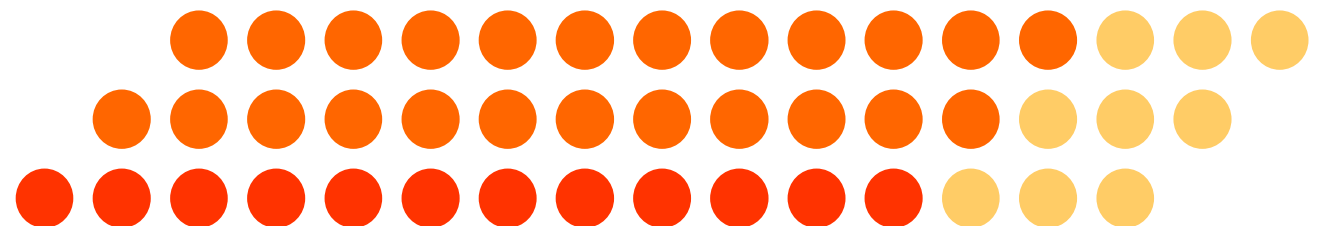


New Advances in Electronic Toll Collection (ETC) Systems

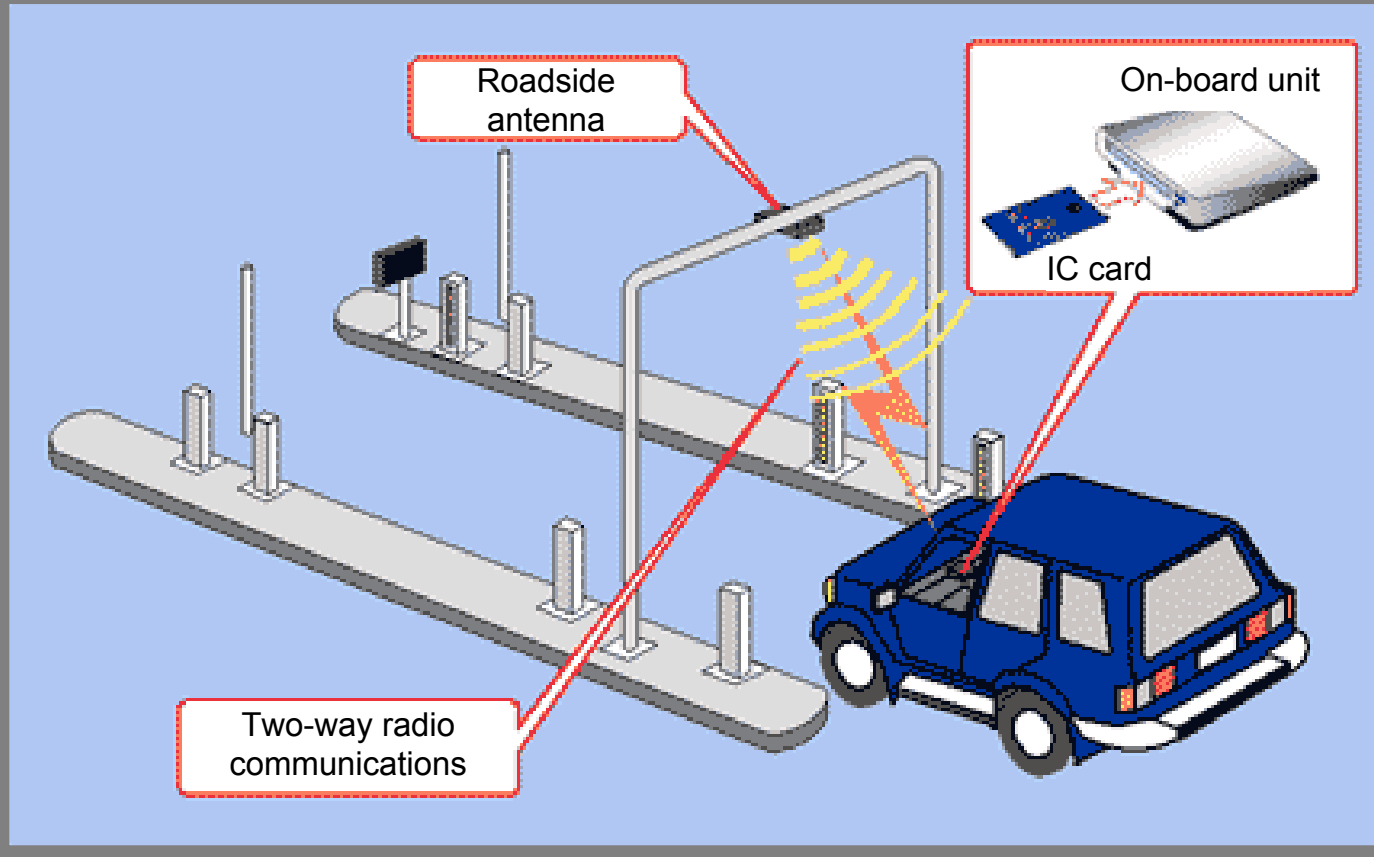
November 2008

Takayoshi Kagei

Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism
Government of Japan



Introduction of ETC



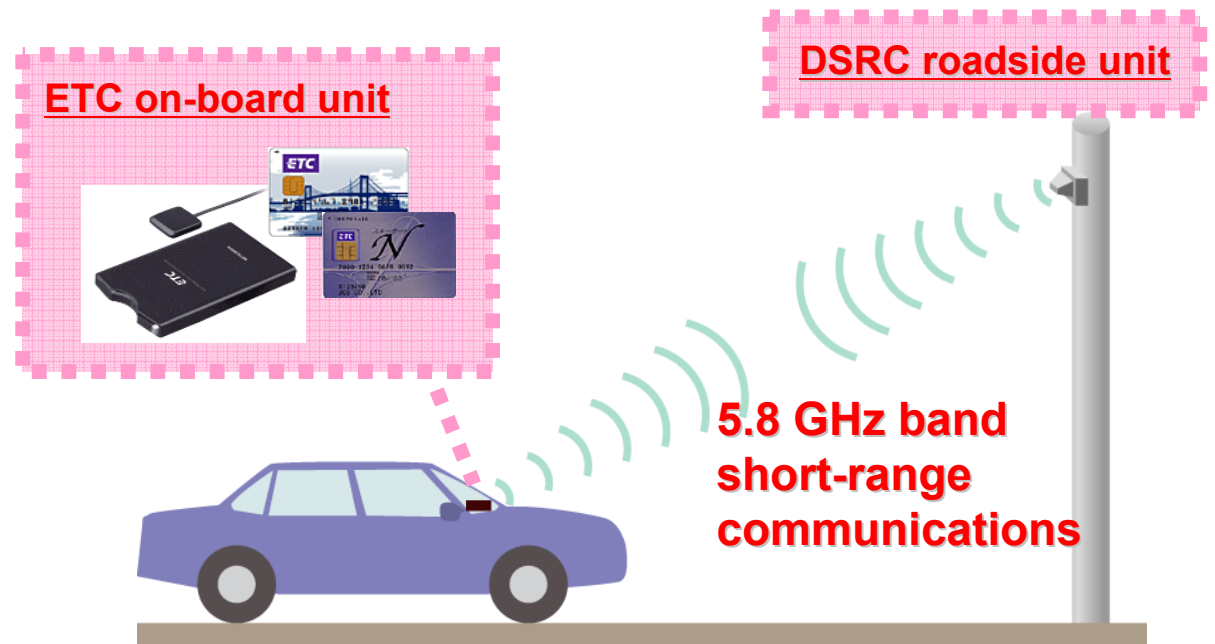
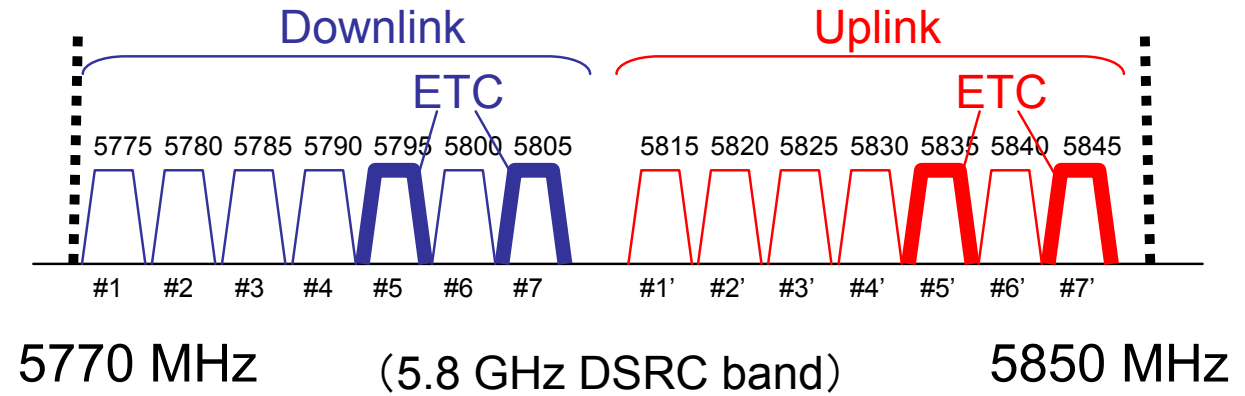
Features of ETC in Japan



<Communications format of the ETC system >

Radio frequency band	5.8GHz band	
System	Active system	
Permitted bandwidth	4.4MHz	
Number of channels (Downlink)	7	
Number of channels (Uplink)	7	
Modulation type	ASK, QPSK (ETC:ASK)	
Transmission speed	1Mbps/ASK, 4Mbps/QPSK (ETC: 1Mbps)	
Radio access type	TDMA/FDD	
Maximum antenna power	Base stations	Mobile land stations
	300mW	10mw

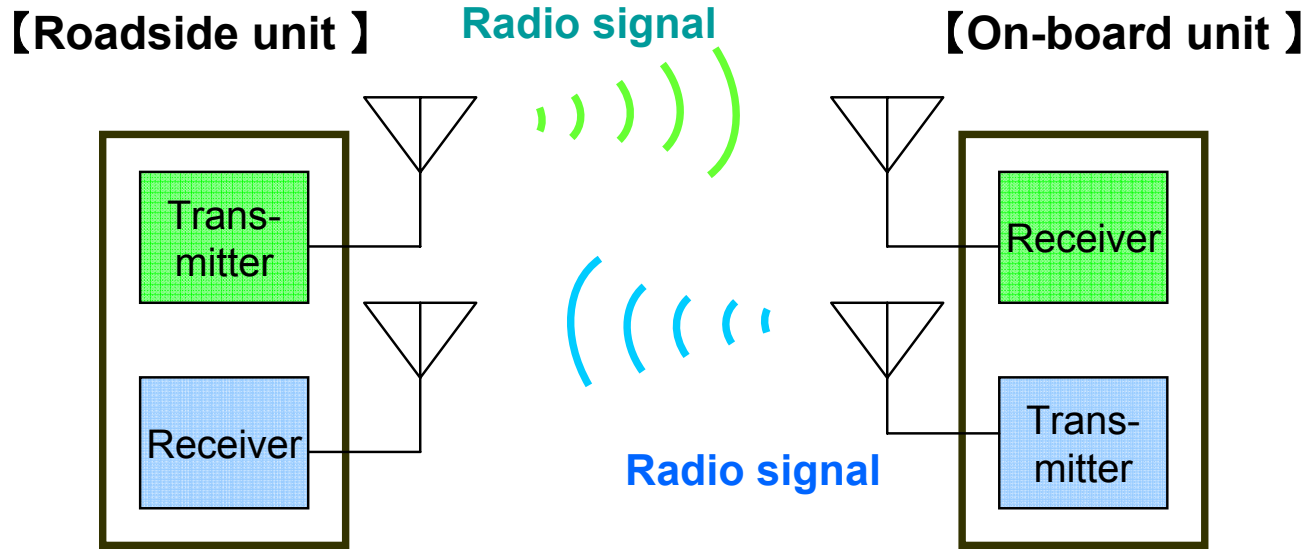
<Radio frequency distribution >



Features of ETC in Japan



<Active DSRC >



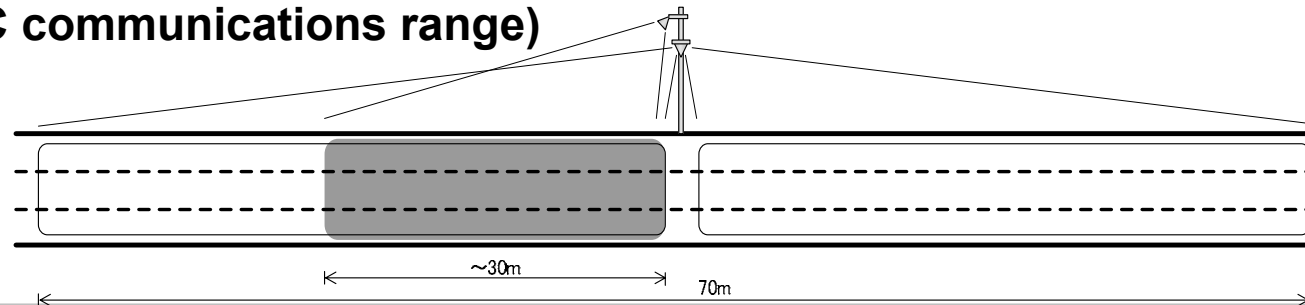
Summary:

Both the on-board unit and the roadside unit have radio transmitters and can send radio signals to each other.

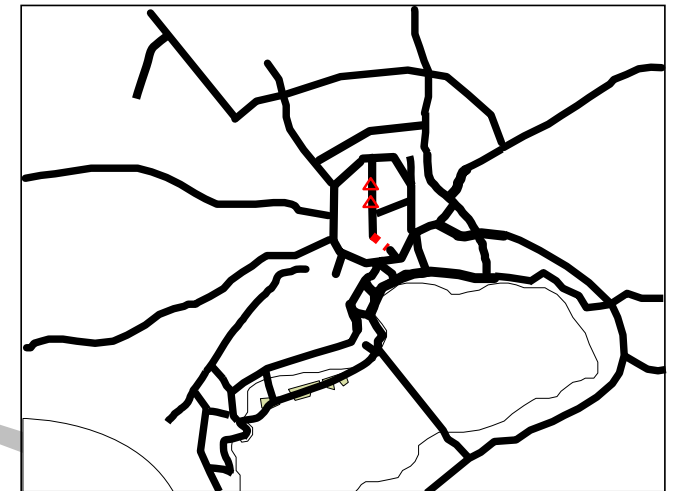
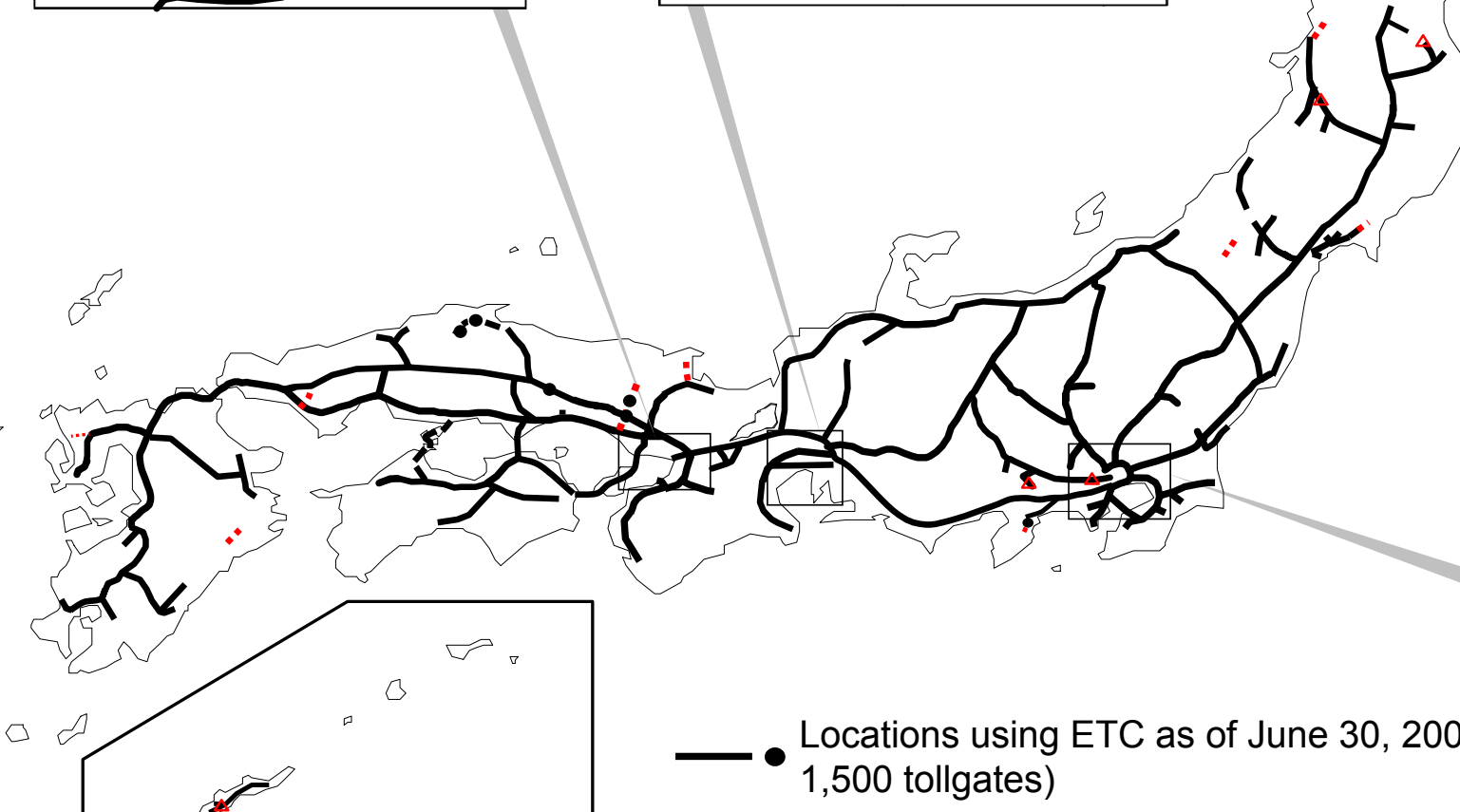
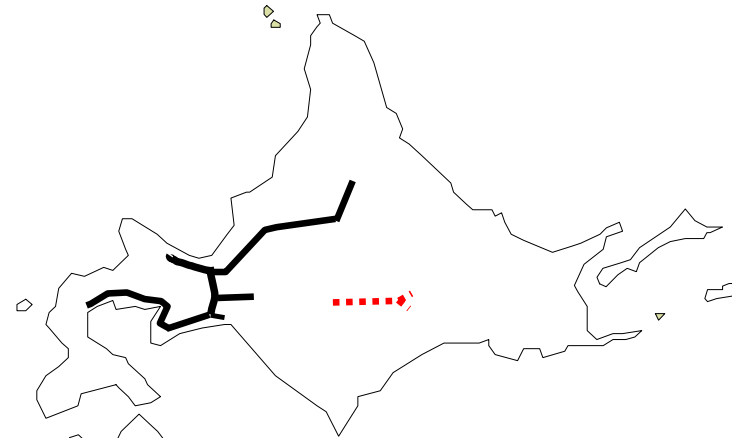
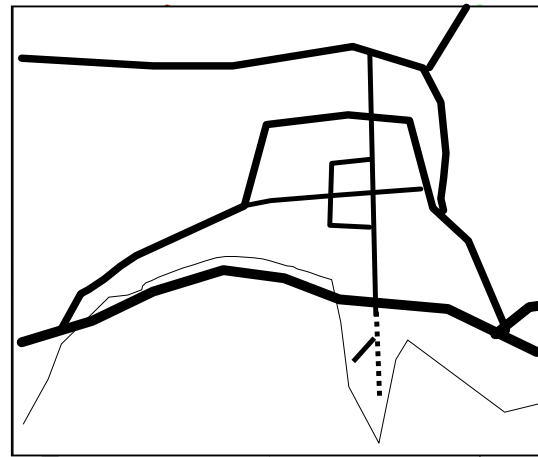
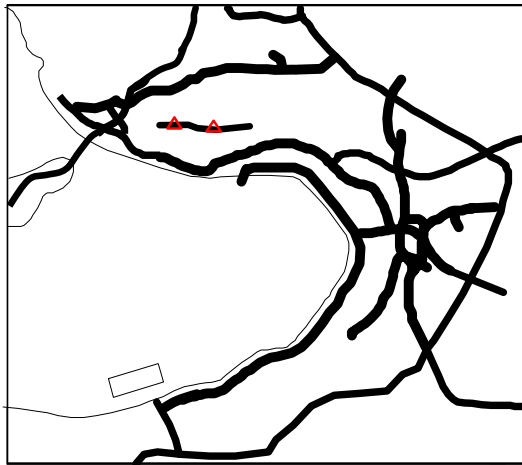
Features:

- Highly reliable communications
- High-capacity two-way communications
- Communications across multiple lanes

(DSRC communications range)



Situation of ETC infrastructure



—● Locations using ETC as of June 30, 2008 (cumulative total: Approximately 1,500 tollgates)

.....△ Locations where ETC has not yet been introduced (However, ETC cards can be used.)

Measures to promote the proliferation of ETC



Issues based on user questionnaires:

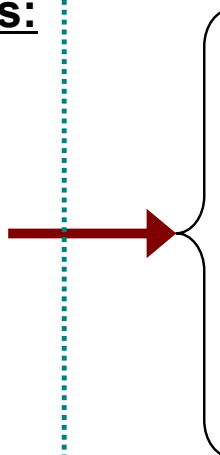
It is expensive to purchase ETC equipment.

Installation and setup are troublesome.

I don't want to use a credit card.

I need a receipt.

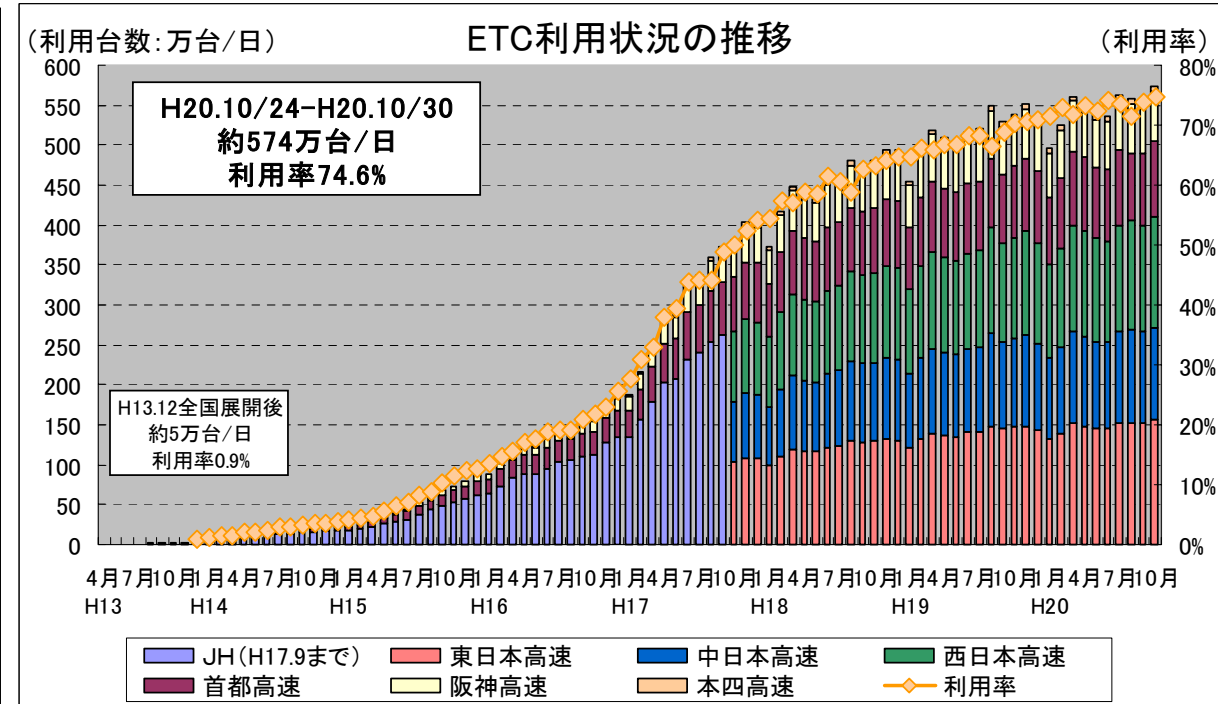
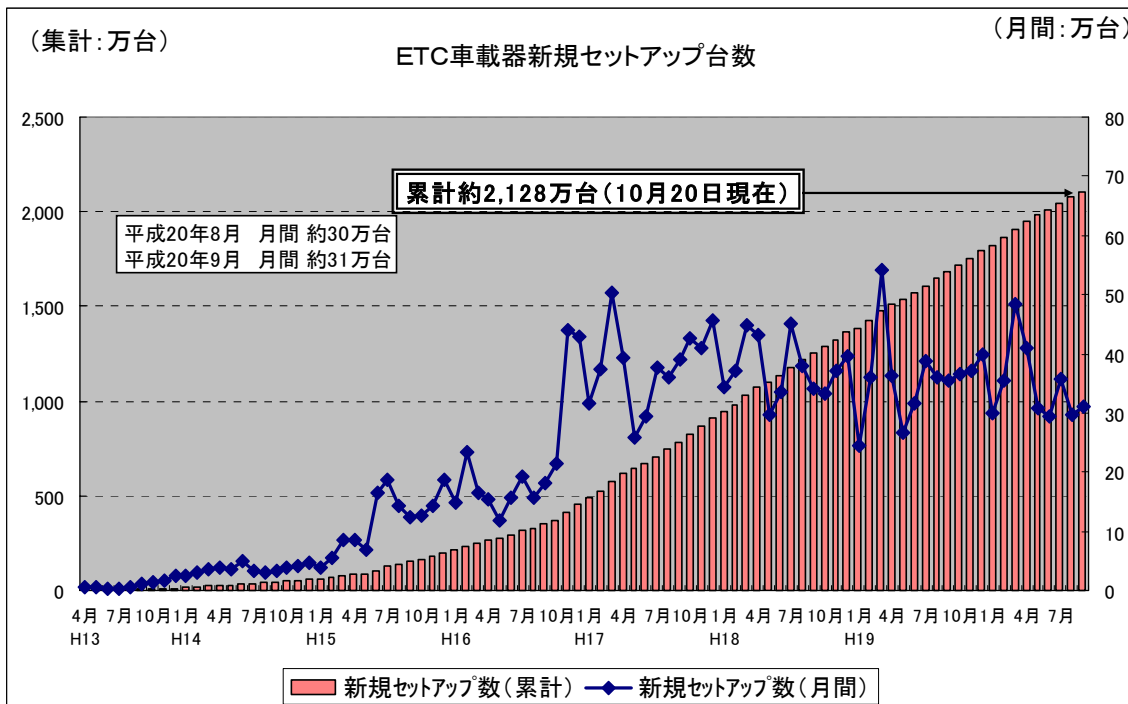
I'm thinking about replacing my car.



Measure to promote proliferation	Details
ETC leasing program	Upon the introduction of ETC, users receive a fixed subsidy from the national government.
Free on-board unit campaign	Provide free ETC on-board units by adding a subsidy to the ETC leasing program for persons such as new purchasers of ETC cards.
Free mileage points	Upon the introduction of ETC, expressway companies are awarding mileage points for users.
One-stop service	With this service, users can obtain an ETC card, purchase an on-board unit, and get it installed and set up at one location, on the same day.
Personal Card	ETC card depositing funds in advance and having the toll charges deducted from their bank accounts.
Providing usage history records	ETC usage history records are available via the Internet and from desktop printers at service areas and parking areas.
Standard installation	ETC standard equipments (The carmakers are increasing these figures every year.)

Penetration of ETC on-board units

- Approximately **20.1 million** ETC on-board units have been installed (as of October, 2008).
- The ETC utilization rate on expressways nationwide is **74.6%** (as of October, 2008).

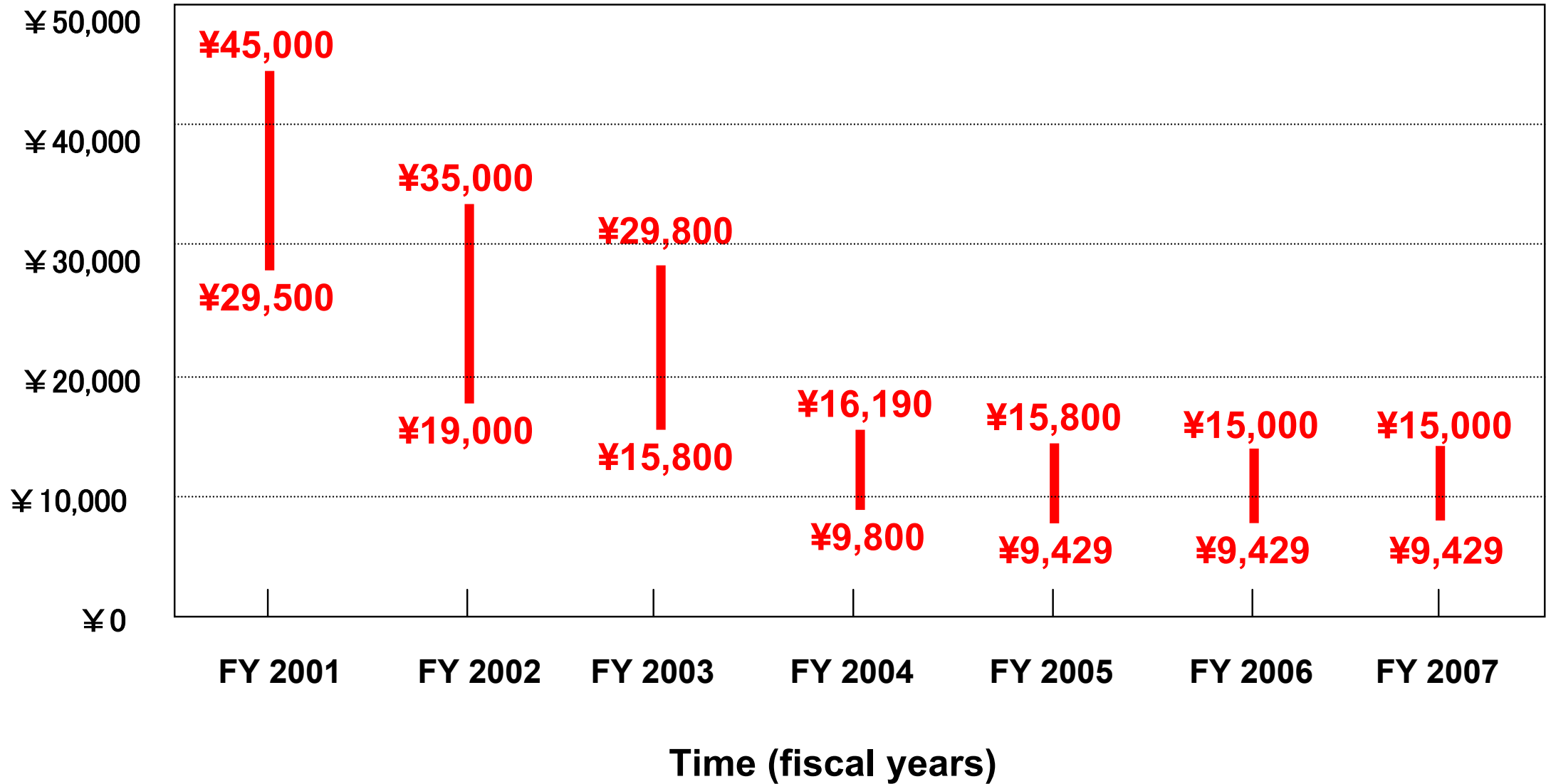


Price distribution of ETC on-board units



< Trends in ETC on-board unit prices >

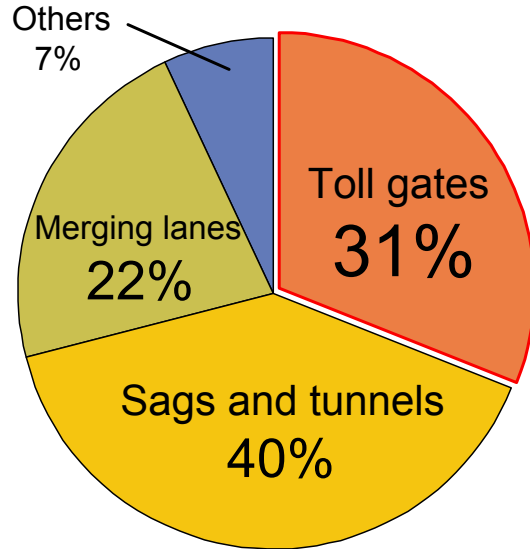
Manufacturer's suggested retail price (yen)



Effects of ETC penetration

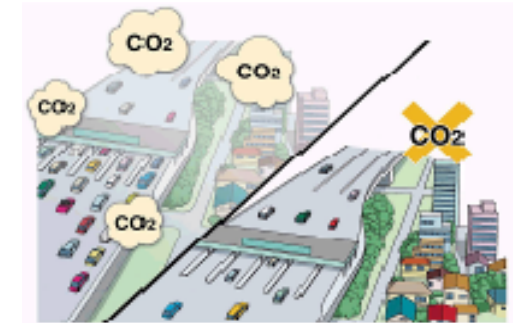
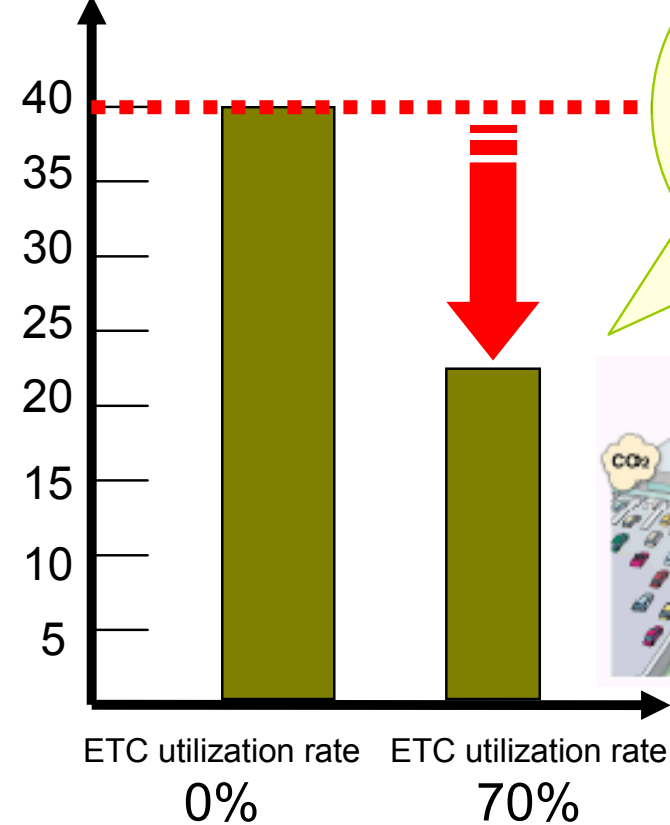


Causes of congestion on expressways

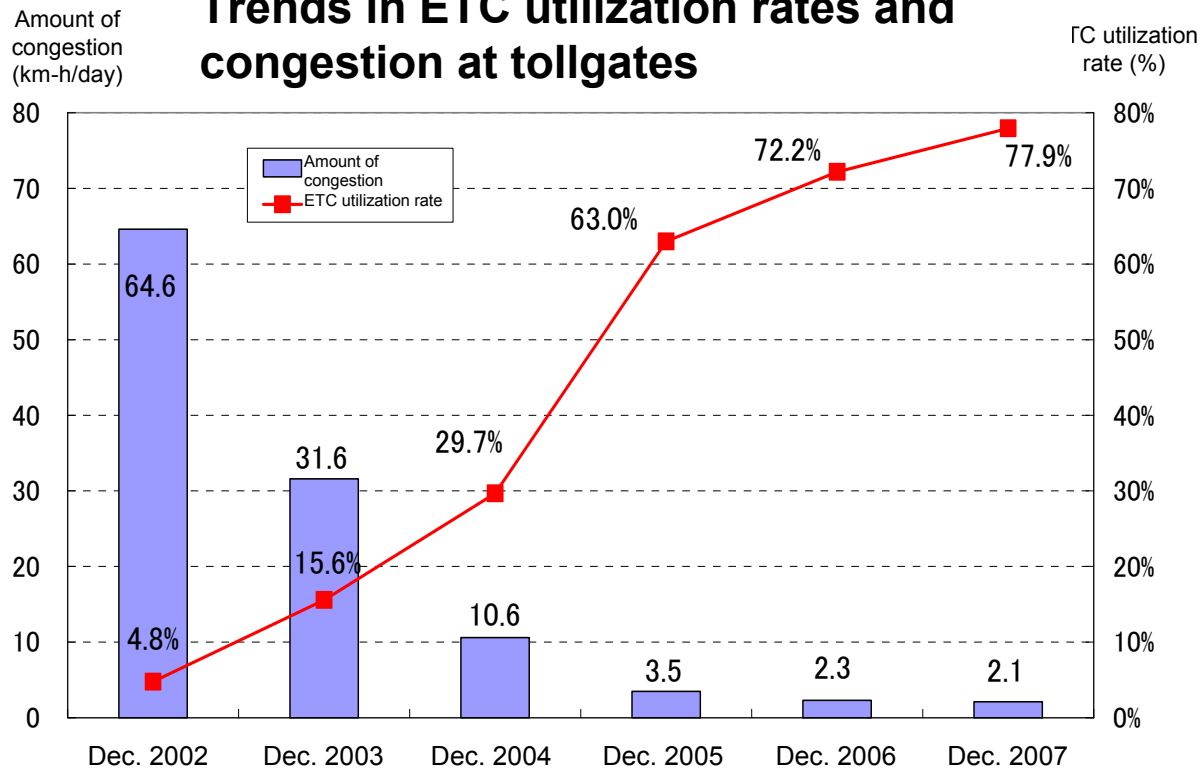


Reduction in carbon dioxide emissions due to ETC

(10,000 tons CO₂)



Trends in ETC utilization rates and congestion at tollgates



Measures using ETC : Smart interchanges

Ordinary interchanges



Problems:

- The cost of labor to collect tolls is high.
- Construction costs are high, and facilities need to be concentrated to limit toll collection expenses.



Smart interchange (directly off the main route)



Smart interchange (off a service area or parking area)



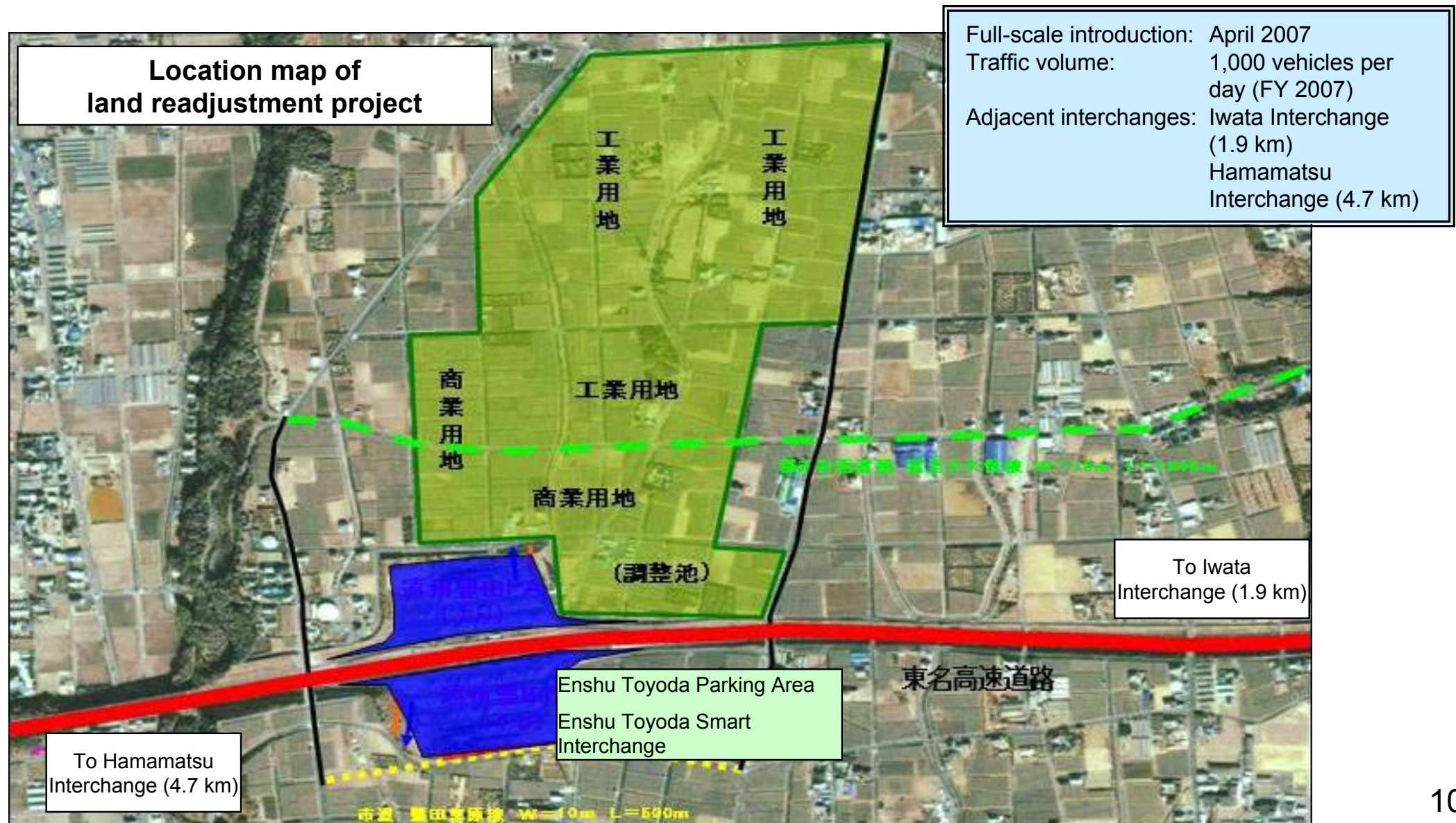
- Because smart interchanges use ETC, there is no need to concentrate the toll collection facilities, and they can be compact.
- The cost of labor to collect tolls can be saved.
- New interchanges can be added efficiently, contributing to regional revitalization and more efficient distribution through the effective use of expressways.

Effects of smart interchanges : Regional economic revitalization



Example: Enshu Toyoda Smart Interchange on the Tomei Expressway

- Attract 13 factories and other businesses, one large-scale commercial facility, and one lodging facility.
- About 2,700 jobs will be created through the establishment of these businesses.



Measures using ETC : Diverse and flexible expressway toll pricing measures

A certain quantity of stock has been established (expressway network):



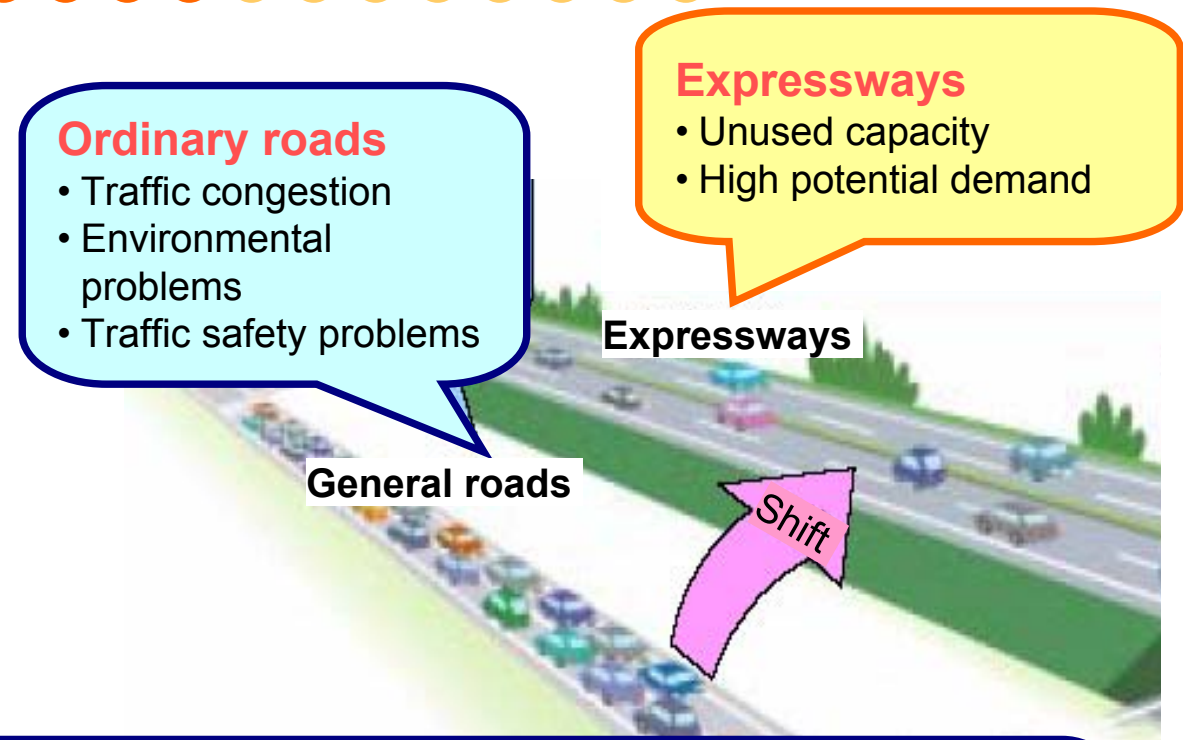
The focus changes from construction to utilization of the expressway network.

Ordinary roads

- Traffic congestion
- Environmental problems
- Traffic safety problems

Expressways

- Unused capacity
- High potential demand



Outline of diverse and flexible expressway toll pricing measures



**Mileage discount
(up to about 13.8%)**

**Volume and frequency discount
(up to about 30%)**

Higher effective discount rates are obtained by combining multiple discounts.

**Commuter discount
(50%)**

**Early morning and
night discount
(50%)**

**Late-night discount
(30%)**

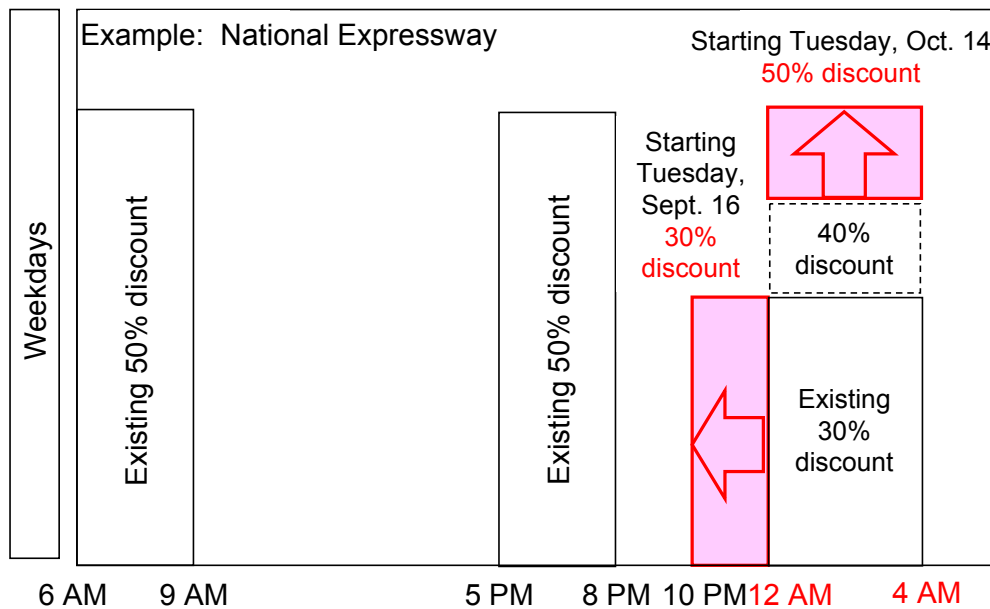
Implementing economic measures by reducing expressway tolls



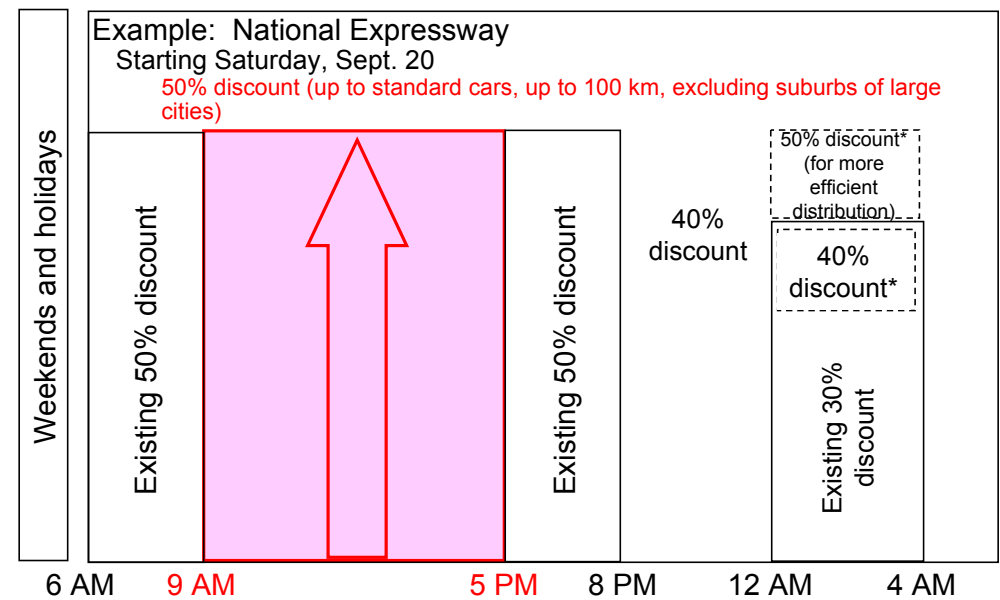
"Emergency Policy Measures for Achieving Peace of Mind"

○ The following toll charge discounts are provided to vehicles that use ETC radio transmission to pass through tollgates.

(1) Expanded late-night discount and night discount time span



(2) Daytime discount for non-working days in the provinces



* Planned implementation from Saturday, Oct. 18, 2008 to Jan. 31, 2009

Toll charges are reduced at night, when a great deal of long-distance freight transport occurs, contributing to **more efficient distribution**.

Toll charges are reduced on weekends and holidays, when a great deal of tourist and leisure travel occurs, contributing to **regional revitalization (promoting tourism)**.

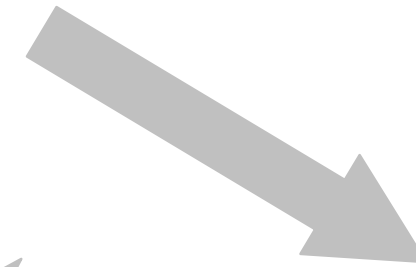
Multipurpose use of ETC



ETC = Toll roads



The vehicle identification function of ETC on-board units is now used for multiple purposes.



Parking garages



Cars can now pass through the exit gates of parking facilities in much less time.

Shopping malls

Parking facility entry/exit management at department stores and shopping malls.



Tourism toll roads

Automated fee payment and automatic gate opening.



Ferries

Boarding procedures are greatly simplified.



Smartway services with expanded ETC technologies



Diverse media

VICS receiver (2.4 GHz)

+

ETC on-board unit (5.8 GHz DSRC)

ITS on-board unit (5.8 GHz DSRC)

Car navigation system

Car navigation system

VICS (wide-area, detailed road traffic information)



Shinjuku-Dori Ave. near Yotsuya-Mitsuke: Congested for 0.5 km

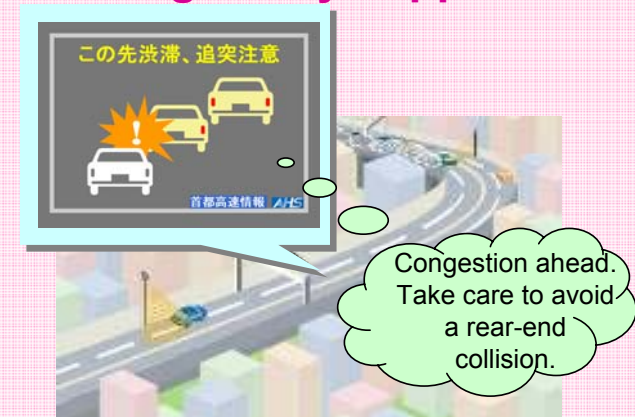
Fee payment at parking facilities, etc.



In-car Internet access



Driving safety support services

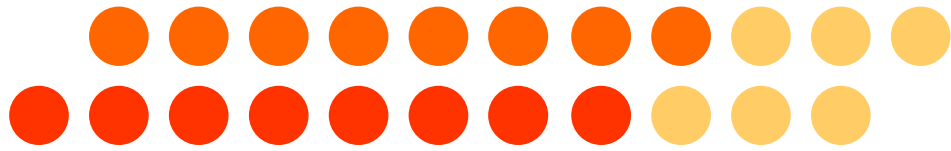


Summary



Japan's Electronic Toll Collection (ETC) ...

- **adopted the technical format that is high level of accuracy and highly reliable.**
- **has spread rapidly and Its benefits are now well established throughout Japan.**
- **is now used in various situations and deployed to various applications.**



Thank you !

