Issues on Road Traffic in Japan and ITS

17 Feb., 2021

Associate Prof. Hideyuki KANOSHIMA
Institution of Industrial Science (**IIS**) &
Mobility Innovation Collaborative Research Organization (**ΜTmobI**)
the University of Tokyo (**UTokyo**)

Contents

1. Problem on Road Traffic in Japan

Major problems on road traffic in Japan (Summary)

- Traffic congestion
  - Delay loss:
    5 billion hours/year, or **40 hours/person**/year
- Traffic accidents
  - No. of accidents: **309,000** per year (2020)
  - No. of fatalities: **2,839** per year (2020)
- Environment
  - CO_2 emission: Transport sector account for approx. **18%** of all CO_2 emission (2017)

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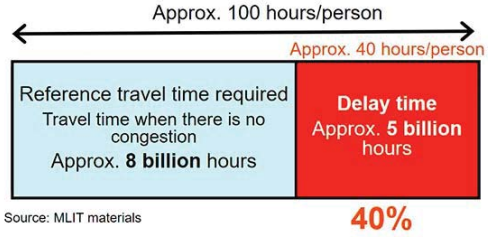
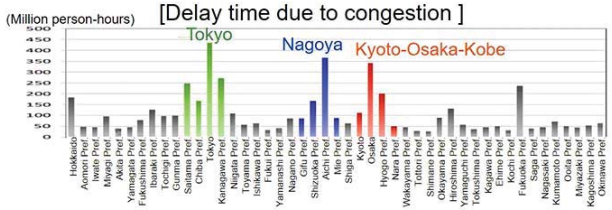
Traffic congestion in Japan



Source: MLIT materials

[Delay time due to congestion]



Source: MLIT materials

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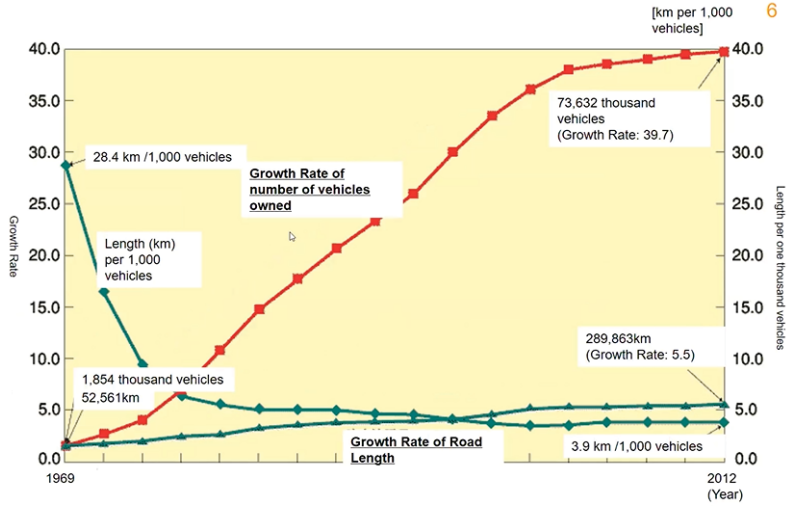

Source: MLIT Road Bureau's materials

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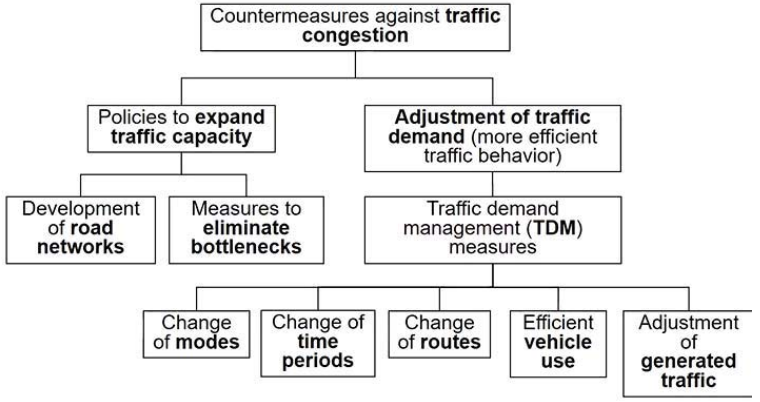
Countermeasure against Traffic Congestion



Source: Prepared based on Ministry of Land, Infrastructure, Transport and Tourism references
http://www.mlit.go.jp/common/000043136.pdf

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Traffic Accidents in Japan

- **Motorization** advanced rapidly after the World War II.
- The number of **fatalities** exceeded **16,000 in 1970** at maximum, but it has decreased since then, and it was about 2,800 in 2020.

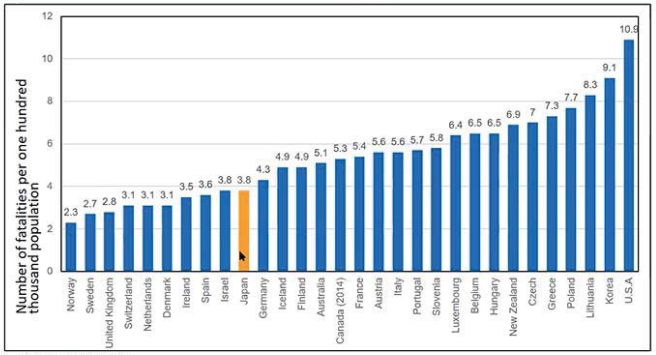
*Expression indicating a high number of fatalities from traffic accidents
*1 Figures of Okinawa prefecture before 1971 is not included.
*2 A Figure for Vehicle kilometer includes light vehicles (less than 660cc), of which figures before 1961 are sited from the estimation by Road Bureau.

Source: National Police Agency

Traffic Accidents in Japan

■ **International comparison of traffic accidents (2015)**

● The number of fatalities per population of Japan is at a low level



Notes: 1. Based on IRTAD data
2. Figures are for 2015, with the exception of those countries with years appearing in parentheses following their names.
3. All figures were calculated based on data for people who died within 30 days from the day of the relevant accident.

Road Safety Countermeasures (3E)

Engineering

- Road network (Expressway, By-pass)
- Road safety facilities
  Traffic control center, Traffic signal, Road information system, Road sign, Road marking, Sidewalk, Pedestrian bridge, Road light, Guard fence, Center strip, Intersection improvement etc.
- Safety regulation for vehicles

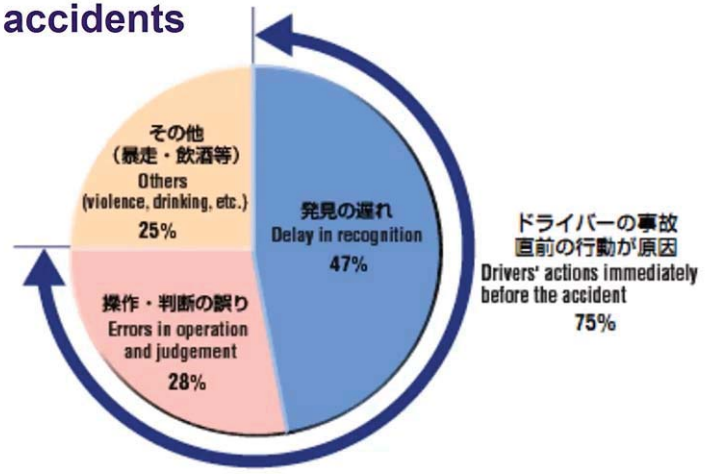
Enforcement

- Driving license
- Crackdown on traffic offence
- Periodic vehicle inspection

Education

- Education for children, students, adults, elderlies, handicapped people, foreigners etc.
- Nationwide traffic safety awareness campaign
- Collaboration with local community on awareness

Classification of factors of traffic accidents



Source: ITS Handbook 2002 (Highway Industry Development Organization)

Environment

Types of environmental measures

Specific measure	Effect	Targeted environmental issue
Low-noise pavement (drainage pavement)	The paved surface to reduce the noise from the vehicle's tires	Noise
Noise barrier	Used as a wall between the road and the roadside area	Noise
Environmental buffer zones	Provide some space between the road and the roadside area (to provide atmospheric dispersion and reduce noise through distance decay)	Air pollution, noise, vibration
Roadside trees	Trees absorb CO2 and purify the air containing vehicle exhaust	Air pollution, "heat island," climate change
Tree planting on slope faces		Air pollution, "heat island," climate change

Source: Ministry of Land, Infrastructure, Transport and Tourism website
http://www.mlit.go.jp/road/soudan/soudan_07_01.html

ITS Center THE UNIVERSITY OF TOKYO

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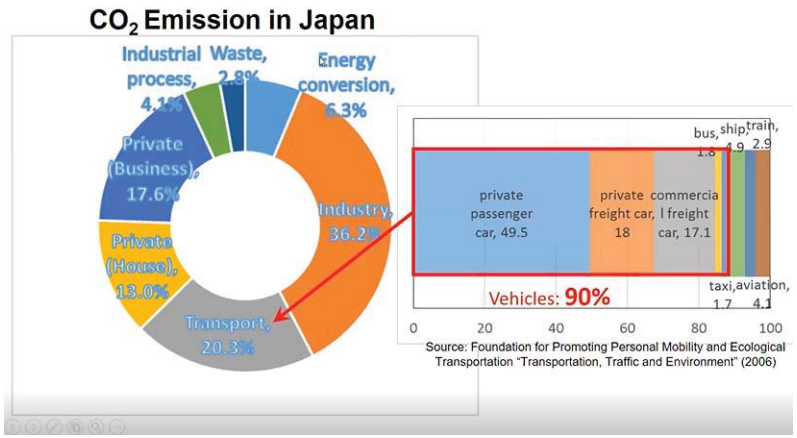
■ Approx. 18% of all CO_2 emission accounts for vehicles



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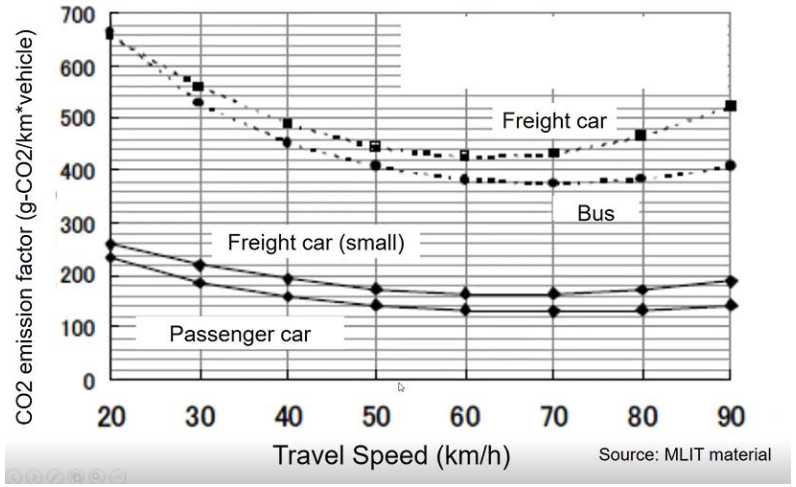
CO_2 emission factor by speed



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Countermeasures for emission reduction

Vehicle measures

- Vehicle emission control
- Low emission vehicle (Electric vehicle, FCV (Fuel cell vehicle), CNG (Compressed natural gas) vehicle, Hybrid vehicle

Traffic demand control

- Mitigate road traffic demand (Modal shift to public transport, use of cargo railway etc.)

Road network improvement for smooth traffic

- Expressway, By-pass
- Improvement of road facilities etc.

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Other Issues

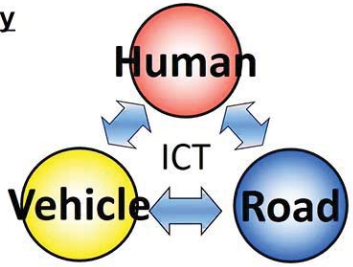
- Disaster prevention (Earthquake, Landslide, Flood etc.)
- Economical gap between mega cities and remote areas, necessity of revitalizing remote areas
- Low birth late, aging population, shortage of working age population
- Aging of infrastructure structures
- Financial deterioration (particularly local governments)

Efficient, Effective, Labor-saving efforts, High productivity

2. What's ITS?

What's ITS ?

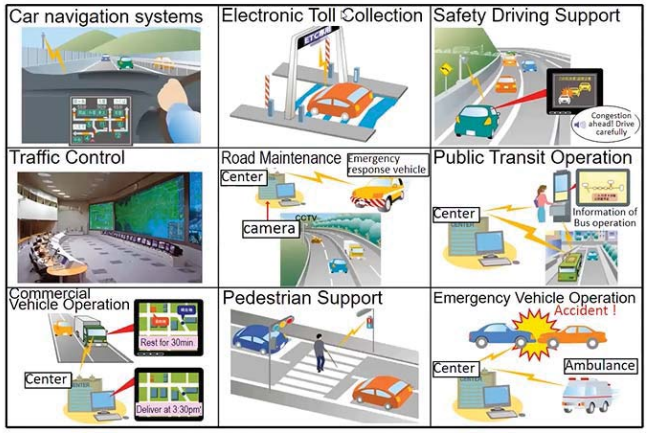
- ITS: Intelligent Transportation Systems
  - New transportation systems in order to solve problems on road traffic such as traffic congestion, traffic accidents and environment by **connecting with human, vehicle and road (infrastructure) using information and communication technology**



3. Development of ITS in Japan

Development of ITS in Japan

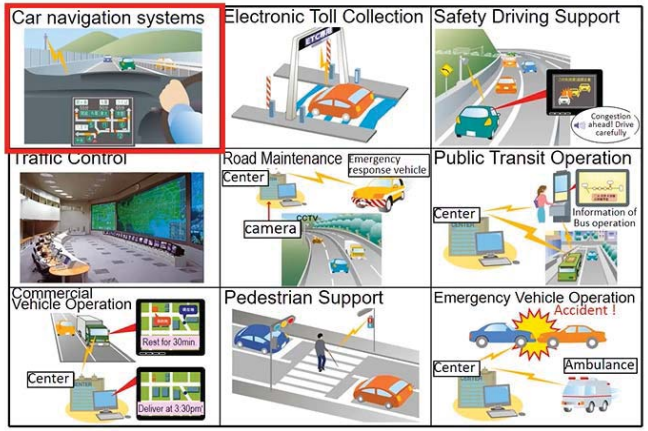
- **9 development fields in ITS in Japan (1996)**



Source: MLIT materials

Development of ITS in Japan

■ 9 development fields in ITS in Japan (1996)



Source: MLIT materials

Car Navigation Systems

On-board type (Japan)

On-board type (Europe)

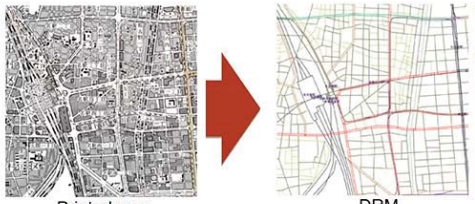
PND type
(Personal Navigation Device)

Cell phone type

Car Navigation Systems

■ Digital Road Map (DRM)

- The Digital Road Map (DRM) Database allows car navigation systems to display road maps on their screens and search for the suitable route to a destination avoiding traffic congestion.



Printed map　　DRM

Example of conversion to DRM

	Total Road Length	No. of Links
Basic road	440,000 km	1.58 million
Narrow road	560,000 km	4.38 million
All roads	1,000,000 km	5.96 million

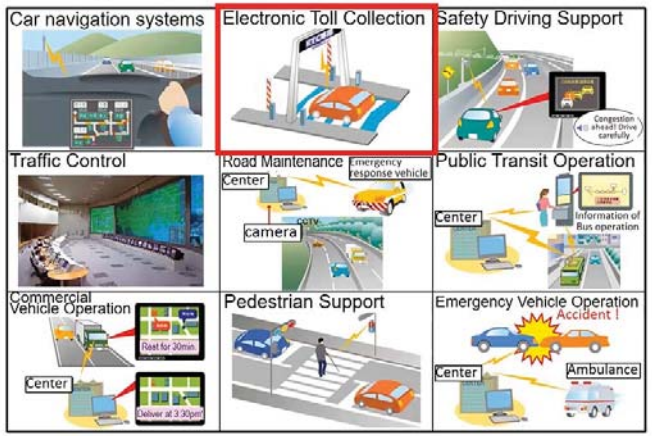
Total road length and number of links

Source: Japan Digital Road Map Association Website

※As of March 2020

Development of ITS in Japan

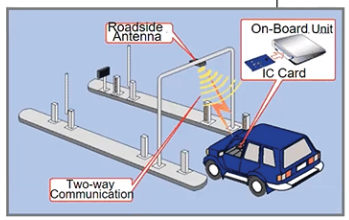
■ 9 development fields in ITS in Japan (1996)

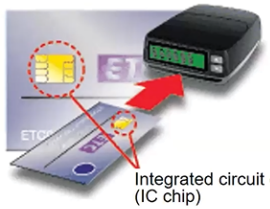


Source: MLIT materials

ETC (Electronic Toll Collection)

or EFC (Electronic Fee Collection)





ETC on-board unit and ETC card in Japan (two-piece system)

Elimination of congestion at tollgate by using ETC

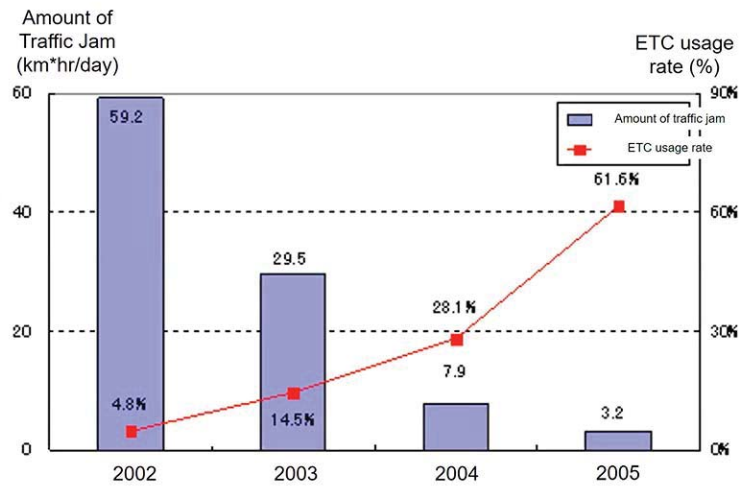
- **ETC** which automatically conducts toll collection by wireless communications between tollgates and ETC onboard equipment has **become widespread**, and **congestion at tollgates has been eliminated**.

[Conceptual drawing of ETC service]

[ETC tollgates]

[Elimination of traffic congestion at tollgates]

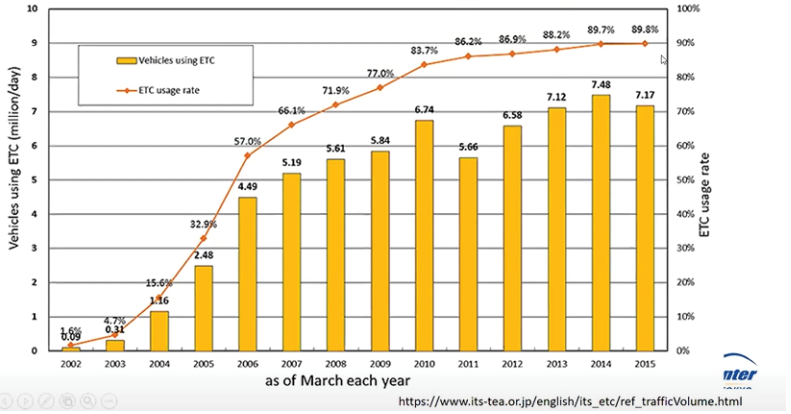
(Photo: Japan Expressway International Company Limited)



ETC (Electronic Toll Collection)

ETC Usage Rate

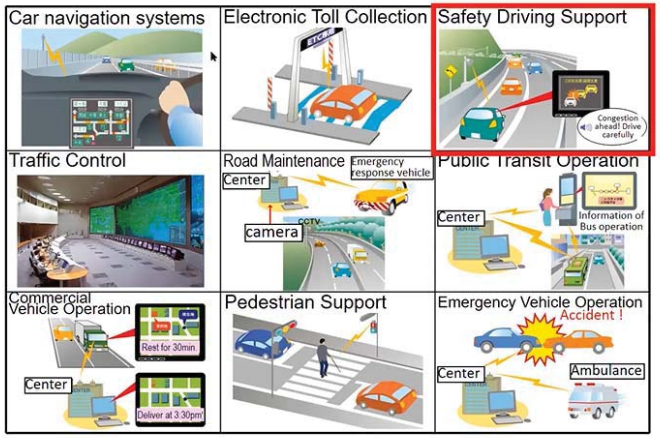
- ETC Traffic: Over 7 million cars per day.
- ETC Usage Rate: Approx. 90% of total traffic on highways.



https://www.its-tea.or.jp/english/its_etc/ref_trafficVolume.html

Development of ITS in Japan

- 9 development fields in ITS in Japan (1996)



Source: MLIT materials

Aim of development of Automated Vehicle

- Safe and secure society
  - Relief of traffic accident, traffic congestion and environmental load, etc.
- Ease and comfort mobility
  - For elderly people,
  - Relief driver's driving load, etc.
- Increase industrial competitiveness
- Market expansion of related industry
- Create new business

Developmental status of automated driving – three domains

	Example
Private Car	
Buses, Shared car	
Trucks, Commercial vehicle	

Definition of Automated Vehicle Level

Level	Name	Narrative Definition
	Human driver monitors the driving environment	
0	No Automation	The full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems
1	Driver Assistance	The driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task
2	Partial Automation	The driving mode-specific execution by one or more driver assistance of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task
	Automated driving system ("system") monitors the driving environment	
3	Conditional Automation	The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene
4	High Automation	The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene
5	Full Automation	The full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver

HONDA
The Power of Dreams

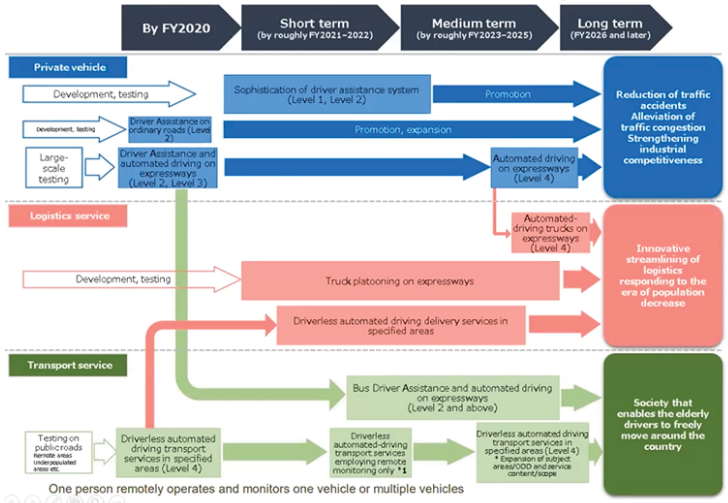
Honda Receives Type Designation for Level 3 Automated Driving in Japan

November 11, 2020, Japan　Automobile

TOKYO, Japan, November 11, 2020 - Honda Motor Co., Ltd. today announced that it has received the required type designation for Level 3 [1] automated driving from the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT). This approval enables the automated driving system to drive the vehicle instead of the driver under certain conditions, such as when the vehicle is in congested traffic on expressway. Honda is planning to launch sales of a Honda Legend equipped with the newly approved automated driving equipment ("Traffic Jam Pilot") before the end of the current fiscal year (Ending March 31, 2021).

To promote commercialization of Level 3 automated vehicles, the MLIT partially amended the Road Vehicle Act, and the revised act (Act No. 14 of 2019) took effect April 1, 2020. By this amendment, equipment for Level 3 automated driving was newly added to the list of motor vehicle equipment subject to the safety standards (defined in the Ministry of Transport Ordinance No.67, 1951).

Developmental status of automated driving in Japan - Public-Private ITS Initiative/Roadmaps 2020



Source: SIP-adus WS2020 website

Easiness of introduction of automated vehicle in general

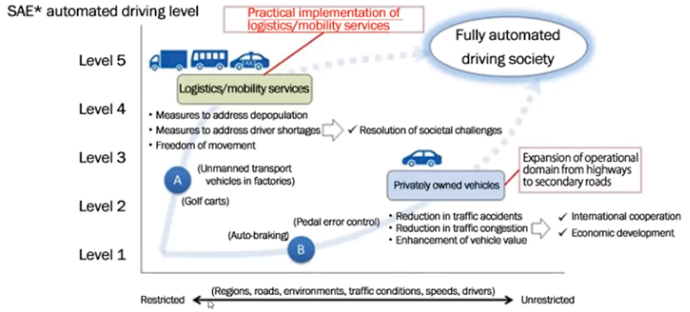
(easy → difficult)

- Technical aspect
  - Low speed → High speed
  - Exclusive road → Mixed road (Existing road)
  - Vehicle following driving → Individual driving
- Legal aspect
  - Manned → Unmanned
- Operation and deployment aspect
  - For business use → For individual use

Overview of 2nd phase of SIP: Automated Driving for Universal Services

- Expansion of range for automated driving from highways to secondary roads.
- Realization of logistics and mobility services that utilize automated driving technology

Project achievements will contribute to resolution of social issues such as reducing traffic accidents and congestion, providing greater mobility in depopulated areas, and alleviating shortages of drivers in the logistics industry, with the ultimate aim of ensuring safe and comfortable mobility for everyone.



※SAE (Society of Automotive Engineers) : U.S. standardization body

Overview of 2nd phase of SIP: Automated Driving for Universal Services

The Latest stream of ITS

17 Feb., 2021

Prof. Takashi OGUCHI

Institution of Industrial Science (IIS) &

Mobility Innovation Collaborative Research Organization (UTmobI)

the University of Tokyo (UTokyo)

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Agenda

1. Overview on the **COVID-19 impacts on mobility in Japan**, and introducing a proposal on "**Mobility vision for post Corona Era Ver.1.0**" by UTmobI in the Univ. of Tokyo [Major contribution by Assoc. Prof. Kanoshima]
2. History of implementation of the **GTFS data in Japan**

   [Major contribution by Proj. Lecturer Ito]
1. Traffic management plan of road network in Tokyo for Olympic / Paralimpic games including **dynamic road pricing**

2

COVID-19 impacts on mobility in Japan

3

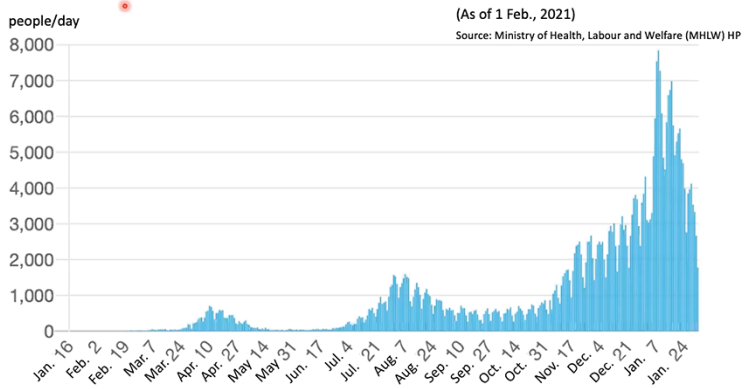
No. of positive cases of COVID-19 in Japan

1,783 peple/day

(Cumulative: 388,153 people)

(As of 1 Feb., 2021)

Source: Ministry of Health, Labour and Welfare (MHLW) HP



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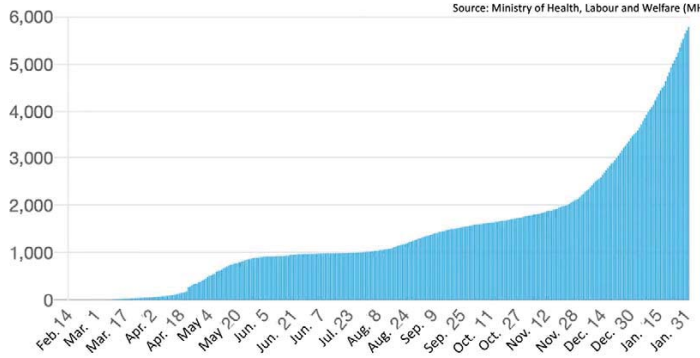
Cumulative No. of death of COVID-19 in Japan

(Day-on Day c

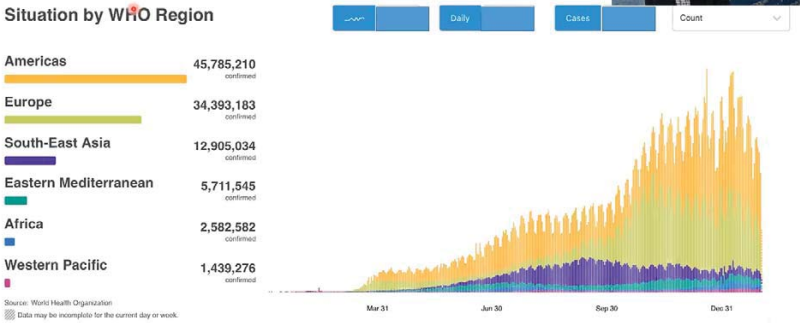
(As of 1 Feb., 2021)

Source: Ministry of Health, Labour and Welfare (MHLW) HP



No. of positive cases in the world

Situation by WHO Region



Source: WHO HP

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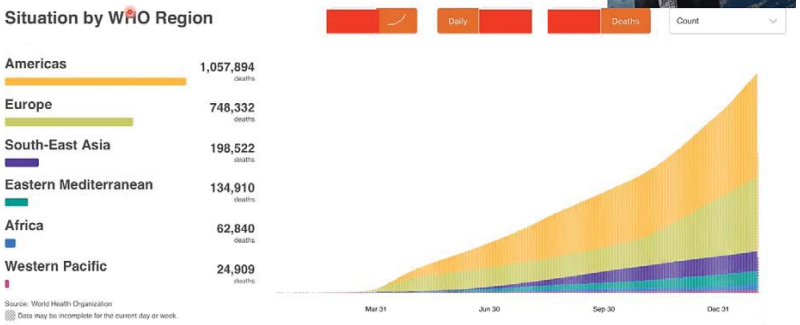
Cumulative No. of death in the world

Situation by WHO Region



Source: WHO HP

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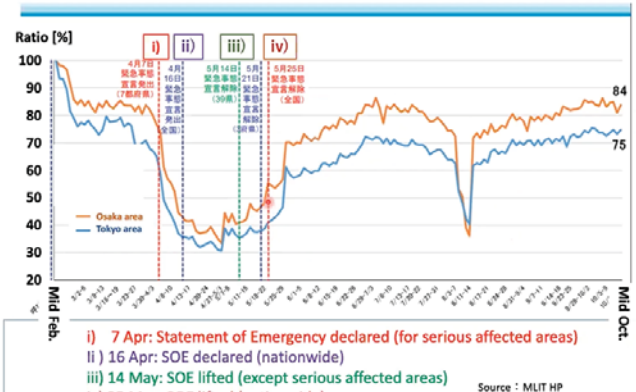
Transition of passengers in major train stations in Tokyo and Osaka areas



i) 7 Apr: Statement of Emergency declared (for serious affected areas)

Ii) 16 Apr: SOE declared (nationwide)

iii) 14 May: SOE lifted (except serious affected areas)

iv) 25 May: SOE lifted (nationwide)

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

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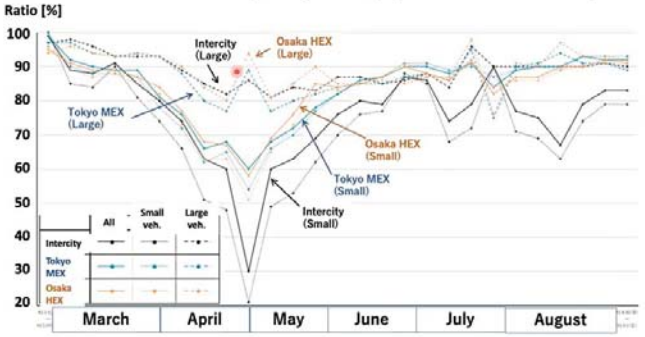
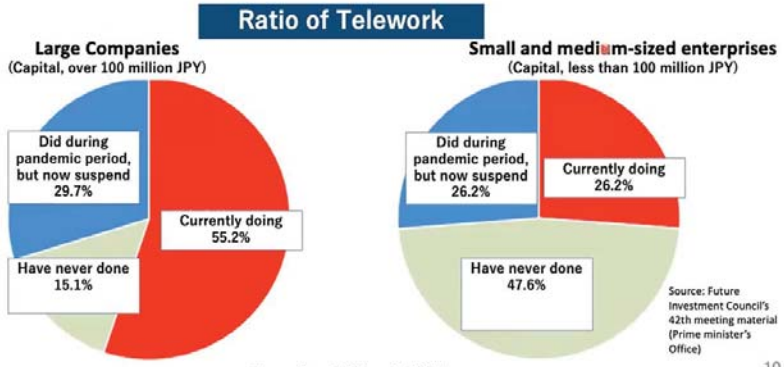
Transition of traffic volume on major expressways [ratio to the volume of previous year]



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

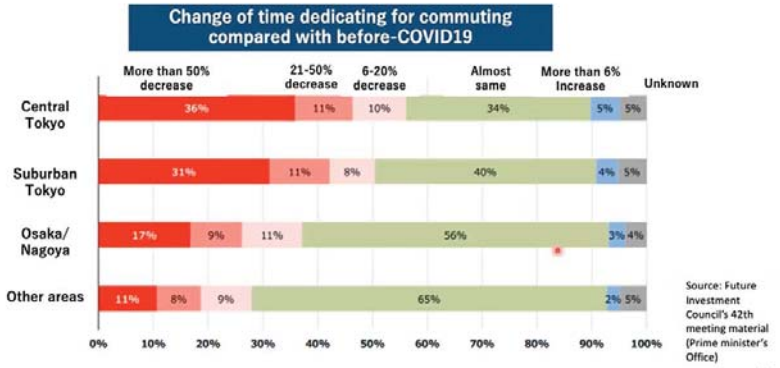
Situation of Telework (Remote work) in Japan



Source: Future Investment Council's 42th meeting material (Prime minister's Office)

Survey from 29th Jun. to 8th Jul.

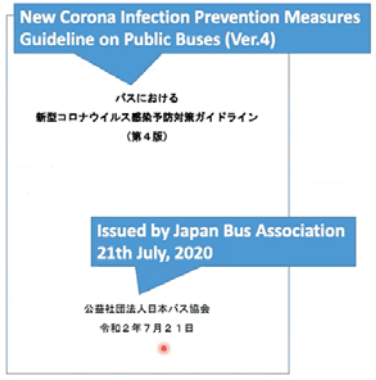
Change of Work Style



Source: Future Investment Council's 42th meeting material (Prime minister's Office)

Survey from 29th Jun. to 8th Jul.

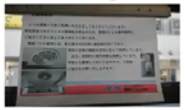
Short-term countermeasures by Transp. Operators



- 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

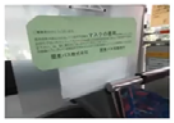


Inside posters showing ventilation capacity of this bus body

Bus stop information system showing infection measures

Bus stop posters requesting mask wearing

Seats near drivers are blocked.



Preparing free masks inside bus and Requesting mask wearing to passengers

(Inside Signage) Requesting mask wearing

Disinfection work inside bus

Source: MLIT HP

Information provision for expected-passengers on congestion levels of expressway bus (non-reserved type) in past one week

Inbound

→ During travel planning, travelers can choose less-congested service to mitigate infection risks.

月日	曜日	赤塚	県庁	赤塚	赤塚	赤塚	赤塚	県庁	赤塚	県庁	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	県庁	赤塚
		5:00	6:00	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	19:30	20:30
11/9	M		57%	14%	23%		50%	16%	46%		39%	27%	23%	14%	32%	34%	46%	25%	36%	21%	14%	11%
11/10	Tu		48%	36%	46%		39%	25%	48%		41%	11%	43%	16%	27%	25%	25%	32%	27%	27%	16%	9%
11/11	W		30%	18%	39%		34%	25%	43%		41%	16%	30%	21%	59%	14%	27%	11%	16%	16%	5%	7%
11/12	Th		39%	23%	64%		46%	34%	41%		41%	21%	36%	16%	25%	16%	18%	16%	25%	39%	14%	21%
11/13	F	9%	32%	27%	75%	39%	43%	48%	59%	41%	21%	46%	30%	34%	32%	50%	27%	27%	59%	57%	23%	34%
11/14	Sa	32%	43%	27%	66%	50%	73%	55%	75%	30%	64%	52%	86%	55%	61%	43%	32%	23%	41%	32%	23%	16%
11/15	Su	18%	21%	25%	36%	23%	59%	48%	80%	30%	48%	39%	46%	50%	61%	66%	61%	82%	64%	66%	43%	32%

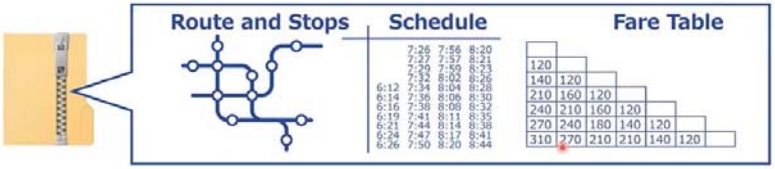
Outbound

月日	曜日	赤塚	県庁	赤塚	赤塚	赤塚	赤塚	赤塚	赤塚	県庁	赤塚	赤塚	赤塚	赤塚	赤塚	県庁	赤塚	赤塚	赤塚	県庁	赤塚	赤塚	赤塚
		7:40	9:00	10:30	11:30	12:30	13:30	14:30	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	22:00	23:00
11/9	M	48%	23%	46%	34%	25%	59%	52%	41%		59%		61%	48%	34%	36%		55%		23%	46%	18%
11/10	Tu	25%	11%	25%	16%	14%	32%	41%	50%		52%		73%	36%	55%	43%		64%		30%	25%	34%
11/11	W	23%	14%	32%	18%	18%	36%	16%	77%		30%		55%	27%	23%	50%		46%		36%	32%	32%
11/12	Th	21%	23%	25%	9%	23%	36%	39%	34%		59%		80%	43%	23%	50%		64%		39%	41%	32%
11/13	F	36%	36%	52%	25%	25%	41%	43%	41%	23%	59%	50%	46%	57%	50%	82%	61%	48%	66%	59%	59%	50%
11/14	Sa	46%	52%	66%	48%	46%	64%	71%	61%	27%	43%	36%	64%	64%	55%	59%	30%	34%	21%	66%	48%	61%
11/15	Su	39%	75%	59%	46%	30%	34%	48%	96%	50%	77%	48%	75%	64%	64%	66%	73%	57%	46%	61%	91%	64%

Source: Kanto railway bus HP

GTFS (General Transit Feed Specification)

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



Applications of the GTFS data

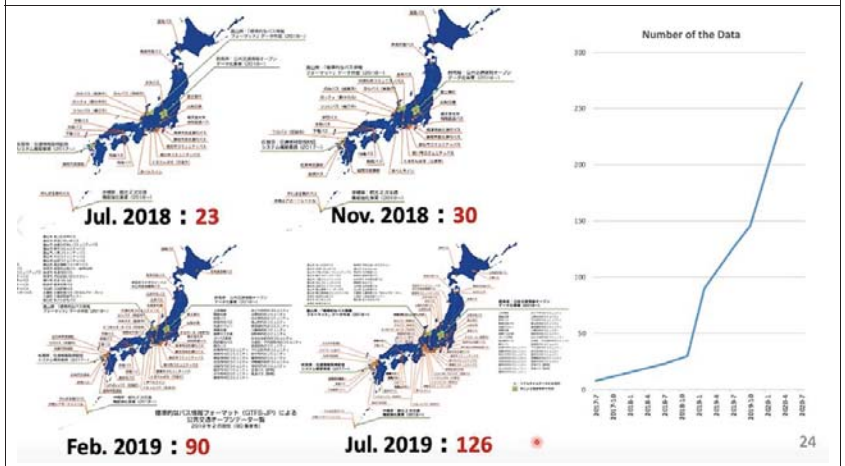
- Journey planning (Google Maps etc.) is a typical application
- The data is applicable for multiple purposes

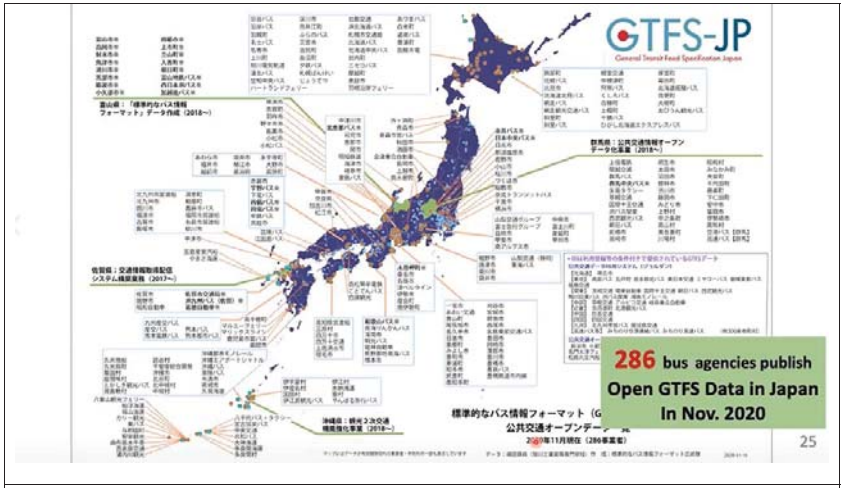
Journey Planning Apps

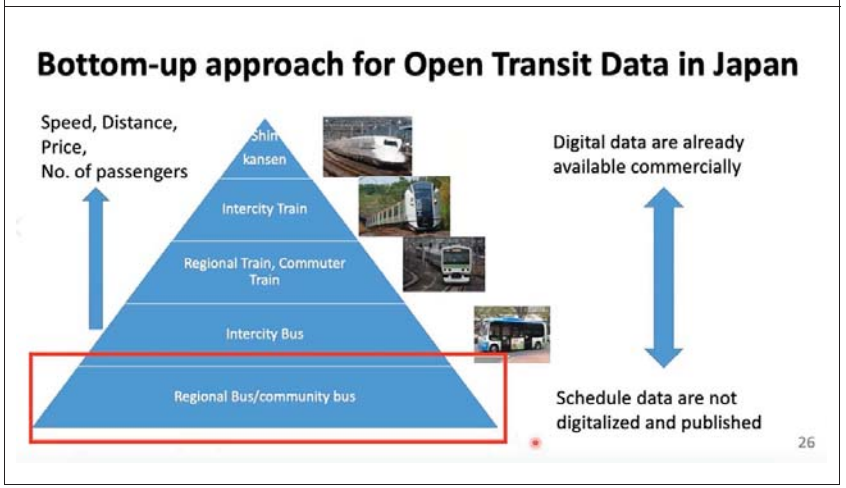
Passenger Information System

Analysis and Planning of the network

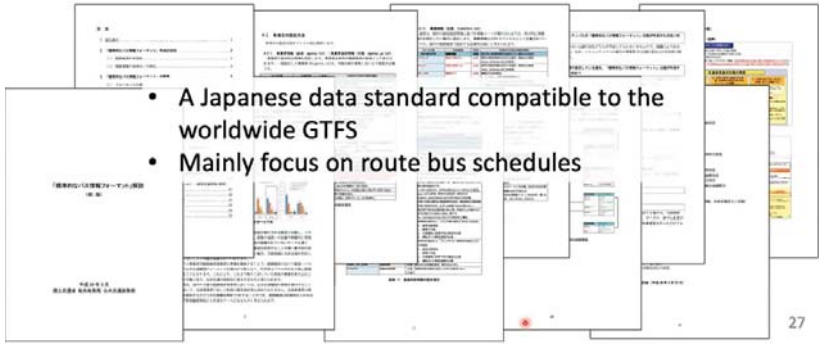

Worldwide transit agencies are publishing GTFS data
1296 providers in 675 locations
as of Nov. 22, 2020
Source: http://transitfeeds.com


Jul. 2018：23
Nov. 2018：30
Feb. 2019：90
Jul. 2019：126
Number of the Data
24


GTFS-JP
286 bus agencies publish
Open GTFS Data in Japan
In Nov. 2020
25


Bottom-up approach for Open Transit Data in Japan
Speed, Distance,
Price,
No. of passengers
Shinkansen
Intercity Train
Regional Train, Commuter Train
Intercity Bus
Regional Bus/community bus
Digital data are already available commercially
Schedule data are not digitalized and published
26

GTFS-JP secification was standardized GTFS-JP spec. in March 2017 by Japanese government



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

27

GTFS-JP Promoting Team

GTFS-JP
General Transit Feed Specification Japan

- 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

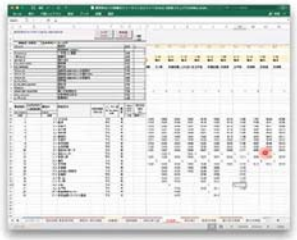
- **Member**
  - Researcher
  - App developer
  - System developer for bus agency
  - Transit consultant
  - Municipal office
  - Route bus agency

Academia, Industry, and Government Collaboration

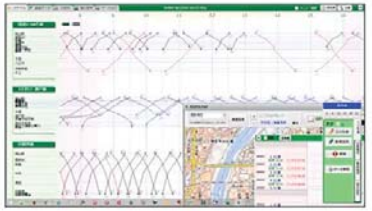
28

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-us

29

Many bus companies are making GTFS data and publishing them as open data by themselves

30

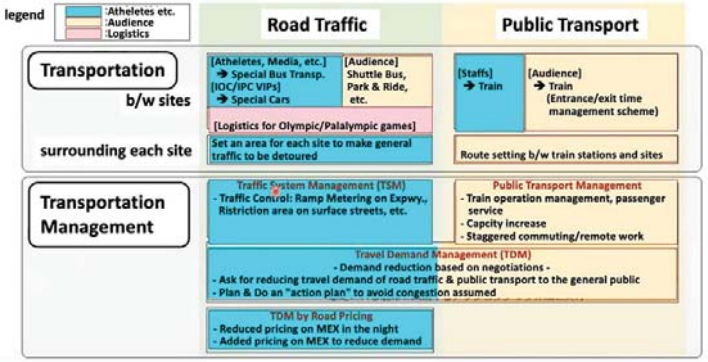
Traffic management plan of road network in Tokyo for Olympic / Paralimpic games including dynamic pricing

*"The plan" has been established & authorized in Feb. 2020

based on the description in
https://tokyo2020.org/ja/games/transportation-management/

31

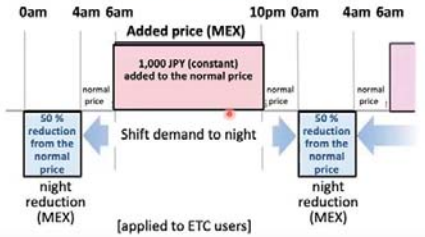
Overall Transport Management Scheme

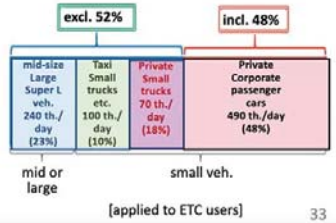


32

Dynamic (congestion) Road Pricing Plan

- The 1st trial to introduce **dynamic road pricing** for congestion mitigation with **ETC system**
  - ← The price in toll roads (expressways) in Japan **was** defined based on the concept for paying off of road construction loans.





33

Addtional Traffic System Management (TSM)

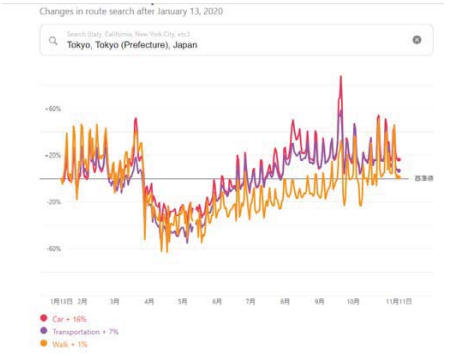
34

COVID-19 Response in Japan and the world

Feb.18, 2021
Atsushi MOCHIZUKI
Nippon Koei Co.,Ltd.

1. COVID-19 Impact on Transportation in Japan

Ghp dqg#Ghfdqh#q#Sxedf#Wudqvsruwdwrq



(Source) https://covid19.apple.com/mobility

Fdsdflw|#Dlp lwdwrq e|#Vrfldo#Glvwdqflqj

(Source) https://www.irasutoya.com/

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

+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

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

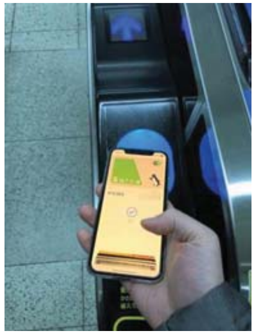
- ✓ Contactless / Automation
- ✓ Social Distancing
- ✓ TDM(Transportation Demand Management)
- ✓ Demand Response
- ✓ Hygiene Management
- ✓ Traceability
- ✓ DX(Digital Transformation)

3. Effort for COVID-19 Response

(Ex.1) Introduction of Fully Contactless Payment

P dqgdwru|#iru HWF2Fdvkohvv#dw#Wroo#errwk	Wudqvsruwdwlrq#LF#Fdug lq#Preloh#Dssv1	Dxwrqrprxv#Exv# zlwk#Idfldo#Uhfrjqlwlrq

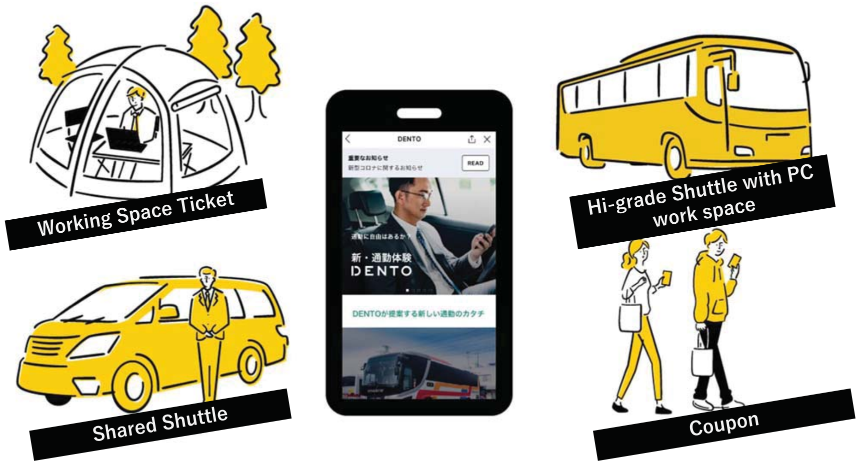
(Source) https://www.mlit.go.jp/road/ir/yuryou/7pdf/1.pdf



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

(Photo by Mochizuki)

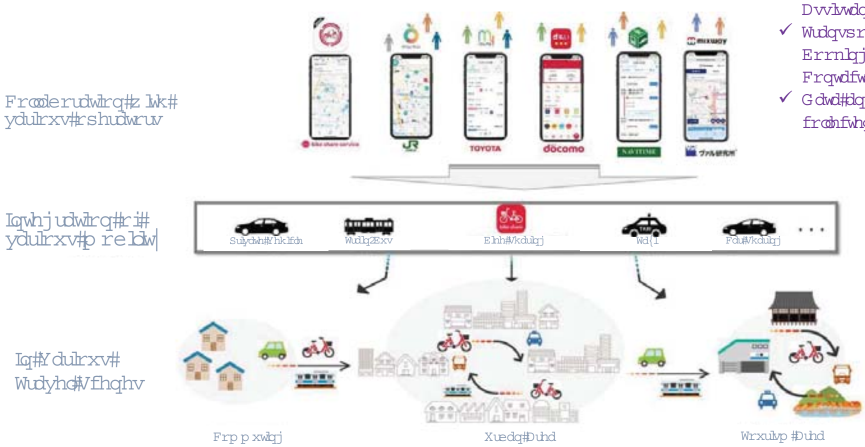
(Ex.2) With-COVID19 MaaS trial by Rail-operator (Tokyu Corporation)



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

(Ex.2) Support from MaaS (Mobility as a service)

- ✓ Prgdo#Fkrlfh# Dvvlvwdqfh
- ✓ Wudqvsruwdwlrq# Errnlqj#dqg# Frqwdfwohvv#Sd|phqw
- ✓ Gdwd#dqdo|vlv# froohfwhg#e|#PddV



(Source) https://image.itmedia.co.jp/l/im/mobile/articles/2008/07/l_st52693_navitime-11.jpg

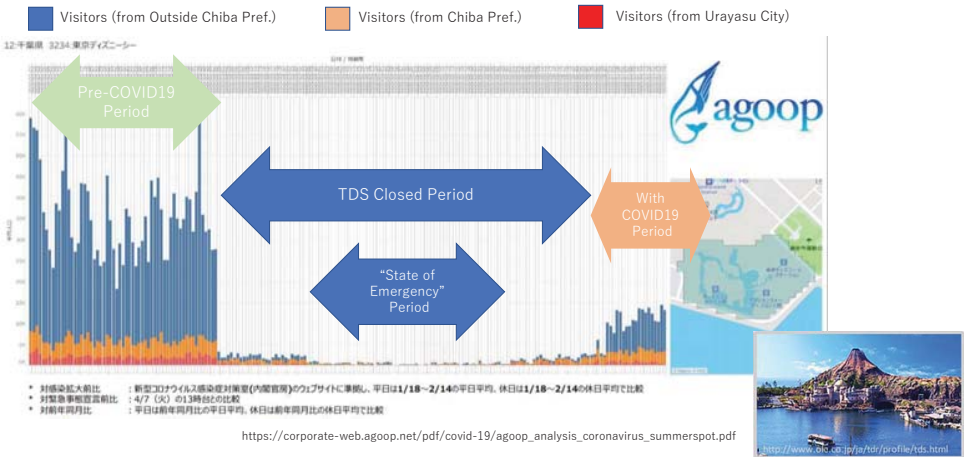
(Ex.3) Monitoring system in public facilities

※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.4) Monitoring Passenger Flow / Density from Mobile Big Data

Visitor Trend Analysis (to Tokyo Disney Sea(TDS)®)



https://corporate-web.agoop.net/pdf/covid-19/agoop_analysis_coronavirus_summerspot.pdf

(Ex.5) Automation Robots in the Station (Takanaka Gateway Station, Tokyo)

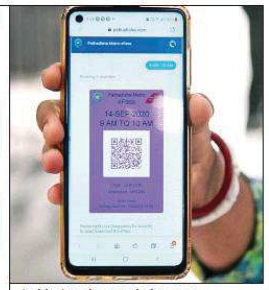
(Source)
https://xtrend.nikkei.com/atcl/contents/18/00342/00002/

(Ex.6) 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.7) 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

COVID-19 and Japanese Expressway

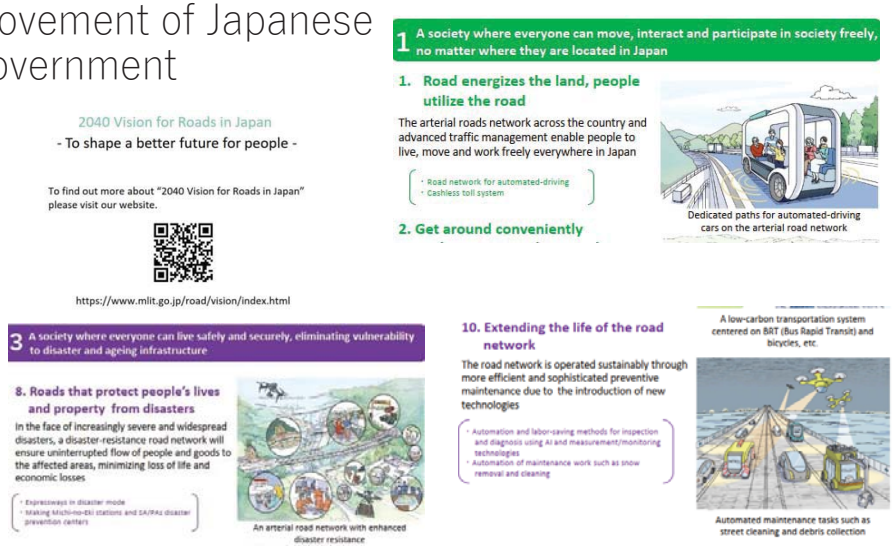
February 17, 2021

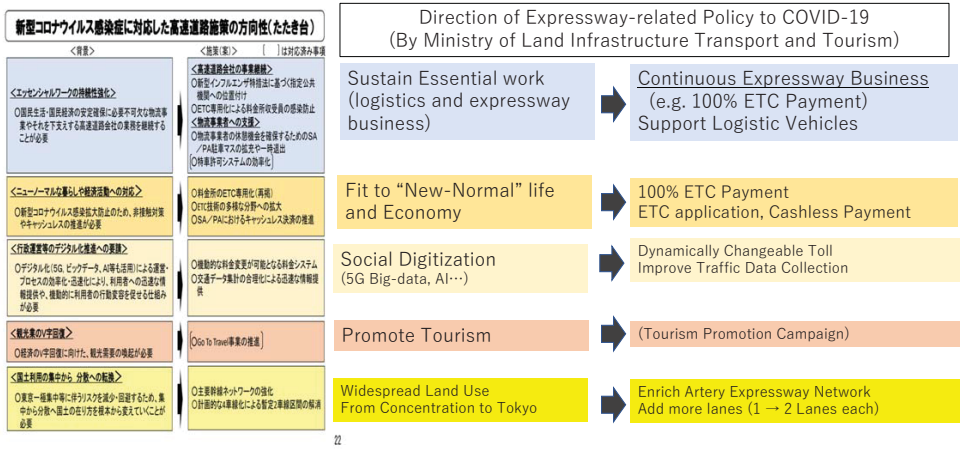
Reported by UNO Takumi
(Hanshin Expressway Company Limited, Japan)

Temporary Observation regarding the traffic counts on Hanshin Expressway (as of summer 2020)

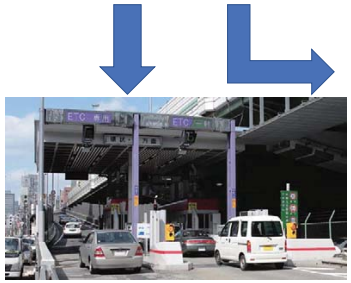
- **Passenger Vehicle**: Decreases especially the period under state of emergency(April to May, 2020)
- Decrease of **small and middle-sized logistics trucks** is smaller than those of other vehicle types.
- Decrease of **Large Passenger Bus** is the most severe. Impact of Lost of Foreign Tourist is huge.
- Decrease trend **in the morning rush hours** is smaller than other time periods such as daytime, evening commute.
- As for **morning commute use**, a few shift from public transport to the vehicle use might be happening.
- Suspension of business and leisure impacts to the use of expressway, especially during **daytime, evening and holiday** as a decrease of traffic count.
- **Further research** is essential to evaluate the impact of COVID-19 to the road transportation

Movement of Japanese Government

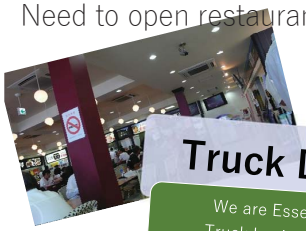




Electronic Toll Collection and Unmanned Expressway Toll Payment Machine



Japanese COVID-19 Controversy
Need to open restaurants on expressway rest area in the night?



Truck Drivers

We are Essential Workers
Truck Logistics is 24 hours!

Eating Dinner on the Driver's sheet?
No way!

No hot dinner for us?

Request From Government

Closing Restaurants and bars in the nighttime are the request from Government!

Now is the state of Emergency!

No Exception !

Take-away is available even in the night!

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。

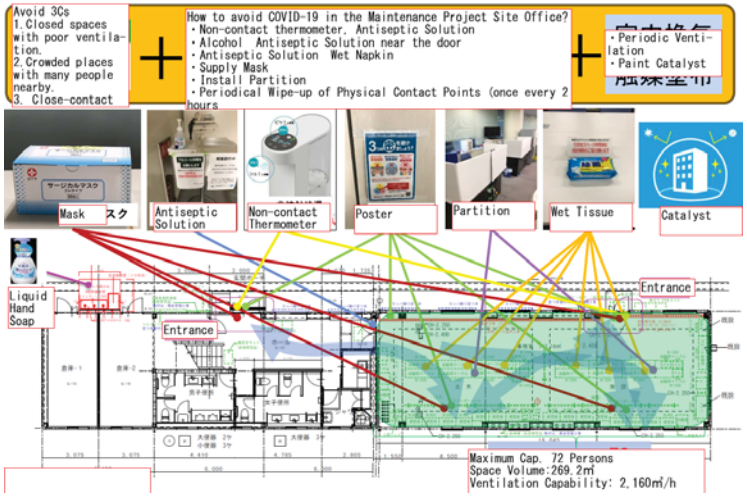
東日本高速道路株式会社
ネクセリア東日本株式会社

Source: NEXCO East

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

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

COVID-19 Measures in the site supervision base office



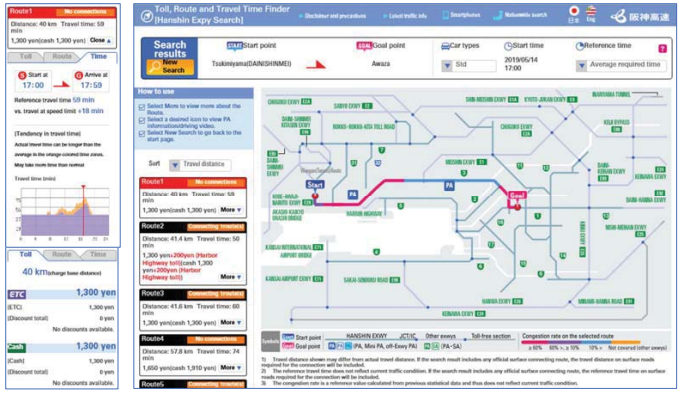
Functions of Traffic Control System

Traffic control system is composed of 3 functions.
(1) Information Collecting
(2) Information Processing
(3) Information Providing

Maintaining them in good condition contributes to the smooth traffic of passengers and logistics!

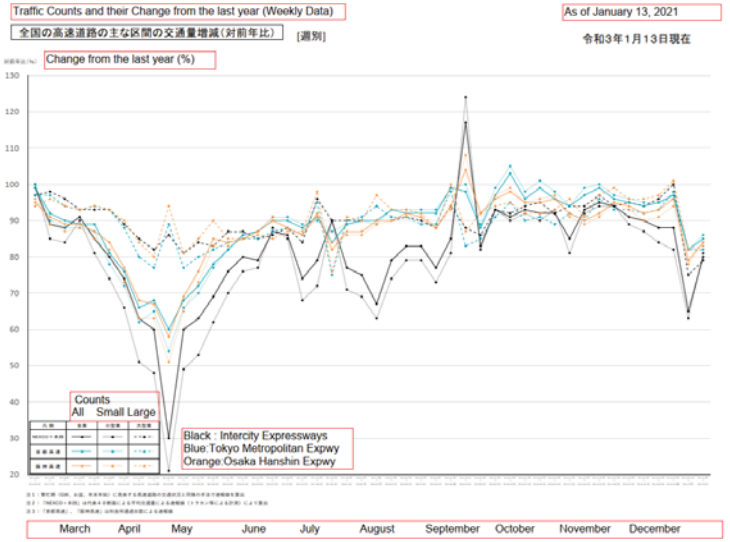
以下のスライドは必要に応じて・・・

4.(1) Toll, Route, Travel time Finder (For PC)



By inputting a specific origin and destination, multiple recommended routes are displayed together with toll, travel distance, travel time and congestion occurrence probability (statistics).

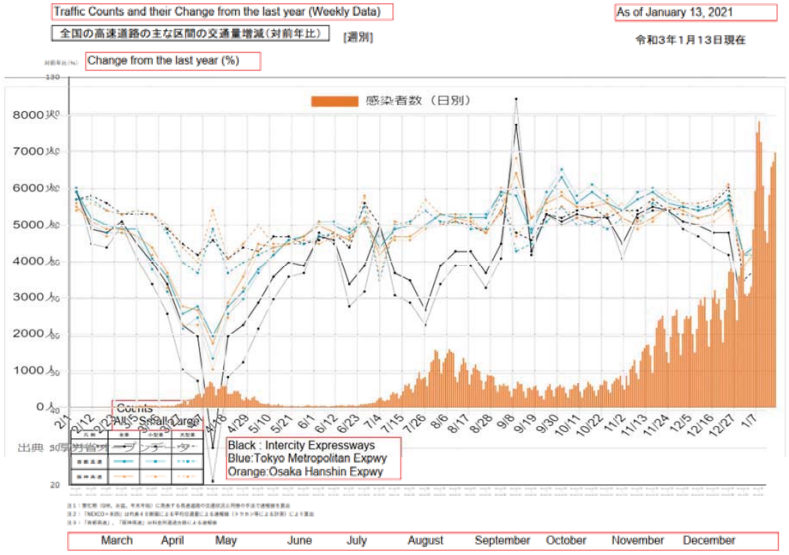
https://search.hanshin-exp.co.jp/navien/search.php#!home



4.(2) Traffic Information Service for Smartphone

・Real time traffic information (congestions, accidents, debris)
・Current travel time
・Toll information
・Live camera images at major congestion points

https://www.8405.jp/en/



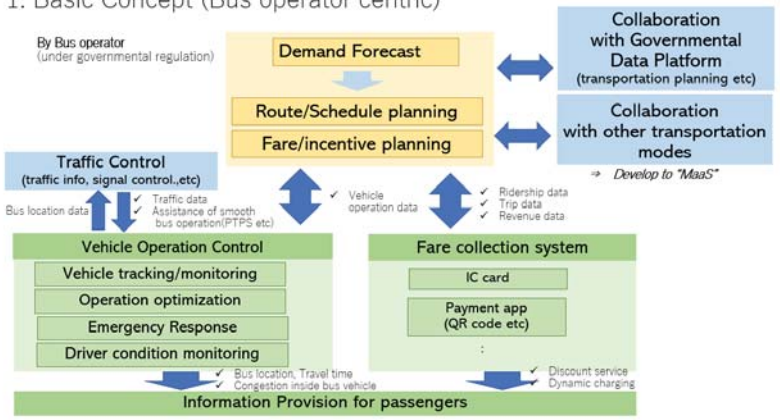
４．新規研修資料

（個別コンサルテーション）

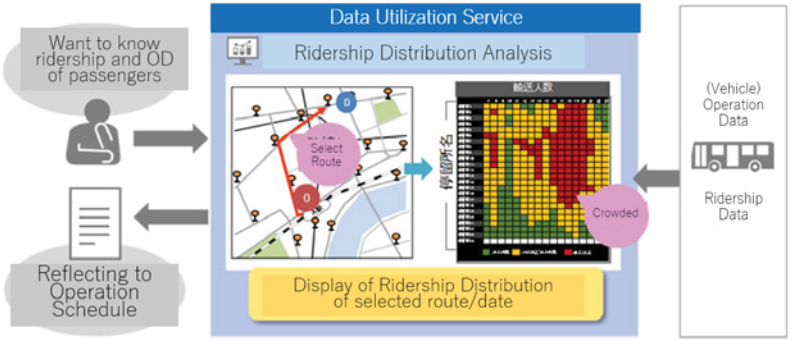
Topics on ITS + Public Transportation

Apr.23, 2021
Atsushi MOCHIZUKI
Nippon Koei Co.,Ltd.

1. Basic Concept (Bus operator centric)



2. Example of experience in Japan (collaboration with traffic data)



https://monoist.atmarkit.co.jp/mn/articles/1804/03/news026.html

2. Example of experience in Japan (Nagoya dual-mode bus)

https://www.guideway.co.jp/summary/index.html

2. Example of experience in Japan (Hitachi BRT)

https://xtech.nikkei.com/atcl/nxt/column/18/00001/01189/?P=2

2. Example of experience in Japan (Various payment methods)

https://tetsudo-ch.com/2133008.html

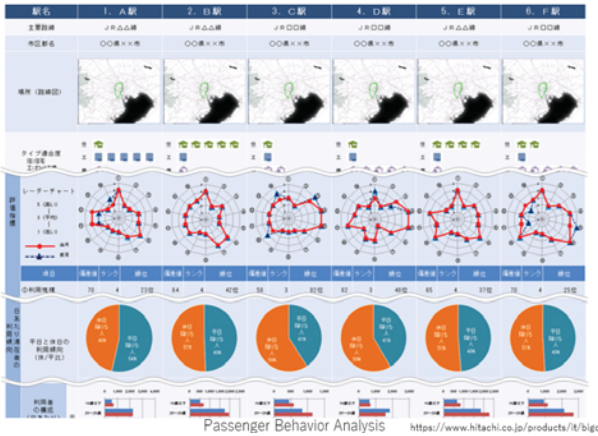
MaaS app (with IC card)

https://www.takubus.com/

QR code (Takushoku bus)

EMV payment (Nankai railway)

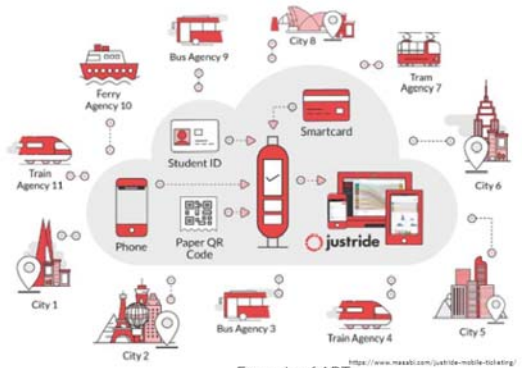
2. Example of experience in Japan (Utilization of IC card data)



Passenger Behavior Analysis

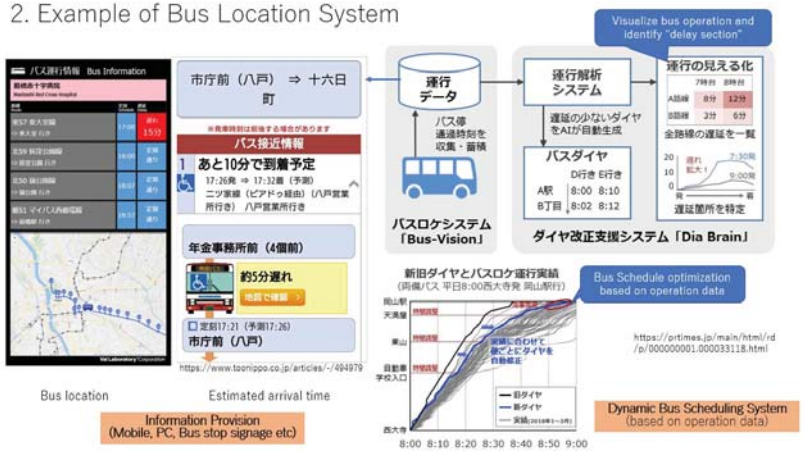
https://www.hitachi.co.jp/products/it/bigdata/field/statica/index.html

2. Example of ABT(Account-Based-Ticketing)

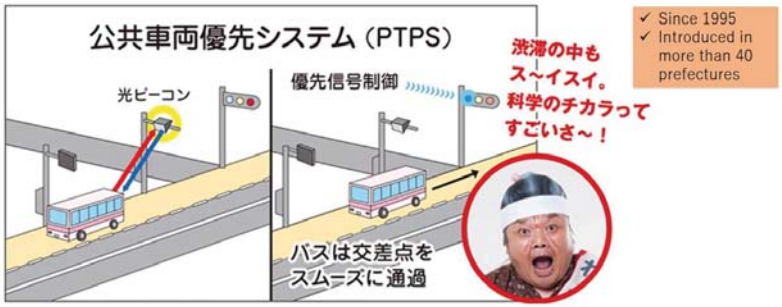


Example of ABT

2. Example of Bus Location System



2. Example of PTPS（Public Transportation Priority System）



- ✓ Since 1995
- ✓ Introduced in more than 40 prefectures

国道58号を通る路線バスが信号をスムーズに通過できるよう、青信号の延長などを行う「公共車両優先システム（PTPS）」が平成28年度より導入されています。
導入路線では所要時間が51分から41分と10分減。導入車両も平203台へ増加しました。

https://www.watta-bus.com/currenttry/

Example of “Smart Bus stop” in Japan

On February 17 2018, Michinori Holdings, Aizu Bus Company, and other companies began a demonstration experiment for the practical use of next-generation smart bus stops in Aizu Wakamatsu City, Fukushima Prefecture.
The system is powered by solar power and uses electronic paper to update timetable data and display bus operation information in real time.

(Source)https://xtech.nikkei.com/dm/atcl/news/16/022010786/

Individual　Consultation for Mr. Pornnarong(EXAT)

Question 1: Incident Detection System algorithm

Worldwide introduction

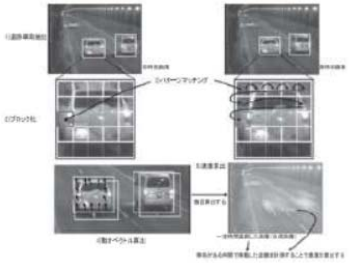
World Road Association(PIARC) website
https://rno-its.piarc.org/en/network-monitoring-its-network-monitoring-vehicles-roadways/automatic-incident-detection

Ministry of Infrastructure and Transport's introduction

https://www.mlit.go.jp/road/ITS/1998HBook/chapter4/4-3e.html

Shuto Expressway's incident detection system (inside the tunnel)

https://jpn.nec.com/techrep/journal/g08/n01/pdf/080106.pdf



Hanshin Expressway's Incident Detection System

https://hanshin-exp.co.jp/company/skill/library/info/31505.html

Question 2: Anti – wrong way system at the Ramp

Automatic system

Automatic system - First Case of the United States

https://www.eenewspower.com/news/wrong-way-driver-detection-system-first-us

Automatic system - Ohio DOT Video

https://aashtojournal.org/2019/07/26/ohio-dot-installing-wrong-way-driver-detection-system/

Japanese Expressway's overall introduction

http://www.crp.pt/docs/A28S67-190.pdf

Shuto Expressway's system

https://www.shutoko.jp/ss/shutokomiraiway/keepout/content02/

Shuto Expressway

Hanshin Expressway's Anti Wrong way System (Automatic system)

https://hanshin-exp.co.jp/company/skill/library/tech/post_1.html

→　Shuto Expressway and Hanshin Expressway's system can capture both wrong-way driving and pedestrian/bicycle's illegal entry

Question 2: Anti – wrong way driving system at the Ramp

Conventional(Static) system

Standard package of static anti-wrong way driving system on Japanese Expressways
(installed in ALL subject locations)


Large arrow road markings, rubber poles, high-intensity arrow boards (highway main line confluence)


Large arrow road marking (ramp confluence)


Warning sign (rest facility)

Arrow road markings / exit guidance (rest facility)


Arrow road markings, warning signs (interchange exit)

Warning sign (rest facility inflow sector)

Application of Shuto Expressway

Hanshin Expressway's Anti Wrong way driving System (Conventional/Static)

How to Implement new system?

Identify Issue
- Data collection
- Analysis

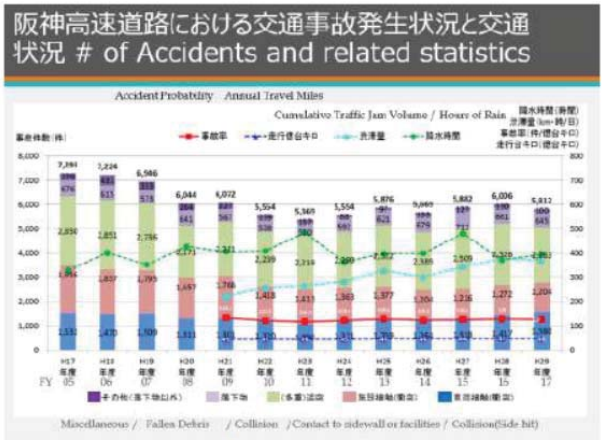
Form Strategy
- Countermeasure Plan
- Consensus (Authorization)
- Budget

Design and Installation
- System design
- Technology dvelopment
- Prepare bill of quantity
- On-site Work
- Contract

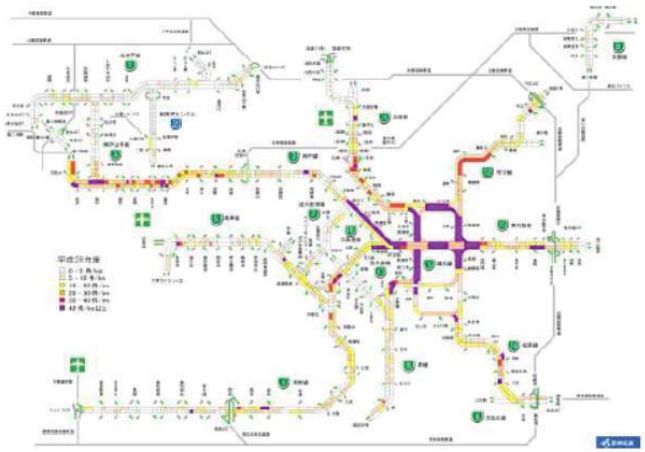
Evaluation
- Check the effect by analysis
- Follow up if necessary

Identify Issue

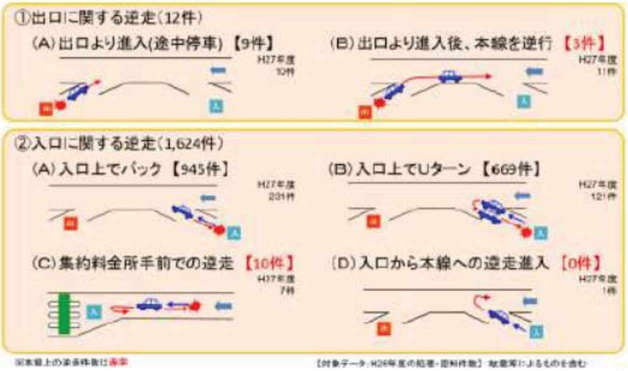
1: Data Collection and Analysis of the problem..



Overall Statistics and yearly change



Accident Probability Map



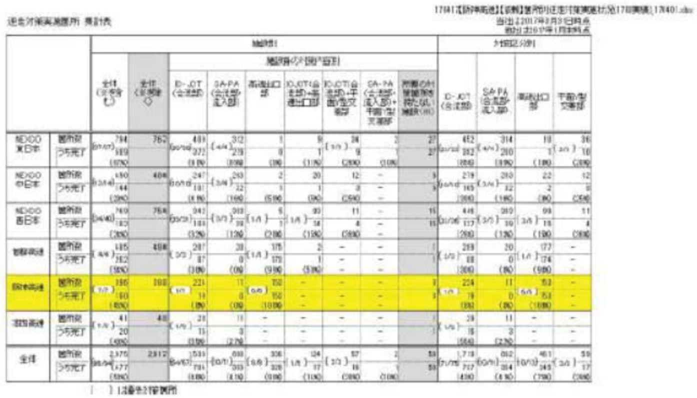
Detail Statistics of Wrong-way Driving on Hanshin Expwy

Ranking of Entry/Exit by the number of pedestrians' illegal entry of Hanshin Expwy

Form Strategy

Countermeasure Plan, Consensus (Authorization)

Expert Committee on anti wrong-way driving on expressways (Photo 2017)
(Established by the Ministry)



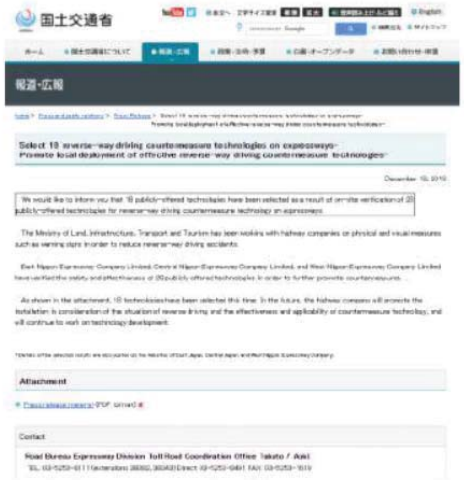
Data Summary of the Progress of Analog(Conventional)
anti wrong-way driving device installation on Japanese Expressways

Overall Strategy Image by the Ministry of Infrastructure and Transport
(Source : Ministry of Infrastructure and Transport)

Explanation Materials for the Exective committee of Hanshin Expressway Company

Design and Installation

System design, Technology development, Prepare bill of quantity On-site Work, Contract



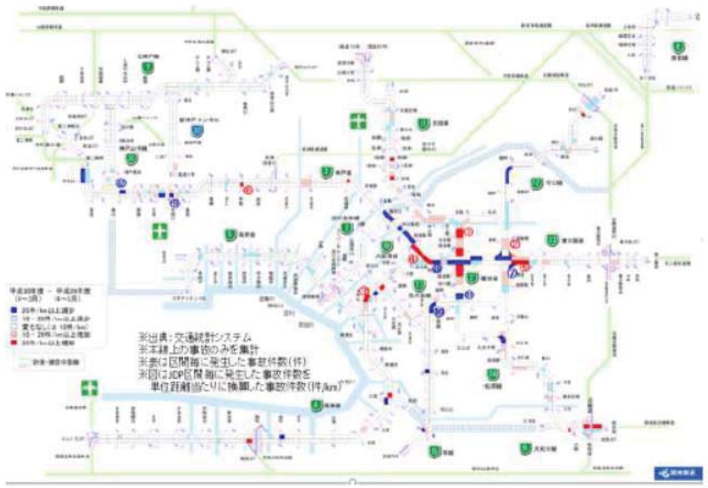
Ministry Press release on the trial use of new technology of anti wrong-way driving
https://www.mlit.go.jp/report/press/road01_hh_001113.html (Translated by Chrome browser)

Countermeasure points		Countermeasure items	Number of countermeasures	solved	Unmeasured	Status at the end of 2016	End of 2017 the goal	2018 fiscal year or later the goal
Confluence measures	Main line confluence (ramp)	Arrow road marking	207	108	99	Construction	Measures completed	
		Nule – Po – Le	207	109	98	Construction	Measures completed	
	Main line confluence (main line)	Arrow road marking	207	44	141	Construction	Measures completed	
		Arrow board middle	207	20	187	Construction	Measures completed	
	Lanes Confluence	Arrow road marking	28	9	19	Construction	Measures completed	
		Nule – Po – Le	28	17	11	Construction	Measures completed	
		Arrow board	28	8	twenty two	Construction	Measures completed	
Exit measures	Rest facility To the next section	Arrow road marking	11	1	Ten	Construction	Measures completed	
		Arrow board	11	1	Ten	Construction	Measures completed	
		Attention sign	11	1	Ten	Construction	Measures completed	
	highway From the exit Several way Connection	Arrow road marking	153	153	0	By legal arrow or large arrow Mark	Consider increasing the size one by one	
		Arrow board	153	153	0			
		Entry prohibited sign	153	153	0	Yellow or green	Shield space sign Replace separately	

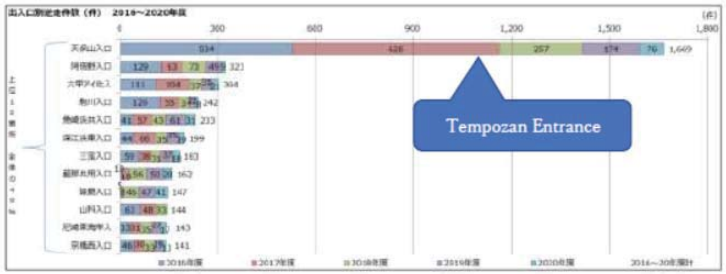
Summary and yearly improvement plan of Hanshin Expwy (Automatic Translation)

Evaluation

Check the effect by analysis, Follow up if necessary

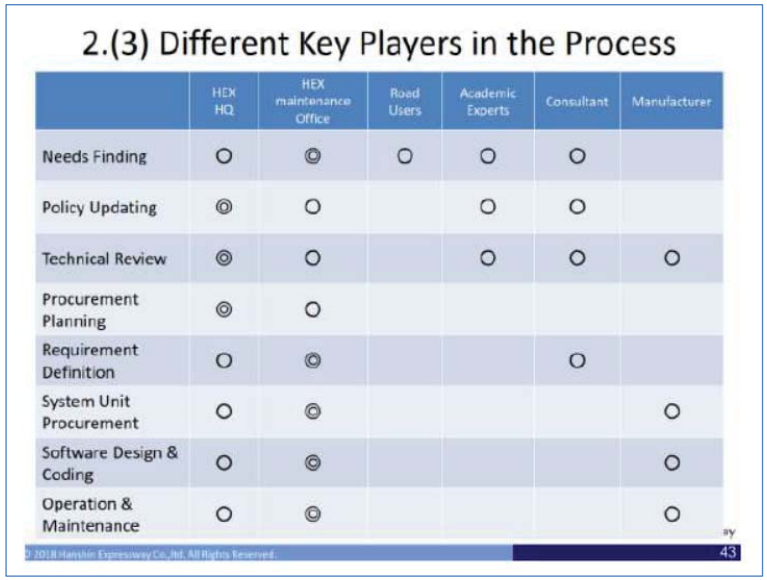


Yealy Change of Accident Count from FY 2017 to 2018
(Blue:Decrease, Red:Increase)



Ranking and Yearly change of wrong-way driving at entrance/exit of Hanshin Expwy

Extra Countermeasures to Tempozan Entrance


2.(3) Different Key Players in the Process
HEX HQ
HEX maintenance Office
Road Users
Academic Experts
Consultant
Manufacturer
Needs Finding
Policy Updating
Technical Review
Procurement Planning
Requirement Definition
System Unit Procurement
Software Design & Coding
Operation & Maintenance
43

Congestion Charge

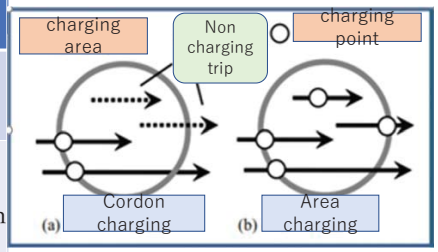
Many matters need to be considered and decided when introducing the system.

1. Technical
- On-board unit (communication method; DSRC, RFID, GNSS, ANPR)
- Charging method (cordon charging, area charging)
- Payment system, charging timing (prepaid, postpaid)
- Detection of violating cars (car database?)

2. Institutional, legal, etc.
- Law that is the basis for charging
  Taxes, Toll
  Usage fees (public service contributions),
- Use of collected money
- Determine charging time・ day, and area
- Citizen‘s agreement, decision of the chief (mayor, governor)
- Project scheme (operation and maintenance)
  PPP , Public
- Penalties
- Determining charges and charging time

List of methods for congestion charging by city

	DSRC (passive)	RFID	GNSS	ANPR
Cordon charging	Oslo Bergen Singapore	Dubai	Singapore (ERP2.0)	Stockholm
Area charging				London Milan Amsterdam Antwerp



DSRC (Dedicated Short Range Communications)
RFID (Radio Frequency Identification)
GNSS (Global Navigation Satellite System)
ANPR (Automatic Number Plate Recognition)

example

London (2003~)

Target area
22km2(2007~2011 +17km2)

ANPR Camera

Signs and Road markings indicating the entrance

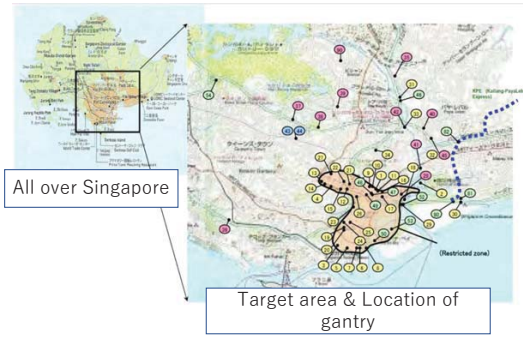
Stockholm (2006~)

Target Area

charging image

charging gantry

Singapore (1998~)



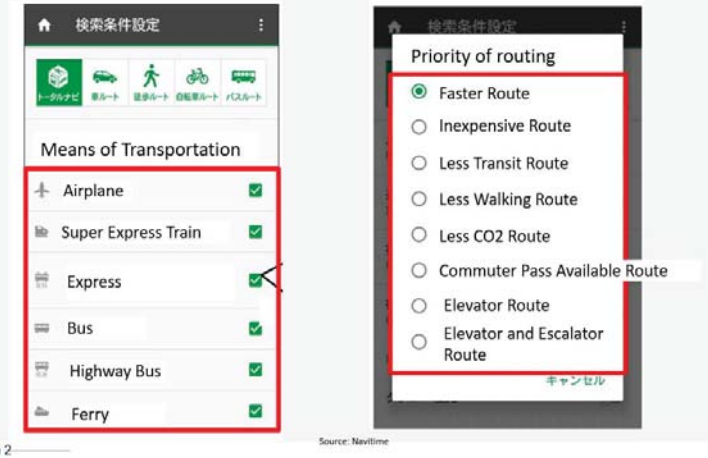
On board unit & Card

Charging Gantry

Multimodal Navigation

Page 1

Multi Modal Navigation for User's Convenience – 1



Source: Navitime

Page 2

Multi Modal Navigation for User's Convenience – 2

Source: Navitime

Page 3

Recent Trend and Examples of Data Utilization

Page 4

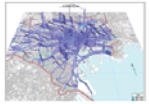
<Probe Data: GPS Based Data >

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

Processing

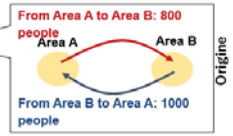
Congestion Understanding

Info. Provision



Analysis

<Population Distribution Data: Mobile Communication Base Station >



Destination

Origine	Area A	Area B	Area C
Area A	2,500	**800**	500
Area B	**1,000**	500	100
Area C	800	100	300

Utilize for a lot of purposes

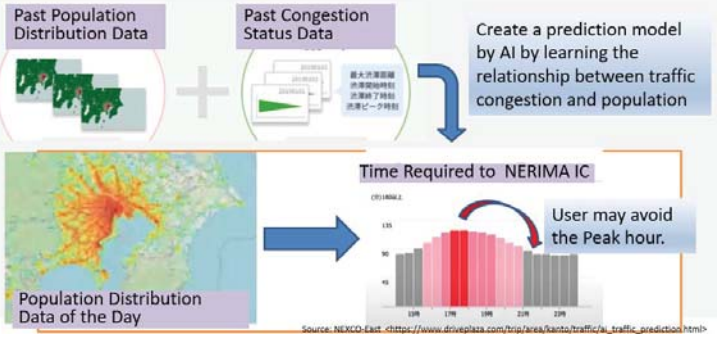
(Little) Movement Volume (Large)

Page 5

Data Utilization can be Possible by Data Accumulation

Prediction of Congestion by Mobile Data

Combining real time mobile wide area data and accumulated traffic data can make the prediction of congestion hours (start, peak, end of congestion) , and queue length, by utilizing AI.



Source: NEXCO-East <https://www.driveplaza.com/trip/area/kanto/traffic/ai_traffic_prediction.html>

Page 6

Data Utilization can be Possible by Data Accumulation

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

・At peak times, traffic was concentrated on a single bridge across the river and causing congestion. VMS are installed on the approach roads to display the transit times of the three bridges to encourage the use of other bridges.

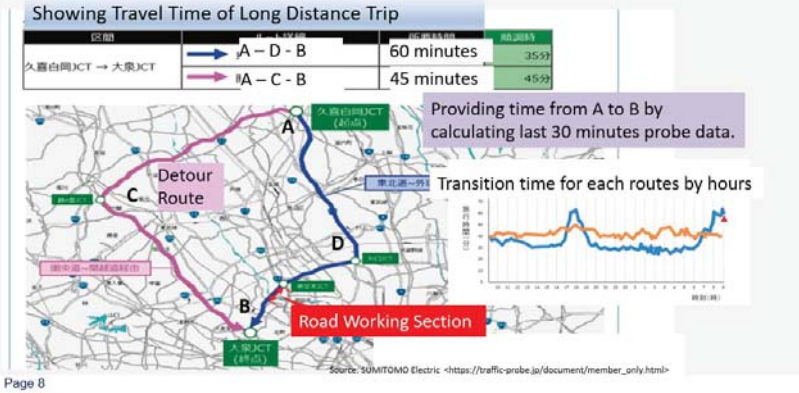
Source: SUMITOMO Electric <https://traffic-probe.jp/document/member_only.html>

Page 7

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.



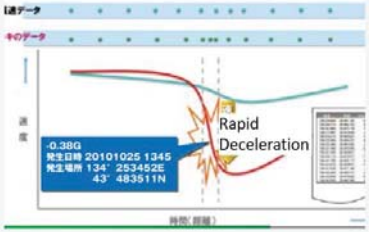
Source: SUMITOMO Electric <https://traffic-probe.jp/document/member_only.html>

Page 8

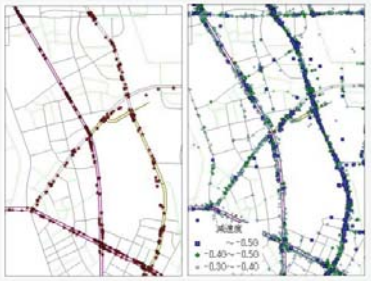
Data Utilization can be Possible by Data Accumulation

Ex. Probe Data can Solve Traffic Problems

The point where sudden blaking 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

Page 9

Source:<http://www.trans.civil.nagoya-u.ac.jp/~yamamoto/presentation/IPO6Spring.pdf>

Example of Information Provision in Japan

Page 10

Road and Traffic Condition Information by Japan Road Traffic Information Center

Together with Ordinary Road and Expressway

Detail Information of Selected Location

Road Name	Baysore Route
Direction	East
Section	Urayasu
Congestion Length	1 km

Road Name	National Rd 357
Direction	West
Section	Urayasu City
Reason	Road Work
Restriction	Closed to 1 Lane

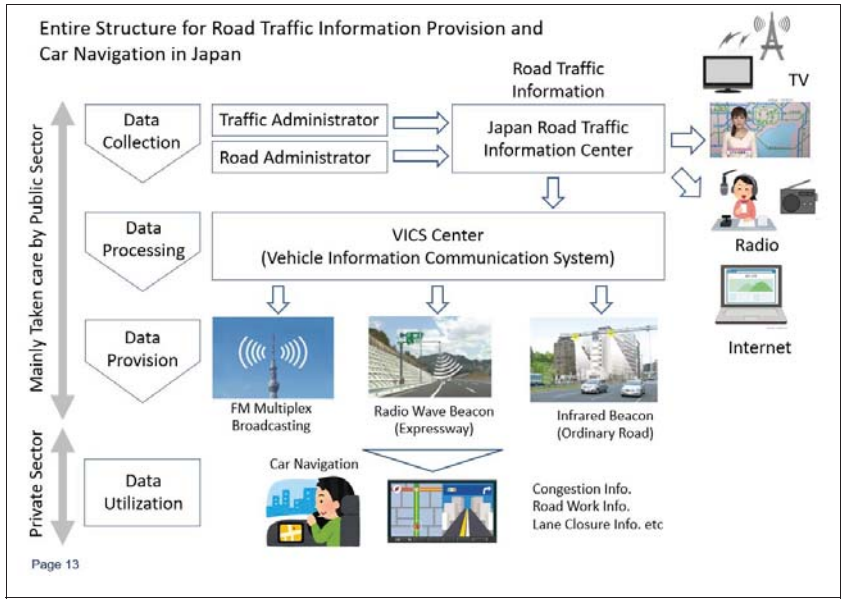
(Translated)

Page 11 Source: Japan Road Traffic Information Center https://www.jartic.or.jp/

Road and Traffic Condition Information by Japan Road Traffic Information Center

Exclusive for Expressway

Page 12


Entire Structure for Road Traffic Information Provision and Car Navigation in Japan
Road Traffic Information
TV
Data Collection
Traffic Administrator
Road Administrator
Japan Road Traffic Information Center
Data Processing
VICS Center (Vehicle Information Communication System)
Radio
Internet
Data Provision
FM Multiplex Broadcasting
Radio Wave Beacon (Expressway)
Infrared Beacon (Ordinary Road)
Mainly Taken care by Public Sector
Private Sector
Car Navigation
Data Utilization
Congestion Info.
Road Work Info.
Lane Closure Info. etc
Page 13

Important Considerations for Introduction of Traffic Control System

A good traffic environment can not be realized only by introducing devices.

The following measures are required;

1. Intersection Improvement
2. Proper Maintenance of Traffic Control System
3. Ensuring observance of traffic signals by people and “trust” of people in traffic signals

Intersection Improvement

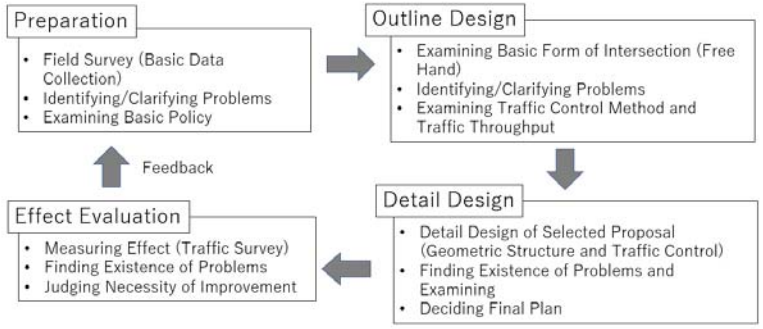
Traffic Processing Capability of Intersection

<**Traffic Capacity**>
How much traffic can intersection process?
<**Traffic Demand**>
How much traffic arrive at the intersection?

- Traffic capacity is determined by the road width, operation method of a lane and control method of a signal

[Traffic Capacity] < [Traffic Demand] → Congestion occurs
[Traffic Capacity] ≧ [Traffic Demand] → Traffic can be processed

General Flow of Intersection Improvement

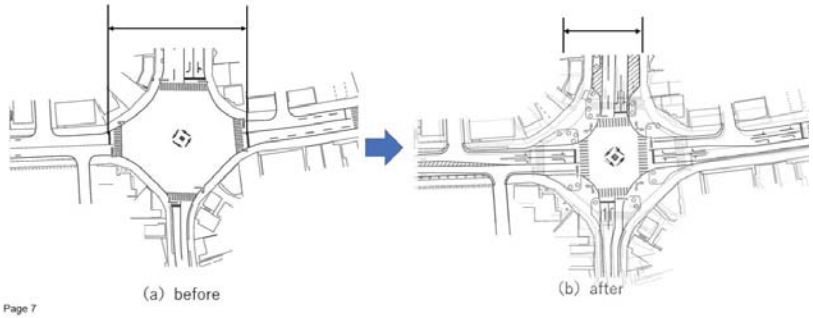


Basic Principles of Intersection Improvement Design

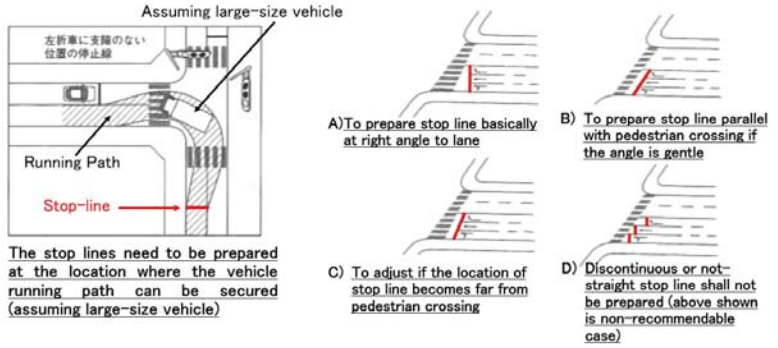
- To make clear main and secondary traffic flow relation
- To avoid the intersection with more than 5 arms
- To design the intersection angle to be close to a right angle
- To avoid strangely shaped intersection such as zigzag shaped crossing, etc.
- To minimize the area of intersection as much as possible
- To separate the straight direction traffic and turning traffic of right or left direction
- To make clear running position for turning traffic of right and/or left direction by such measures as guiding path, etc.
- To have consistency between intersection structure and signal control method

Examples of Intersection Improvement

- Minimizing area of intersection and preparing right-turn lanes, and thereby increasing traffic processing capacity of intersection

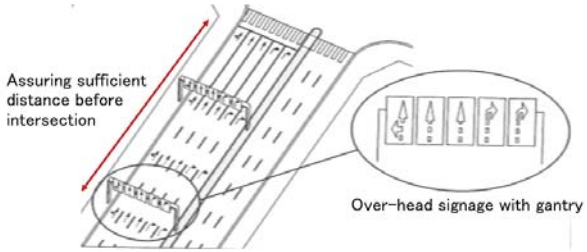


Basic Rules of Preparation of Stop Line



Lane Division at the Intersection

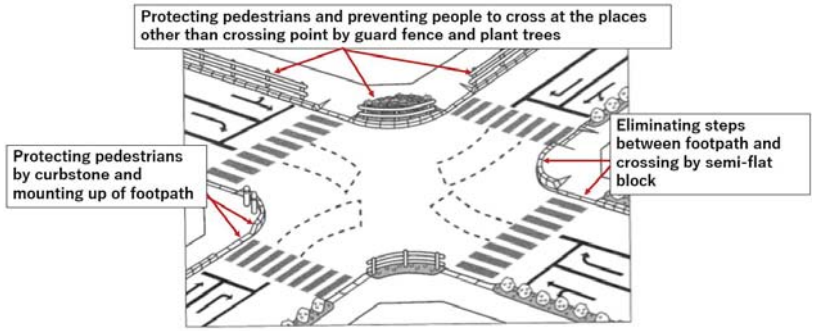
It shall be prepared with margin



- ✓ The arrow notation which indicates direction to run ahead needs to be installed at the location long enough before the drivers can recognize the way to pass.
- ✓ The over-head signage with gantry shall be prepared to make it possible for the drivers to change their lanes in advance if the driving lane is for left-turn only or right-turn only.

Page 9

Installation of Safety Facilities at Intersection to Protect Pedestrians



Page 10

Maintenance of Traffic Control System

Purpose: To maintain good condition of traffic signal by proper maintenance

(1) Check
(a)Regular Check : By personnel at traffic control center going around
(b)Periodic Check : To be carried out more than once a year
To be carried out for traffic signal controller, sensor, traffic light, cable, pole, etc.

(2) Accident/Failure Response
- Understanding incident : To understand the situation by traffic control system, and prepare action
- Requesting to maintenance company which has been contracted for 24 hours and 365 days measures
- Storing emergency materials and equipment: pole, traffic light, cable, signal controller (storing removed equipment)

(3) Measures for Blackout
- For short-time black out: To equip battery in traffic signal
- For long-time black out: To use mobile generator
- In the case of no generator: To cope with by hand-signal of police officers at important intersection (Training is required)

(4) Operation Management
- To manage operation and maintenance by allocating management representative at control center
- To train and educate maintenance company and engineers

Page 11

Situation in the Event of Accident

Response in the Event of Accident

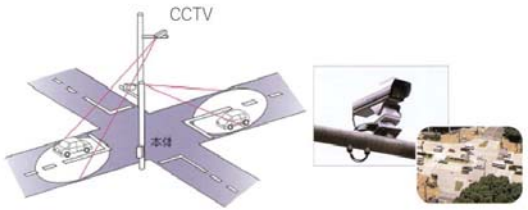
Maintenance of Equipment

Training of Hand-Sing

Page 12

CCTV

- ✓CCTV is installed at major intersections and used for monitoring traffic flow at intersection and for early detection of incident such as accident.
- ✓All CCTV images are collected in the traffic control center, and detailed traffic conditions are grasped by operating the camera.
- ✓It is possible to read vehicle number plate and automatically detect incident by image processing by fixed CCTV camera



Page 13

Ensuring observance of traffic signals by people and “trust” of people in traffic signals

Traffic signals exert their functions, thereby reducing traffic accident and congestion, on the condition that vehicles and pedestrians obey the traffic signals.

Therefore, it is vitally important

- ✓ To enhance traffic safety education to obey traffic signals on such occasions as school, workplaces, driving licensing renewals, etc.
- ✓ To implement traffic guidance and enforcement by police officers in the vicinity of intersection
- ✓ Not to carry out artificial manipulation of traffic signals by human, stopping system operation of traffic signal due to mistrust of the systems.

Page 14

Important Considerations for Traffic Signal Project

Example of JICA Grant Project for Traffic Signal in India

Example of Measures for O&M

- There are many cases that O&M is not appropriately carried out after introducing ITS in developing countries
- Many facilities are left and neglected without proper maintenance.

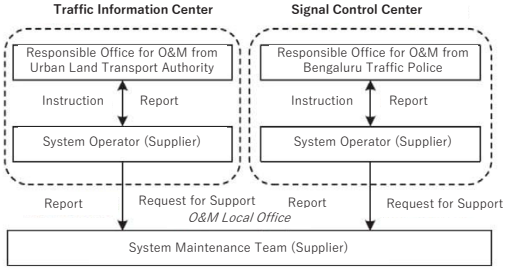
Existing signal controller box without key in Bengaluru city in India

- O&M for 5 years was included in the project component (O&M cost is to be covered by Indian side)
- O&M will be done by supplier of signal system

Broken traffic signal in another city in India

O&M Structure

- Two centers were planned to be introduced: Traffic information center at Directorate Urban Land Transport (DULT), and Signal control center a Bengaluru Traffic Police (BTP)
- Responsible officers from each organization are allocated in both centers.
- System operators (supplier) station both centers and handle first-hand measures in case of problem.
- They closely work together with system maintenance team (same supplier)



O&M Structure and Workflow

Service Level Agreement for O&M

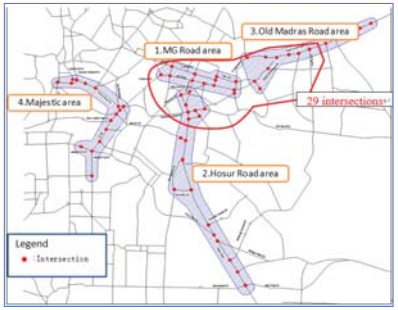
- Evaluation index was defined and SLA(Service Level Agreement)was made to ensure the quality of O&M service.
- O&M fee is to be deducted in case that the contractor fails to achieve the evaluation index.
- System availability ratio (actual hours of operation against total hours of operation) is used for the evaluation index.
- It was defined that Not less than 99.0% is required.
- Downtime which is not responsible of the contractor, e.g. damaged by traffic accident, stopped due to blackout, etc. was omitted from the calculation.

$$\text{Availability Ratio} = \left(1 - \frac{\text{Downtime} - \text{Allowable Downtime}}{\text{Total Operation Hours} - \text{Allowable Downtime}}\right) \times 100$$

Formula

Importance of Intersection Improvement

- Intersection improvement together with installing traffic signals is vitally important.
- All target 29 intersections were improved in the project in India.
- Minimal physical improvement (without land acquisition and resident relocation) was done.
- Roundabout intersection is basically designed to handle traffic without traffic signal.
- Thus, it needs to be changed to the crossing-intersection if the traffic signal is installed. (it was excluded from the project scope in case of the project in India)



Target Intersections in the Project in India

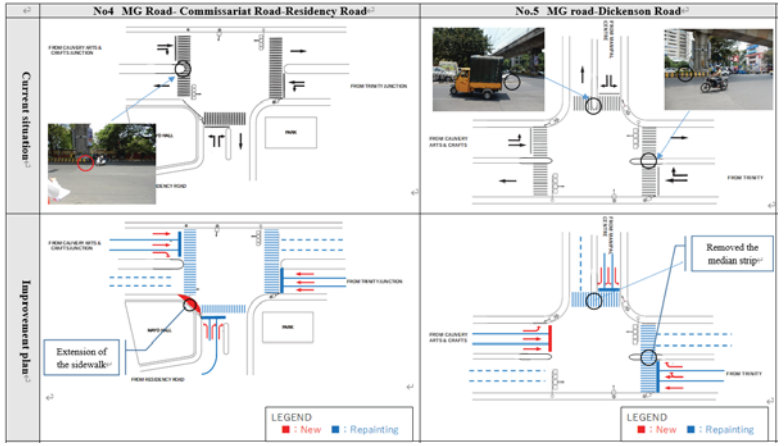
Example of Major Items of Intersection Improvement

- Traffic lane painting
- Travel direction indication
- Pedestrians' crossing Marking/relocation
- Stop-line marking/relocation
- Reducing area inside intersection (by relocating stop-line, footpath leveling, etc.)
- Removing objects, etc.

Absence of Traffic Lane and Other Indications in Intersection

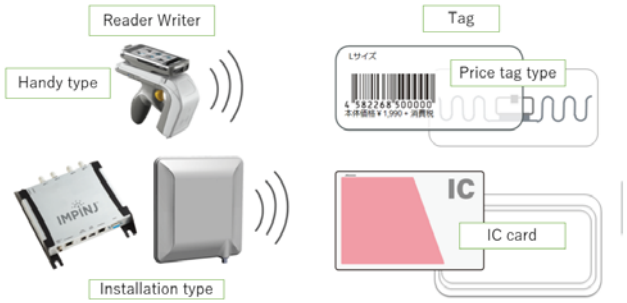
Blocking Pedestrians' Crossing

Example of Intersection Improvement



RFID；Radio Frequency IDentification

- Radio waves are emitted from the RFID reader to read the data written in the RF tag.



Features

- Reading distance: 0.5 cm to 30 cm (HF band), maximum 20 m (UHF band) depending on the frequency
- Can read Moving objects; about 100 km / H~
  Multiple tags at once
  Even if hidden (inside the box)
- Long life, built-in memory (rewritable)
- Tag is cheap; less than $ 1 & Small ,Thin
- Resistant to dirt, vibration and shock

Reading experiment image @ Brazil

https://www.youtube.com/watch?v=4GRCuUaQUDE

Use applications

- Various management

store / warehouse inventory, factory production process, leasing equipment, cargo, construction machinery, etc.

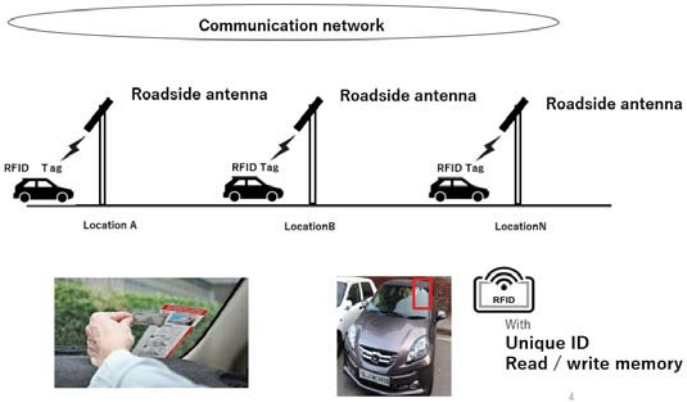
- Utilization for various transportation measures

Measurement of movement speed (travel time) between points
Understanding the movement route for each vehicle
Toll charging(ETC,ERP)
Judgment of congestion
Tracking criminal vehicles, violating vehicles, etc.
Electronic license plate

- Countries that have introduced Electronic license plates

All cars have been introduced: Bangladesh
New car (statutory): Brazil, India, Egypt
Planning; Kenya

for transportation



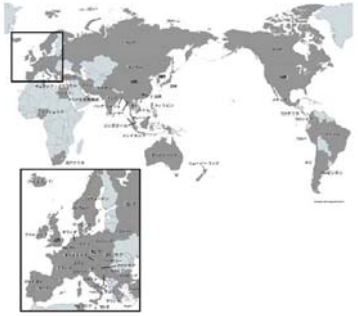

Electronic license plate
Bangladesh For Motor Bike
Peru
ETC
Nigeria
Pakistan
Taiwan

Overview of ETC in the World

Electronic Toll Collection System Across the World

At least, 63 countries have adopted ETC system.

- Europe: 29 countries
  UK, France, Germany , Italy, Sweden, Austria, Russia, Poland, Turkey, etc.
- Asia・Oceania: 18 countries
  Japan, China, Korea, Taiwan, Malaysia, Indonesia
  India, Thailand, Australia, New Zealand, etc.
- North-south America: 9 countries
  Canada, USA, Mexico, Brazil, Peru, Argentina, Chile
  etc.
- Africa: 4 countries
  South Africa, Egypt, Tunisia, Nigeria
- Middle East: 2 countries
  United Arab Emirates, Iran



Source:ETC Hand Book <https://www.its-tea.or.jp/library/pdf/i02_ETC_binran_web.pdf>

Various Purposes of Road Charging System

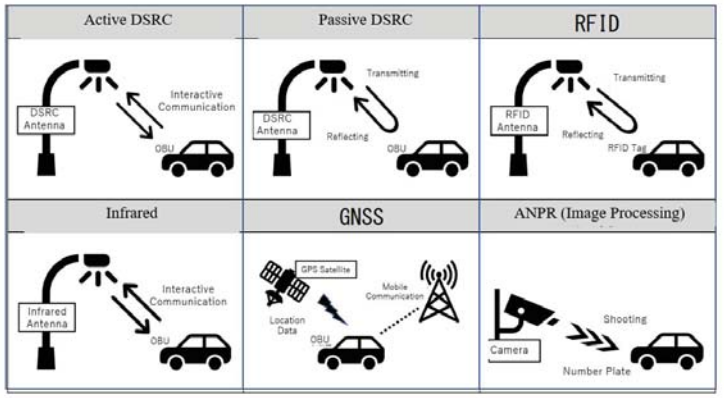
- Toll Charge for Highways
- Heavy Vehicle Charge (Charges for Large-sized Vehicle to Protect Road Condition)
- Congestion Charge (Charges for Mitigating Congestion of City Core Area)
- LEZ (Low Emission Charge for Environmental Zone)
- Road Usage Charge (Distance Based Charges Instead of Fuel Tax)
- High Occupancy Toll Lanes (Charge on Low Occupancy Vehicle on Indicated Traffic Lane)

Source: <https://www.telegraph.co.uk/women/life/transport-london-apologises-using-waive-congestion-charge/>

Source: <https://www.traffictechnologytoday.com/news/tolling/hawaiis-ruc-demo-decides-telematics-option.html>

Source <https://ops.fhwa.dot.gov/publications/fhwahop08034/index.htm>

Various Systems of Road Charging System-1



Source:ETC Hand Book <https://www.its-tea.or.jp/library/pdf/i02_ETC_binran_web.pdf>

Various Systems of Road Charging System-2

Comparison Table of Road Charging Systems (Red letter means best evaluation for each items.)

Items	DSRC		RFID	Infrared	GNSS	ANPR
	Active	Passive				
Communication Accuracy	**Excellent**	Good	Fair	Fair	Good	N/A
Requirement of Roadside Equipment	Required	Required	Required	Required	**Less**	Required
Price of On-board-unit (OBU)	Fair	Cheaper	Excellent	Cheaper	Fair	**N/A**
Collection of travel route and distance	Good	Good	Good	Good	**Excellent**	Good

- ANPR (Automatic Number Plate Recognition) is camera system. Thus, antenna is not required.
- ANPR is an image processing camera system. Thus, OBU is not required.
- GNSS needs to ensure the communication in such area as tunnel, valley of high raised buildings, etc.
- GNSS requires some infrastructures for audit but not necessary as dense as other systems.
- GNSS can recognize the travel route of each vehicles based on matching with digital road map

Various Systems of Road Charging System-3

Purpose & Systems for Introducing Road Charging in Major Regions, Countries, and Cities

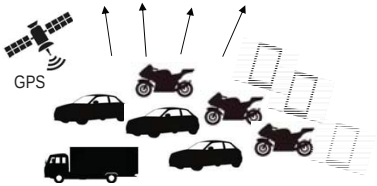
Purpose	DSRC		RFID	Infrared	GNSS	ANPR
	Active	Passive				
Toll Charge for Highways	Japan Korea China	EU Australia South-Africa Chili	U.S.A Mexico Taiwan India	Korea Indonesia		
Heavy Vehicle Charge		Austria Czech Poland			Germany Russia Slovakia	
Congestion Charge		Singapore Oslo	Dubai		Singapore(2023)	London Milan Amsterdam Oslo
LEZ	Japan	Austria			Switzerland Germany	London
Road Usage Charge			U.S.A			E.U.

Source:ETC Hand Book <https://www.its-tea.or.jp/library/pdf/r02_ETC_binran_web.pdf>

Recent Trend and Examples of Data Utilization

<Probe Data: GPS Based Data >

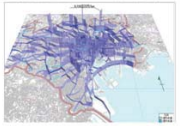
Time	Latitude	Longitude
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx
・・・	・・・	・・・
XX：XX	xxx.xx.xx.xx	xxx.xx.xx.xx



(GPS On-board Unit or Smartphone etc.)

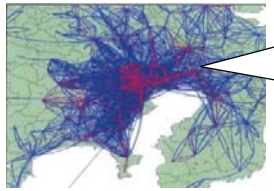
Congestion Understanding

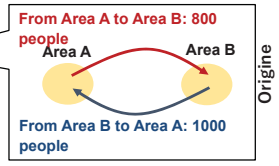
Info. Provision



Analysis

<Population Distribution Data: Mobile Communication Base Station >





Destination

Origine	Area A	Area B	Area C
Area A	2,500	**800**	500
Area B	**1,000**	500	100
Area C	800	100	300

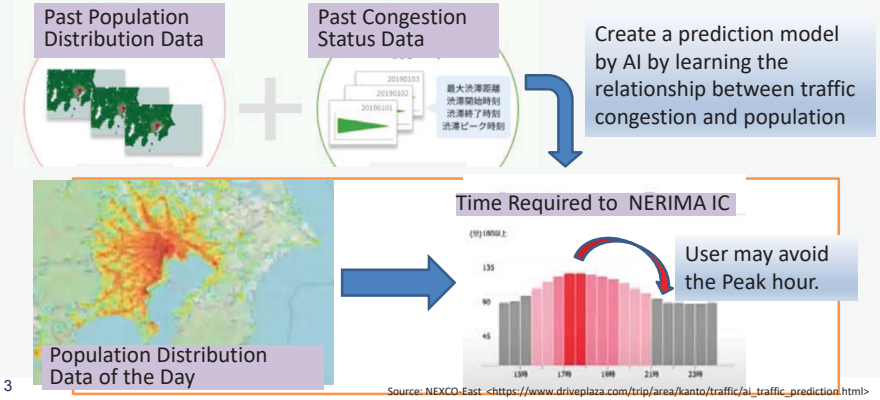
Utilize for a lot of purposes

(Little) Movement Volume (Large)

Data Utilization can be Possible by Data Accumulation

Prediction of Congestion by Mobile Data

Combining real time mobile wide area data and accumulated traffic data can make the prediction of congestion hours (start, peak, end of congestion) , and queue length, by utilizing AI.



Source: NEXCO-East <https://www.driveplaza.com/trip/area/kanto/traffic/ai_traffic_prediction.html>

Data Utilization can be Possible by Data Accumulation

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

・At peak times, traffic was concentrated on a single bridge across the river and causing congestion. VMS are installed on the approach roads to display the transit times of the three bridges to encourage the use of other bridges.

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

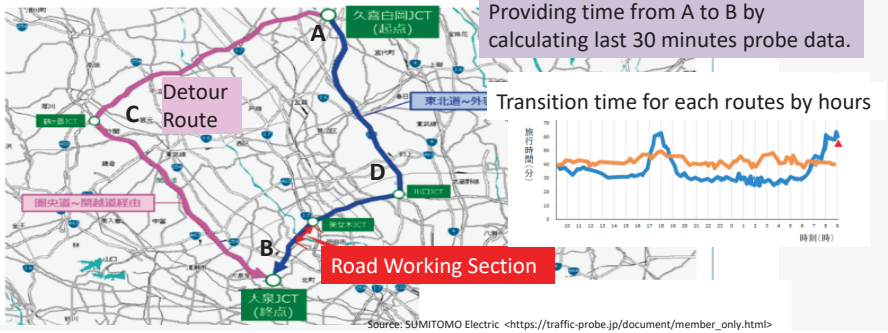
Data Utilization can be Possible by Data Accumulation

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	I A – D - B	60 minutes	35分
	II 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

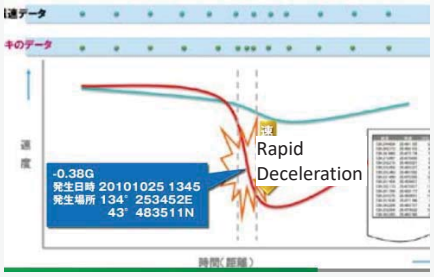
Source: SUMITOMO Electric <https://traffic-probe.jp/document/member_only.html>

Multimodal Navigation

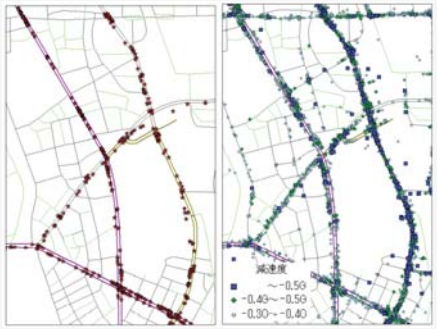
Data Utilization can be Possible by Data Accumulation

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

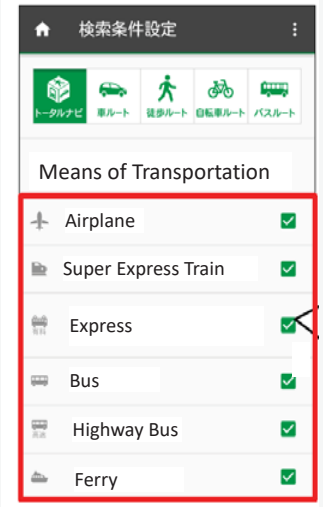


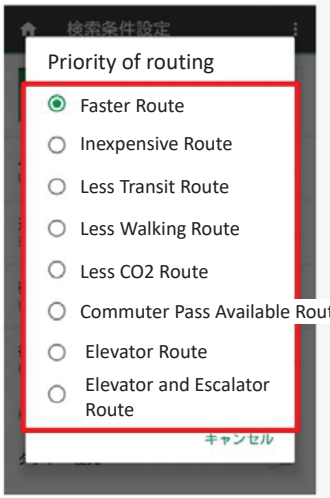
Accident occurring location

Sudden breaking location

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

Multi Modal Navigation for User's Convenience－1





Source: Navitime

Multi Modal Navigation for User's Convenience – 2

Source: Navitime

Example of Information Provision in Japan

Road and Traffic Condition Information by Japan Road Traffic Information Center

Together with Ordinary Road and Expressway

Detail Information of Selected Location

路線名称	高速湾岸線
方向	東行
規制区間	浦安付近
渋滞長	1km

Road Name	Baysore Route
Direction	East
Section	Urayasu
Congestion Length	1 km

路線名称	国道３５７号
方向	西行
規制区間	浦安市舞浜付近
規制原因	施設工事
規制内容	1車線規制

Road Name	National Rd 357
Direction	West
Section	Urayasu City
Reason	Road Work
Restriction	Closed to 1 Lane

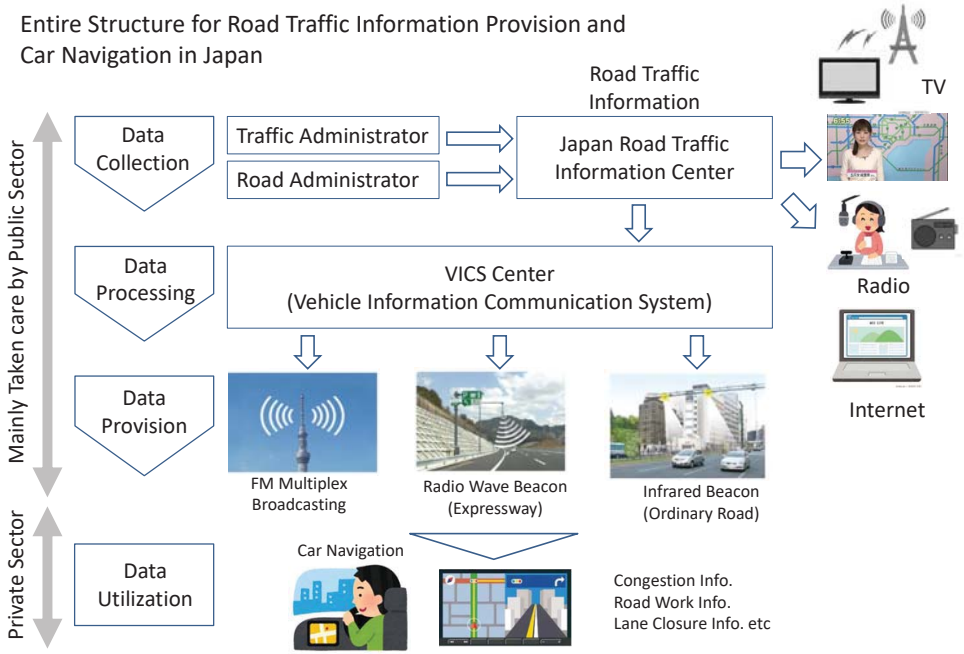
(Translated)

 Source: Japan Road Traffic Information Center https://www.jartic.or.jp/

Road and Traffic Condition Information by Japan Road Traffic Information Center

Exclusive for Expressway

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



2021 年度 ITS 実務課題別研修　巻末資料

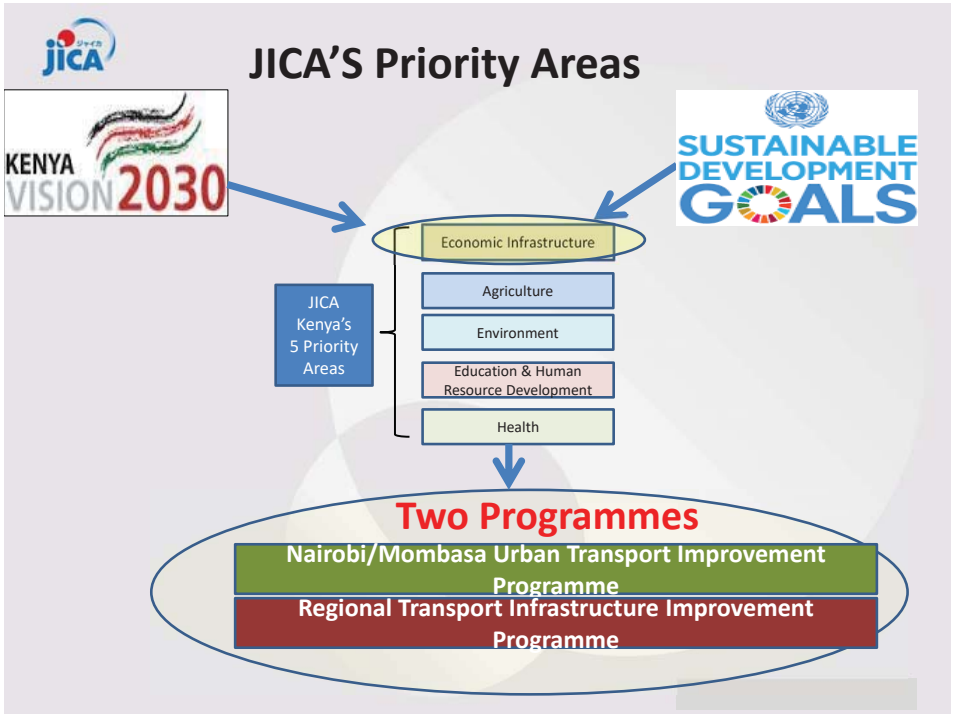
ページ

１．ケニア ITS セミナー発表資料

Outline

I. JICA'S Priority Areas
II. Concept and Objective of JICA's Program
III. Operational Pillars
IV. JICA Current/Planned projects

JICA'S Priority Areas

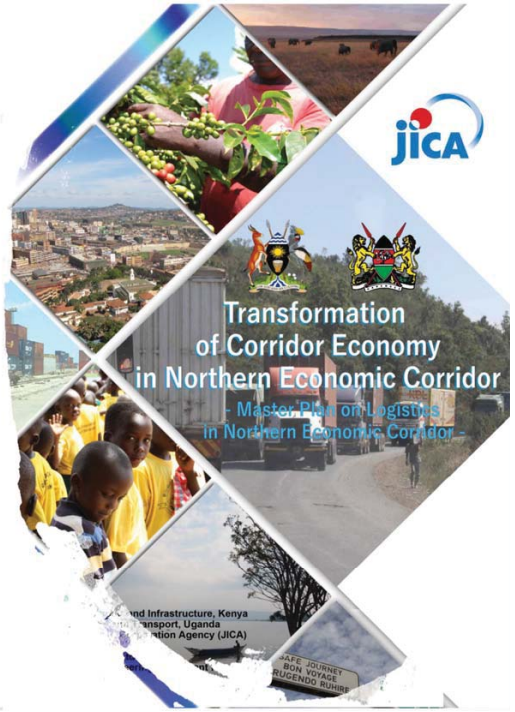


Concept and Objective of JICA's Programme

Contribute to the Quality Economic Growth in Kenya

Objective of JICA Kenya Programme:

Promote quality infrastructure to reinforce connectivity, logistics and competiveness of Northern Economic Corridor in Kenya



JICA Kenya Overall Pillars

1.Improvement of Integrated Mobility in Urban Cities

2.Improvement of Facilities and Functions at Mombasa Port

3.Improvement of Trading and Logistics Hub

Overview of 3 JICA Pillars

I. Improvement of integrated Urban Cities Development

Transformation of cities for a brighter future

Improvement of Nairobi City NIUPLAN

Improvement of Mombasa Gate City

I. Improvement of integrated Urban Cities Development

Mitigation of Traffic congestion

Photo: Mr. Eshiwani(NMS)

JICA

JICA Ongoing/Planned Projects

JICA

I. JICA YEN LOAN

2.JICA Technical Cooperation and Grant

Tripartite relationship for Traffic Demand Management

Intelligent Transport Systems with MCG

Road safety with National Police Service

Mobility Management with NAMATA

独

3.Private Sector Investment Finance

- JICA Kenya Office intends to invest in SDG centric companies,projects and financial institutions.
- Example **An entrance to the special economic zone under development in the Thilawa area near Yangon.**

独

Thank you for Listening

Asante

Arigatou gozaimas(u)

独

KENYA URBAN ROADS AUTHORITY

Efficient and safe urban roads

Barabara Plaza, Mazao Road - Off South Airport Road, JKIA
Tel: 254-020-8013844 / 254-717-105233
Email: info@kura.go.ke Web: www.kura.go.ke
P.O. Box 41727-00100, GPO, NAIROBI

ONLINE SEMINAR ON ITS BY JICA

MAJOR ISSUES IN THE TRANSPORT SECTOR IN KENYA

Eng. Silas M. Kinoti, MBS
Director General
Kenya Urban Roads Authority

25th October, 2021

2 KENYA URBAN ROADS AUTHORITY

- The **mandate** of KURA as defined in the Kenya Roads Act, 2007 Management, Development, Rehabilitation and Maintenance of N Urban Trunk Roads.
- **Vision:** A world class urban road network for sustainable developme
- **Mission:** To provide and manage quality, safe and adequate urba network.

Enhancing Urban Mobility

3 INSTITUTIONAL FRAMEWORK

Government of Kenya

Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works

- Kenya Urban Roads Authority – *National Urban Trunk Roads*
- Kenya National Highways Authority – *National Trunk Roads*
- Kenya Rural Roads Authority – *National Rural / Secondary Trunk Roads*
- Kenya Ports Authority / Kenya Maritime Authority – *Port and Water Transport - NATIONAL TREASURY*
- Kenya Airports Authority / Kenya Civil Aviation Authority - *Port and Water Transport – NATIONAL TREASURY*
- Kenya Railways Corporation - *Rail Transport*
- NAMATA – *Mass Rapid Transit*
- NTSA – *Safety Policies, Registration & Licensing - INTERIOR*

Kenya Boa Ro Maint Levy

4 ROLE OF ROAD INFRASTRUCTURE IN DEVELOPMEN

- Infrastructure is identified as a key enabler in:
  - The realization of Kenya Vision 2030
  - The implementation of the "Big Four" National Agenda
  - Attainment of the Sustainable Development Goals (SDG)
- Infrastructure and Development
  - Infrastructure supports development
  - Development sustains infrastructure

The Government of has given a lot of em on infrastructure development in roa maritime and air tra through continuous investment in infrastructure development and maintenance strategies

5 TRANSPORT CONNECTIVITY

- Transport connectivity is an essential part of the enabling environm sustained and inclusive growth.
- The Rural Access Index (RAI) – one of the global indicators that m transport connectivity – **Kenya is among highest in Africa.**

Country	Population (million)	Land area (1,000 km2)	Population density	Road data length (km)	Original RAI, 2006	New RAI	
Bangladesh	159.1	130.2	1,222	250,688	37	86.7	2015
Nepal	28.2	143.4	197	77,819	17	54.2	2015
Ethiopia	97.0	1000.0	97	85,880	32	21.6	2015
Kenya	**44.9**	**569.1**	**79**	**160,886**	**44**	**56.0**	**2009**
Mozambique	27.2	786.4	35	29,614	27	20.4	2010
Tanzania	**51.8**	**885.8**	**59**	**94,039**	**38**	**24.6**	**2014**
Uganda	37.8	199.8	189	140,910	27	53.1	2015
Zambia	15.7	743.4	21	51,070	64	17.0	2011

6 CHALLENGES IN THE SECTOR

- Urban Structure;
  - Disorderly and low density outward
  - CBD Concentration
  - Road Network concentrated
- Road Network;
  - Arterials, collectors and local roads congested due to concentration
- Public Transport;
  - Insufficient Buses/ Matatu coordination, regulation and integration
  - No incentives to private sector hence completion
  - Railway service insufficient and limited to specific areas of the city
- Traffic Managemen
  - Accidents due to c at junctions
  - Traffic Managemer system not city wi
- Environment
- Legislation & Organization
- Financing of infrastructure
- Optimum transport master plan

Kenya Urban Roads Authority
Enhancing Urban Mobility

7 CHALLENGES IN THE SECTOR

- Encroachment on the road reserves
- Relocation of services within the road reserve
- Dumping of household waste/ solid waste on the roads
- Inadequate capacity of local contractors
- Inadequate resources to fully undertake works
- Inadequate research on alternative materials for road construction
- Costly land acquisition
- Low uptake of IT in the management of roads

Kenya Urban Roads Authority
Enhancing Urban Mobility

8 CHALLENGES IN THE SECTOR

- Kenya Has Robust Infrastructure and Institutional & Legal Framework
- Nairobi has the **largest density of road** network per square kilometers in the Country;
- Largest Concentration of **Traffic Police Officers;**
- Largest Concentration of **Traffic Engineers**;
- Has a **Traffic Management Center**;
- Has the Control Command Center.

BUT CONGESTI REMAINS

Kenya Urban Roads Authority
Enhancing Urban Mobility

9 THE PROBLEM – RESULT OF LACK OF INTEGRATION

Invincible to the other players in the Transport Sector

Manual Control of Transport System

Resources are independent, duplicated & cannot be integrated / Combined

Congestion Remains

10 THE SOLUTION - Integrated Management Solution

All Institutions Coordinated

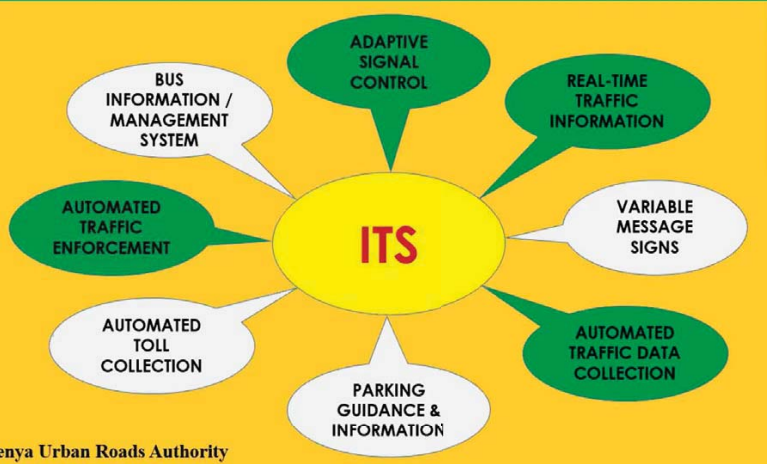
Data Shared Across

Avoid Duplicity

- KURA and other road agencies
- Nairobi City County / NMS
- NTSA (TIMS, PSV & Taxis)
- Traffic Police
- KAA
- Kenya Railways
- NAMATA

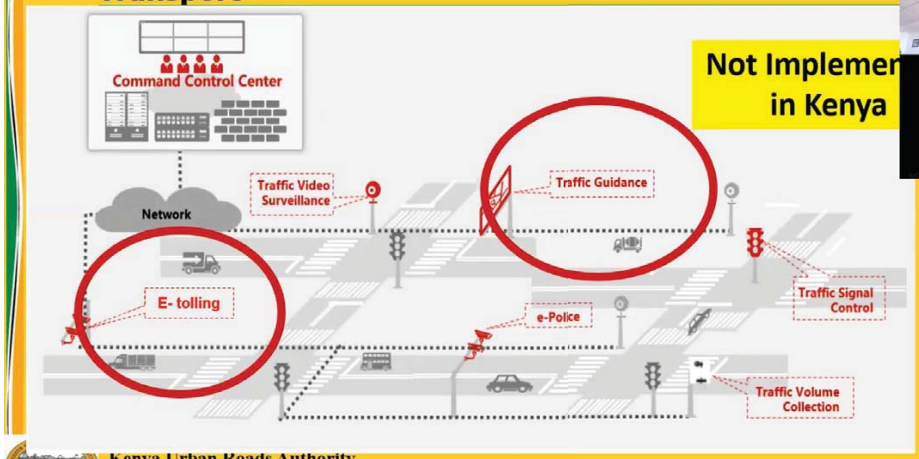
Coordination Through ITS

12 Current Intelligent Transport System (ITS) in Kenya



13 Intelligent Transport System (ITS) Configuration in Ro Transport

Not Implemer in Kenya



14 KURA's Traffic Management Center

- **Data Center**: All Traffic Data and infrastructure information in one place
- **Monitoring Center**: Real time Operation & monitoring of traffic information, violations
- **Analysis Center**: Congestion & Traffic data
- **Evaluation Center**: Transport Planning, Forecast and simulation / modelling
- **Information Center**: To public on traffic information on demand

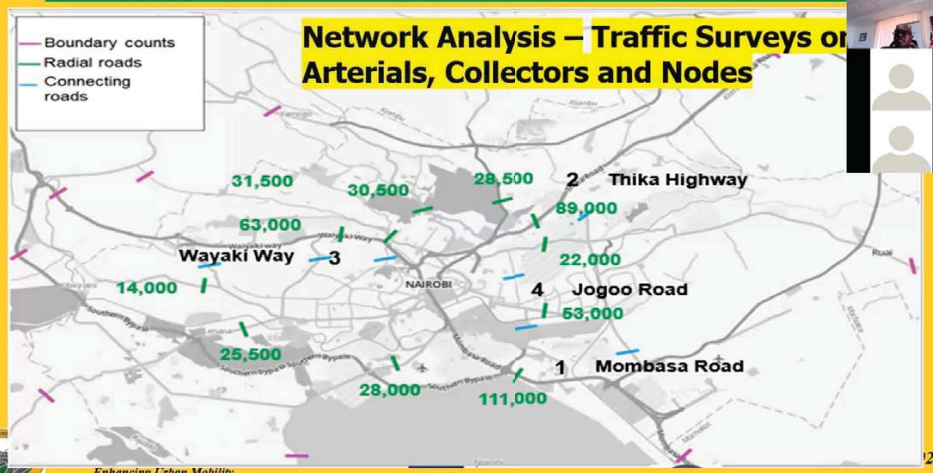
Kenya Urban Roads Authority
Enhancing Urban Mobility

15 The Solution – Current Situation

- KURA ITS Pilot Project
  - Traffic management center
  - 7 Junctions Fully Intelligent and connected to TMC
- 10 Junctions Semi Intelligent – Not Connected to TMC and Stand Alone
- 3 Junctions – Not intelligent and Stand Alone
- 21 Junctions under county government – Stand Alone

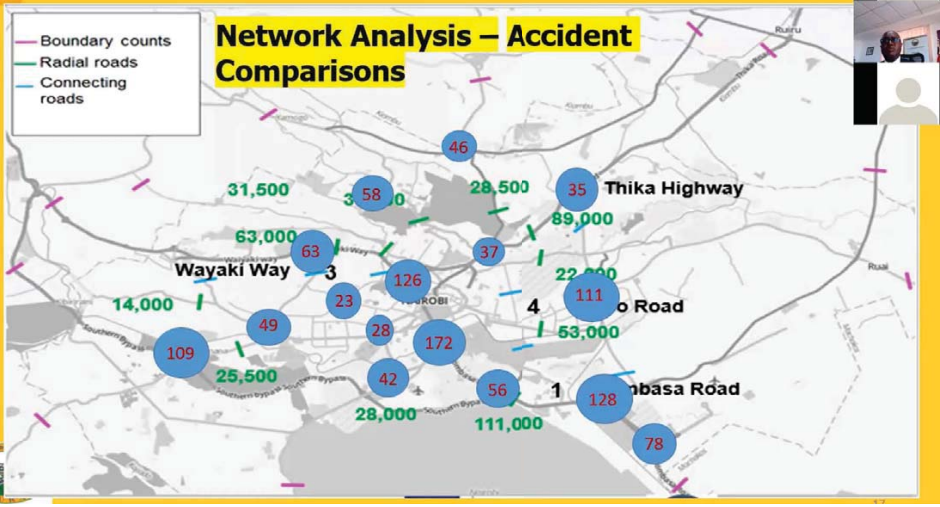
Kenya Urban Roads Authority
Enhancing Urban Mobility

16 Criteria for Junction Selection / Prioritization



Kenya Urban Roads Authority
Enhancing Urban Mobility

17 Criteria for Junction Selection / Prioritization



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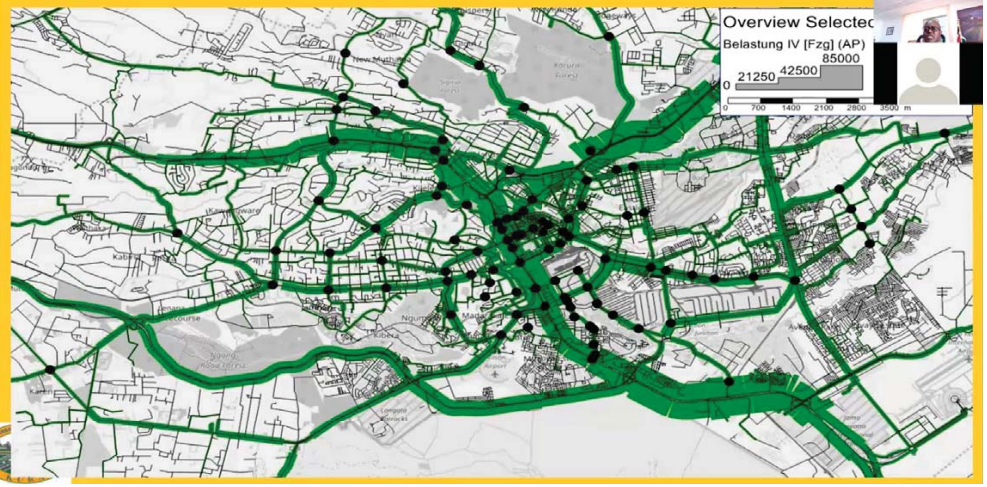
Traffic Macroscopic Model & Junction Selection



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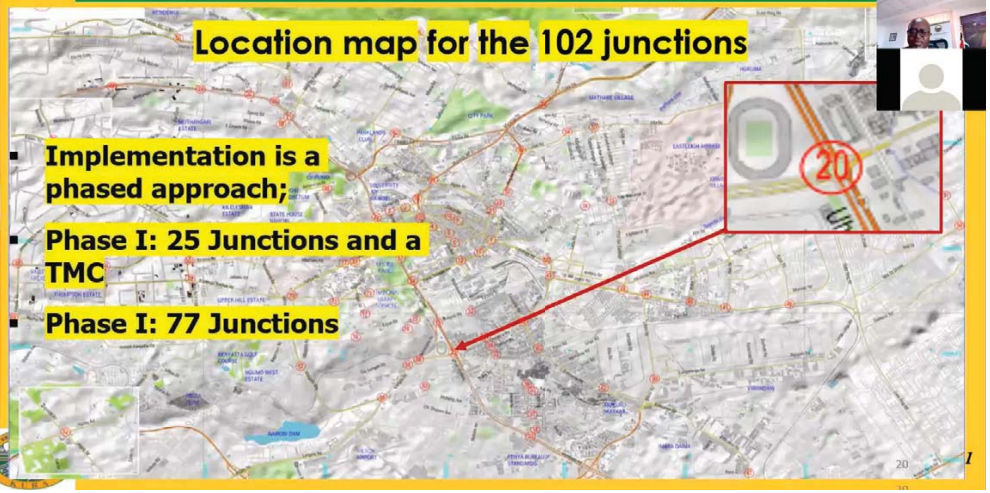
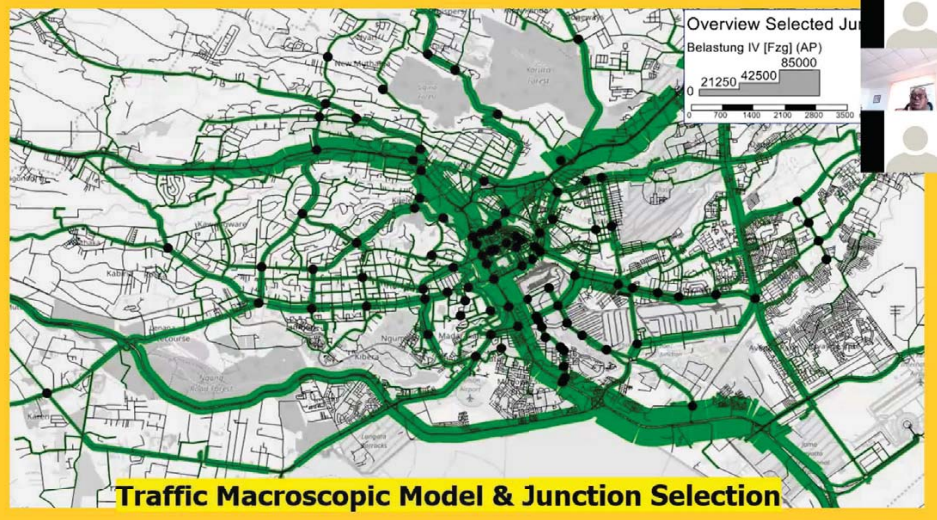
Criteria for Junction Selection / Prioritization





19

21

Situation Before Operationalization of ITS

22 The Solution - ITS Infrastructure Design & Installation

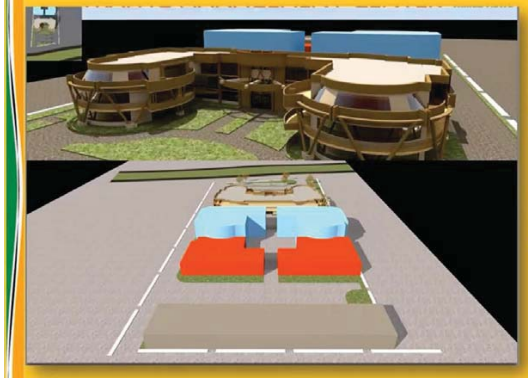
- Multiple Closed Circuit TV (CCTV) cameras and a communication network

  Real time monitoring of traffic at the **TMC**

Data recorded and stored for analysis of incidences and traffic patterns

23 E-Police Camera – Captures Violations

24 NAIROBI ITS AND JUNCTIONS IMPROVEMENT PROJEC



- 102 Junctions and a furth junctions;
- Ultramodern fully equipped metropolitan wide Traffic management center
- Integration of all modes including BRT, rail and air

KENYA URBAN ROADS AUTHORITY
Efficient and safe urban roads
Barabara Plaza, Mazao Road - Off South Airport Road, JKIA
Tel: 254-020-8013844 / 254-717-105233
Email: info@kura.go.ke Web: www.kura.go.ke
P.O. Box 41727-00100, GPO, NAIROBI

Contacts

Block D
Barabara Plaza
Mazao Road off Airport South
Road
020 – 801 3844
info@kura.go.ke
www.kura.go.ke
@KURAroads
@KURAroads

Kenya Urban Roads Authority

enhancing urban mobility

Situation of Urban Transport and ITS Measures Taken

Mwinyi Bwika |Senior ITS Analyst

- KURA Background
- Transport Situation in Nairobi City
- ITS Measures Taken
- Question & Answer

KURA Background

KURA was established by the Kenya Roads Act 2007.

Mandate

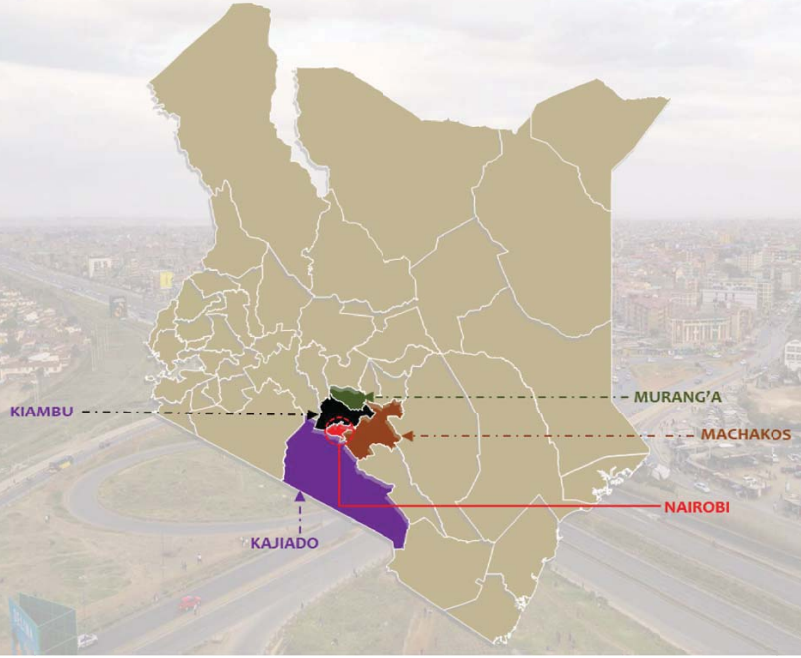
Management, development, rehabilitation and maintenance of national urban trunk roads

Ongoing projects covering close to 650km of roads across the country valued at Kshs. 77 Billion.

- Nairobi County – 160km – KSH 42B
- Kiambu County – 48km – KSH 1B
- Mombasa County – 25km – KSH 2B
- West Pokot County – 21km – KSH 1B

Transport Situation in Nairobi City

Nairobi Metropolitan Area



Nairobi Metropolitan Area … cont.

County	Population (2019/2020)	%	Area (KM²)	%	Density (P/KM²)
Nairobi	4,397,073	42.2%	694.9	2.1%	6,328
Kiambu	2,417,735	23.2%	2,449.2	7.5%	987
Kajiado	1,117,840	10.7%	21,292.7	65.1%	52
Machakos	1,421,932	13.7%	5,952.9	18.2%	239
Murang'a	1,056,640	10.1%	2,325.8	7.1%	454
Totals	**10,411,220**	**100.0%**	**32,715.5**	**100.0%**	**8,060**

Source: NaMATA

Transport situation in Nairobi City

Characterized by heavy traffic congestion with long ques of slow-moving vehicles, long waiting times & competition for limited road space.

Growing volume of traffic & road traffic accidents, booming urbanization, increasing environmental pollution. These are the challenges cities and municipalities are facing and that call for innovative transport solutions.

Traffic Congestion Mitigation Measures

Hard Measures

Soft Measures

Traffic Congestion Mitigation Measures

Hard Measures

- Increasing Infrastructure capacity
  - Road network development
  - Grade separation
- Enhance Efficiency
  - Junction geometry improvement

Soft Measures

- Travel Demand Management
  - Route & Time Alteration Encouragement
  - Transport Mode Alteration Encouragement
  - Giving priority to public transit
- **Enhance Efficiency**
  - **Adoption of ITS technology**

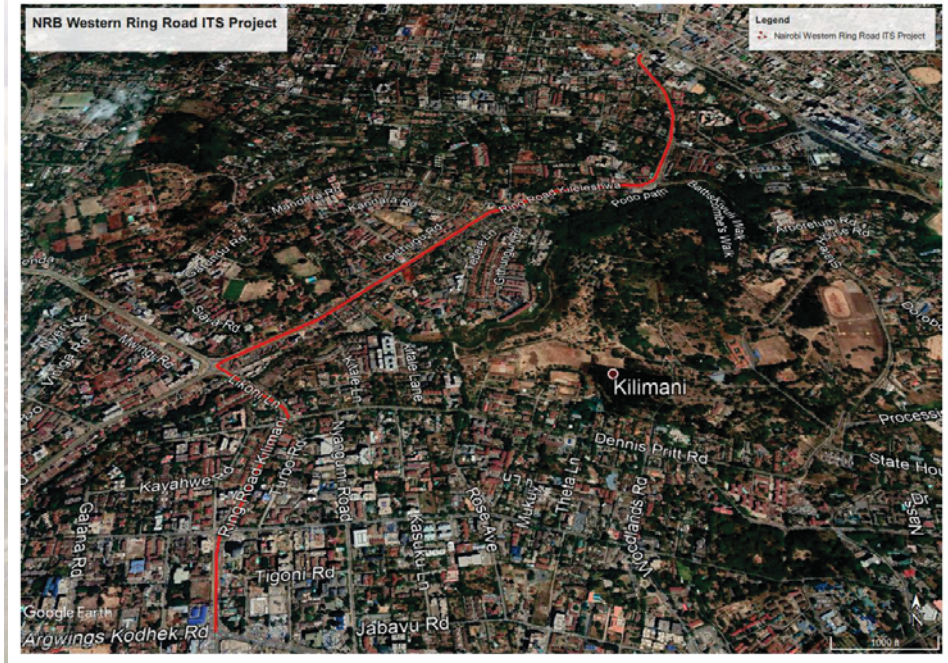
ITS Measures Taken

KURA has implemented an ITS pilot project to improve traffic management along the Nairobi Western Ring Road corridor linking Ng'ong Road and Waiyaki Way (A104) at Westlands Roundabout (🕭4.07km).

From the initial seven (7) piloted intersections, the Authority has increased the number of intelligent intersections to thirteen(13).

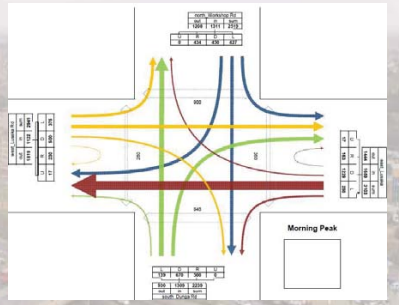
System Features

- Centralized traffic control
- Real-time surveillance
- Traffic enforcement (E-Police)
- Real-time traffic data collection
- Centralized network management



Urban Traffic Control (UTC) & Data collection System

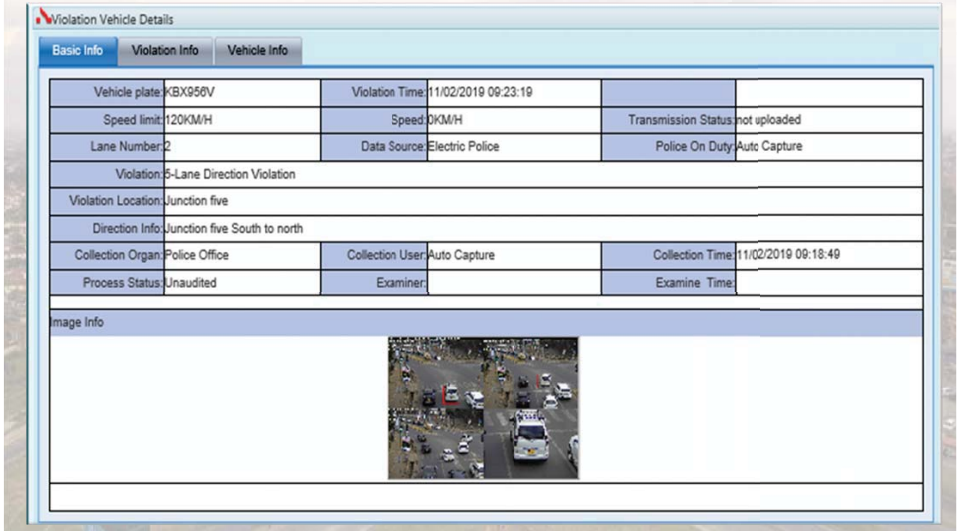
Video vehicle detectors and surveillance system continuously detects directional flows and collates data on turning movements



Data analyzed and used to optimize signal plans

Realtime Traffic Surveillance

Automated Traffic Enforcement System (E-Police)

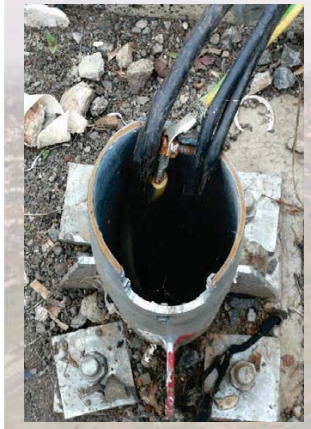


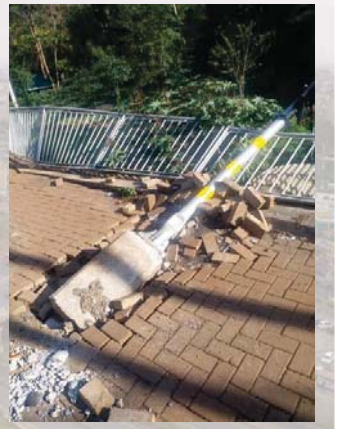
Benefits of the Pilot ITS Project

- Improved traffic flow efficiency of upto 40% from survey analysis:
- Reduced waiting time to an average of 30 seconds at intersections:
- Traffic enforcement (E-Police) system eliminates the need to have physical presence of police:
- Real-time traffic data collection provides accurate information for forecasting and engineering design: and
- Centralized traffic infrastructure and network management.

Challenges Facing ITS Implementation

- Vandalism and breakage of existing infrastructure





- High Cost of Maintenance
- High cost of network connectivity

ITS related organizations in Kenya

- Kenya Urban Roads Authority (KURA)
- Nairobi Metropolitan Area Transport Authority (NaMATA)
- National Police Service – Traffic Department
- Nairobi City County Government (NCC)
- Nairobi Metropolitan Services (NMS)
- National Transport & Safety Authority (NTSA)

Planned & Ongoing ITS Projects in Nairobi City

Project Title	Description	Implementing Agency
Nairobi ITS Establishment & Junction Improvement Project	Improvement of geometry and installation of Intelligent Transport Systems (ITS) facilities for 105 junctions and construction of a fully equipped Traffic Management Center (TMC)	KURA
BRT Line 1	Detailed Engineering design & Construction of BRT Line Kangemi to Imara Daima along A104	KeNHA
BRT Line 2	Detailed Engineering design & Construction of BRT Line Ruiru - Nairobi CBD - Kenyatta National Hospital	NaMATA
BRT Line 5	Detailed Engineering design & Construction of BRT Line along Outer-ring Road	KURA

Asante Sana

ありがとうございました

Kenya Urban Roads Authority

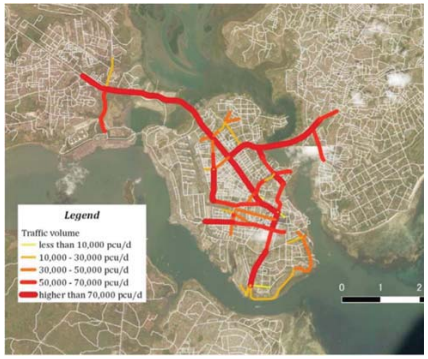
enhancing urban mobility

ITS ACTION PLAN FOR MOMBASA

Ali Shariff
Director – Operations and Services
Department of Transport, Infrastructure and Public Works

PROBLEM STATEMENT

- Mombasa City is around 294 sq kms in size
- An influx of automobiles in last 10 years and small taxis(TUKTUK)- around 8000 within cbd.
- No road extensions or diversions done as an intervention to the traffic congestion.
- Lack of clear visible road marking eg stop line, pedestrian sidewalk, zebra crossing etc on Roads and highways hence accident risk is high.
- City has around 17 intersections within cbd. Only three have traffic signals.
- Congestion levels higher that 70000 pcu/d (JICA Report)



$$\frac{\text{Num. of Heavy Vehicles}}{\text{Total Num. of Vehicles}}$$

RATIO OF HEAVY VEHICLES

- Most Heavy Vehicles use the western corridor to ferry load to the express highway to Nairobi hence congesting the Sabasaba and Makupa intersections

How to combat the growing traffic congestion???

- High traffic congestion leads to Economic losses through fuel consumption, air pollution and also social problems like stress to drivers and increase in road accidents.
- The Mombasa County Govt sought the help of the Japanese Govt in the formulation of the Mombasa Gatecity Masterplan that will allow for construction of;
- A ring road (Southern Bypass project)
- Likoni Gate Bridge – Link between southern Mainland and CBD.
- A special economic zone in a sub-urban area away from the CBD
- Creation of other alternate mass public transport systems. BRT MAIN FOCUS
- **This would all pave way for efficient traffic management within the CBD**
- **An agreement signed in 2016 by PM Abbey and President Kenyatta to allow for ODA loan to finance the projects in Mombasa**




EXAMPLES OF THE FOUR MAJOR INFRASTRUCTURE PROJECTS TO BE UNDERTAKEN

PROPOSED INTERVENTIONS FOR TRAFFIC MANAGEMENT AND ROAD SAFETY

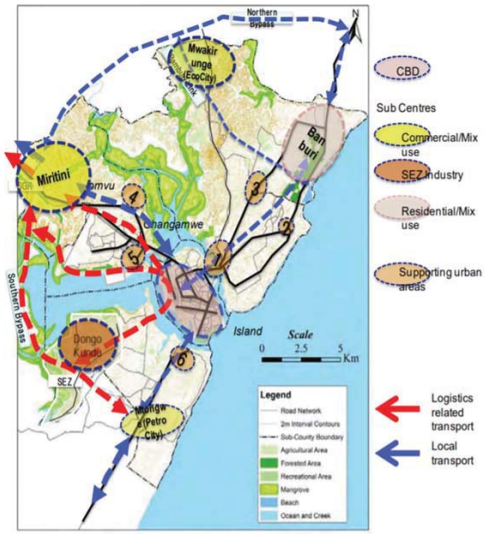
Grouped into two categories

Short term

- Road marking of all intersections (immediately)
- Public participation meetings to encourage safe driving, pedestrian safety etc. (Immediately)
- **THE HAPPY HOUR- Allowing motorists to use both lanes during peak hours.(Very Effective)**

Expected Outcome

- Image shows location of the new industrial areas
- New housing estates
- Formation of ring-road once road construction is complete.



Source: JICA Expert Team

Figure 8.2.10: Structure Plan and Supporting Urban Areas

LONG TERM INTERVENTIONS

- Replace some round abouts with intersections after conducting feasibility study and simulation tests. (2 years)
- Install traffic signals- 25 Intersections through the Grant Aid by JICA (2 years)
- Area control of all intersections in CBD using available vision sensors and installed fiber cable and Backend system (2 years)
- Introduce BRT as final step use priority signal to allow smooth operations instead of dedicated lane. (Discussions with KENHA)

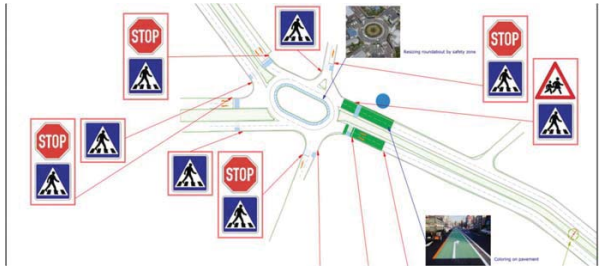
Short Term (Non-ITS)

A. To improve on safety of road users including pedestrians road marking is very important. (Low Budget needed)

Road Marking to control Traffic Flow

1) Resizing the intersection to avoid traffic confusion @ Sabasaba intersection
2) Lane marking of Mombasa Road to direct traffic flow

MAKUPA ROUND ABOUT ROAD MARKING PROPOSAL



Busiest round about in the city

Volume of traffic very high as it connects the CBD to the airport and class A highway to Nairobi.

For safety Road marking it very urgent and important

Design done by KOEI AFRICA-Nrb Office

CURRENT ITS SITUATION

We have 60 cameras installed in all intersections and round about junctions within the centre of business district

All cameras are linked to Shimanzi Traffic Office with a **dedicated fibre optic cable.**

A large LCD available for display of footage. (Used for monitoring traffic congestion and security purposes)

PROPOSED INTERSECTIONS

MEDIUM PLAN

- Set up a Road Traffic Accident Database
- Emulate the example of ITARDA.
- Involve the Private Sector Alliance of Kenya (KEPSA) for Policy formulation and funding
- Partner with Insurance companies for support.
- Database to assist in mapping out blackspots and hence information can be sent to users through App
- Assist in further research activities

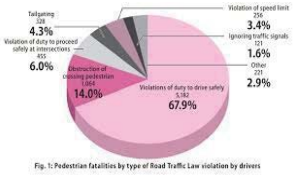
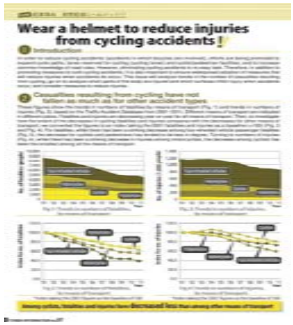
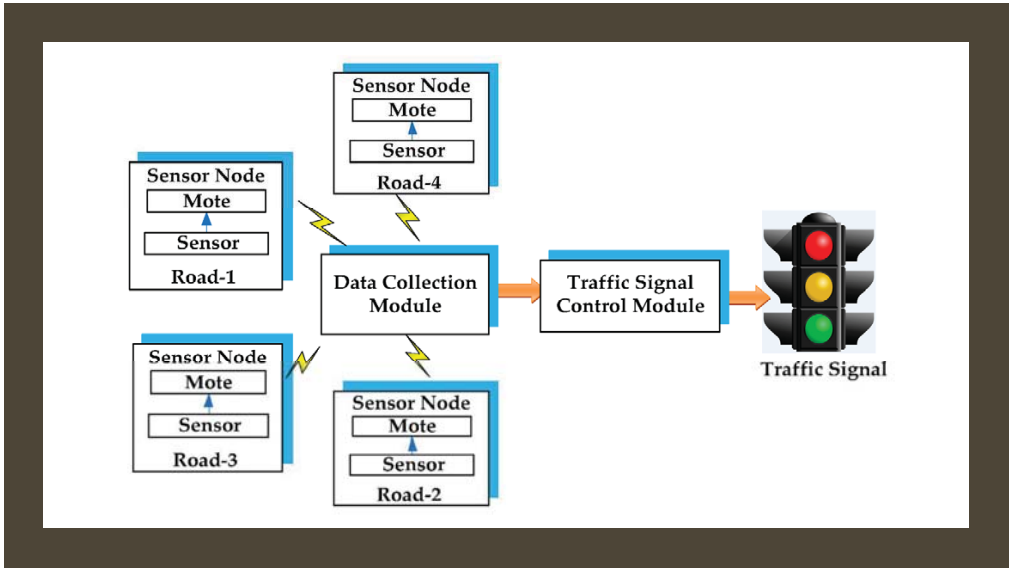


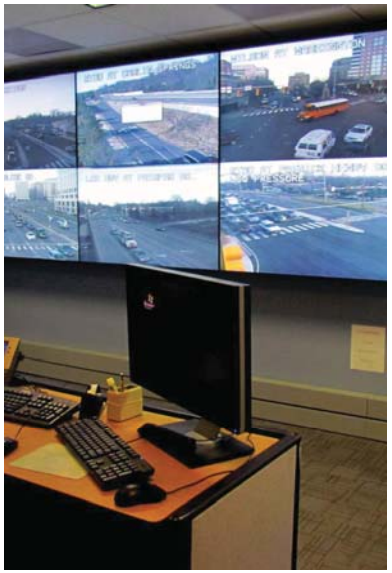
Fig. 1: Pedestrian fatalities by type of Road Traffic Law violation by drivers





LONG TERM ITS SOLUTION

AREA CONTROL SIGNALLING	CURRENTLY WE HAVE MOST OF JUNCTIONS WITH CCTV CAMERAS	MOST PTZ WITH ONE ANPR	TO INSTALL ATLEAST 25 INTERSECTIONS WITH TRAFFIC SIGNALS
TO LOOP THE 25 SIGNAL CONTROLLERS TO CONTROL SYSTEM	CONTROL SYSTEM TO RELAY INFORMATION TO DRIVERS THROUGH ANDROID/IOS MOBILE APP (CELLULAR)	TO USE VMS TO DISPLAY CONGESTION/ROAD INCIDENTS	REVENUE FROM ADVERTISEMENT USING MOBILE APP AND VMS AND BUDGET ALLOCATION



SET UP OF THE MOMBASA ITS CENTER

- Have a Traffic Monitoring and Control Centre located in Shimanzi (Traffic Headquarters in Mombasa)
- Office Space, LCD, Furniture , computers ,internet connection, backup generator Fibre Connection and DVR + Server already exist.
- The centre will be on a 24 hours 7 day Operation
- **Need Assistance for Setting up AI tools to analyse the incoming data from sensors to perform the following;**

❑ Signal Jumping Enforcement System
  - ✓ ANPR cameras to capture number plate of offender and send image of offense and fine to driver(MPESA FOR PAYMENT) Mitsubishi Heavy Industries had something similar

❑ Area Control of 25 intersections – Use of MODERATO to control traffic flow

❑ Congestion and road incident information sent to road users by downloadable mobile app and/or VMS. (Income generation through app sale and advertisement)

SIGNAL JUMPING ENFORCEMENT USING ANPR

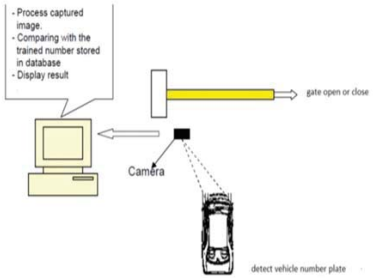
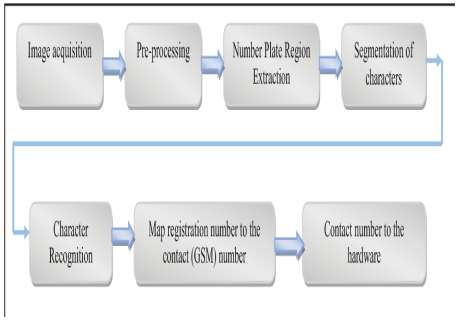


Fig. 2: Block Diagram of ANPR System



INTRODUCTION OF BRT

- The Governor of Mombasa wants to deliver BRT before he leaves office in 2022.
- Good mass transit system for Mombasa. (Average capacity and velocity)
- Once Area control of intersection is effectively working, BRT can operate with priority control of signals from the Traffic Control Centre.
- To enact law that will control the movement of tuktuks within cbd to pave way for BRT. Increase the license fee for operation within cbd
- Negotiate with private operators of public transport to operate at outskirts of the town.

DESIRED OUTPUT

- Link National Transport and Safety Authority Database to ours for crosschecking of Vehicle owners
- Message sent to violator to pay fine or face prosecution

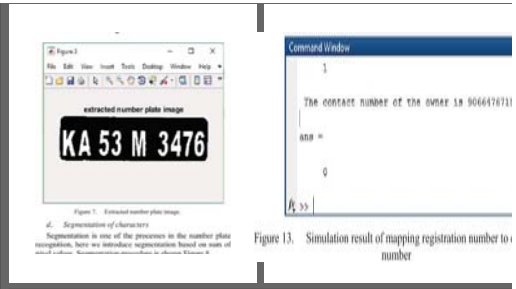


Figure 13. Simulation result of mapping registration number to number

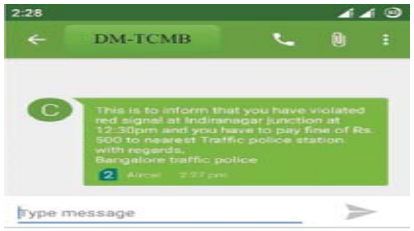


Figure 16. Final output of sending SMS

CONCLUSION

- As per the Mombasa Gate City Master Plan document -Traffic demand Management is essential as Traffic density is high in the City
- Agreement between Japanese and Kenyan Governments has paved way for construction of the southern bypass Roads.
- Agreement also supports the SEZ in Dongo Kundu hence need for efficient traffic flow.
- Road marking project to support road safety efforts.(Short term)
- Need for control of intersections and round about using ITS by 2025 , Japanese Grant Aid
- Traffic control centre to assist in Traffic Congestion, Improve Safety for motorists and pedestrians.
- Introduction of BRT to use priority signal method instead of dedicated lane to improve public transport, congestion

KARIBUNI MOMBASA

WELCOME TO MOMBASA

2021年度巻末資料－25

25, October, 2021 Online ITS Seminar in Kenya

Recent Major Issues in Transportation in Japan

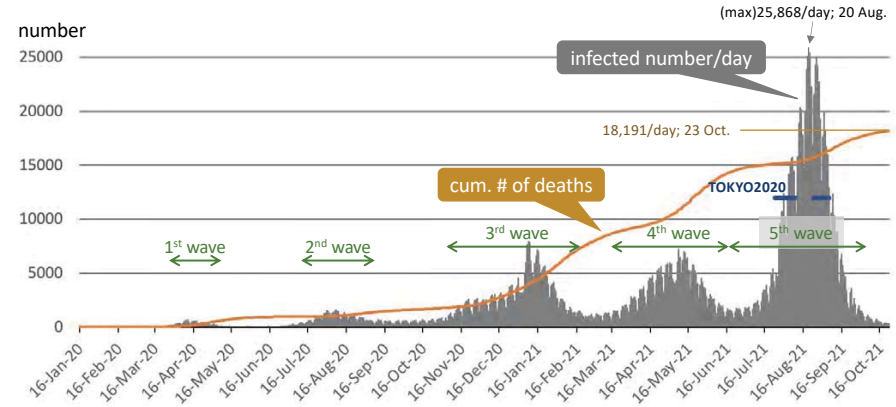
Professor/Ph.D **Takashi OGUCHI**

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

Insitute of **I**ndustrial **S**cience (**IIS**), the **U**niversity of **Tokyo** (**UTokyo**)

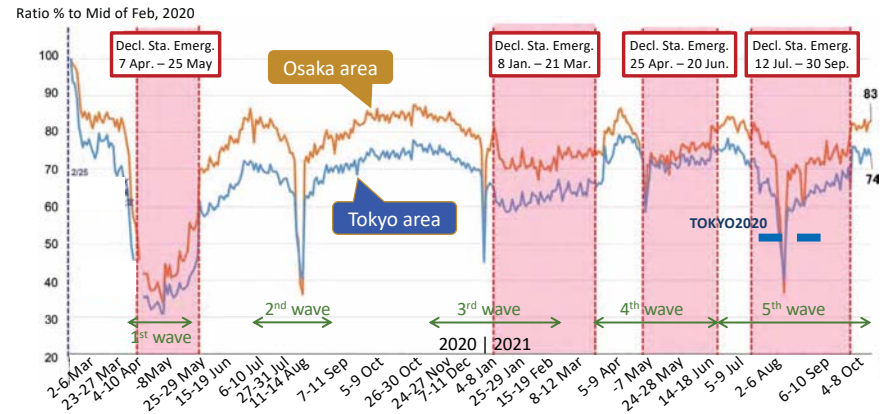
(add.) a member of **Mob**ility **I**nnovation Collaborative Research Organization (**UTmobI**) in **UTokyo**

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



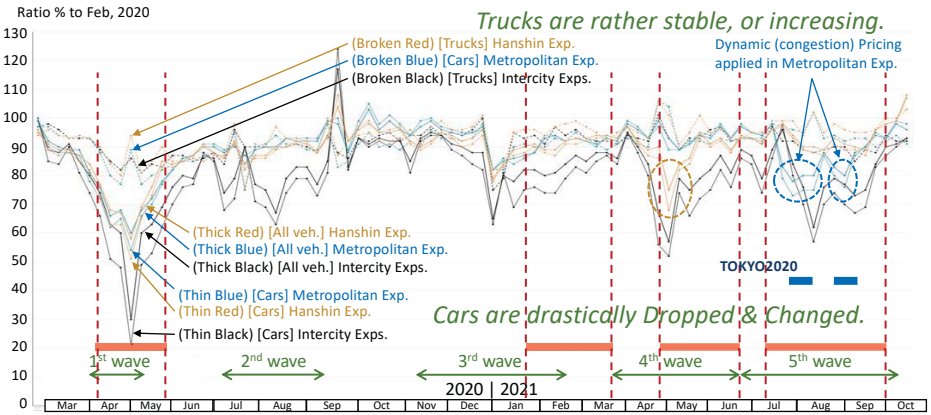
Source：NHK website
https://www3.nhk.or.jp/news/special/coronavirus/data-widget/

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

TOKYO 2020: Building the legacy

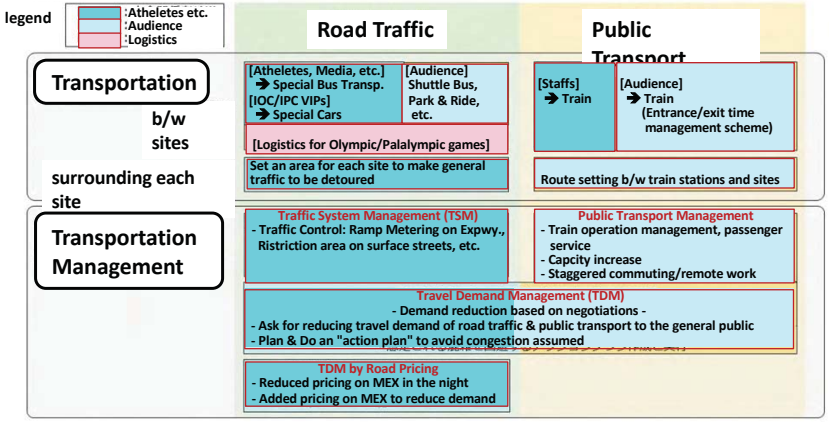
- TOKYO 2020
- Olympic 24 Jul. – 9 Aug., 2021
- Paralympic 24 Aug. – 5 Sep., 2021
  - without audience
  - strict COVID-19 control for athletes, etc

- Transportation
  - TDM (remote work, dynamic pricing, logistics,...)
  - TSM (ETC gate closure, area restrictions, ...)
  - w/o Olympic Lanes ←→ set only Olympic Routes

Source：TMG website
https://www.2020games.metro.tokyo.lg.jp/18bb65c7f3441af918b5d03601929e21.pdf

Overall Transport Management Scheme

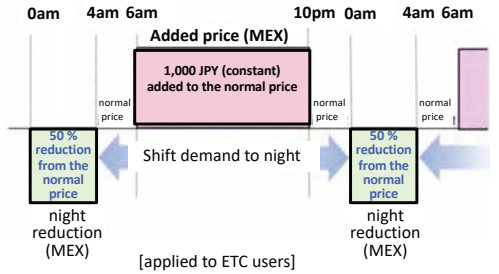
recall the material of 2020 JICA-ITS KCCP

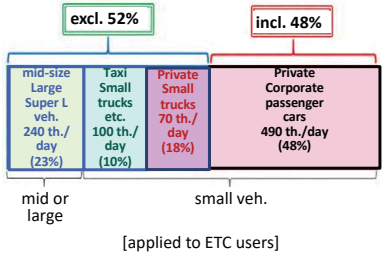


Dynamic (congestion) Road Pricing Plan

recall the material of 2020 JICA-ITS KCCP

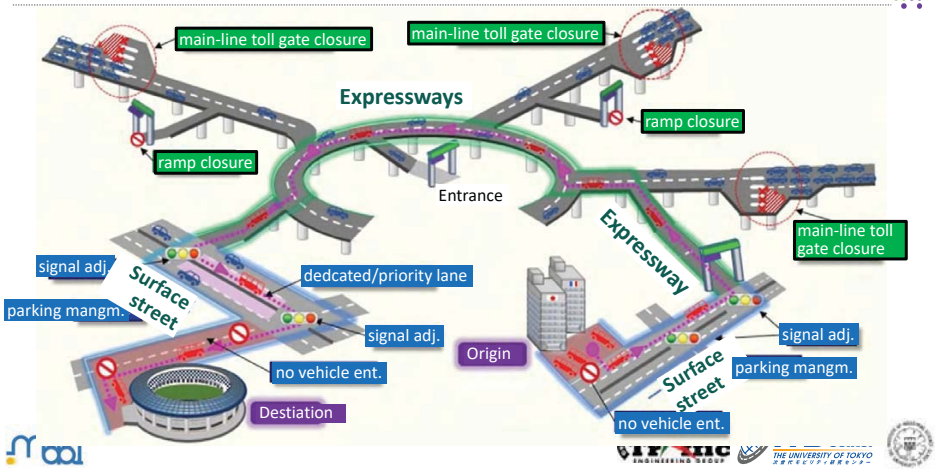
- The 1st trial to introduce **dynamic road pricing** for congestion mitigation with **ETC system**
  - ← The price in toll roads (expressways) in Japan **was** defined based on the concept for paying off of road construction loans.





Addtional Traffic System Management (TSM)

recall the material of 2020 JICA-ITS KCCP

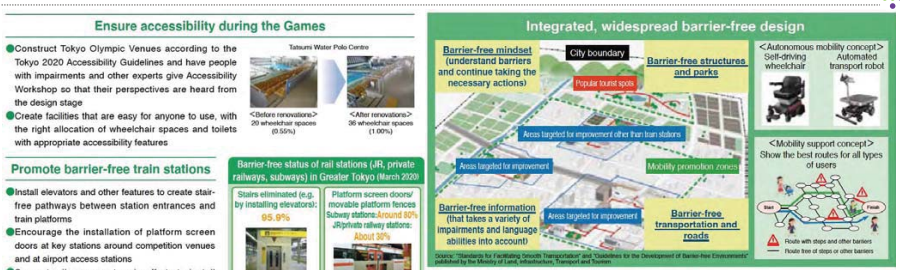


TOKYO 2020: Building the legacy

- The 1st Introduciton of BRT in Tokyo Bay area

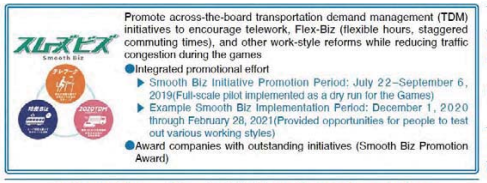
Source：TMG website
https://www.2020games.metro.tokyo.lg.jp/18bb65c7f3441af918b5d03601929e21.pdf

TOKYO 2020: Building the legacy



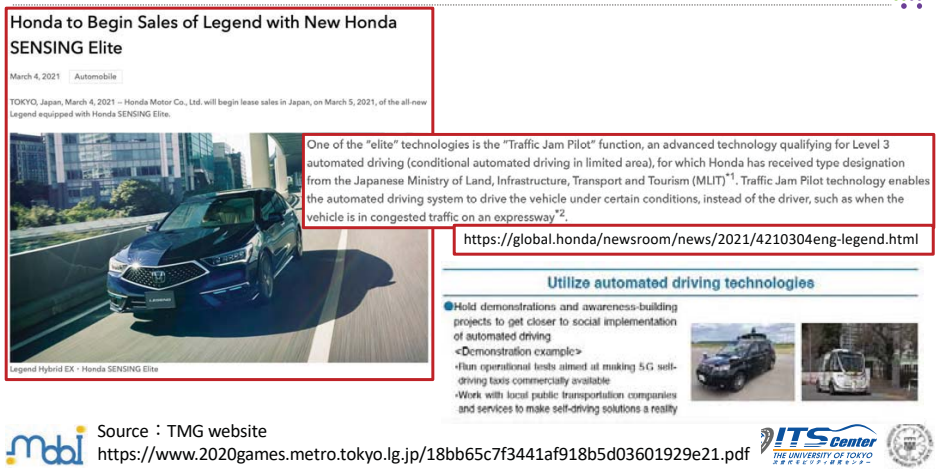
Source：TMG website
https://www.2020games.metro.tokyo.lg.jp/18bb65c7f3441af918b5d03601929e21.pdf

TOKYO 2020: Building the legacy



Source：TMG website
https://www.2020games.metro.tokyo.lg.jp/18bb65c7f3441af918b5d03601929e21.pdf

TOKYO 2020: Building the legacy



Source：TMG website
https://www.2020games.metro.tokyo.lg.jp/18bb65c7f3441af918b5d03601929e21.pdf

KCCA
KAMPALA CAPITAL CITY AUTHORITY
For a better City

SMART TRAFFIC CONTROL PILOT PROJECT IN KAMPALA, UGANDA

(2021/10/26)

Eng. Jacob Byamukama
Deputy Director ROADS MANAGEMENT
Directorate of Engineering and Technical Services, KCCA

Together we can transform Kampala city

ENG. JACOB BYAMUKAMA
ACADEMIC QUALIFICATIONS AND PROFESSIONAL MEMBERSHIPS QUALIFICATION

COURSE OF STUDY OR PROFESSIONAL GRADE AWARDING BODY YEAR AWARDED
BSc(Eng)-with Hons. Civil Engineering Makerere University Kampala 1998
MSc(Eng)-with Merit Transport Planning and Engineering University of Leeds, UK2004
MUIPE Corporate Member Uganda Institution of Professional Engineers2005 MCIHT Corporate Member Chartered Institution of Highways and Transportation 2009
MICE Corporate Member Institution of Civil Engineers 2009 IEng Incorporated Engineer Engineering Council (UK) 2009
REng Registered Engineer Engineers Registration Board (UG)2016

- **2016-Present**
Deputy Director Roads Management,
Kampala Capital City Authority (KCCA)
- **2012-2016**
Manager, Transport Planning and Traffic Management , KCCA
- **2010-2012**
Traffic & Transport Planning Team Member
The Highland Council , UK
- **2009-2010**
Senior Transport Engineer, Cundall, UK
- **2007-2009**
Transportation Engineer, Waterman Boreham, UK
- **2005-2007**
Transport Planner /Engineer MOUCHEL plc, UK

Eng. Jacob Byamukama
Specialist, Transportation Engineer Bsc(Eng.) MSc(Eng.)

Kampala Capital City Authority (KCCA) was formed in 2011, which is the legal entity, established by the Ugandan Parliament. KCCA is responsible for the operations of the capital city of Kampala in Uganda. Total employee is 458 as of December 2019

KAMPALA CAPITAL CITY AUTHORITY (KCCA)

BRIEF OF JICA'S TECHNICAL COOPERATION PROGRAMME

PROJECT FOR CAPACITY ENHANCEMENT OF KCCA IN MANAGEMENT OF TRAFFIC FLOW IN KAMPALA CITY

1. Project Commenced :

- March, 2015

2. Project Overall Goal:

- Traffic flow of the main roads in Kampala City becomes smooth

3. Project Purpose:

- The capacity of traffic flow management on the roads in Kampala City by KCCA is enhanced

4. Expected Project Outcomes

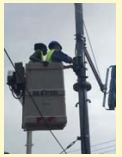
1. The urban traffic management policy by KCCA is strengthened	2.The capacity for junction improvement design is enhanced	3.The capacity for installation and maintenance of traffic signals at junction is enhanced	4.The capacity for raising consciousness programme concerning observance of traffic rules is enhanced	5.The capacity for traffic flow management mainly on junctions is enhanced	**6.Skill of traffic control using "MODERATO SYSTEM" is built on KCCA**

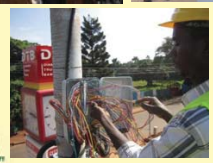
Kampala has about 2,110 of roads of which 646 km are paved and the rest unpaved (August 2021).

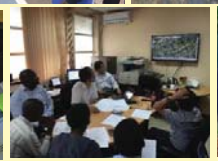
It is estimated that **60% of vehicles in Uganda use Kampala roads** even though the Kampala road network is less than **5.0% of the estimated road length** in Uganda.

c	Classification of Road Condition			Total (Km)
	Good	Fair	Poor	
Paved (Km)	282.2	277.8	84.0	**646**
(%)	44	43	13	
Unpaved (Km)	351.4	380.6	732.0	**1464**
(%)	24	26	50	

ROAD NETWORK /TRAFFIC IN KAMPALA



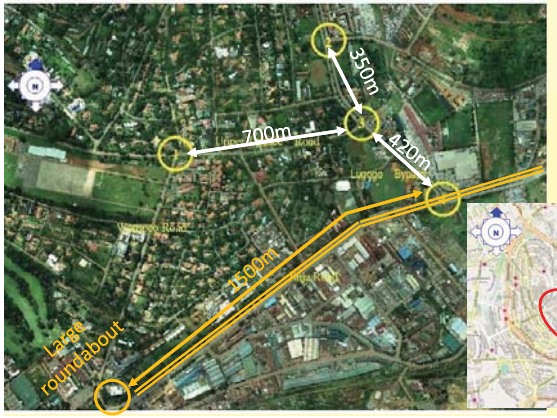


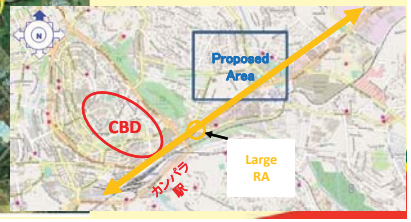


PILOT PROJECT PLANNING FOR SMART TRAFFIC CONTROL

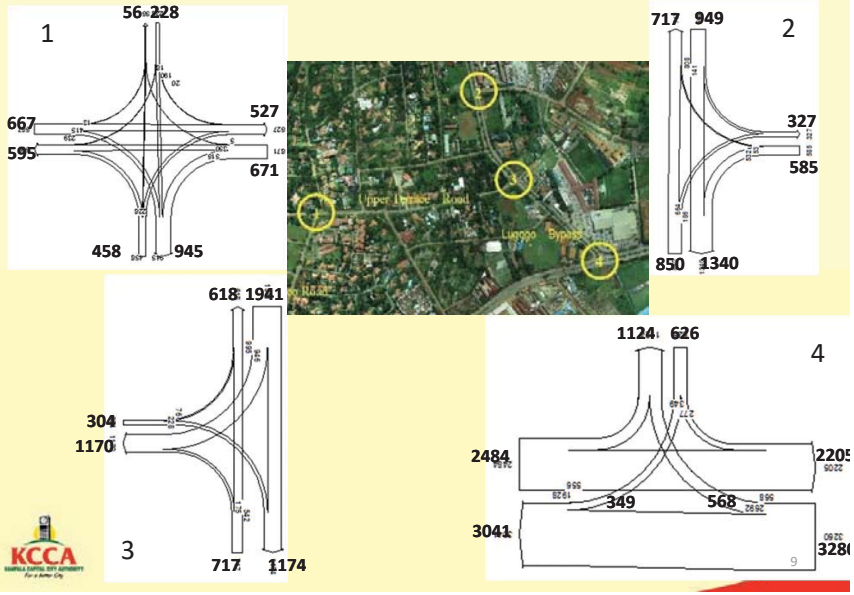
※Selection Criteria for Junctions (Area)

1) High traffic demands and heavy congestions observed
2) Zero or least geometry improvement required
3) No duplications of the other development plans
4) Communication infrastructures (Fibre cable or Public WIFI) availed

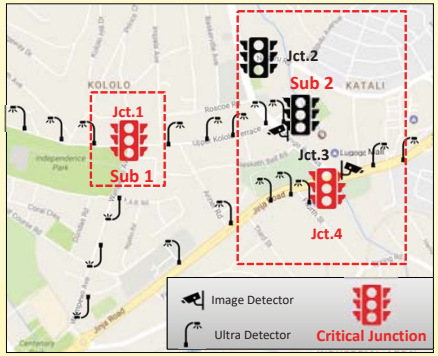




AM Peak Traffic Flows（PCU/HR）



Pilot Project Design



System Control Principal

- Junction with large traffic loads and fluctuations is made to the Critical Junction(CJ) where automatic cycle and split calculations are given,
- The other junction is made to the non-critical junction (NCJ) whose control follows its CJ's control parameters (Cycle and Split) in the sub-area,
- The sub-area shall be designed as the smallest unit as possible and should not be designed too large,
- Detecting right-turning traffic demands is always a challenge, the flow is therefore not subject to the Split calculation (Macro)
- Optimization of right-turning demand shall be subject to Gap detection (Micro).

Design Outline

1. Sub-area

As figure shows, two (2) Sub areas are designed, the Sub 1 is the single sub-area (Junction 1 only) and Sub 2 includes Junction No.2, 3 and 4

2. Critical Junctions (CJ)

NO.1 and NO.4, which are designed for the CJs in the sub areas because of their large traffic loads and fluctuations.

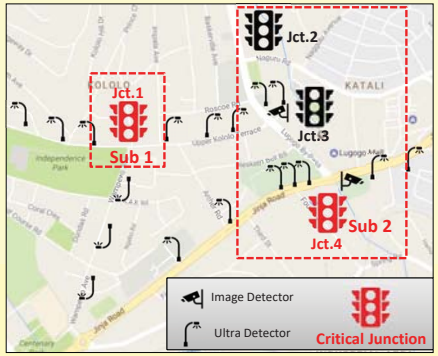
3.Non-Critical Junctions(NCJ)

NO.2 and NO.3, which have less traffics than these of the CJs, are designated for the non critical junctions(NCJ), and their split and cycle are linked by the those of No.4.

4. Right Turn Flow Detection

To minimize the dead green times ,Gap detection control is applied on No.2,3 and 4

Pilot Project Design



MODERATO control takes place at four (4) junctions of which two (2) junctions are designed as the critical (control master) junction.
The cycles and splits are automatically calculated/estimated according to the real-time traffic demand at the critical junction.

Moderate Control Approach

The area to be controlled is divided into some sub-areas. To respond to varied traffic demand patterns, the sub-areas are designed available to be combined or separated.
The system control is structured by the two (2) sub controls.

Macro Control

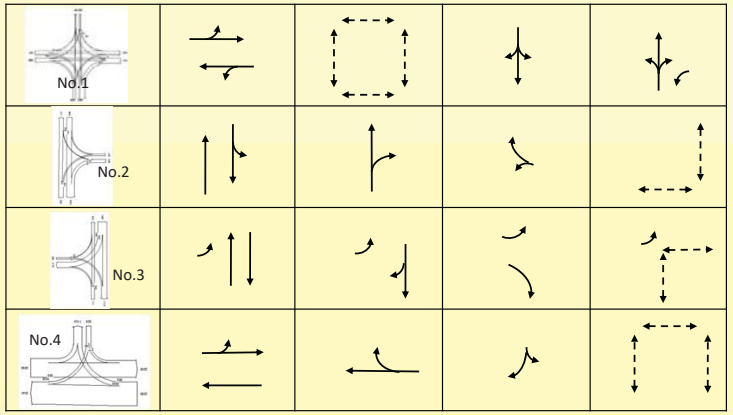
The system automatically calculates the cycles and the splits at the critical junctions in real-time to make the traffic flows optimum.

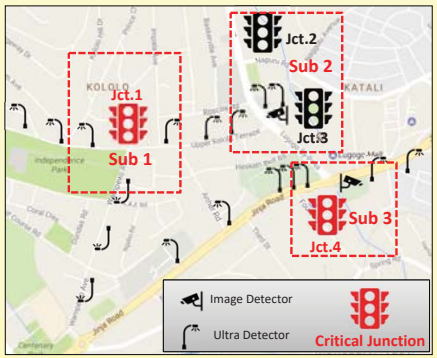
Micro Control

The cycles and the splits given by the Macro Control are fine-tunned according to the traffic flow at each junction(e.g. dilemma, gap, etc.).

5. Signal Stage Design

- Permanent (individual) stage at pedestrian crossing traffics are designed to avoid the conflicts with vehicle traffic in consideration of the behavior of the drivers in Kampala (not good discipline)
- Max cycle time shall be designed at 180sec
- *Unlike the Japanese system, the green light for the right turning shall be shown on the dedicated signal head (arrow)*
- *Wirings are designed by the pier to pier arrangement between each device and the console of the controller (no looping) that does not require the wiring works when the phase design changes in future*





6. Signal Control Parameters Design

• Junction No,1 &4

Cycle and Split are automatically calculated by the load factor assessed by traffic volume and queue length

Cycle C = (a1·L + a2)／(1－a3·ρ)

L：Loss time

ρ：Junction Load Factor（ρ=Σρi）

a1, a2, a3：Factors

Split ρi=Max（ρi1, ρi2）

gi=ρi／Σρi

ρi：Load factor on leg I at phase i

ρi：Load factor at phase i

gi：split at phase i

・Junction No.2 &3

The cycle follows the one calculated in NO.1.

For the split, the traffic volume ratio of the vehicle detections designated for each junction is used, and the split is selected from the pre-set pattern table.

Reviewing after the commission（January, 2020）

Review on Sub-area

The original design have had been for No.1 as a single sub-area and No.2, 3, & 4 in the same sub-area, however, No.4 has become a single sub-area as a result of the review. This was because the cycle of No.4 developed too long that did not suit with traffics on No.2 & 3, so we have separated it and have made linked it with the cycle of No.1. The maximum cycle time of No.4 was originally 180 seconds, but the cycle of No.4 had become made at 220 seconds to maintain the offset between No.2 and 3.

Review on Split on No.2 &3

These junctions, which were NCJ, were set up with the pattern-based cycle, however, the split pattern based on cycle times could have not met the real-time traffic demands, therefore, they have been changed to follow the split pattern selection based on the traffic demand ratio at the designated detectors.

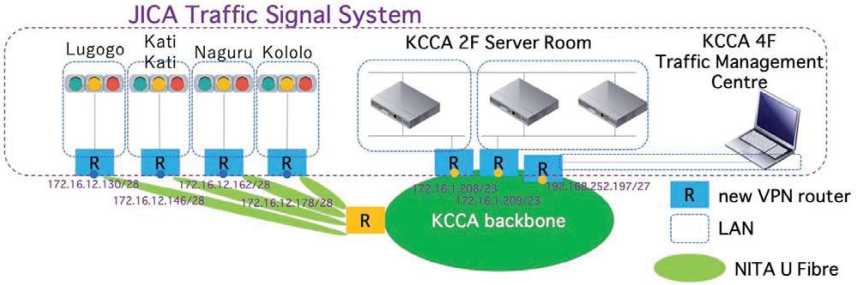
SIMULATION TO CONFIRM MODERATO CONTROL ADVANTAGE：JCT 2&3

Case 1 - (Fixed Traffic Signal)
Inefficient traffic movement
(Note: Jct2 and Jct3 are nearby but have different cycle time, due to this directional movement is inefficiently performing)

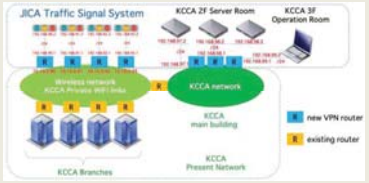
Case 2 – (MODERATO)
Efficient traffic movement when controlled under Subarea
(Note: Due to sub area, the cycle of both Jct2 and Jct3 are same)

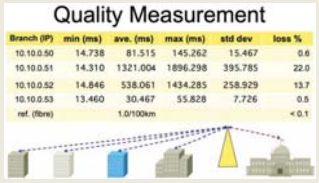
NETWORK STRUCTURE

Constructing an overlay network dedicated to the signal system using tunneling technology on the KCCA's optical fiber network.



The originally planned Private WiFi has been replaced with the optical fiber based system after the review.



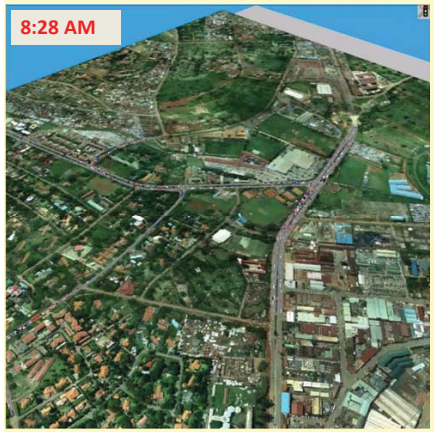


SIMULATION TO CONFIRM MODERATO CONTROL ADVANTAGE：JUNCTION NO.2

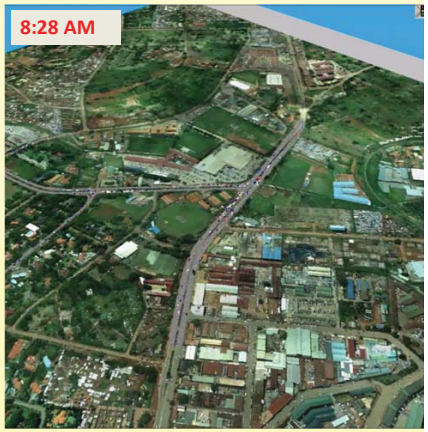
Case 1 - (Fixed Traffic Signal)
Due to fixed cycle timing, green time cannot be adjusted by demand

Case 2 – (MODERATO)
Green time split automatically adjusted by demand

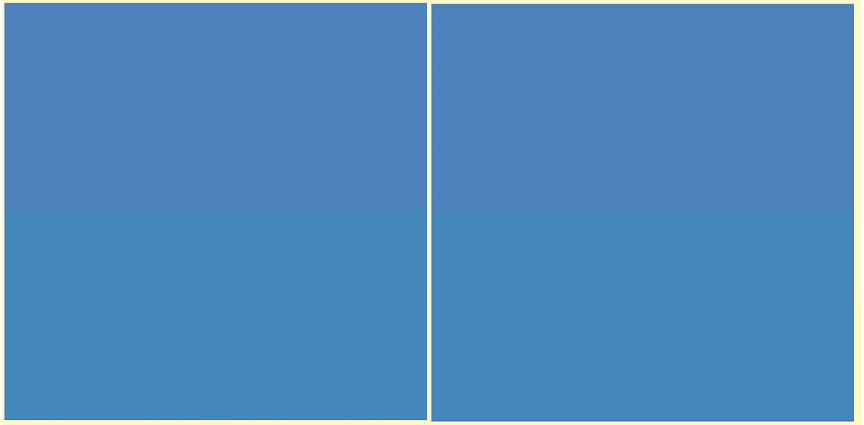
SIMULATION TO CONFIRM MODERATO CONTROL ADVANTAGE : JUNCTION NO.4



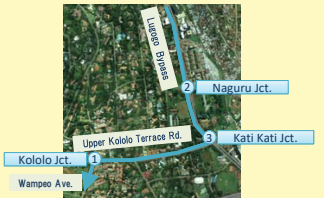
Case 1 - (Fixed Traffic Signal)
Ques observed at Kampala direction



Case 2 – (MODERATO)
Ques disappeared as the green time adjusted based on the traffic volume

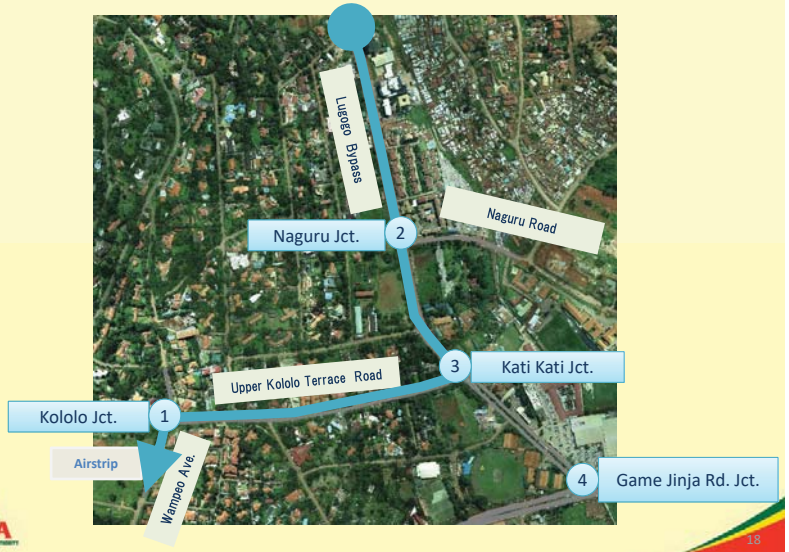


Case 1
(Fixed Traffic Signal)

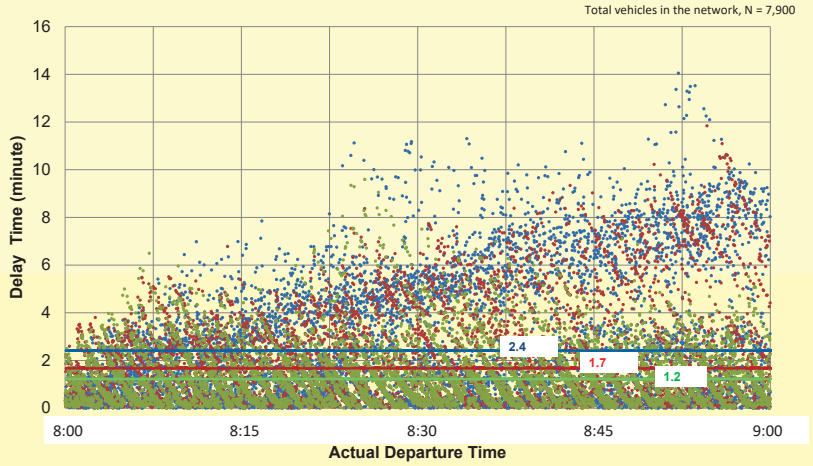


Case 2
(MODERATO)

Driver's View – Route Setting

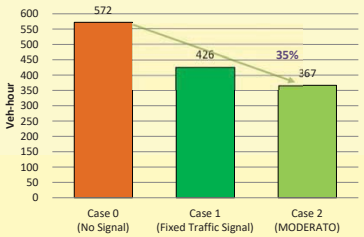


DELAY TIME ANALYSIS FOR EVERY VEHICLE IN 3 CASES



RESULT COMPARISON

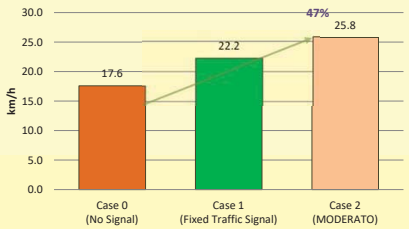
Total Travel Time (Veh-hour)



Total vehicles in the network, N = 7,900;

- Travel time will be decreased by 35% compared to present

Average Speed (Km/hour)



Total vehicles in the network, N = 7,900;

- Travel speed will be increased by 47% compared to present

LESSONS &LEARNS TO DATE

THE BIGGEST CHALLENGE IS TO ESTABLISH STABLE COMMUNICATION SYSTEM

- KCCA's intention changes (pursuit of cost effective mode) <Public Wifi→Google Fiber→Private Wifi→National Backbone>.
- A need to follow the network environment changes and developments
- No stable supply of high quality power
- Unrestorable network operating environmental/conditions after power cuts
- Insufficient communication technology skills on the engineers
- Insufficient experience in overseas traffic control projects for both JP consultants and manufacturers
- User un-friendly software of MODERATO
- Absence of communication line between Japan and UG. (Remote monitoring on the servers from Japan)
- Damages on the devices by abnormal lighting surge

RECOMMENDATIONS

- The detector is the key device for MODERATO control, it involves both advantage and disadvantage aspects (A need of costly infrastructure construction/ Accurate detecting of traffic demand)

Response →Use of wireless communication

Response → Use of probe data (Possible reduction of the numbers of detector)

- Secure a dedicated communication system
- Involvement of system integrators in the planning stage
- Secure spare parts for the key devices
- Human resource development for the engineers (Japan and UG)
- A need of remote monitoring system from Japan

PUBLICITY

Thank you.....

Kampala Smart Traffic Project

INSTALLATION OF CHENNAI METROPOLITAN AREA INTELLIGENT TRANSPORT SYSTEMS

Funded by

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AGENDA

- Project Overview
- Similar Projects
- Detailed Scope of Work
- Project Benefit Analysis
- Bid Process Management

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PROJECT OVERVIEW

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Introduction | Project Background

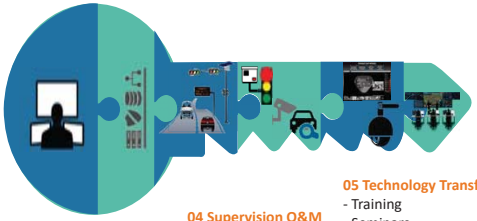
Loan Agreement
- Loan Agreement between JICA & GOI - March 2018

Project Cost
- JICA loan portion - Rs.465 Cr
- GoTN portion – Rs.195 Cr
- Additional allocation from GoTN – Rs.244.88 Cr
- Total Original Project Cost = Rs. 660 Cr
- Total Revised Project Cost = Rs. 904.88 Cr

Selection of Consultant
- Commencement of Consulting Services - 14th Feb 2020
- *M/s. Nippon Koei Co., Ltd , Japan*
- *M/s. Nippon Koei India Pvt Ltd*
- *M/s. IBI Group, Canada*
- *M/s. IBI Group India Pvt Ltd, India*

01 Basic Design
- Project Definition Report
- Draft Basic Design Report
- Cost Estimation Report
- Final Design Report

02 Tender Assistance
- Bidding Documents
- Technical Evaluation Report
- Financial Evaluation Report



03 Supervision of Construction
- Design Approval
- FAT Approval
- Acceptance Testing

04 Supervision O&M
- Service Level Monitoring

05 Technology Transfer
- Training
- Seminars
- Technology Transfer

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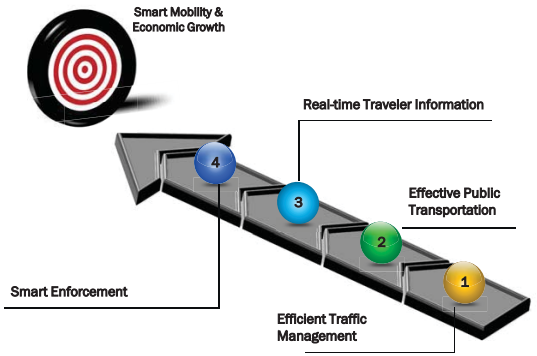
Project Statement

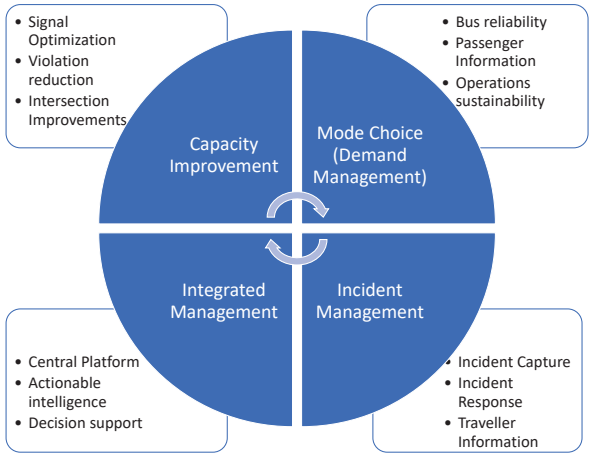
- Problem Statement
  - Reduce congestion & improve safety in Chennai
- Solution Statement
  - Holistic outlook at the Chennai congestion & safety challenges and provide solutions that can support the city long term.



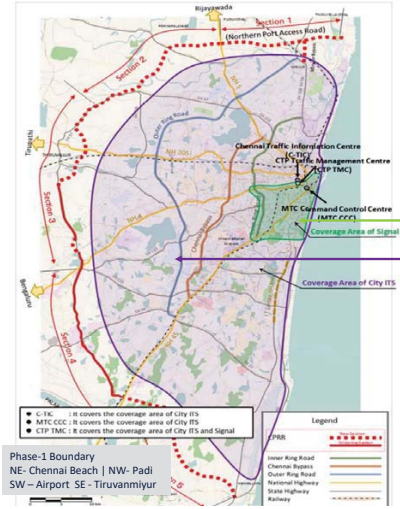
Overview – Project Components

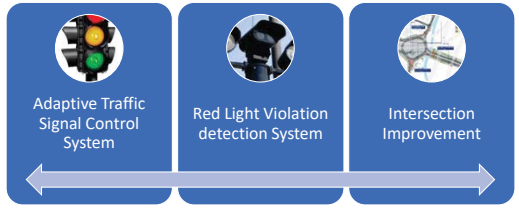
S. No.	Components	Sub-system	Phase 1 – Design, Implementation and O & M	Phase 2 - Design
1	Chennai Traffic Information & Management System	Chennai Traffic Police –Traffic Information & Management Centre	1 set	-
		Adaptive Traffic Signal Control System (ATCS)	165 junctions	332 junctions
		Intersection Improvement	165 junctions	332 junctions
		Traffic Incident detection System (TIDS)	58 locations	-
		Variable Message Sign System (VMS)	17 locations	-
		Red Light Violation detection System (RLVD)	50 junctions	-
		Speed Limit Violation Detection (SLVD)	10 locations	
		Automatic Traffic Counter-cum-classifier System (ATCC)	230 numbers	-
		ITMS Platform and Probe System	1 number	-
2	City Bus System (CBS)	Command Control Centre (Integrated control system)	1 set	-
		Automatic Vehicle Location (AVL)	3500 numbers	-
		Passenger Information System	20 numbers	-
		Depot Management System (33 depot)	1 set	-
3	O & M	O&M for all systems listed above	5 years	-

Overview – Solution Space



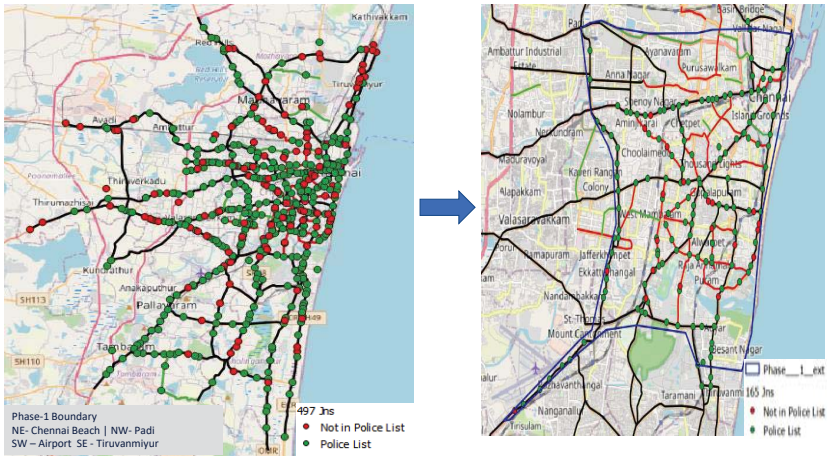
Overview - Project Study Area



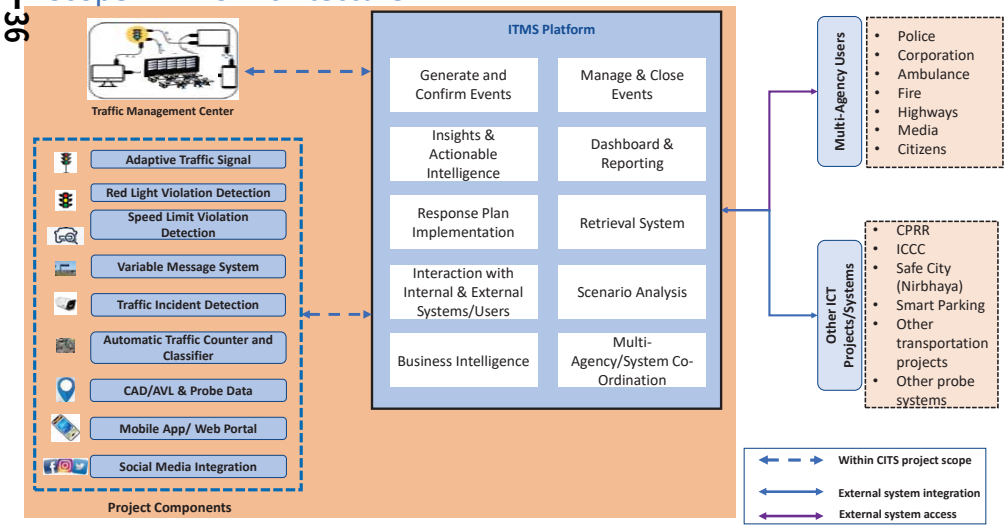


DETAILED SCOPE OF WORK

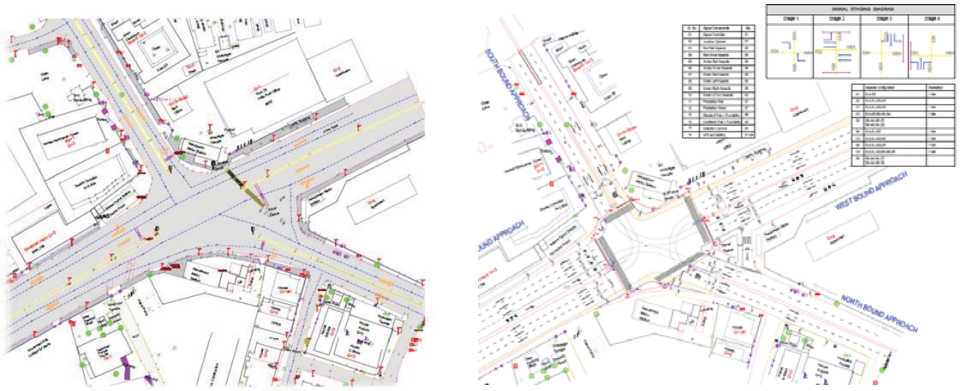
Selection of Intersections



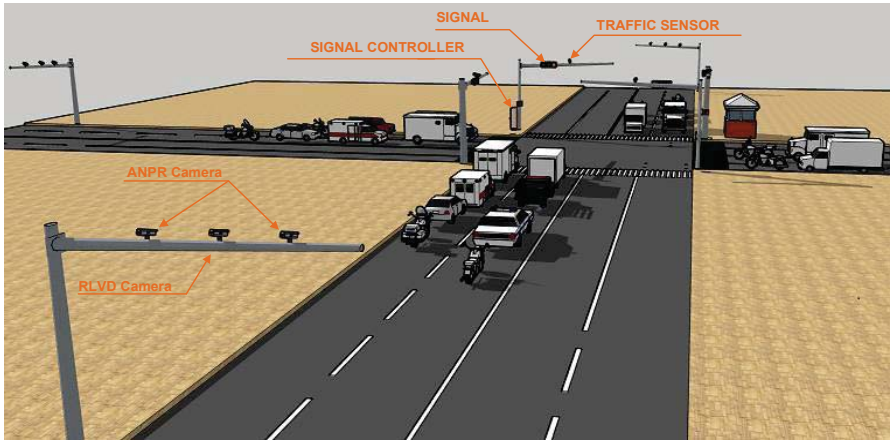
Scope – TIMS Architecture



Intersection Improvement



Adaptive Traffic Control Signal (ATCS)



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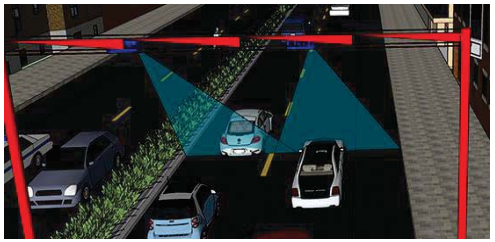
Speed Limit Violation Detection (SLVD)

- Detect vehicles violating speed limit
- Capture standard number plate of vehicle
- Violator's images provided as evidence
- Real-time alerts of suspected Vehicle to control room
- Integration with e-challan system



Sample incident detection

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Red Light Violation Detection (RLVD)

- Detect violated vehicles crossing the stop line during red light
- Able to capture standard number plate of vehicle.
- Vehicle Images will be provided as violation evidence.
- Real-time alerts for suspected Vehicle in control room.
- Integrated with e-challan system

Sample violation screen

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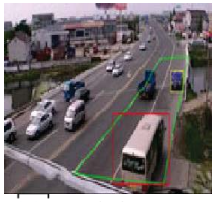
Traffic Incident Detection System (TIDS)

- Monitor traffic situation at merging location of major road
- Detect traffic anomaly (congestion, wrong-way vehicle, unattended object & vehicle)
- Incident response, Realtime alerts at Control Centre for quick action
- Images/videos transmitted to control center for real time monitoring
- Incident record for further analysis and enforcement



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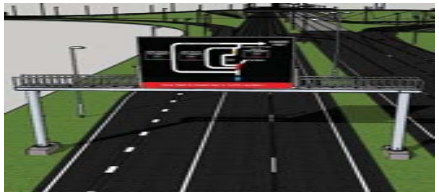
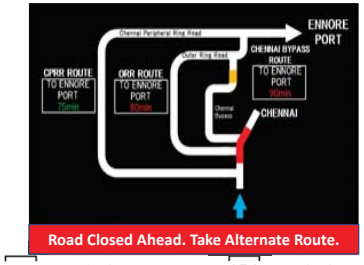
Variable Message Sign (VMS)

- Information dissemination by Control Centre ITMS application
- Accident & congestion messaging
- Suggest alternative non/less congested route
- Accident/construction information and travel time with route map
- Most effective and safe methods to show the traffic information
- Traffic awareness, safety advisories





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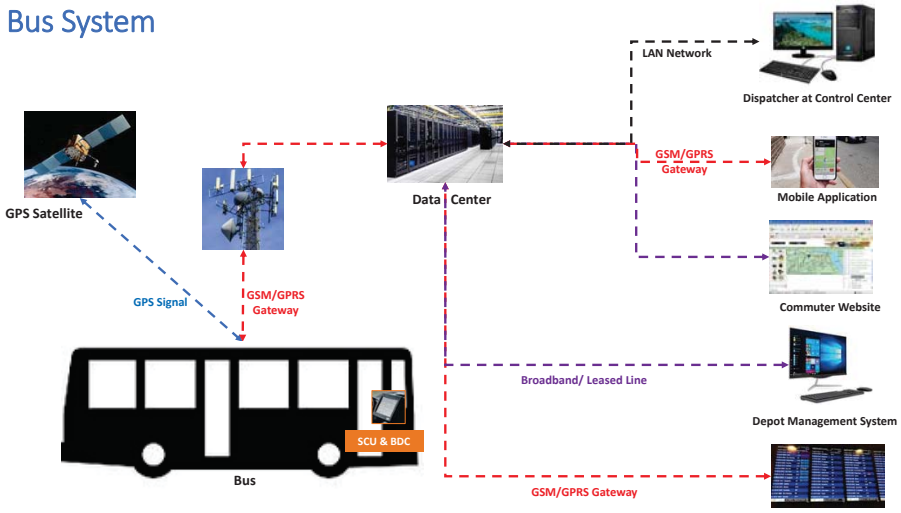
City Bus System



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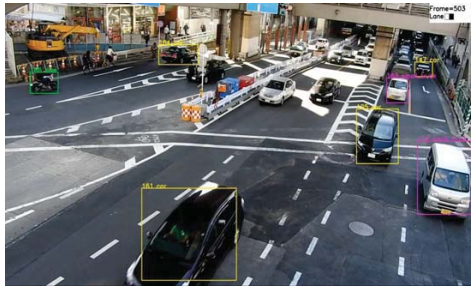
Automatic Traffic Counter & Classifier (ATCC)

- Permanent data stations
- Accurate traffic data collection
- Measures avg. speed, occupancy, count and classify the traffic
- Store historic traffic data and analyse as per requirement
- Exchange traffic information with various agencies



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PROJECT BENEFIT ANALYSIS

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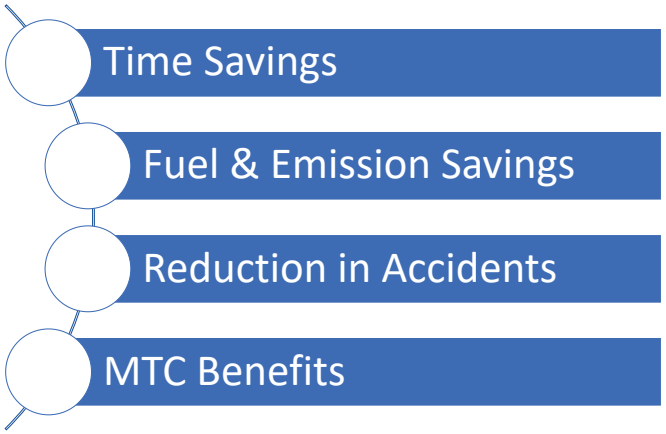
Benefit-Cost Analysis - Components



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Expected Future Benefits

S. No.	Year	Tangible Benefits in Rs. Cr							Total Benefits
		Travel Time Savings	Fuel Savings	Reduction in Accidents	Reduction in Emissions	CTP Salary Savings	MTC Salary Savings	MTC Savings (Opteration & Fuel)	
1	FY 2025-26	266	106	17	11	1	1	70	472
2	FY 2026-27	286	114	18	12	3	6	75	512
3	FY 2027-28	307	122	19	12	4	10	81	555
4	FY2028-29	330	131	19	13	5	10	87	597
5	FY2029-30	355	141	20	14	7	11	93	642
	Total	1543	614	93	63	20	38	406	2777

Note:

Travel Time:

- Reduction in the delays at the intersection (C-DAC Study).
- Weighted average value of time per vehicle in Rs. 125 per hour. (Per capita income / Average number of working hours)
- Per capita income – (Ministry of Statistics and Programme Implementation / World Bank)

Fuel Savings

- Average fuel consumption during idle phase - 0.4 liter per hour (CRRI Estimation)

Note:

Reduction in Social Cost of Carbon

- Estimate of fuel savings = 13 Million litres (0.4kg emission per litre)
- Average social cost of CO2 emission in India = Rs. 6450 per Ton

Reduction in Accident

After ICT implementation in Phase1 area 5% reduction in accidents, as per MoRTH 2018 report.

Salary:

Savings from salary after System is implemented.

BID PROCESS MANAGEMENT

Single Stage - Two Envelope Bidding

1. ***Announcement***
2. ***Pre-Bid Meeting***
3. ***Bid submission***

60 days after announcement

- Envelope 1 : Technical Bid
- Envelope 2 : Financial Bid

4. Technical Evaluation

- Evaluation of Technical Bid
- ***Selection of Qualified bidders***
- Evaluation Committee approval
- JICA Concurrence

5. Financial Evaluation

- Opening Financial Bid of ***Qualified bidders***
- ***Selection of Lowest bidder***
- Approval of Evaluation Committee
- JICA Concurrence

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Tender Schedule

S.No.	Activity	Day
1	Publishing Notice Inviting Tender & sale of RfP	1
2	Pre-bid meeting	21
3	Submission of Pre-bid meeting responses/corrigendum to JICA	28
4	Approval from JICA on responses and corrigendum	35
5	Last date for submission of bids & opening of technical bids	60
6	Submission of Technical evaluation report to JICA	90
7	Approval from JICA on Technical evaluation report	105
8	Opening of Financial bid	106
9	Submission of Financial evaluation report to JICA	110
10	Approval from JICA on Financial evaluation report	115
11	Placing of Tender evaluation details and shortlisted System Integrator (SI) before CSCL Board	116
12	Award of Work on approval of CSCL Board	120

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