ITS Intelligent Transport Systems

ETC in Japan

Ministry of Land, Infrastructure and Transport

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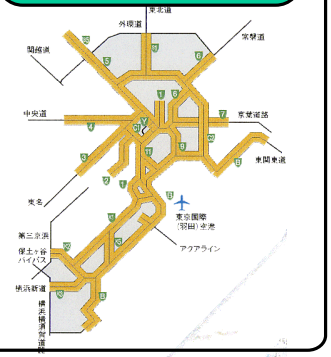
ETC Deployment in Japan

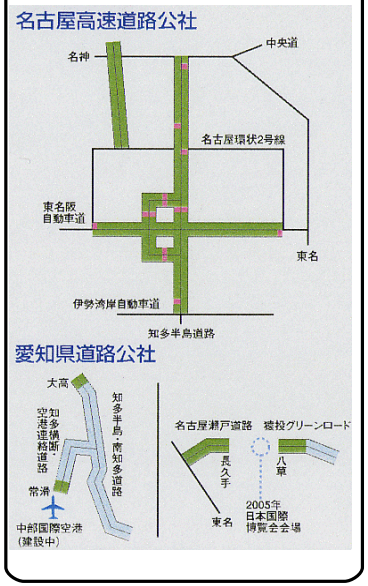
- launched in March, 2001
- Interoperable and compatible in all over Japan
- Basically all toll gates are equipped with ETC facilities. (About 1,200 toll gates)

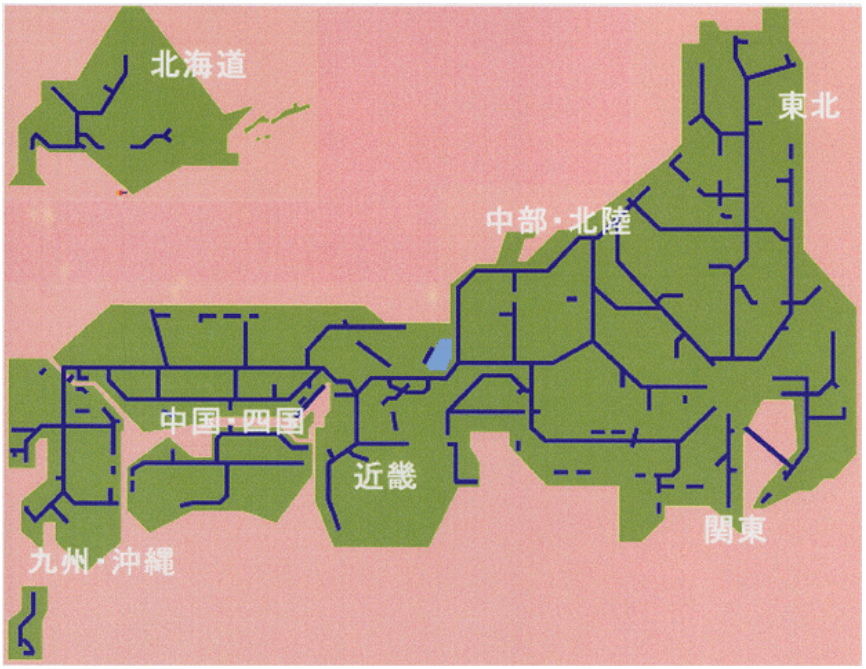
Hanshin Expressway

Metropolitan Expressway



Nagoya Region

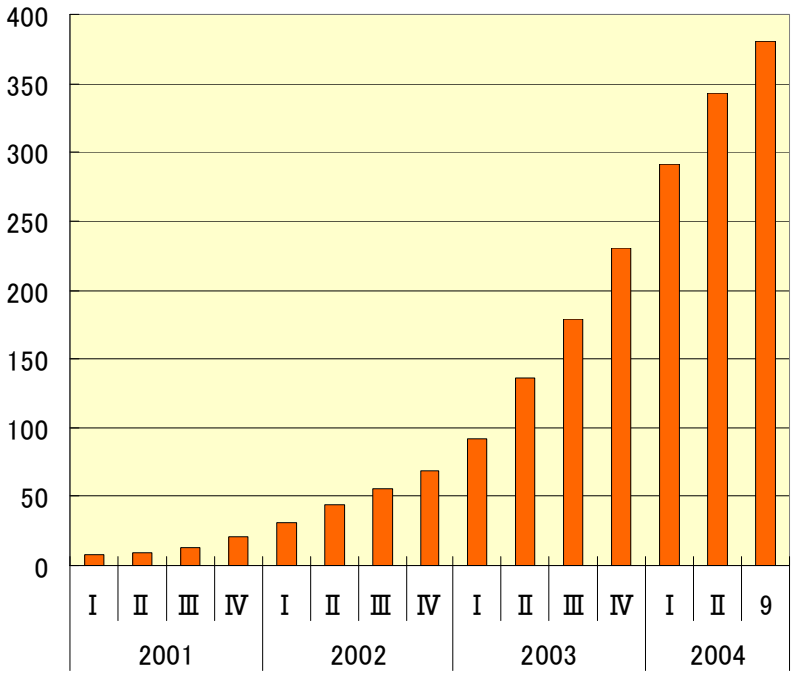




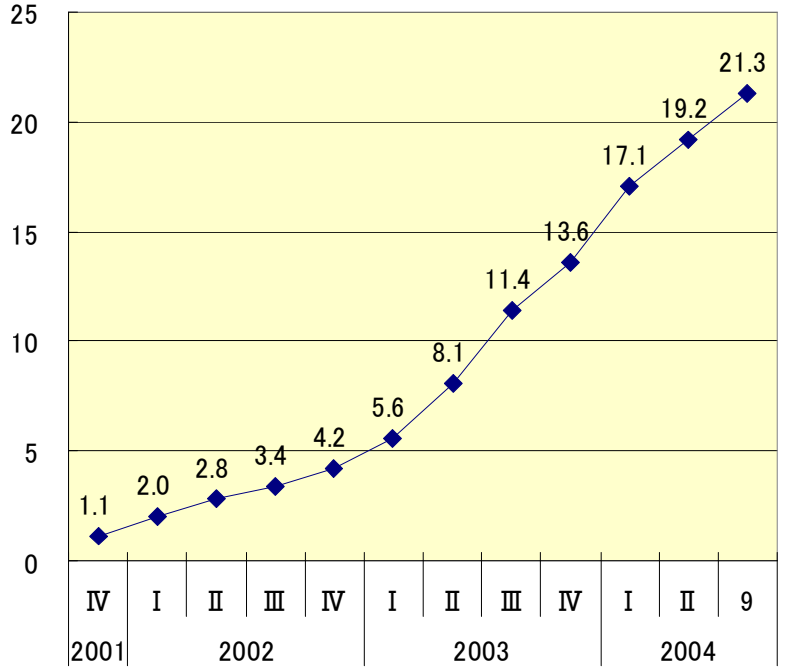
Spread of In-Vehicle Devices

- The 3.8 million in-vehicle devices are marketed in September, 2004.
- Currently 20% more drivers pay their highway toll by ETC.

The total number of marketed in-vehicle device



The percentage of drivers paying toll w ith ETC



Components of ETC

- ETC is composed of three components

1. In-Vehicle Devices
2. Smart Cards (ETC cards)
3. Roadside Equipments

Characteristics of In-Vehicle Devices

- In Japan, an in-vehicle device is separated from a smart card.
- In-vehicle device and smart card have their own functions.

In-Vehicle Device

- Communication with roadside
- Memorizing vehicle data
- Exchanging information with smart card

Smart Card

- Memorizing data for settlement

Functions of In-Vehicle Devices-(1)

■ Functions of in-vehicle devices

-Memorizing vehicle data when the device is installed at auto supply store

->Corresponding to Japanese toll price system depending on vehicle class

-Protecting the secure information with Security Application Module (SAM)

-Using the fast handshake type communication having consistency with international standards (ITU-R M1453, ISO15628)

Functions of In-Vehicle Devices-(2)

- Produced and sold by private companies

- Various types of in-vehicle devices are marketed in.

Integrated with
car navigation system

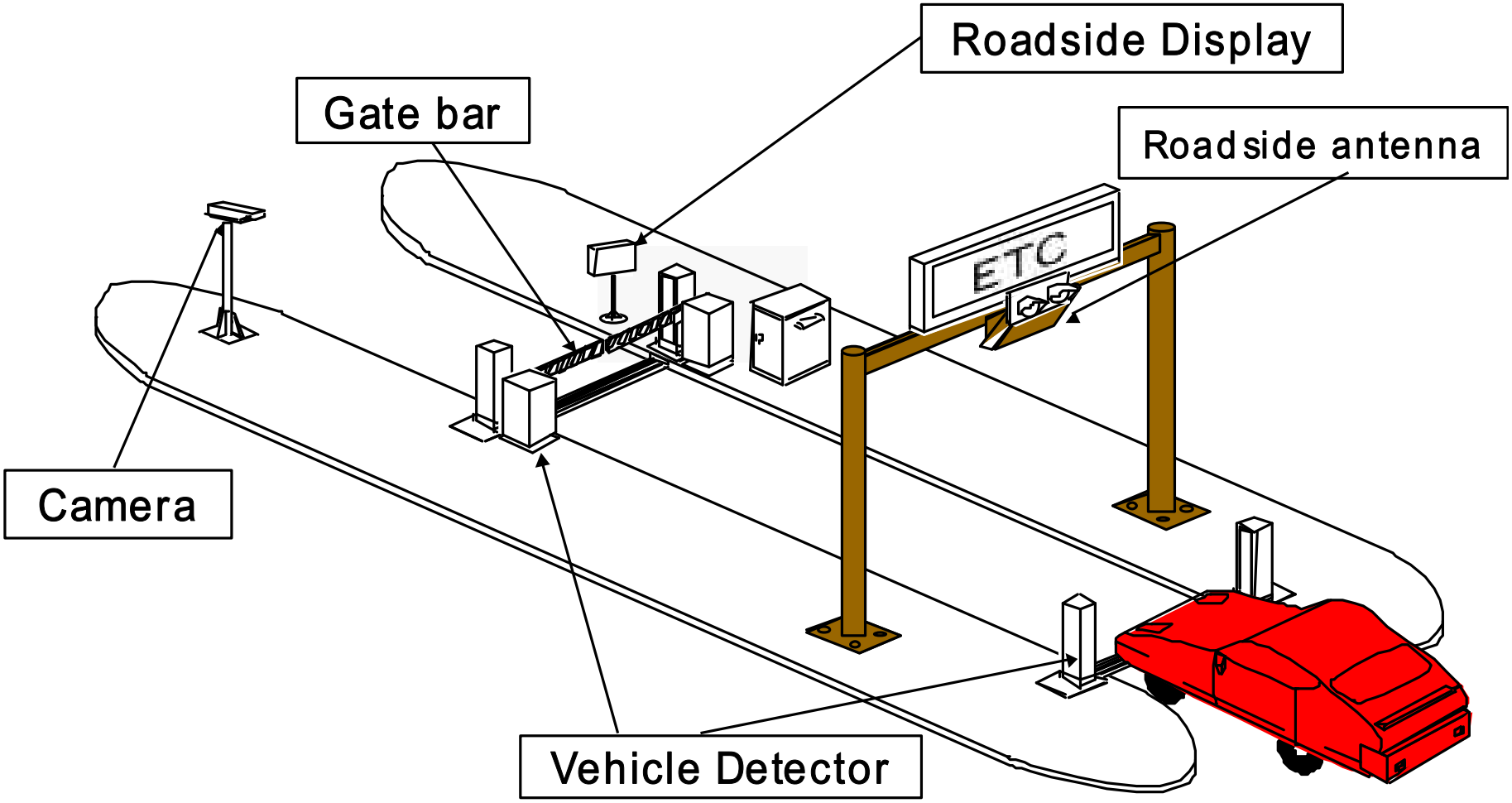
Built-in

Overhead

Characteristics Smart Cards

- Memorizing payment information
- Issued mainly by credit card companies as the specialized card for ETC
- Provided with encrypted data to ensure information security
- Having consistency with ISO/IEC standards (ISO/IEC 7816 etc.)
- IC chip can also include the other applications .
  (Ex. ETC card with credit card function)

Roadside Equipments

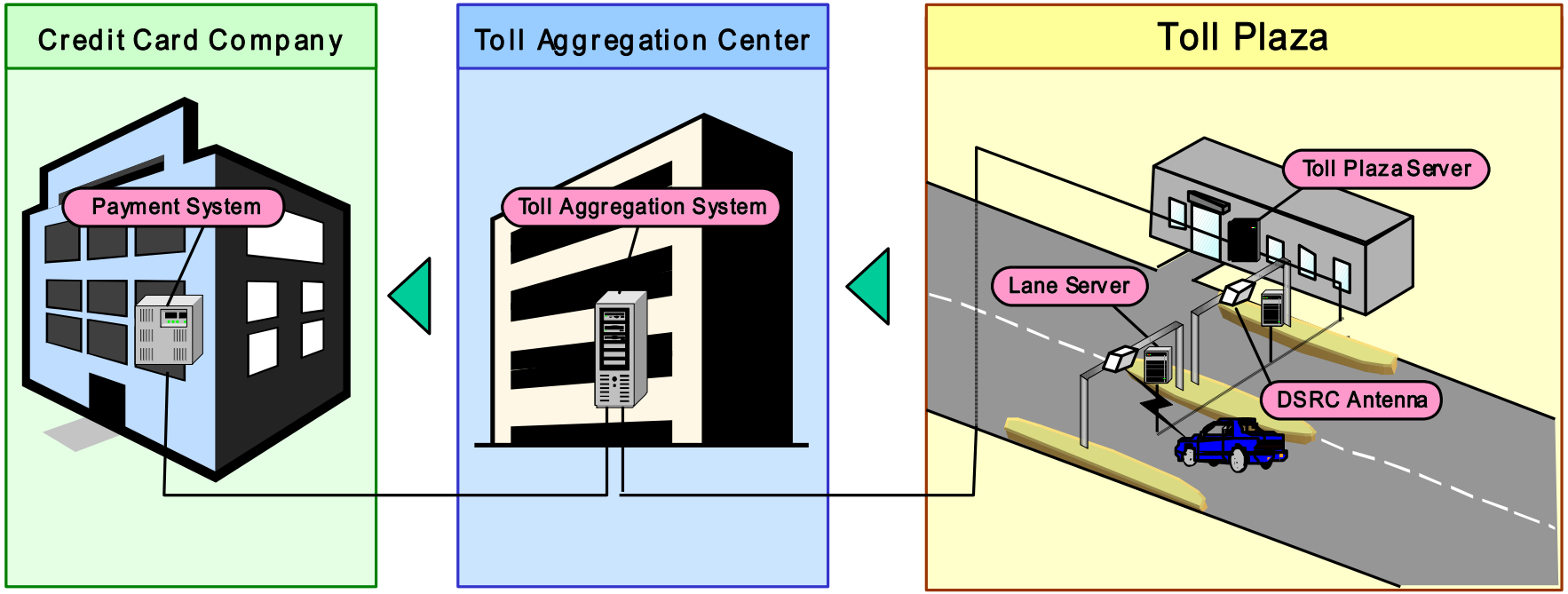


Back Office System

-Lane Server : Communicating with in-vehicle devices and calculating a toll

-Toll Plaza Server :Collecting toll logs from Lane Servers from Toll Plaza Servers

-Toll Aggregation System : Correcting the toll information and transfer it to credit card companies



Stakeholders

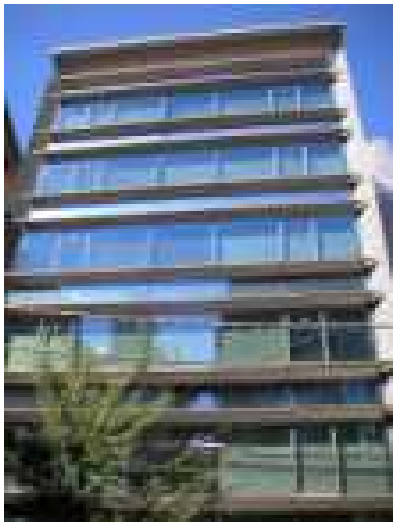
- Stakeholders in ETC operation

1)Users
2)Toll Road Operators
3)Credit Card Companies
4)Security Administrator(ORSE)
5) Car dealers and auto supply stores

Security Administration

- ORSE is responsible for managing encryption keys for secure information.

Outline of ORSE



Establishment : Sep.,1999

Activities

- Disclosure of standards for data security in ETC system
- Offer of processed data for identification in ETC system
- Enhancement of ETC-related technologies through R&D
- Standardization of ETC system
- Promotion of ETC system

Enforcement

- Gate bar ··· Open to allow the passage of authorized vehicles
- Cameras ··· A supplementary measure for preventing unauthorized vehicles from passing

Gate Bar

Camera

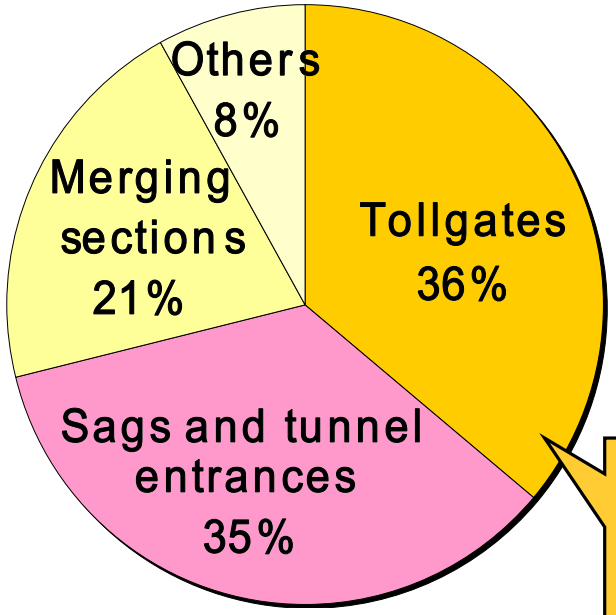
Objectives

- Three objectives of ETC in Japan

1) Reducing congestion
2) Improving convenience for users
3) Improving surrounding environment

Objectives -Reducing Congestion-

Roughly 30% of all traffic congestion on Japanese toll roads occurs at toll gates.



Insufficient processing capacity at tollgates

Manual tollgates:
(230 vehicles / hr)

Approx.
3X - 4X

Improvement in vehicle throughput by ETC (by 300-400%)
(800 vehicles / hr)

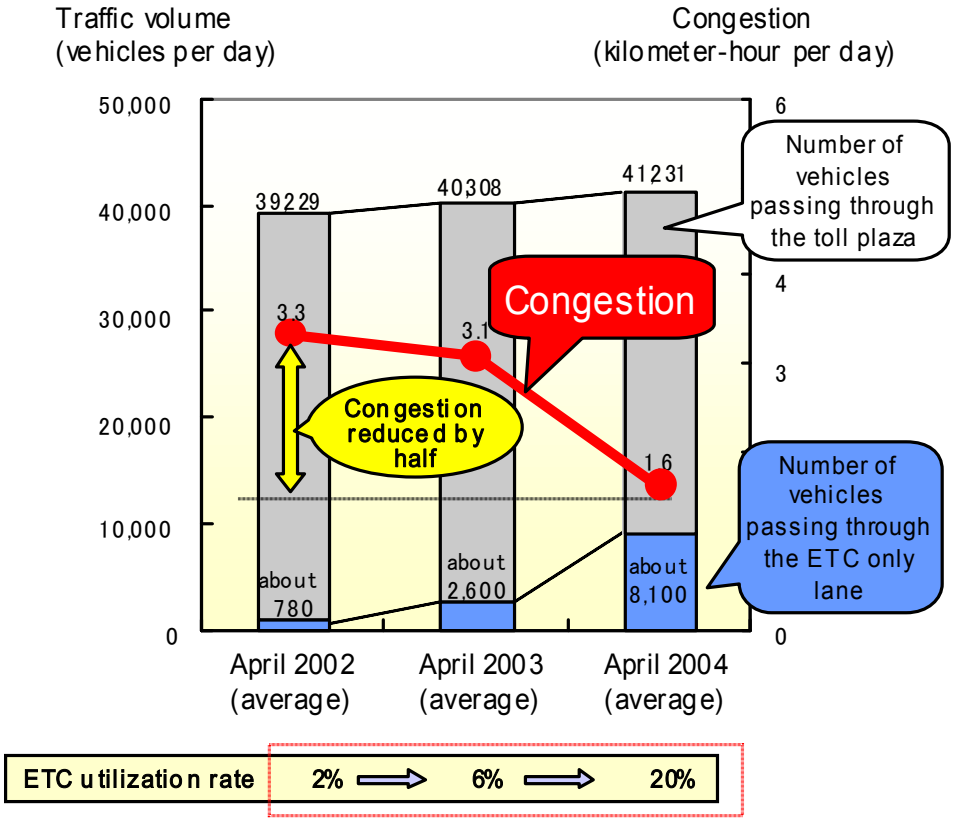
ETC Gate

Traffic congestion at toll gates is expected to decrease due to the spread of ETC

Benefit -Reducing Congestion-

- The spread of ETC has decreased congestion by half, even though traffic volume has increased.

Fig. Present Toll Plaza
(Kawaguchi Toll Plaza)

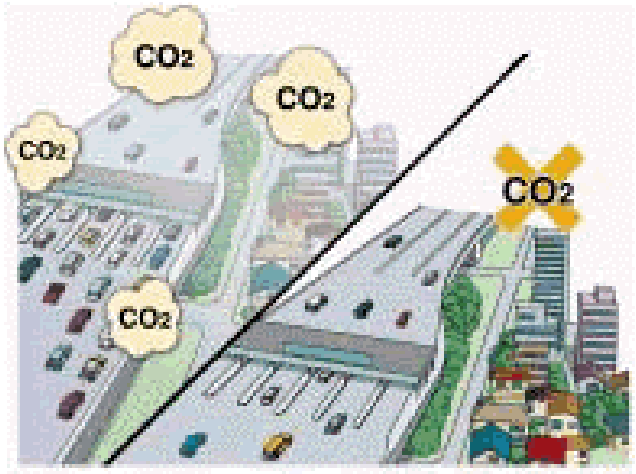


Objectives -Improving convenience and surrounding environment-

- Improving user convenience with cashless system that eliminates the bother of handling coins

- Improving surrounding environment by reducing traffic congestion around toll plazas

Before introduction of ETC	Increase in ETC utilization rate	After introduction of ETC
Carbon dioxide (CO2) Nitrogen oxides (NOx)	→	Roughly 20% reduction



Objectives -Other-

- The electronic collection of tolls makes it possible to introduce the diversified toll price system.

- In comparison with conventional IC having high costs due to their complex structure, ETC IC (Smart IC) results simple structure and in lower costs.

Lessons Learned

■ The anticipated price of an in-vehicle device was 10,000 Japanese yen(about 100 US$).

- Not achieved for high level security function
- But currently it closed to the ideal price for the efficient of product volume.

■ The anticipated smart card for ETC was a general IC credit card.

- Not achieved for high level security function and no-generalized system elements without facing settlement and PIN

Future Deployment

- The following services will be realized on the base of widespreading ETC.
  - Vehicular information transmission (probes, facility entry/exit management)
  - Fee payment (parking fees, multi-purpose payment)
  - Information supply (regional guides)
  - Data and warnings (driving support information)
- These services are targeted for realization by 2007