

# **Development Direction and Perspectives on Probe-car**

1. Progressing ITS Effort of Japan
2. Current Status and Challenges of Expressway-bus Location System
3. Expressway-bus Location System Deployment Potentials with DSRC
4. Approach to Utilize Data
5. Concluding Remarks

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# Introduction

## What is 'Smartway'?

Reverse the negative legacy of road transport



Provide better mobility for the elderly



Realize well-off & vital communities



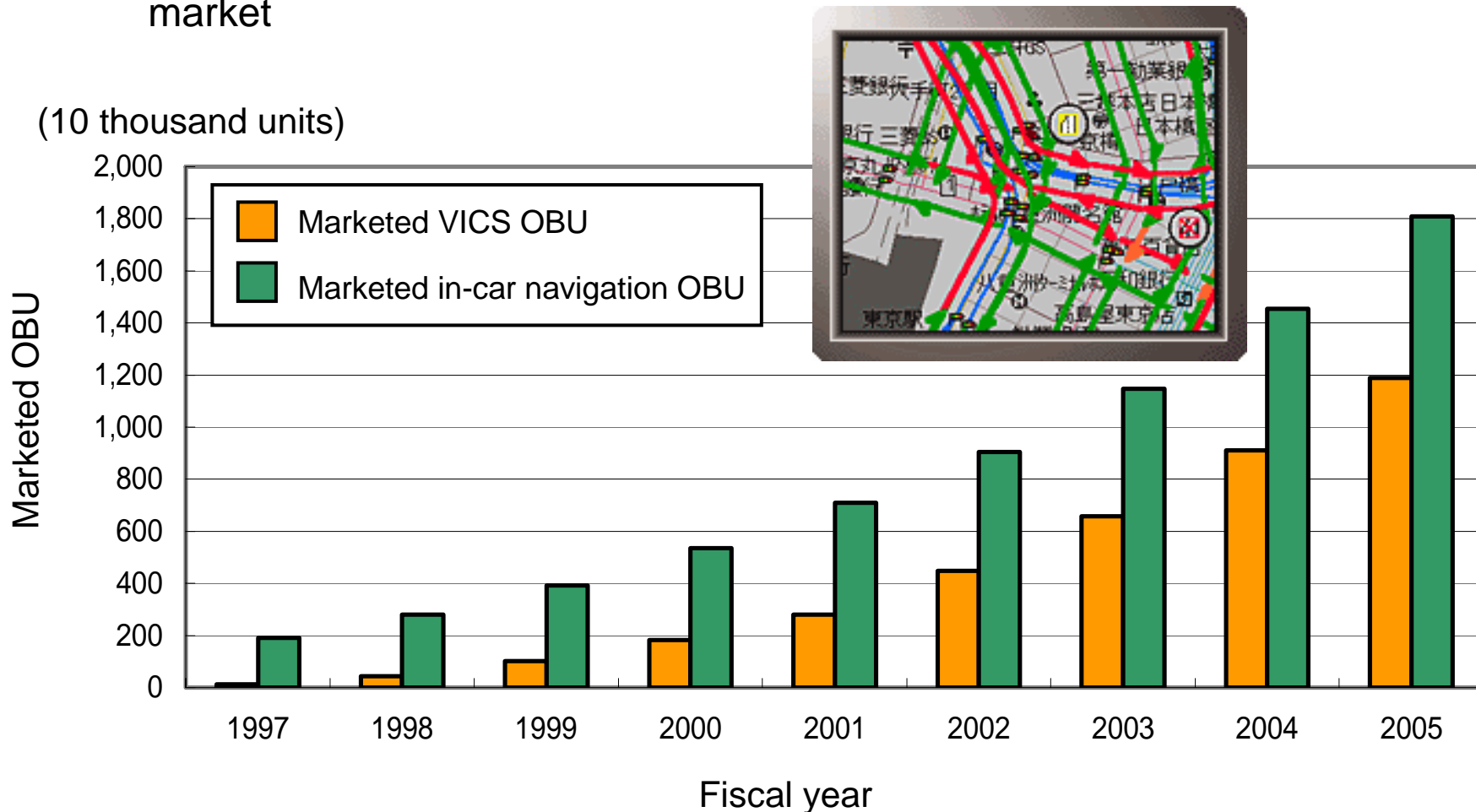
Enhanced the business milieu



# 1. Progressing ITS Effort of Japan

## (1) In-car navigation and VICS

- The marketed in-car navigation units and VICS are steadily increasing
  - As of 2005, 18 million in-car navigation units and 12 million VICS units are in market



# 1. Progressing ITS Effort of Japan

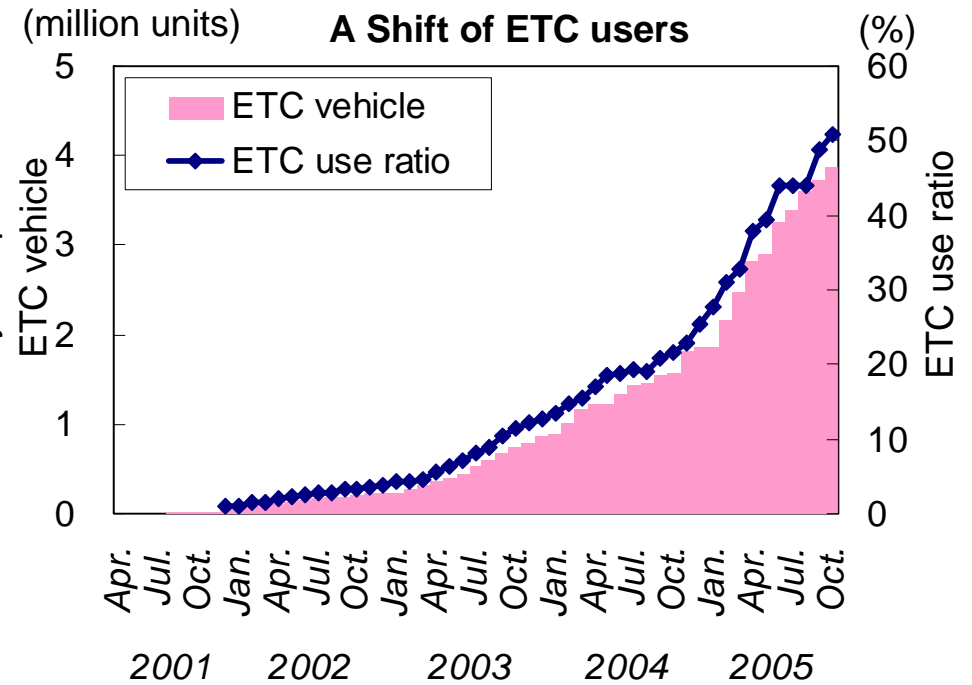
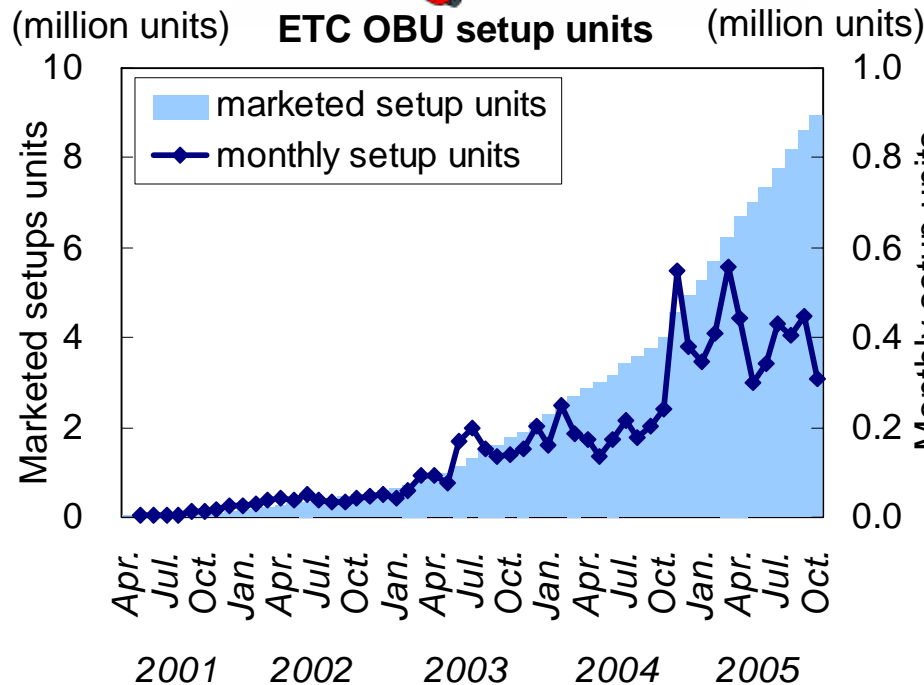
## (2) ETC

- ETC on the increase
  - About 10% of vehicles across the country have installed OBUs
  - About 51% of vehicles on expressways pass through ETC transaction



Chart: ETC transaction ratio

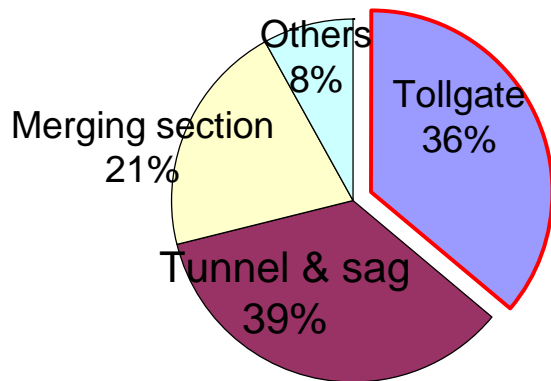
| nation wide           |                                   |
|-----------------------|-----------------------------------|
| ETC vehicle           | Approx. 4.0 million units per day |
| Total                 | Approx. 7.7 million units per day |
| ETC transaction ratio | <b>51.5%</b>                      |



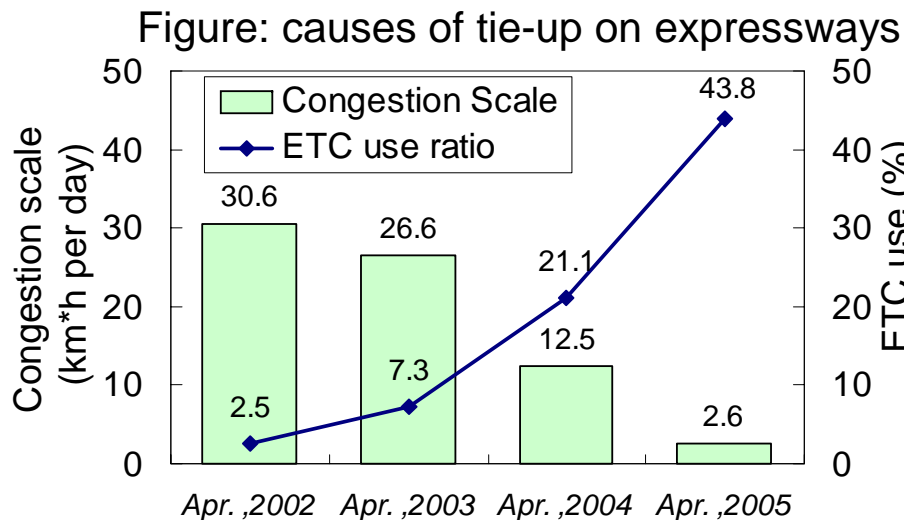
# 1. Progressing ITS Effort of Japan

## (3) ETC impact

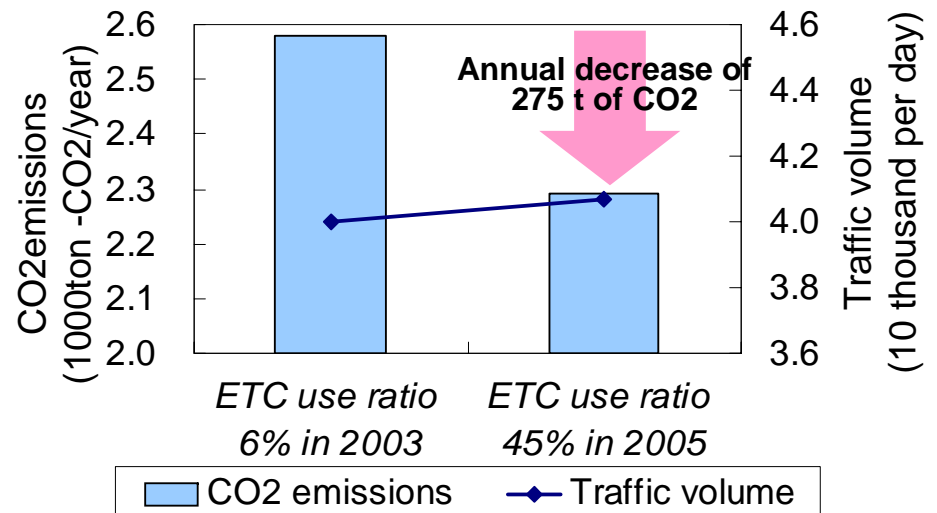
- ETC pervasiveness clearly impacts tie-up alleviation
  - Approx. 90% of tie-ups at tollgate section on Metropolitan expressways have been eliminated
  - CO2 emissions (at Kawaguchi tollgate of JH) are dissipating



Kawaguchi tollgate with no tie-up



A shift of tie-up at main lane tollgate and ETC transaction ratio on Metropolitan expressways



A shift of CO2 emissions at Kawaguchi tollgate 4

## 2. Current Status and Challenges of Expressway BLS

- Phased introduction of BLS along expressways from 2005 in order to assist public transit with ITS
- Introduction to BLS deployment with a cross-sectional platform



•A cross-sectional platform will serve expressway bus location system operations across the country

## 2. Current Status and Challenges of Expressway BLS

### (1) A shift of BLS operators

- As of now, approx. 500 operators exist and more are being added year on year
- Of these operators, about 80 have installed BLS
- The advent of BLS of GPS locating type was in 1999
- A market model of the GPS type BLS followed shortly after

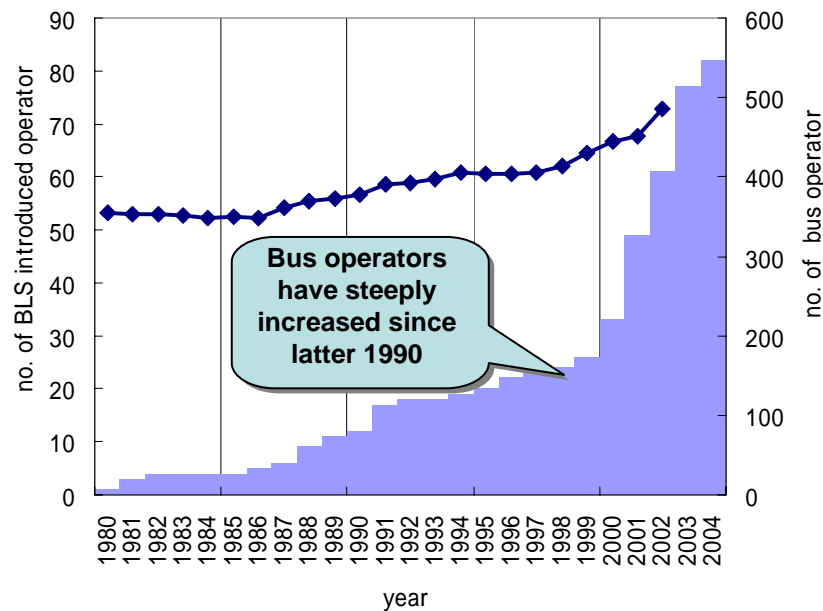


Figure: Shift of bus operators and BLS introduced operators

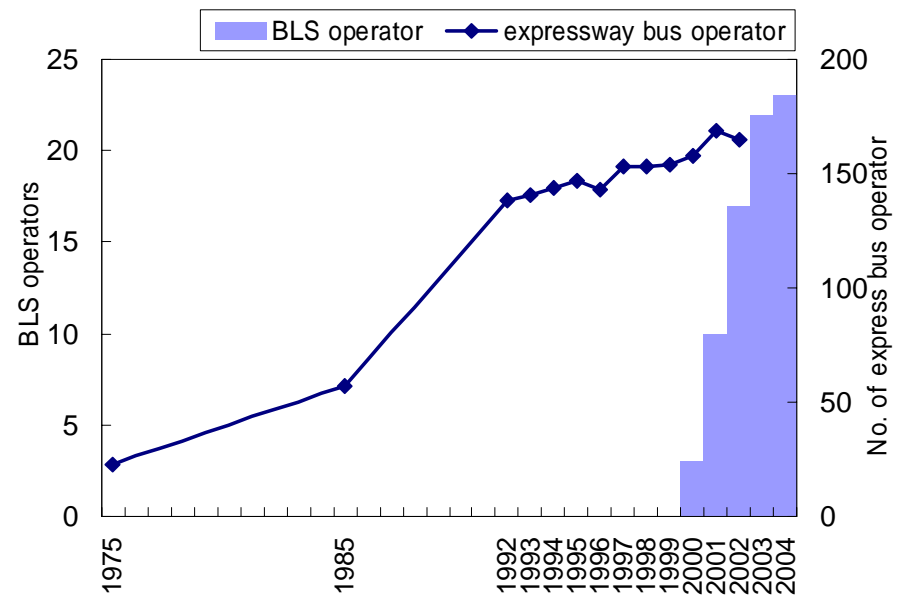


Figure: Expressway bus operators and BLS Introduced operators

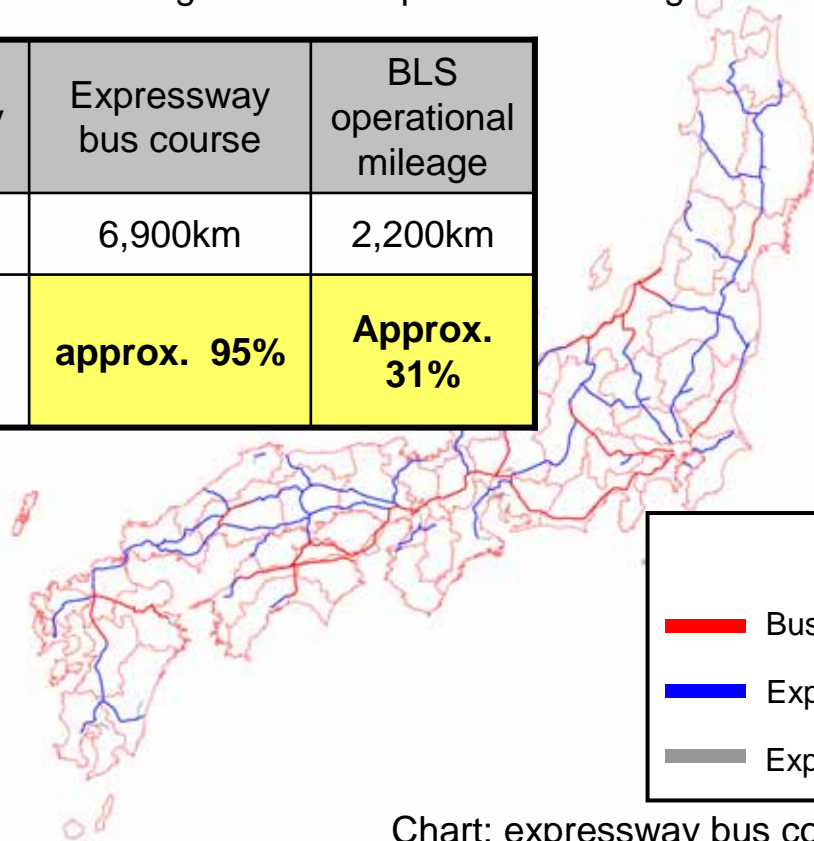
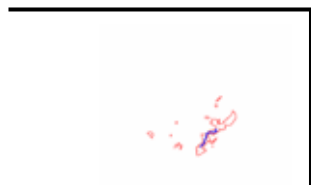
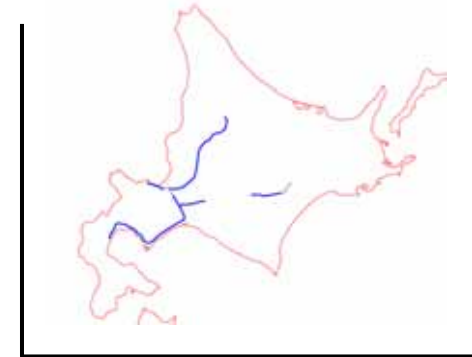
# 2. Current Status and Challenges of Expressway BLS

## (2) Mileage of expressway bus

- Mileage of expressway bus: about 6,900km (4,300mile)
  - 95% of expressway total mileage (about 7,200km)
- BLS operational mileage: about 2,200km (1,400mile)
  - 31% of expressway total mileage

Chart: expressway bus operational mileage and BLS operational mileage

|  | Expressway | Expressway bus course | BLS operational mileage |
|--|------------|-----------------------|-------------------------|
| Mileage                                | 7,200km    | 6,900km               | 2,200km                 |
| Ratio against expressway total mileage | -          | <b>approx. 95%</b>    | <b>Approx. 31%</b>      |



legend

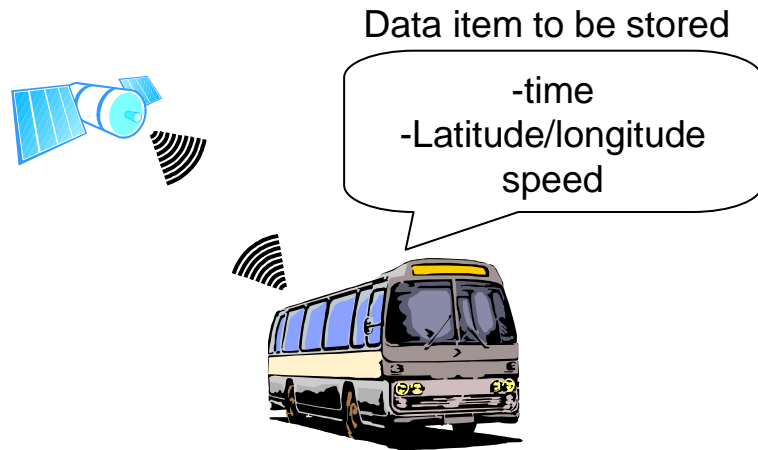
- Bus location sys operational expressway
- Expressway bus available expressway
- Expressway bus unavailable expressway



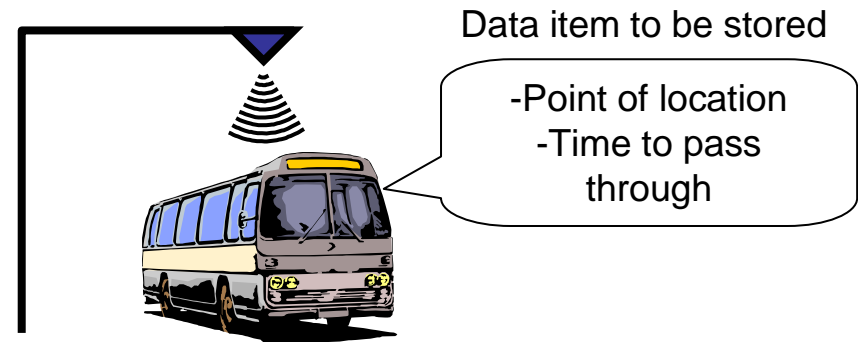
## 2. Current Status and Challenges of Expressway BLS

### (3) An approach to gather location data of expressway bus operations

#### a) with GPS

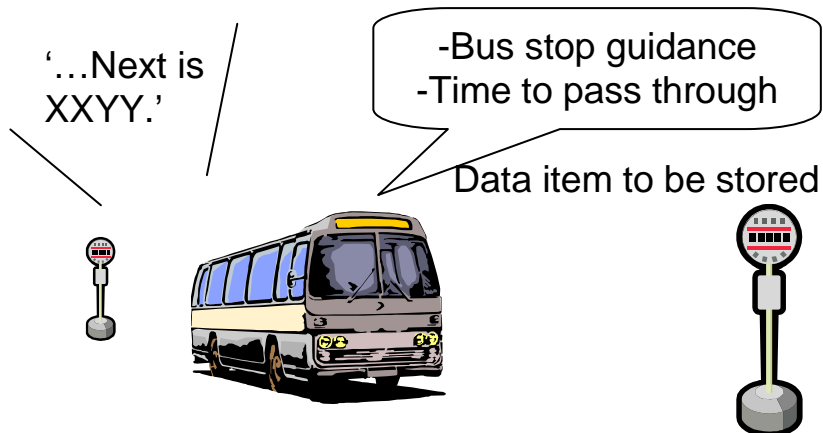


#### b) with roadside sensor



#### c) by pushing a button

Correlates by pushing a button for synthetic guidance

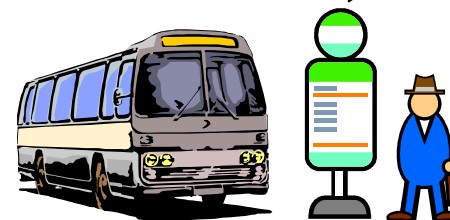


#### d) with door operation timing

Correlates with door operations

Data item to be stored

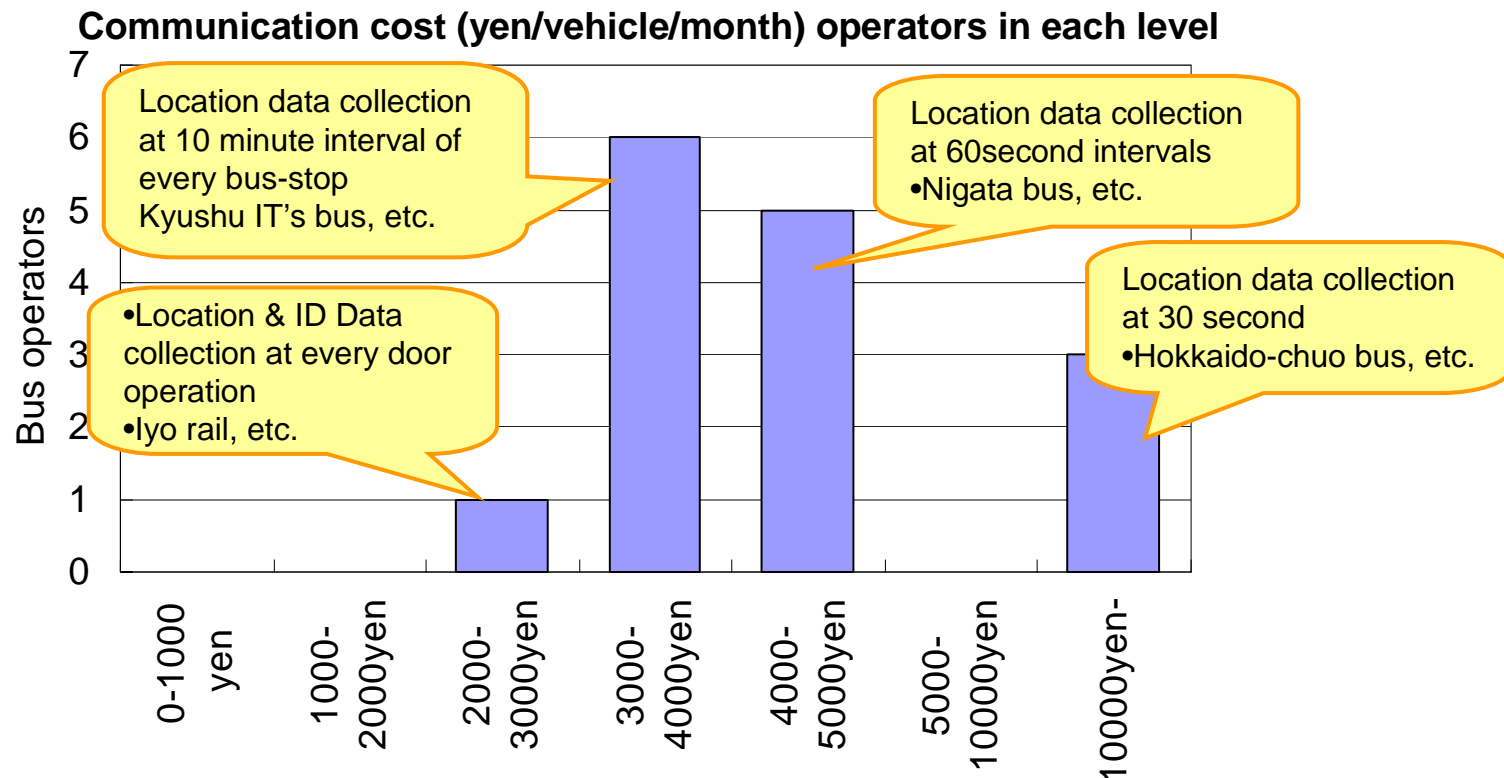
- a bus-stop guidance
- Open/close time



## 2. Current Status and Challenges of Expressway BLS

### (4) Communication cost to gather location data

- Monthly cost is 5,480 yen (approx. \$48) per vehicle
- Cost is contingent on transferring frequency
- **A challenge for pervasiveness is the cost reduction**



# 3. Expressway BLS Development with DSRC

## (1) System configuration

- A running cost reduction is possible for BLS with DSRC

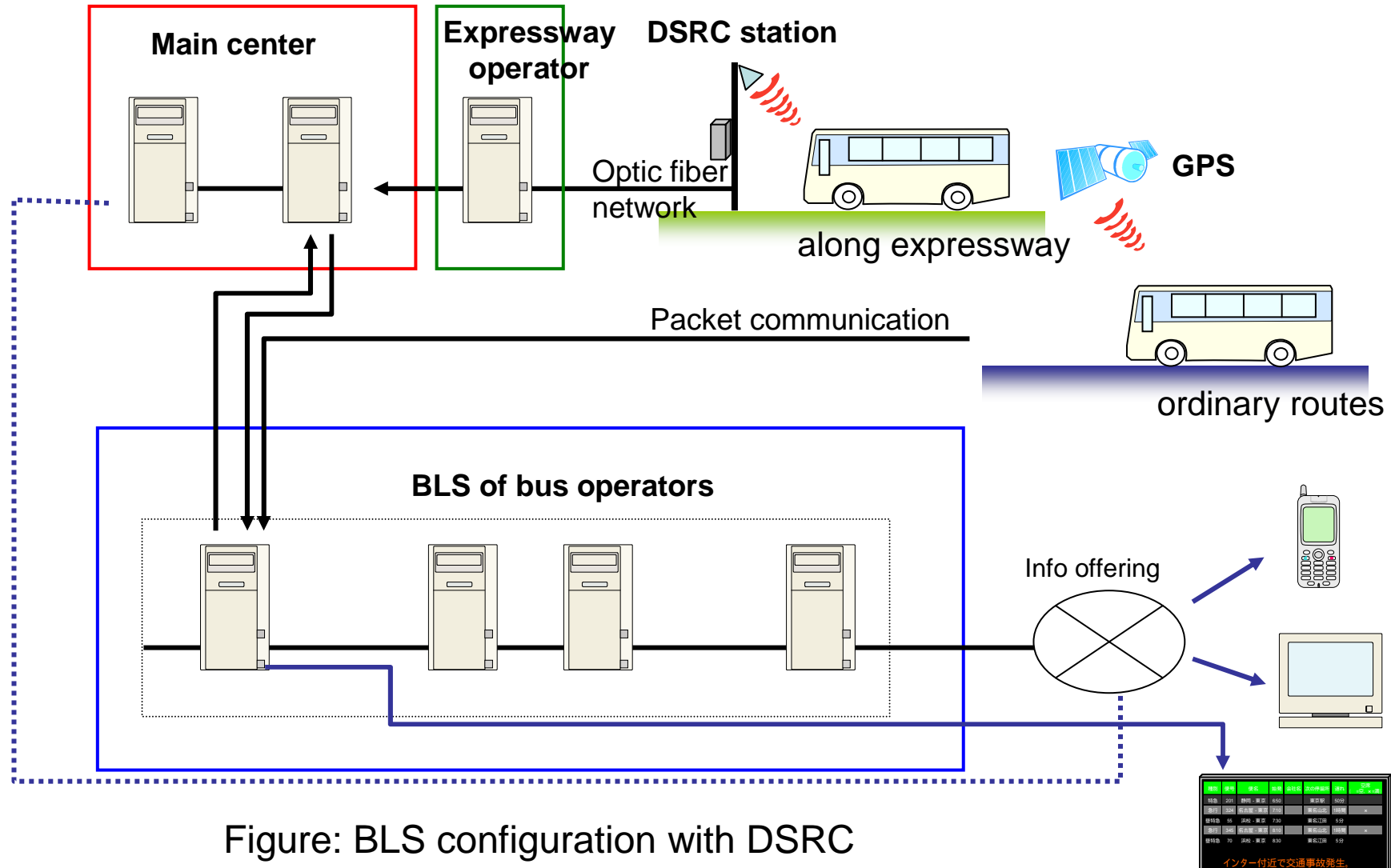


Figure: BLS configuration with DSRC

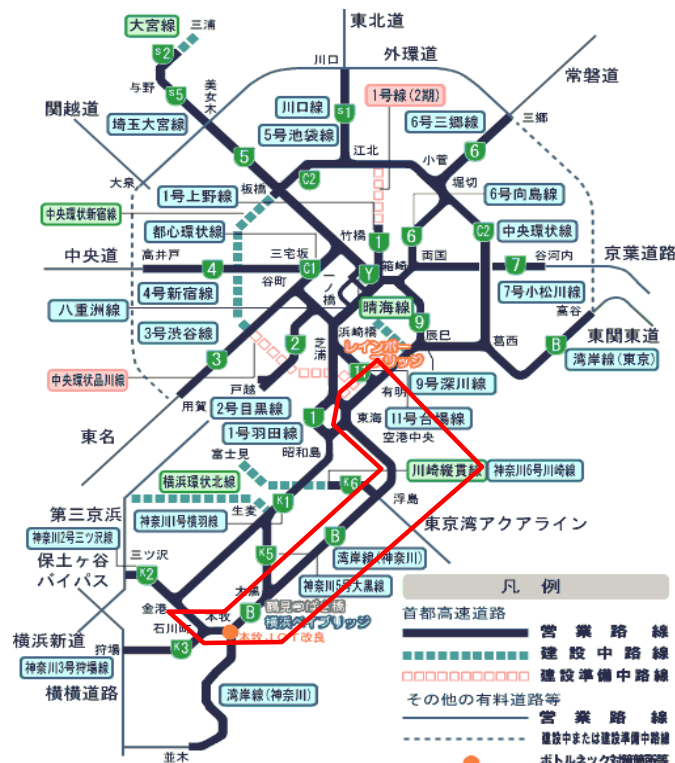
# 3. Expressway BLS Development with DSRC

## (2) Pilot test

- Pilot test starts in fiscal 2005 along two routes
- DSRC beacon placement and ITS OBU development is required

### Kanto area

Route: from YCAT to Haneda airport  
Metropolitan expressway  
Mileage: 23 km (14 mile)



### Kyushu area

Route: from Fukuoka to Kumamoto  
Kyushu expressway  
Mileage: 117 km (73 mile)



# 4. Approach to Utilize Data

## (1) Measures

- Anticipated enhancement of works in each area

Chart: measures to utilize probe data by expressway bus (draft)

|                | Road administration   | Bus operator   |
|----------------|---|--|
| Stored data    | <ul style="list-style-type: none"> <li>• data for outcome rate calculation</li> <li>• performance monitoring on expressway</li> <li>• traffic demand forecast (identify LOS of inter-cities)</li> </ul> | <ul style="list-style-type: none"> <li>• use for operation control</li> <li>• Use for personnel management</li> </ul>  |
|                | <ul style="list-style-type: none"> <li>• use for road works management</li> <li>• use for detour guidance</li> <li>• use for optimal toll charge system</li> </ul>                                      |  |
| Real-time data | <ul style="list-style-type: none"> <li>• use for road control and management</li> </ul>   | <ul style="list-style-type: none"> <li>• use for enhanced user service</li> <li>• use for operation control</li> </ul> |

# 4. Approach to Utilize Data

## (2) Utilizing bus operations to isolate problems along expressways

- Allows a problematic section to be isolated in terms of expressway bus operations
- Allows a priority decision to be made on road planning or works, as well as performance monitoring after the road works

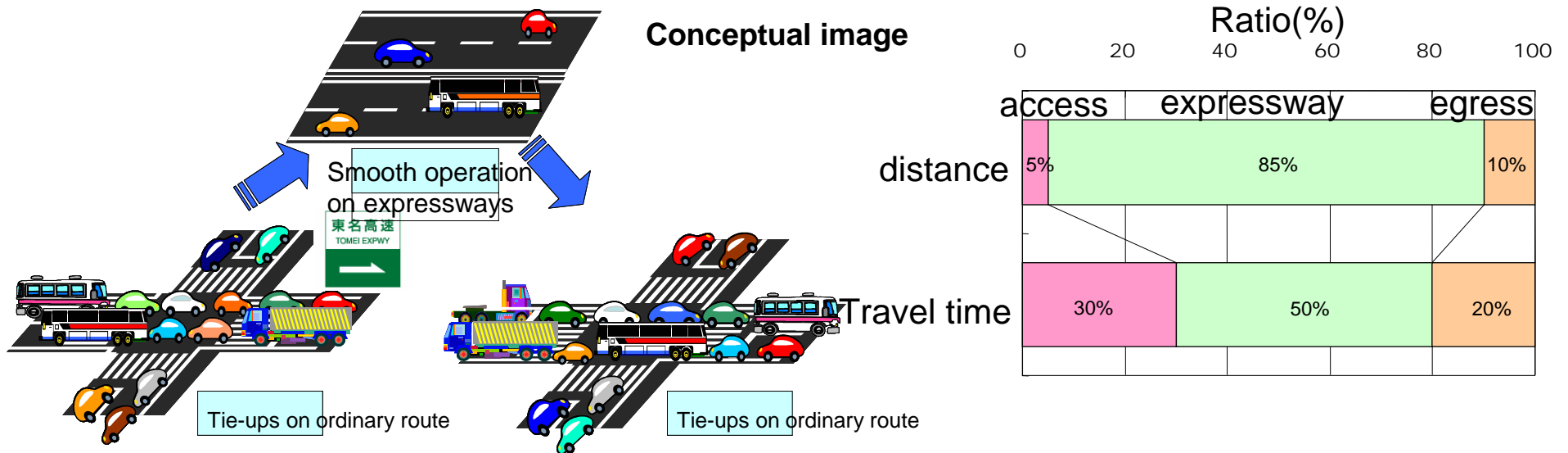


Illustration: operation section composition ratio of access, expressway, and egress sections

# 4. Approach to Utilize Data

## (3) Identify the Level of service (LOS)

- Identifying LOS in each travel mode is of consequence to predict traffic demand
  - Airplane, rail are primarily on schedule → identify of LOS is not difficult
  - Expressway bus : a delay due to tie-ups → identify of LOS is difficult
- History data of bus operations enables LOS to be precisely identified

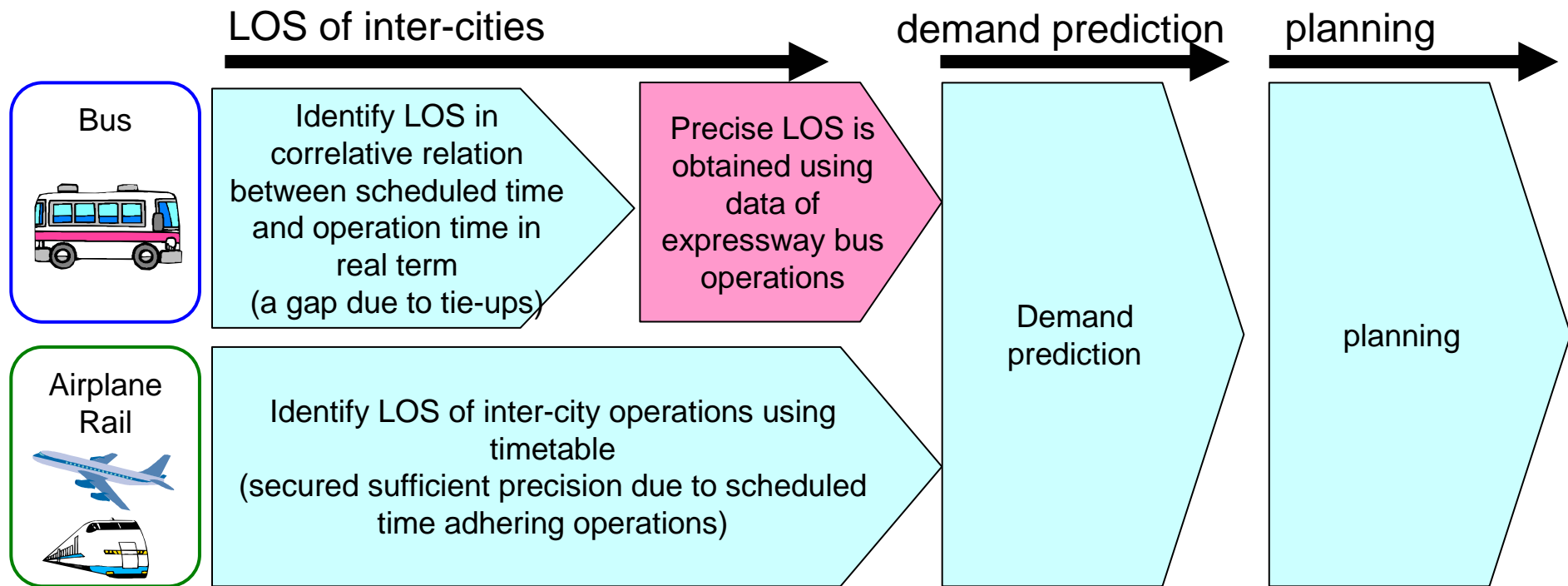


Figure: Planning flow

## 4. Approach to Utilize Data

### (4) Assistance for service vehicle patrolling

- A road operator conducts service vehicle patrolling
- A expressway bus driver will inform of any anomaly  
- their actions help enhance patrolling efficiency along expressways

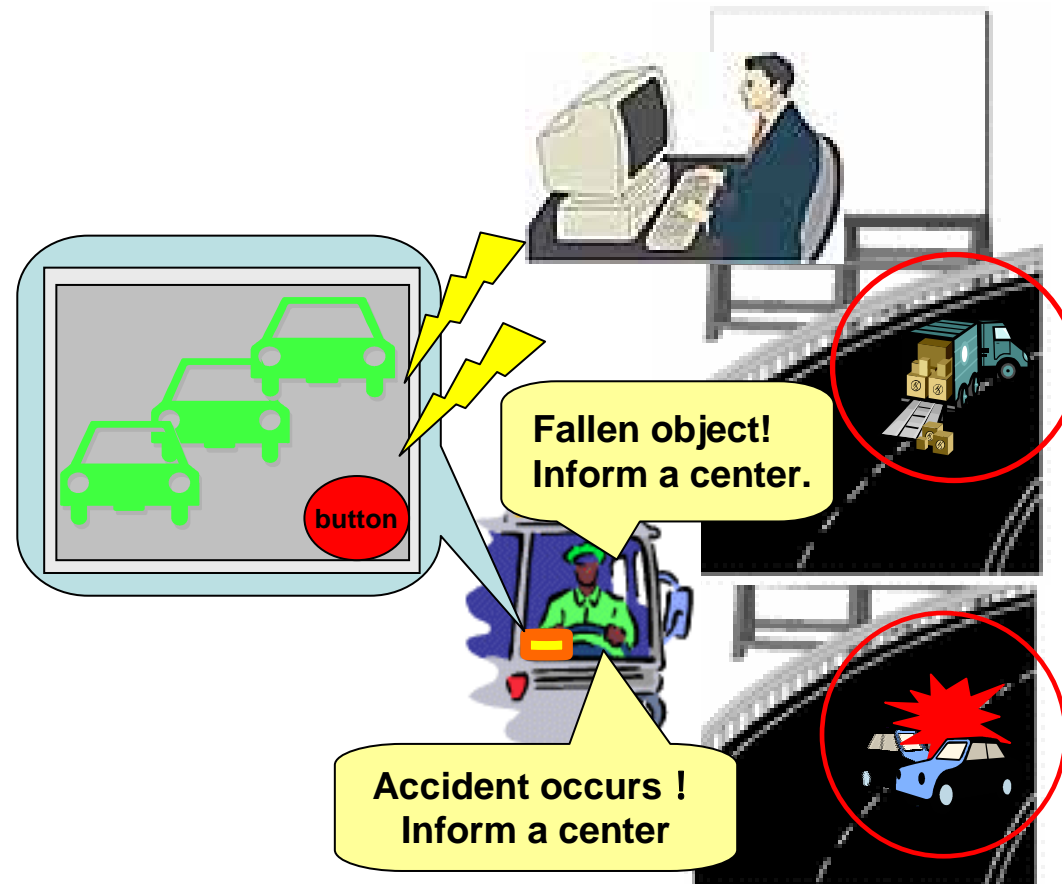


Figure: An expressway bus driver provides assistance for service vehicle patrolling 15



# 5. Concluding remarks

- Wraps on progressive status of Smartway
  - Pervasive VICS · ETC operations
- Proposal of bus location system with DSRC
  - System configuration
  - Pilot test courses in community
- Proposal on approach to BLS data use

# Future Development

- Diversified ITS services are to be operational in 2007
- As of today, of the 200 thousand kms of VICS in service, road traffic information is available over 30 thousand kms
- Enhancement for 'quantitative and qualitative sufficiency' will be achieved, responding to the user's need

## Quantitative sufficiency

### Current



Offering Road traffic information along primary routes

### Future



Offering more precise road traffic information on more routes

# Pilot test on safe driving assistance service

- In-car navigation provides tie-up conditions over a bend section
- A beep and graphic information on-screen make a driver aware in order to prevent rear-end collisions

