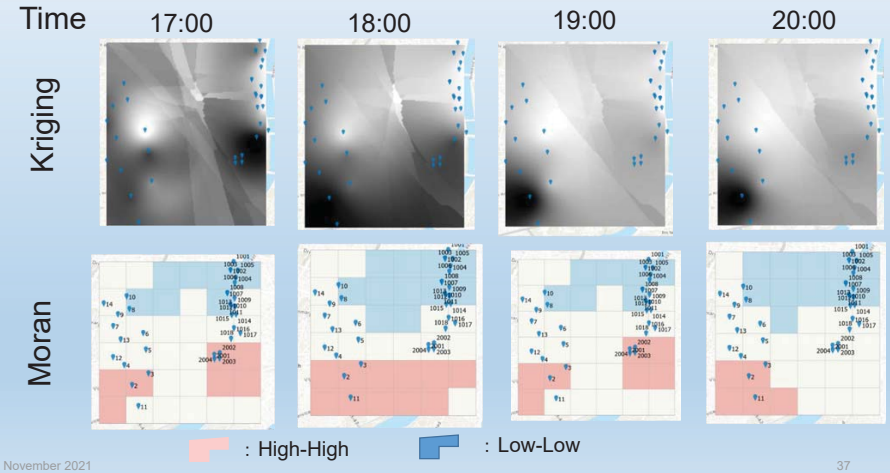
AMD



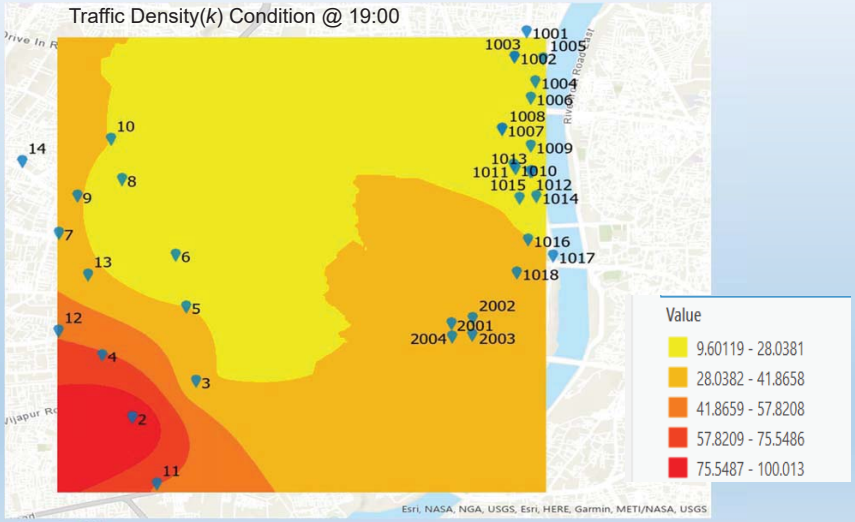
4-3. Visualization of Traffic condition

- Identify Traffic Congestion Hot-Zone

(Traffic Density @Oct.2020)



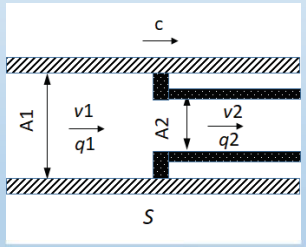
4-4. Spatial Traffic Congestion



4-5. Traffic Congestion Analysis example

Congestion Model

- Equivalent situation from wide road to narrow road
- Shock Wave (c)



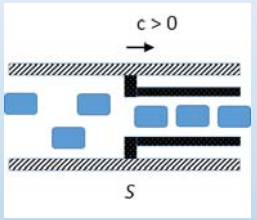
Balance condition

$$N = (v_1 - c)k_1 t = (v_2 - c)k_2 t$$

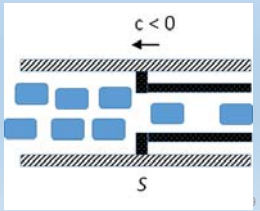
Shock Wave speed

$$c = \frac{v_2 k_2 - v_1 k_1}{k_2 - k_1} = \frac{q_2 - q_1}{k_2 - k_1}$$

(A) Forward forming wave



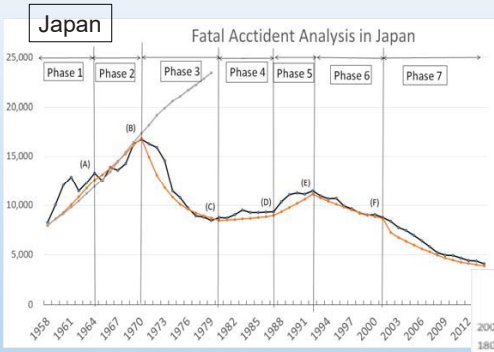
(B) Backward recovering wave



4-5. Traffic Congestion Potential Reason

4-6. Traffic Fatality Analysis example

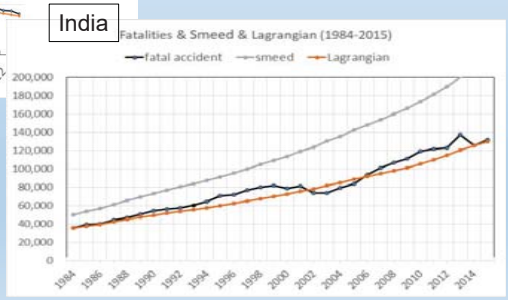
Japan



Smeed's Law $D = 3 \times 10^{-4}(np^2)^{\frac{1}{3}}$

Enhanced Smeed's Law $D = An^{\alpha}p^{\beta}s^{-\gamma}$

s : Number of signal
A: constant
α : 1/3 , β : 2/3,
γ : variable constant

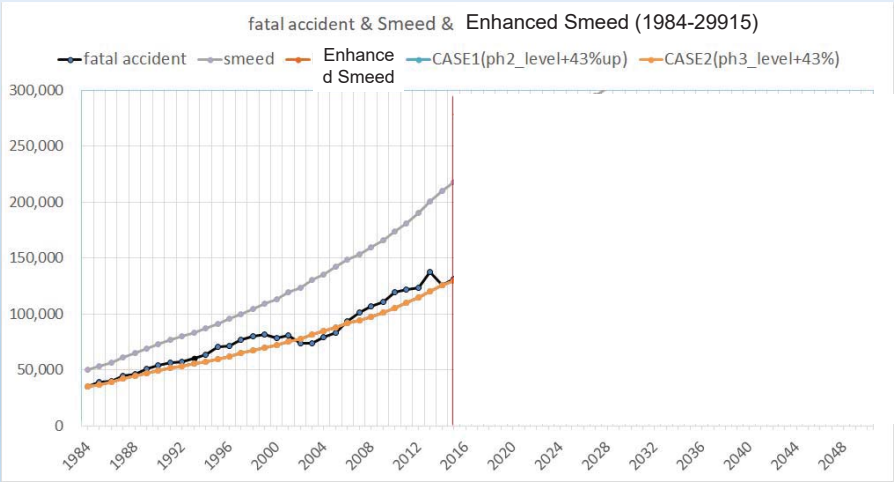


India

Source: T.Tsuboi "Quantitative Traffic Safety Analysis for India by Japanese Experience", Sociology Study, Jan.-Feb. 2020, Vol. 10, No. 1, 1-14
doi: 10.17265/2159-5526/2020.01.001

4-7. Traffic Fatality Estimation in India

- Using Enhanced Smeed's Law for Indian Fatality in future



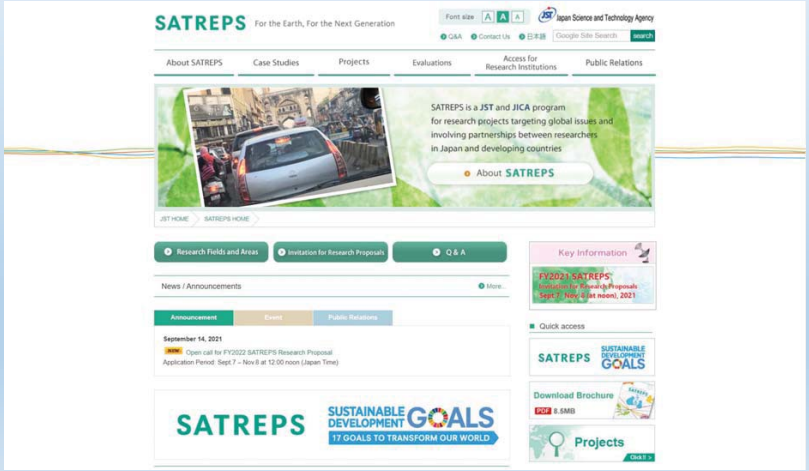
4-8. No Secret for Fatalty reduction

Japanese Traffic Management Policy History

Year	Term	Major Policy Action & Item	Note
1958 - 1964	Phase 1	Under development for traffic management	
1965 - 1970	Phase 2	**1st Policy plan**	
		Singal development	
1971 - 1980	Phase 3	**2nd Policy plan**	
		Vehicle sensing installation	
		Sensitive type traffic signal	
1981 - 1987	Phase 4	**3rd Policy plan**	
		Central Conrol system for signal	Overall Japan
		Operation Center for traffic manegement	ditto
		Traffic regulation & More installation	ditto
		Education for traffic	ditto
1988 - 1996	Phase 5	**4th Policy plan**	
		Traffic signal algorithm improved	
		Traffic Information display	
		Network among centers	
1997 - 2001	Phase 6	**5th Policy plan**	
		ITS system development	
		Cogestion control system (VICS)	
		Optimized algorithm (MODERATO)	
2002 - 2014	Phase 7	**6th Policy plan**	
		ITS sysem installation	
		Zonening	

4-5. Traffic Congestion Potential Reason

This research is part of SATREPS program 2017
(ID: JPMJSA160) between India and Japan 20217-2022



SATREPS SUSTAINABLE DEVELOPMENT GOALS

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

We are going together with you

M2Smart Members photo 2018

Asia High School Factory visiting photo 2019

Thank you for your attention !

SUMITOMO ELECTRIC
Connect with Innovation

Traffic Control System

Masazumi HORIE
Sumitomo Electric Industries, Ltd.
22 / Nov / 2021

SUMITOMO ELECTRIC GROUP

2021年度巻末資料－266

Contents

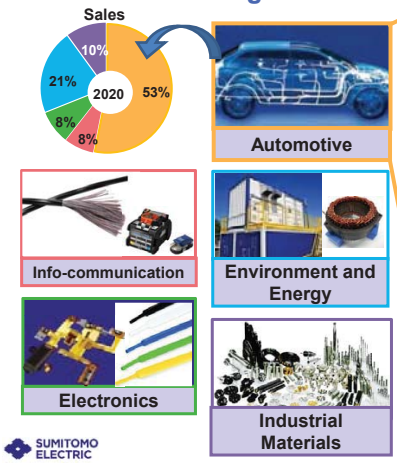
CONFIDENTIAL

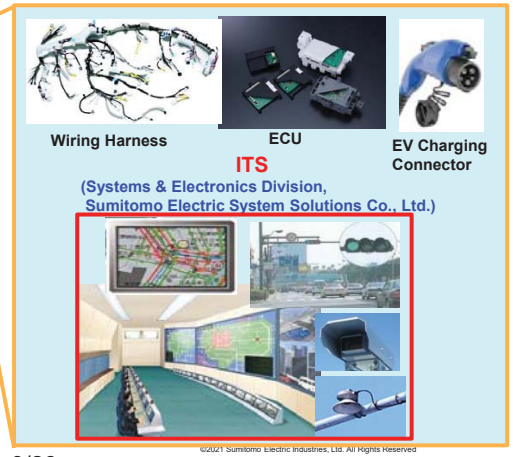
Company Profile

CONFIDENTIAL

- Established : Apr/1897
- Group Companies : 415*
- Employees : 286,784*
- Net Sales : 2,919B Yen* (* Consolidated, as of Mar/2021)

Five business segments

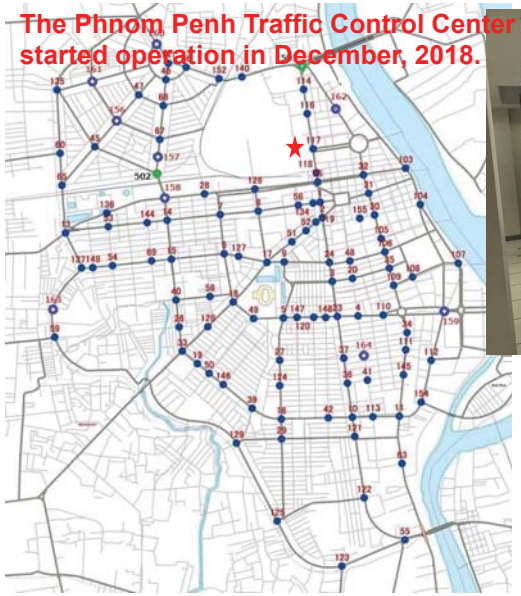




Phnom Pen City - Traffic Control System

CONFIDENTIAL

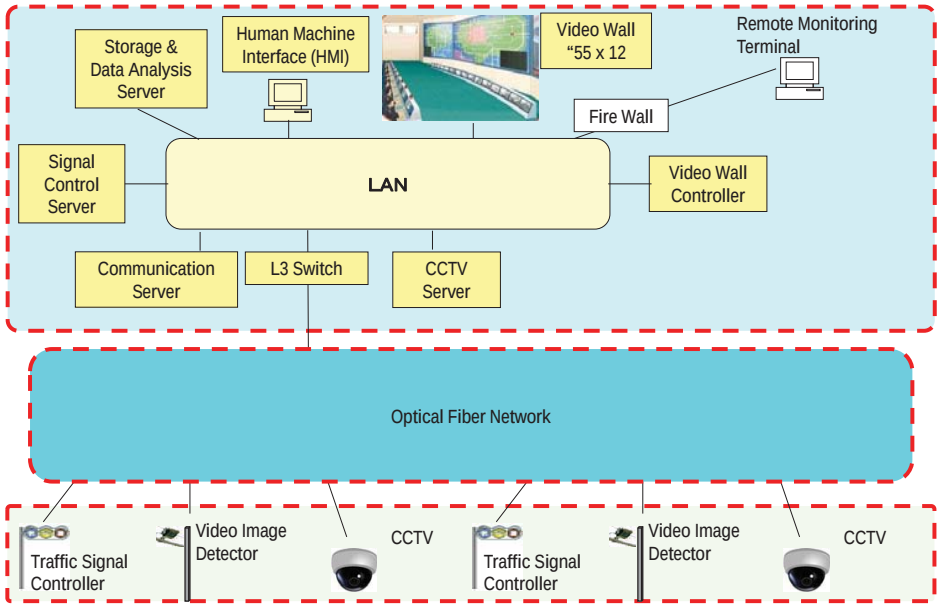
The Phnom Penh Traffic Control Center started operation in December, 2018.



Device	Number
Intersection	115
Detector	196
CCTV Camera	26

System Configuration

CONFIDENTIAL



Function of Traffic Control Center

CONFIDENTIAL

*Traffic data collection, storage and data analysis.
*Field surveillance by CCTV.
*Signal green time adjustment (Automatic mode).
*Signal green time adjustment (Manual mode).
*Health check of all kinds of system equipment.

Additional Functions (under proposed)
*Emergency (Public) car priority green.
*Road information service.

Installation of facilities at site

CONFIDENTIAL

Underground Conduit

Hand hole

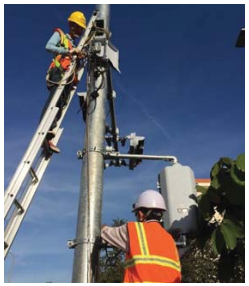
Pole

Pole onto Base plate

Installation of facilities at site

CONFIDENTIAL

Arm with Lanterns



Wiring

Connection with Controller

Before and After

Before

After

In addition…….

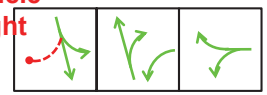
Importance of Intersection Design

CONFIDENTIAL

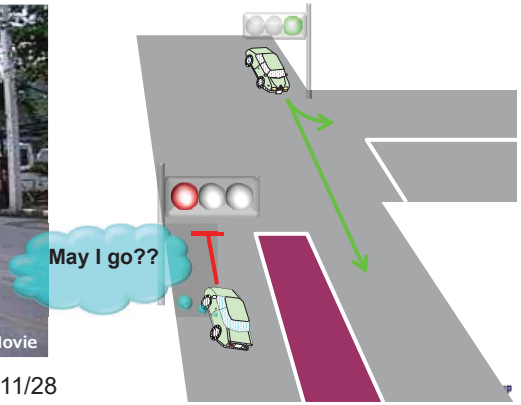
If phase plan is not suitable……

Suitable plan for T-shaped intersection

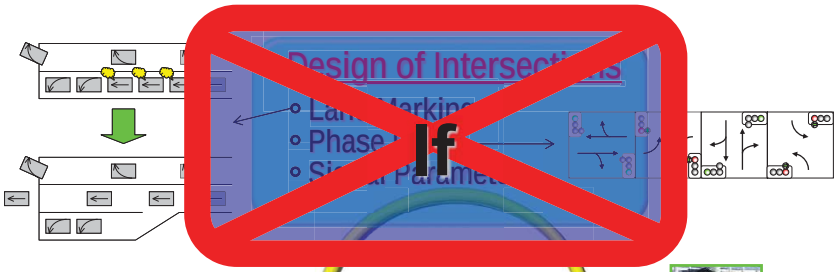
No vehicle turn right



Phase plan at the intersection



"Three Key Elements" for Traffic Management



Operation and Maintenance
- Training
- Operation
- Hardware, Software

System Construction
- Traffic Control Center
- Existing rules / Culture
- Construction Work

Importance of Intersection Design

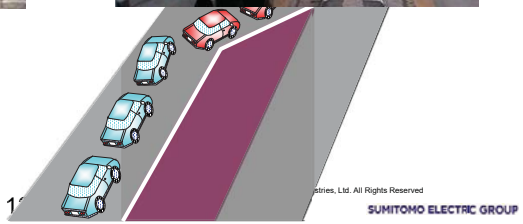
CONFIDENTIAL

If green time is not suitable……..

6:30-7:00

16:30-17:00

Residential Area



Importance of Intersection Design

CONFIDENTIAL

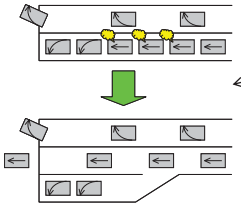
If lane marking is not clear….

Before

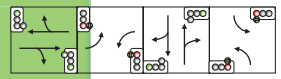
After

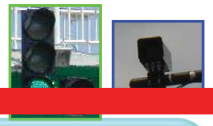
"Three Key Elements" for Traffic Management

CONFIDENTIAL



Design of Intersections
- Lane Marking
- Phase Plan
- Signal Parameter





Operation and Maintenance
- Training
- Operation
- Hardware, Software

System Construction
- Traffic Control Center
- Existing rules / Culture
- Construction Work

Outline of Traffic Control System

CONFIDENTIAL

Road

Traffic Data Collection

Network

Control Center

Analysis and Data Processing

Network

Road

Traffic Signal Control

Vehicle Detector for Traffic Data Collection

CONFIDENTIAL

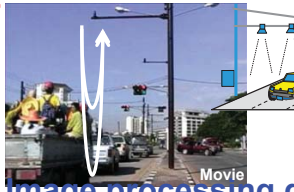
Loop detector

Civil works often cut the wire.

Inductance

Index	Superior
Initial cost	Good
Maintenance	
Accuracy	Good
Additional Value Data	

Ultrasonic detector



Reflecting time

Index	Superior
Initial cost	
Maintenance	Good
Accuracy	Good
Additional Value Data	

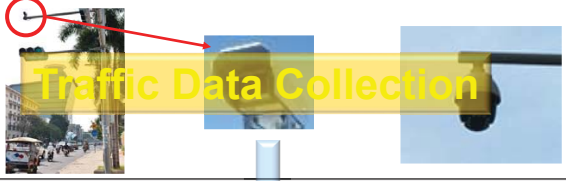
Image processing detector

Index	Superior
Initial cost	
Maintenance	
Accuracy	
Additional Value Data	Good

Outline of Traffic Control System

CONFIDENTIAL

Road



Network

Control Center

Network

Road

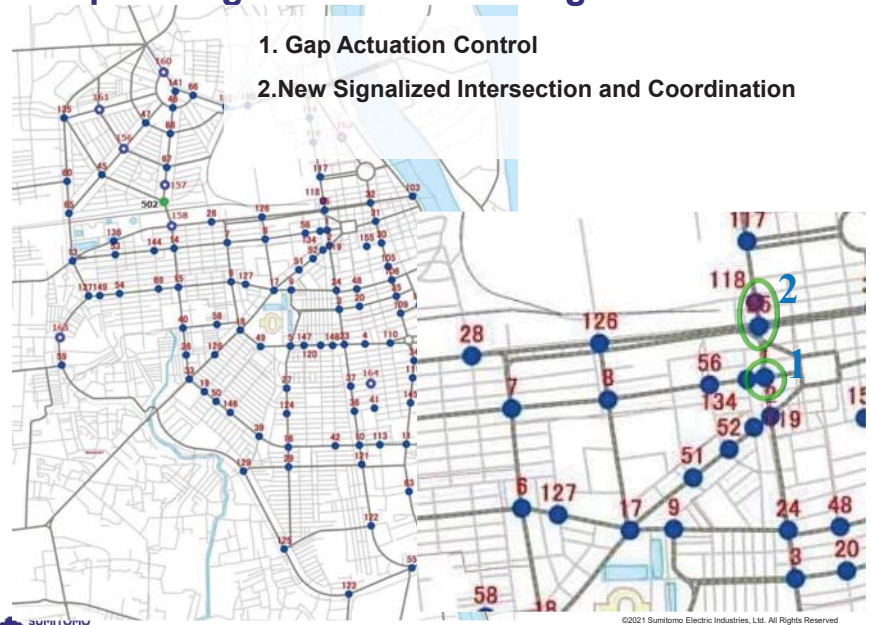
Adaptive Signal Control at Congested Intersection

Vehicle Detector

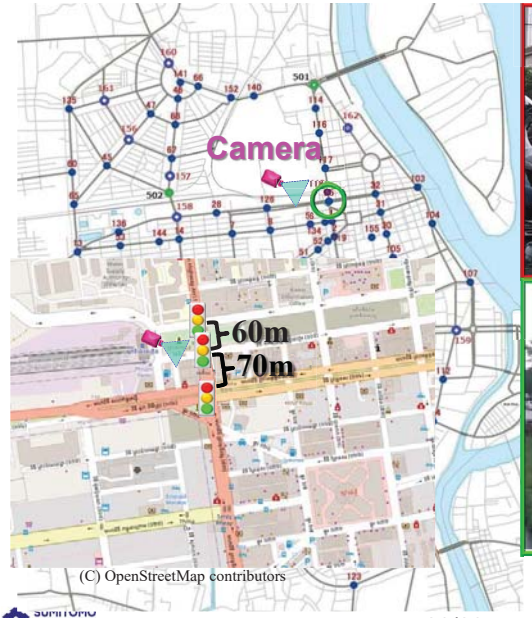
Camera

Adaptive Signal Control at Congested Intersection

1. Gap Actuation Control
2. New Signalized Intersection and Coordination



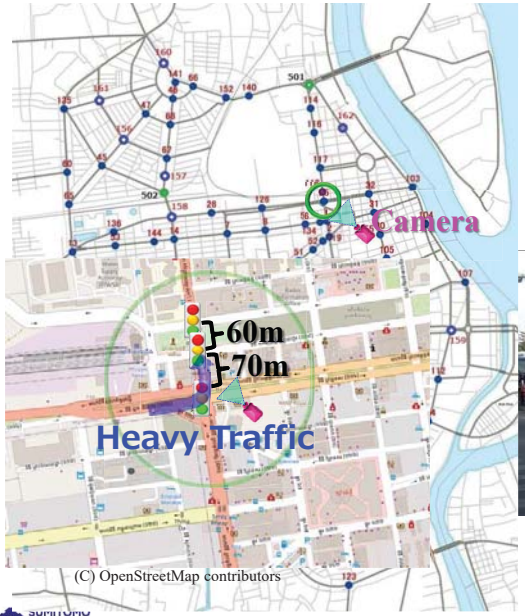
New Signal Intersection



x16

(C) OpenStreetMap contributors

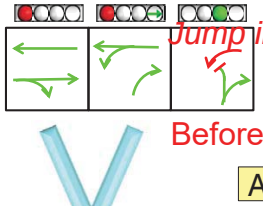
Coordination Control

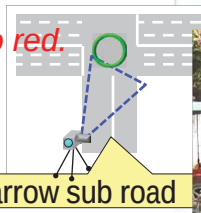


x2

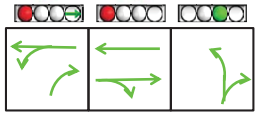
Adjustment for change of traffic condition

CONFIDENTIAL



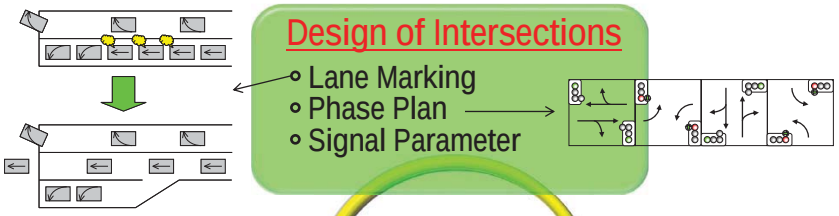


Change order of phase #1 and phase #2



Only 2 cars could pass the stop line during Green time.

"Three Key Elements" for Traffic Management



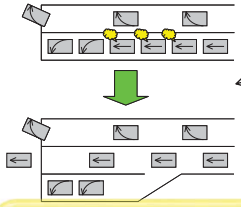
Design of Intersections
- Lane Marking
- Phase Plan
- Signal Parameter

Operation and Maintenance
- Training
- Operation
- Adjustment

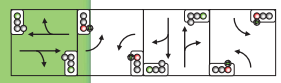
System Construction
- Policy for Signal Control
  Existing rules / Culture
  Construction Work

"Three Key Elements" for Traffic Management

+ One



Design of Intersections
- Lane Marking
- Phase Plan
- Signal Parameter



Collaboration
- Government / Authorities
- Private sector
- Educational institutes

Operation and Maintenance
- Training
- Operation
- Hardware, Software

System Construction
- Traffic Control Center
- Existing rules / Culture
- Construction Work

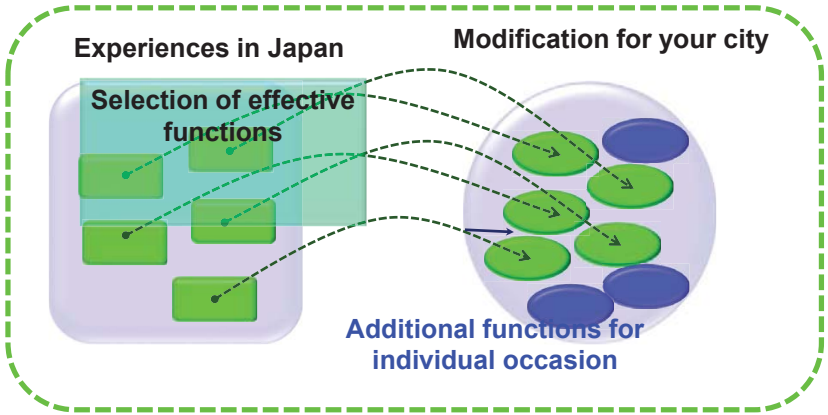
Conclusion and Points to be discussed

CONFIDENTIAL

Traffic environment in Japan

Traffic environment in your city

Not same



Conclusion and Points to be discussed

CONFIDENTIAL

Question

1 What are problems of traffic situations in your city / country?

2 Are there any intersection signalized but congested or dangerous?

3 Do you have engineers who can perform O&M for working system?

- Adjustment (Length of Green Time, ...)
- Redesigning of intersection (Phase Plan, Lane Marking, ...)

Contact Us

CONFIDENTIAL

Topics	PIC	E-mail
General	Masazumi “Martha”, HORIE	horie-masazumi@sei.co.jp
Technical	Hajime, SAKAKIBARA	sakakibara-hajime@seiss.co.jp
Website	https://sumitomoelectric.com/intelligent-transport-systems-its	

SUMITOMO ELECTRIC

Connect with Innovation

https://sumitomoelectric.com/

SUMITOMO ELECTRIC GROUP

Trend on Mobility

Prof. Takashi OGUCHI

Institution of Industrial Science (**IIS**) &

Mobility Innovation Collaborative Research Organization (**UTmobI**)

the University of Tokyo (**UTokyo**)

Agenda

1. Vehicle Automation; from "automobile" to "automated auto"!?
2. Big Data; GTFS format emergence
3. Pandemic; COVID-19
4. Global Warming; Electrifications

Automobilie (Auto - mobile) innovation (approx.) 100 years ago

1886: **Karl Benz** (GER): combustion engine vehicle

[after 22 years]

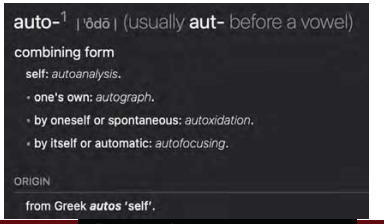
1908: ***'Ford Type T'*** enables industrialization

The definition of **Automobile**

← "**auto**" + "**mobile**" ... why "**auto**"?

- Independent from "others" (like horse) or from human-power
- Moving machine autonomously as a magic

➔ Saving labor with machine (opposite of NMT*)
Easy and high-speed move (enjoyable)



ref) New Oxford American Dictionary

1990's: proposal of ITS "Intelligent Transport Systems"

Automotive Transport

- three evils: environmental polution, traffic accident, traffic congesiton

Information Society ... ***Does communication take the place of transport?***

System thinking for **Road Transport System**

elements: Human, moving-body, road-infrastructure

➔ **Interactions** between **elements** are required [ability of communication]

IVHS America(1990, US), **ERTICO**(1991, EC), **VERTIS**(1994, JPN) established ➔
(1994) "**ATT & IVHS Congress & Exhibition**" in Paris
(1995) "2nd **World Congress on ITS** in Yokohama, Japan ➔ **"ITS"** come to stay

← The word "**ITS** (Intelligent Transport Systems)" was firstly proposed by Japan

2010's: innovation for once a centry = Automated Driving

Driving Automation / Vehicle Automation

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

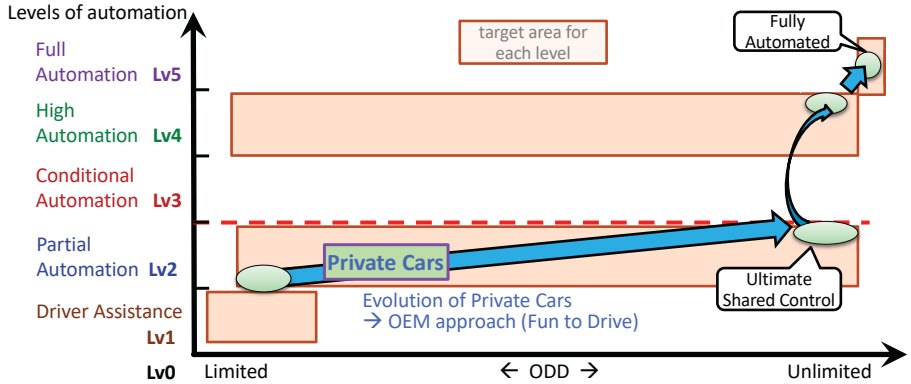

http://www.itmedia.co.jp/news/articles/1208/08/news027.html

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

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

Automated Vehicle development scenario

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



Modified based on the proposal written in entrusted study by ITS center, UTokyo in FY2016
Report available: http://www.sip-adus.jp/wp/wp-content/uploads/cao_2016_cao1-11_01.pdf

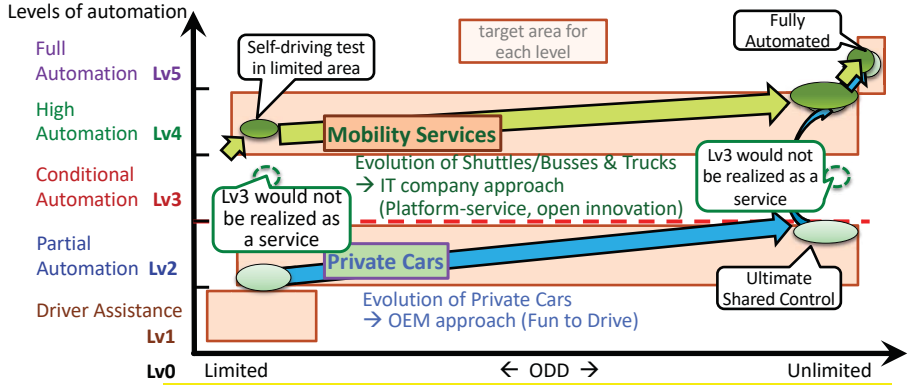
J3016 "Levels of Driving Automation"

	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 are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not 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

➢https://www.sae.org/news/2019/01/sae-updates-j3016-automated-driving-graphic

Automated Vehicle development scenario

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



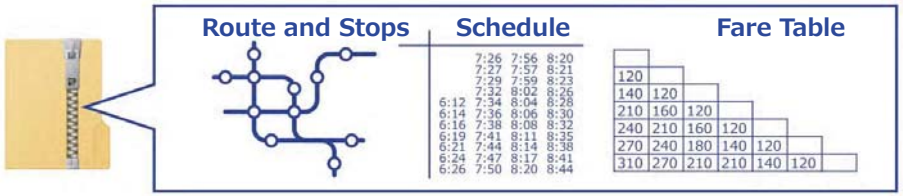
Modified based on the proposal written in entrusted study by ITS center, UTokyo in FY2016
Report available: http://www.sip-adus.jp/wp/wp-content/uploads/cao_2016_cao1-11_01.pdf

Agenda

1. Vehicle Automation; from "automobile" to "automated auto"!?
2. Big Data; GTFS format emergence
3. Pandemic; COVID-19
4. Global Warming; Electrifications

GTFS (General Transit Feed Specification)

- De facto format for public transportation schedules
- Containing schedules, stops and related data in CSV format
- "Google Map"



Applications of the GTFS data

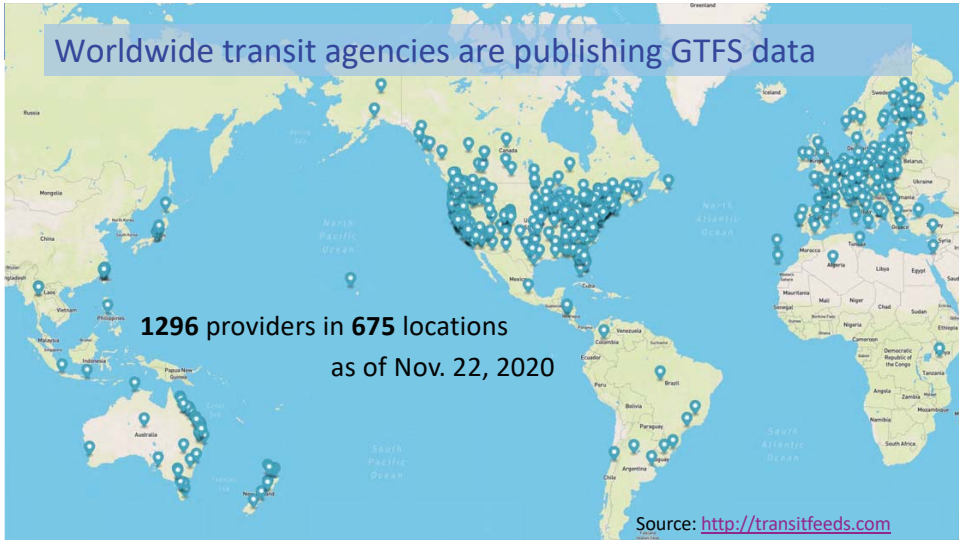
Journey planning (Google Maps etc.) is a typical application

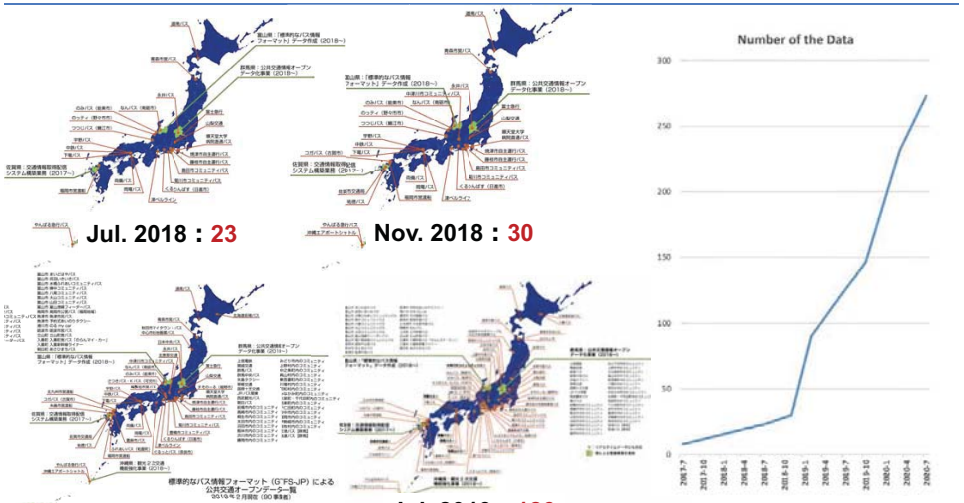
The data is applicable for multiple purposes

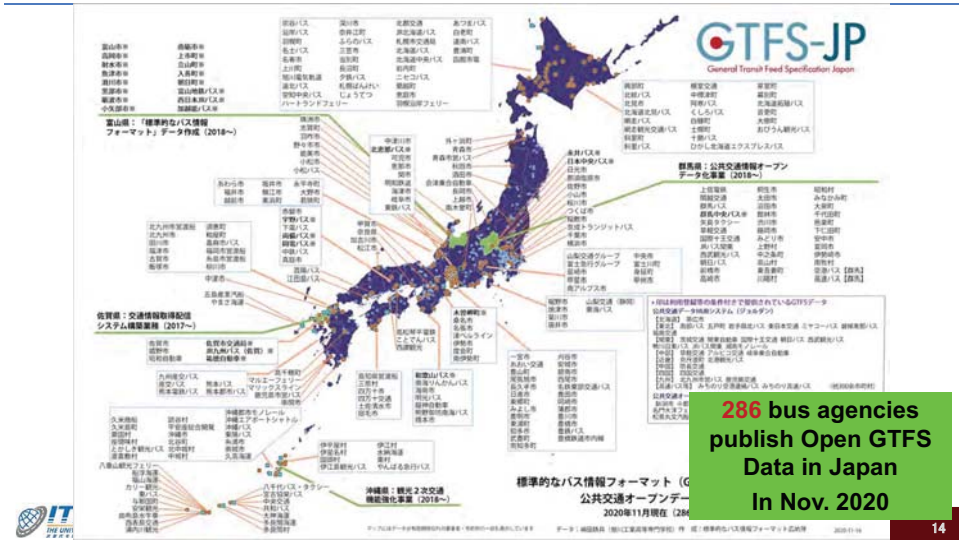
Journey Planning Apps

Passenger Information System

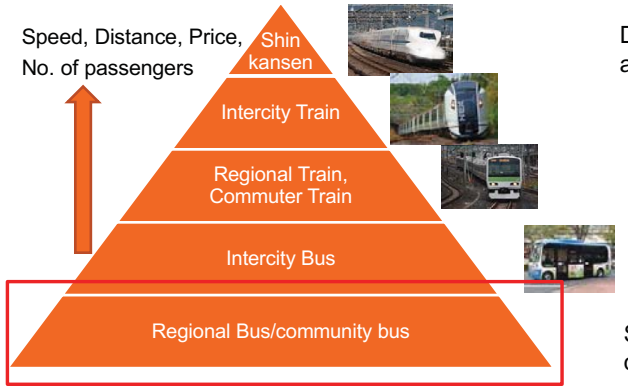
Analysis and Planning of the network



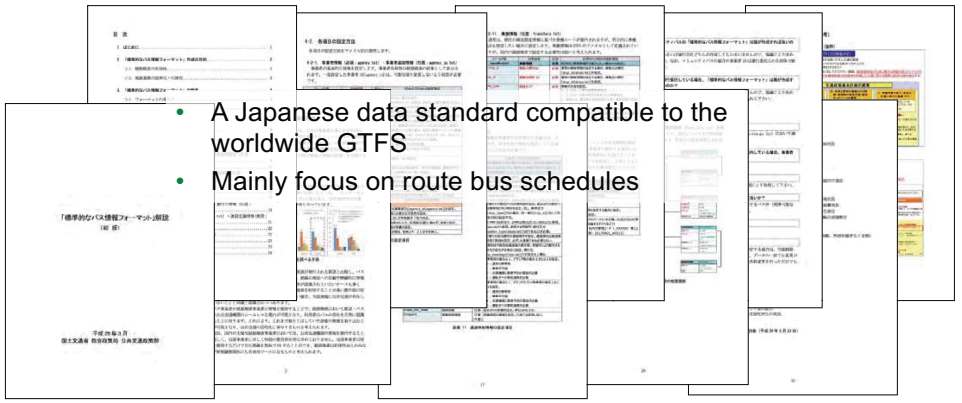




Bottom-up approach for Open Transit Data in Japan



GTFS-JP secification was standardized GTFS-JP spec. in March 2017



- A Japanese data standard compatible to the worldwide GTFS
- Mainly focus on route bus schedules

GTFS-JP Promoting Team

- A group of people involved in the GTFS data making and maintenance
- Development of tools to create GTFS data
- Give a lecture to create data for a bus company

GTFS-JP
General Transit Feed Specification Japan

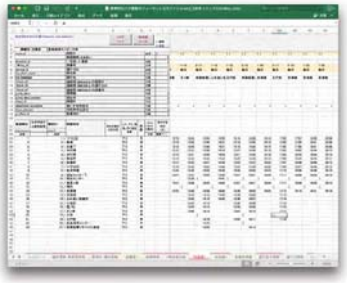
Member

- Researcher
- App developer
- System developer for bus agency
- Transit consultant
- Municipal office
- Route bus agency

Academia, Industry, and Government Collaboration

Development of Tools to Make GTFS Data

- Tools are freely available for bus companies



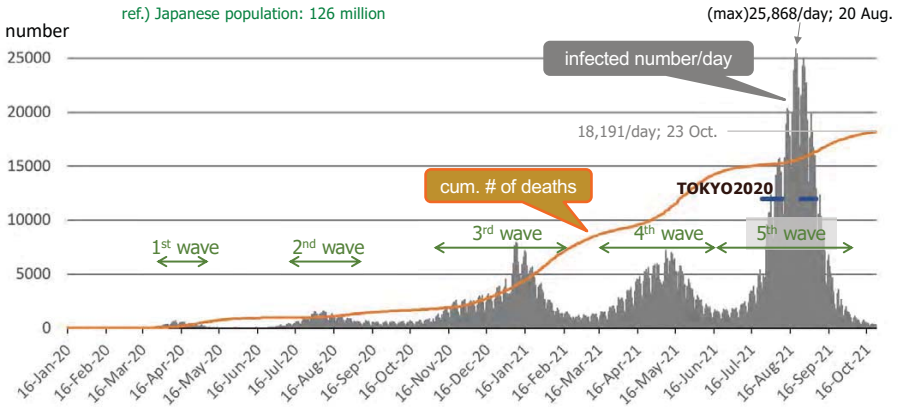
Excel-based tool for small bus agencies

- bus schedule management system for professional-use

Agenda

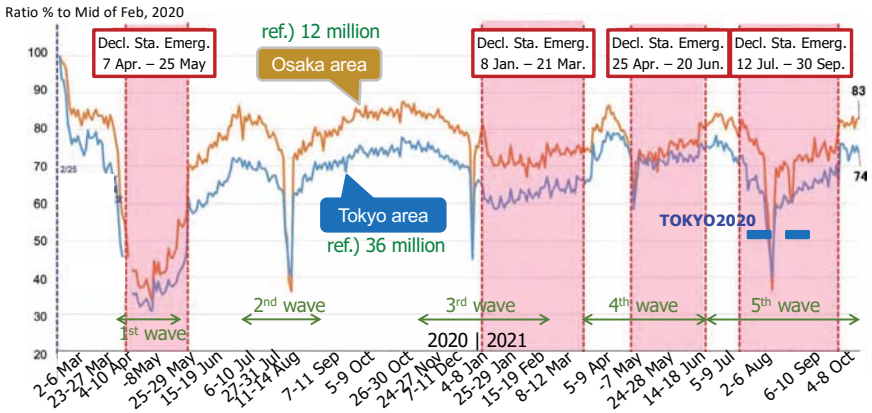
1. Vehicle Automation; from "automobile" to "automated auto"!?
2. Big Data; GTFS format emergence
3. Pandemic; COVID-19
4. Global Warming; Electrifications

COVID-19 infected persons, cum.# of deaths in Japan



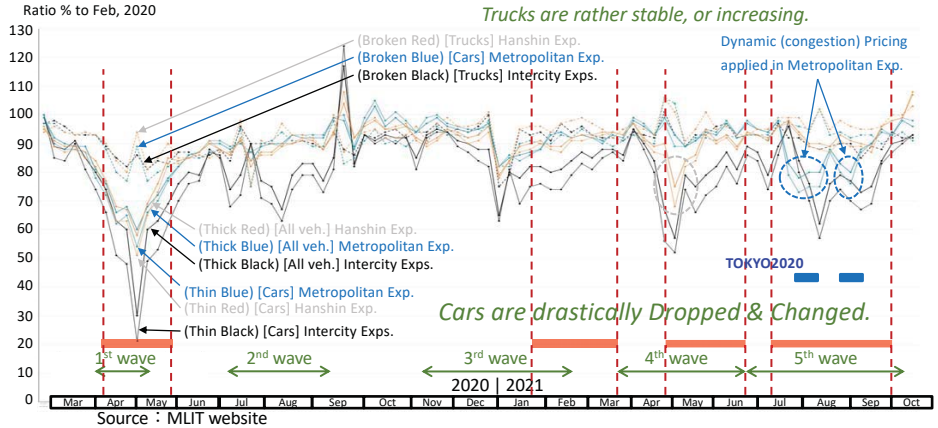
Source：NHK website
https://www3.nhk.or.jp/news/special/coronavirus/data-widget/

Transition of passengers in major train stations in Tokyo and Osaka areas



Source：MLIT website
https://www.mlit.go.jp/tetudo/tetudo_fr1_000062.html

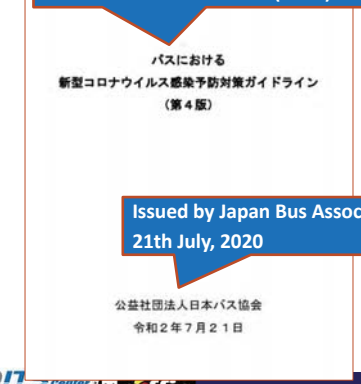
Transition of traffic volume on major expressways [ratio to that of previous year]



Source：MLIT website
https://www.mlit.go.jp/road/road_fr4_000090.html

Short-term countermeasures by Transp. Operators

New Corona Infection Prevention Measures Guideline on Public Buses (Ver.4)


バスにおける
新型コロナウイルス感染予防対策ガイドライン
（第４版）

公益社団法人日本バス協会
令和２年７月２１日

Issued by Japan Bus Association 21th July, 2020

- These kinds of "guidelines" are prepared by sectors.
- The first version of those guidelines were issued in early May around.
- Most of those guidelines are usually prepared by each corresponding business association.
- Basic ideas and some samples that operators (member or each association) should follow are described.

Example: Actual infection countermeasures (by Kanto Bus Company)

Protection plastic cover between cockpit and passenger space

Seats near drivers are blocked.

Disinfection work inside bus

Inside posters showing ventilation capacity of this bus body

Preparing free masks inside bus and Requesting mask wearing to passengers

Bus stop information system showing infection measures

Bus stop posters requesting mask wearing

(Inside Signage) Requesting mask wearing

Source: MLIT HP

Mobility under the effects of the pandemic COVID-19

Avoid 3C (gathering in **crowded** places, close **contact** settings and **closed** spaces)
Refrain from any **"nonessential and non-urgent outings"**

➔ Crisis for **public transport(PT)** **riding together**
"riding together many peoples": **Crowded & Closed**
→ established efficient services of PT in urban area: **Contact**

Observed social changes are;
- ***Communications take place of transport.*** (Remote work/meeting, virtual tourisms,...)
  Satelite Office, Remote working ➔ **mobility reduciton**
- **PD** (physical distribution) takes place of **PF** (passenger flow) ➔ **logistics increase**
- **Revival of personalized** transport **modes** (cars, bicycles)
- **Complete destruction** of a part of businesses (hotels, restaurants, **transportations**, ...)
- Rising of **novel businesses** & **technologies** (**contacless** tech., virtual tech., ...)

Mobility under the effects of the pandemic COVID-19

Where the mobility goes? Is the mobility realy ever reducing?

- **Are mobility sysems Avoiding 3C** available?

➔ Techs would achieve the **Avoiding 3C**, and to alleviate the **3 evils of transport!**

- Anything else of other than **"nonessential and non-urgent outings"**
  - **Really the urgent mobility**
    - emergency life saving activities
    - fire fighting, disaster relieving,
    - arresting criminals, ...
  - **Really Essential mobility ... ???**
    ➔ needs to reconsider what is the **Traffic Demand**

Mobility Vision for Post-Corona Era Ver. 1.0

proposed on 24th October, 2020 by
Mobility Innovation Collaborative Research Organization (**UTmobI**), UTokyo

1. **Efforts for demand leveling and utilization of the margin generated by it**
2. **Further enguagement of public sector in public transport**
3. **Technology development and installation of new mobility services and realization of integrated mobility services by MaaS**
4. **Technology development and system design that contribute to improvement of efficiency and productivity of logistics**
5. **Responding to existing mobile demand**

Reconsideration of the Traffic Demand

Traffic Demand (in textbook)

Principal Demand: : **Instinctive** request of mobility which purpose is to move

Derivative Demand: mobility needs caused by some social purposes

Different types of Derivative Demand

- **Passive Derivative Demand**
  - Business requests: fixed time work, regular meetings, signing requests, ...
  - Custommer requests: Business sales, meeting to visitors, ...
  - (passive) human relations: sociable drinker, ...
- **Derivative Demand with active desire**
  - **on-the-spot experiences:** theater, concert, sports, exhibits, show, ...
  - **nature of humankind:** encounter, share time & place, dialog in person, ...

Reconsideration of the **Traffic Demand**

Why not to meet this "Demand/Desire" !

In addition, it is important to

avoid 3 C, promote contactless, reduce nonessential and non-urgent outings

← These measures are also useful for alleviating **3 evils of transport**.

- **Derivative Demand with active desire**
  - **on-the-spot experiences:** theater, concert, sports, exhibits, show, ...
  - **nature of humankind:** encounter, share time & place, dialog in person, ...

Importance of logictics under the effects of the pandemic COVID-19

Logistics has a function of alternative of passenger movement

← relate to the nature of animals

- Physical goods cannot move by themselves:
  - → Autonomous mobility needs by the "automation" technology

    logistic-center along with highways ← **Level 5 ?** → home, offices
  - → Importance of loading & unloading: data circulation, Robotics

- Human should comit at the both ends of transport of physical goods
  - → senders' will/receiver's check, customs in circulation of goods, ...

Agenda

1. Vehicle Automation; from "automobile" to "automated auto"!?
2. Big Data; GTFS format emergence
3. Pandemic; COVID-19
4. Global Warming; Electrifications

Replies to my Question

- Introduction of vehicles with alternative power sources:
  - Electric vehicles/taxis, CNG bus
  - restriction for old used vehicles
  - enhancing non-motorized transport (NMT)

    → check the energy resource composition of electricity

    fossil fuel(coal,oil), renewable energy,

- Waste management

- Congestion management

  ← to reduce additional energy consumed in congestion

Participants responses

Lagos, Nigeria [Mr. AMZAT Mutiu Adebayo]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer:

1. Test running of a full CNG bus for public transport operations in Lagos State is now at an advanced stage. After satisfactory test running, the CNG buses will be filly deployed on bus corridors in Lagos State.
2. LRMT Blue Line from Okokomaiko to Marina will use EMU rolling stocks.
3. There was a "failed" plan for deployment of AGT technology on Victoria Island/Ikoyi CBD monorail corridor through JICA ODA loan. This would have reduced both congestion and pollution on the corridor.

Algeria [Ms. BOUKHAMES Nora]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer:

Algeria is not a country where industrialization is increased and which has a share of responsibility, however, it feels responsible in so far as it shares the plan with other countries. Which is why we find many associations that activate as part of benivolat in the service of sustainable development, its actions can be summarized as follows :

1-Tree flattening of any kind

2-Protection of animal species

3- Waste recycling cleaning operation

4-Protection of water sources and construction of storm water retention dam

Thailand [Ms. KORNKRAI Thaksina (Em)]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer:

In my country, The organization supports the implementation of Multilane free flow (MLFF). We are working on the first phase of multilane free flow system using the video tolling. At first, we design for mixed operation to study the user reaction and system integration, it mean that 1 toll plaza with combine with the MLFF, DSRC and cash by separate toll both. We hope that the benefit of the new tolling system such MLFF will reduce the delay at the toll plaza and reduce the operating cost both in term of operator and road user. In this regard, we hope that this will be another way to avoid pollution.

Nigeria [Mr. ARUWA Joel Thomas (JT)]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer:

Some of the actions taken by Nigeria in preventing global warming issues includes:

- The ban on importation of vehicles above ten years of manufacture was put in place by then President Obasanjo government.
- The FCTA, introduced computerized inspection for road worthiness certification for every vehicle that plies the FCT roads.
- The recent introduction of smart electric vehicles intended to be used as taxis in the FCC.

All the above are measures taken to meet the UN SDGs.

Ghana [Ms. AFRIYIE-DARKWA Victoria]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer:

- the use of electric cars instead of fuel in the near future in my country I believe would help. The use of electric cars would lower carbon emission's.
- Greening along roadways I believe would also help with the absorption of carbon emissions. For the greening of roadways, it is currently being implemented as a short term measure.
- Putting in place infrastructure that would enable the use of non motorized transport like cycling or walking is also another good measure,

Uganda [Mr. KAMOGA Abel]

Considering new trends in the world, would you please explain any transport related actions which intend to contribute to Sustainable Development Goals (SDGs) defined by UN and/or Carbon-neutral for preventing Global warming issues, if such actions are promoted in your own countries. If there is no clear such actions in your country, please provide your own opinion related to such actions in your country.

Answer: SDGS directly tackled by my organization.

Actions:

- Introduction of no motorized transport lanes to promote ecofriendly mobility
- Regulatory framework like Non-Motorized Transport Policy (2012), National Environment Policy (1994),The National Construction Industry (NCI) Policy, 2010, Road Safety Policy, 2014
- Regulation on importation of second hand vehicles
- Manufactured of solar powered vehicles