NISSAN

Japan Market Case Study
Collaborative Advanced Driver Assistance Systems using Vehicle to Infrastructure technologies

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Disclaimer

This presentation refers to advanced technology and innovation in the Japanese transportation market, a suite of technologies that is rapidly advancing. A best effort was made to present the market situation as accurately as possible. However, Nissan Motor Company and its representatives can not assume responsibility for any errors.

Agenda

1. Japanese government goals
2. Overview of Industry / Government Cooperation in Japan
3. SKY Project
4. National Project
5. Summary and conclusions

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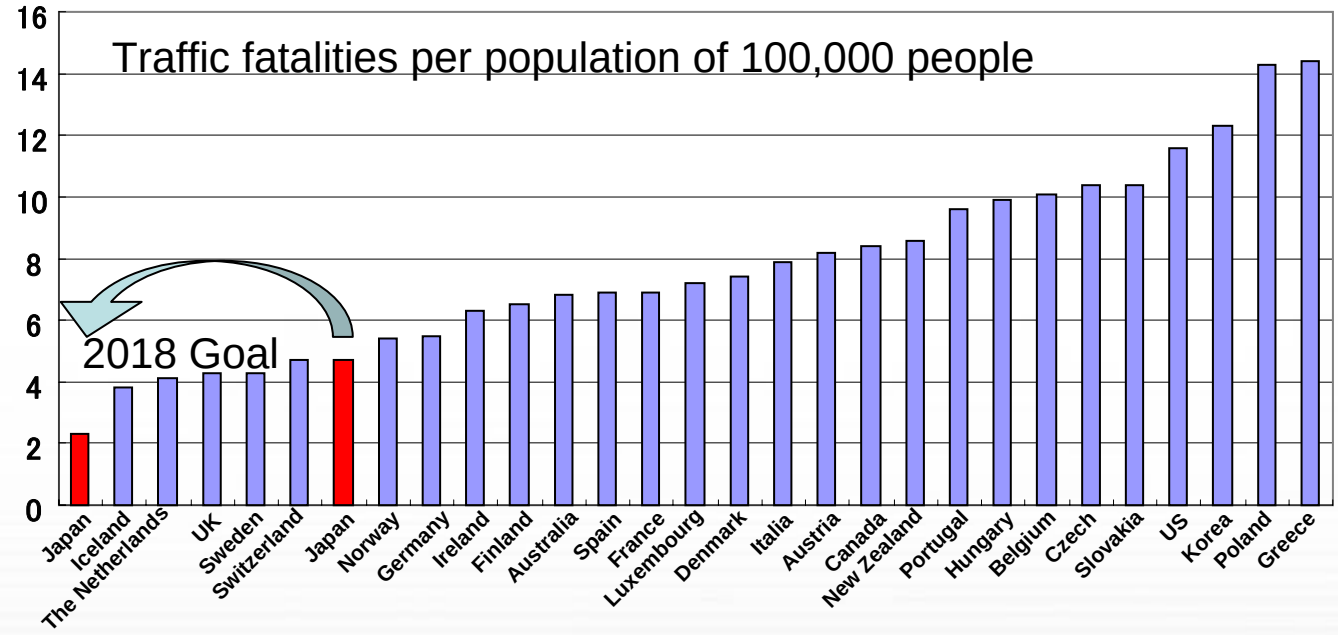
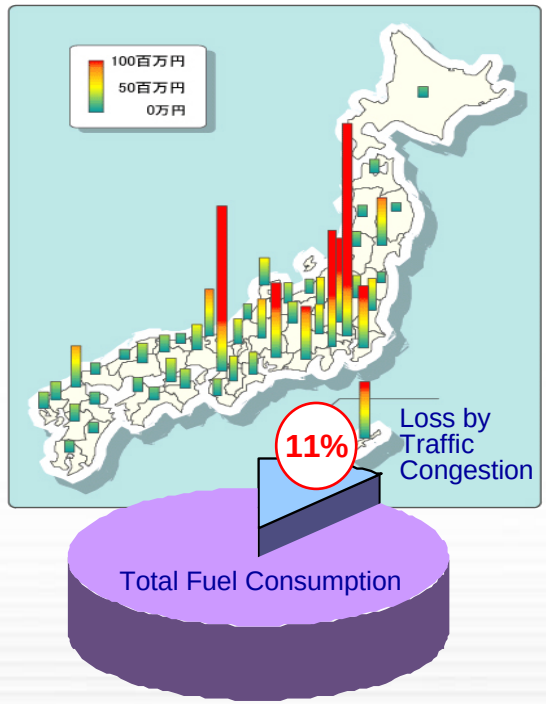
Japanese Government's Goal for Traffic Safety

- Under 2,500 traffic fatalities by 2018 to become the world safest transportation network.
- Reduce economic loss due to traffic congestion.





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SKY Project Overview

SKY PROJECT

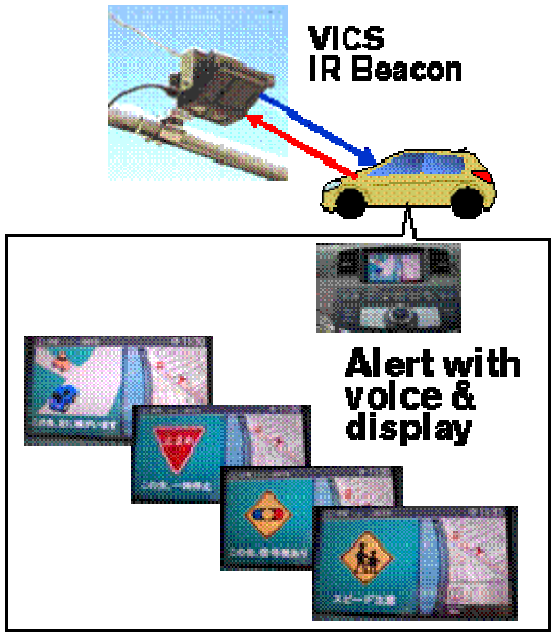
Start ITS from Kanagawa, Yokohama

Field Operation Test with public sectors and partner companies

- Objective
  1. To help reduce traffic accidents
  2. To ease traffic congestion utilizing ITS.
- Measures

  Collaboration with infrastructure, in addition to in-vehicle technology.

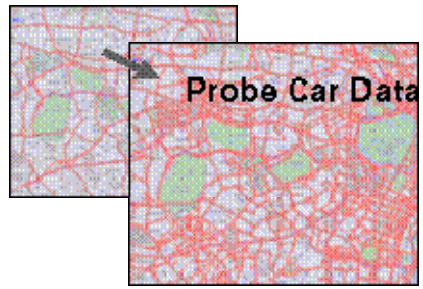
  Use of information on the status of nearby vehicles and the surrounding traffic environment.



- Partners

NISSAN NTT docomo Panasonic clarion

National Police Agency Japan, Kanagawa Prefectural Police
Universal Traffic Management Society of Japan(UTMS)



ITS 2010 – Japan National Project

- Objectives

Enabling Infrastructure
Develop low cost Driver Safety Support System road side units.

Safety
Reduce pedestrians / bicycles / small motor bikes accidents using Vehicle to Pedestrian or bikes communication.
Reduce Right turn / Left turn collisions at the dangerous intersections using V2V and V2I.
Smooth traffic flow using traffic signal rotation cycle information.

Traffic management
Reduce traffic jams by road / vehicle communications.
(Enhanced ACCs with V2I, etc)

Enabling user friendly technology
Develop intuitive HMI solutions for when V2V-V2I information overlaps.

- Locations / Partners

- Kanagawa / Nissan
- Aich / Toyota
- Tochigi / Honda
- Hiroshima / Mazda
- Osaka / road operators

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SKY Project Summary

Intersection Collision Avoidance.
9 intersections
2,000 vehicles
Oct 2006 --

Opposite Direction Driving Prevention on highway
Dec 2008 --

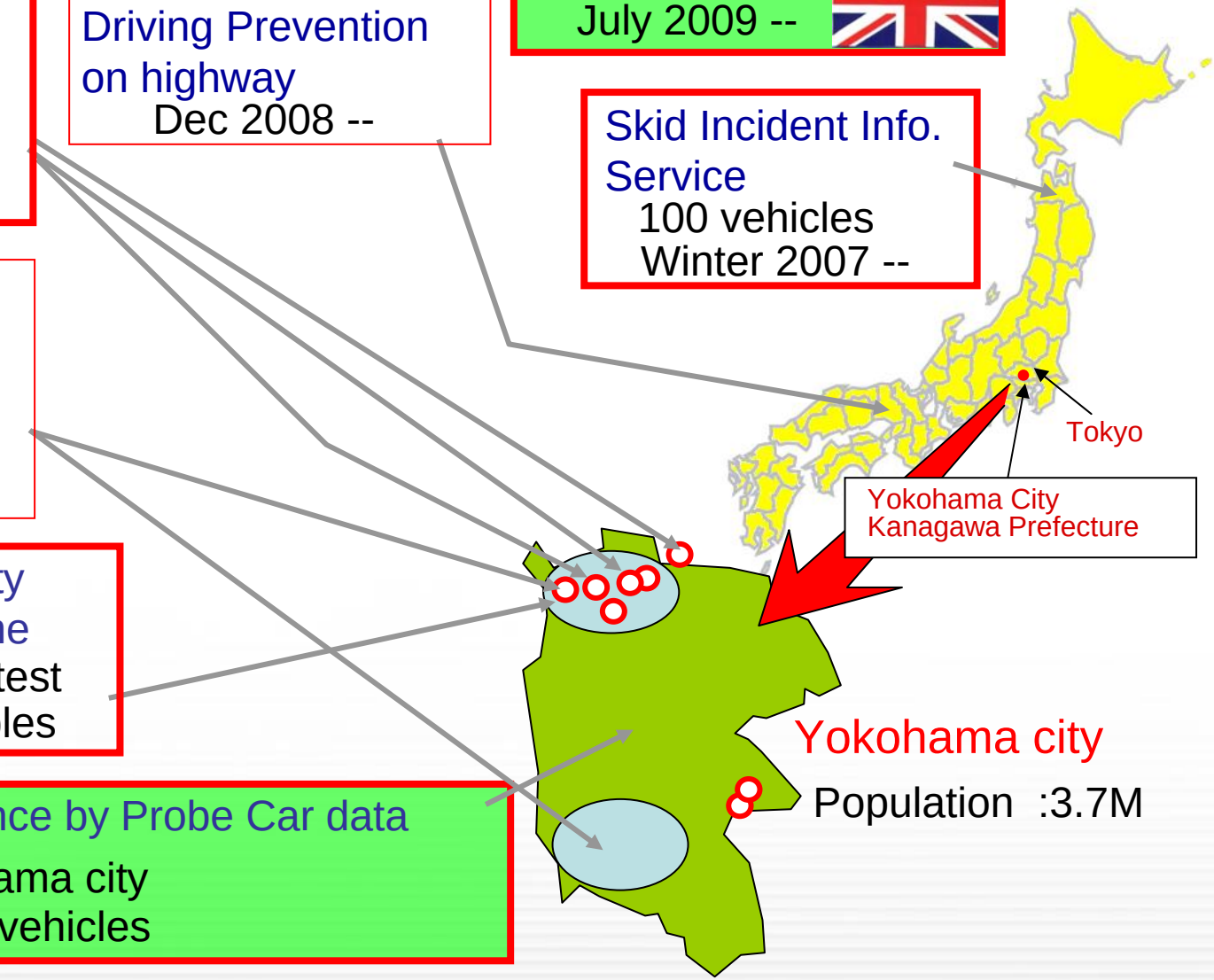
ECO Management System
100 vehicles
July 2009 --

Skid Incident Info. Service
100 vehicles
Winter 2007 --

ISA (Intelligent Speed Advisory)
62 primary schools
2,000 vehicles
Oct 2006 --

Pedestrian Traffic Safety using GPS mobile phone
2007:Proof of concept test
2008:FOT by 700 peoples

Dynamic Route Guidance by Probe Car data
Whole area of Yokohama city
Equivalent to 10,000 vehicles



Active Safety Applications

Infrastructure Technologies

IR Beacon

DSRC
Vehicle detector

-Stop sign recognition enhancement

Traffic Signal

Stop Sign

-Crossing collision prevention

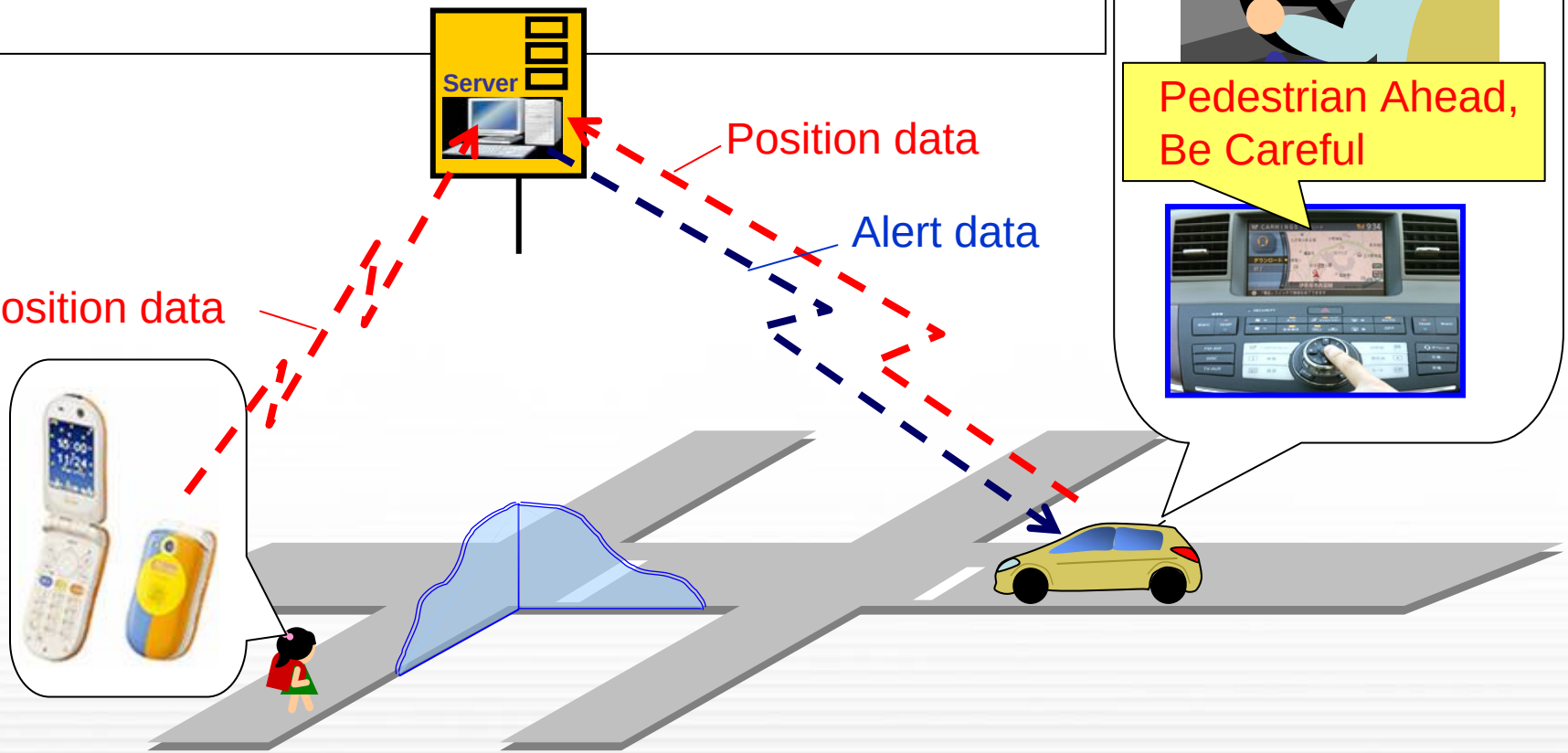
-Signal recognition enhancement

-Rear end collision prevention at end of red signal queue

DSRC: Dedicated Short Range Communications

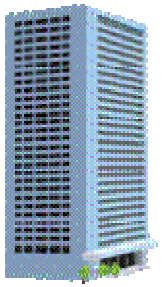
Pedestrians Collision Avoidance Applications

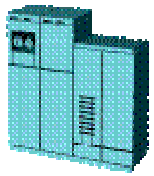
GPS mobile phone sends pedestrian position data.
Server sends the filtered pedestrian data to vehicle through CARWINGS function



Skid Incident Information Service Application

CARWINGS®

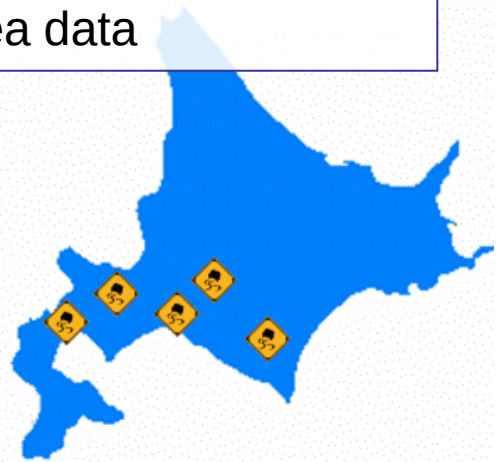




Slippery area data base

- Real time skid incident information
- Historical slippery area data

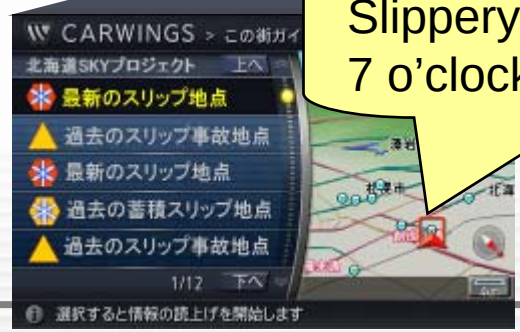
Down Link



Collect

- time
- position
- ABS operation flag

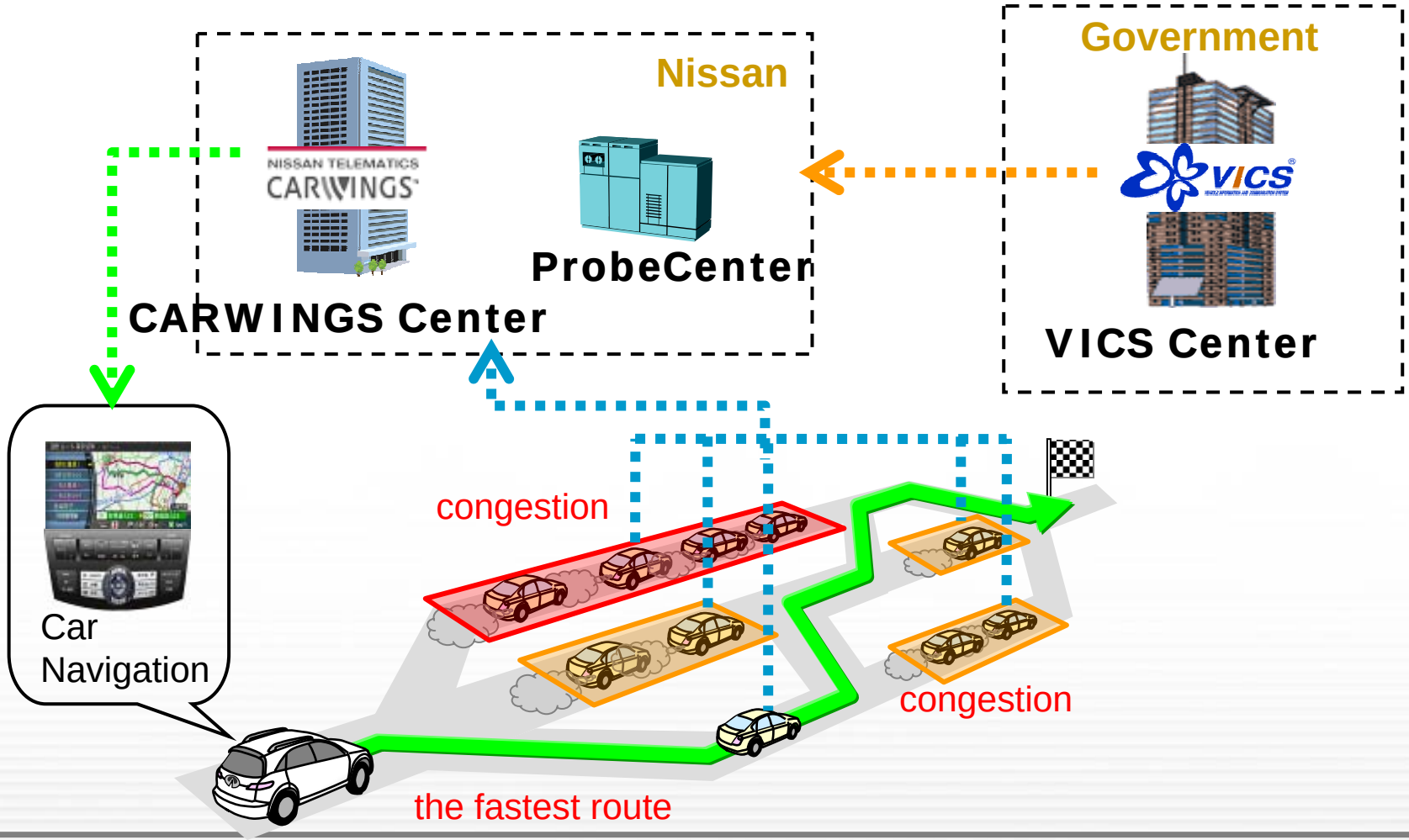
Skid!!



Slippery Area Ahead
7 o'clock in this morning

Dynamic Route Guidance Application

Probe：Information regarding location, speed, etc. acquired from cars by using wireless communication technology



Eco-Drive Application

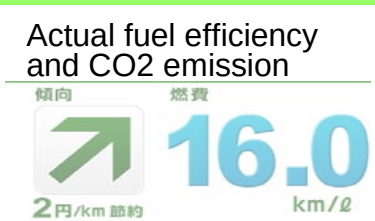
■ Helps improve driving behavior by eco-driving advice.

(Applied in Japan in January, 2007)

Eco-driving

Key point
maintain motivation
for cycle turning

1) Drive with Eco-meter



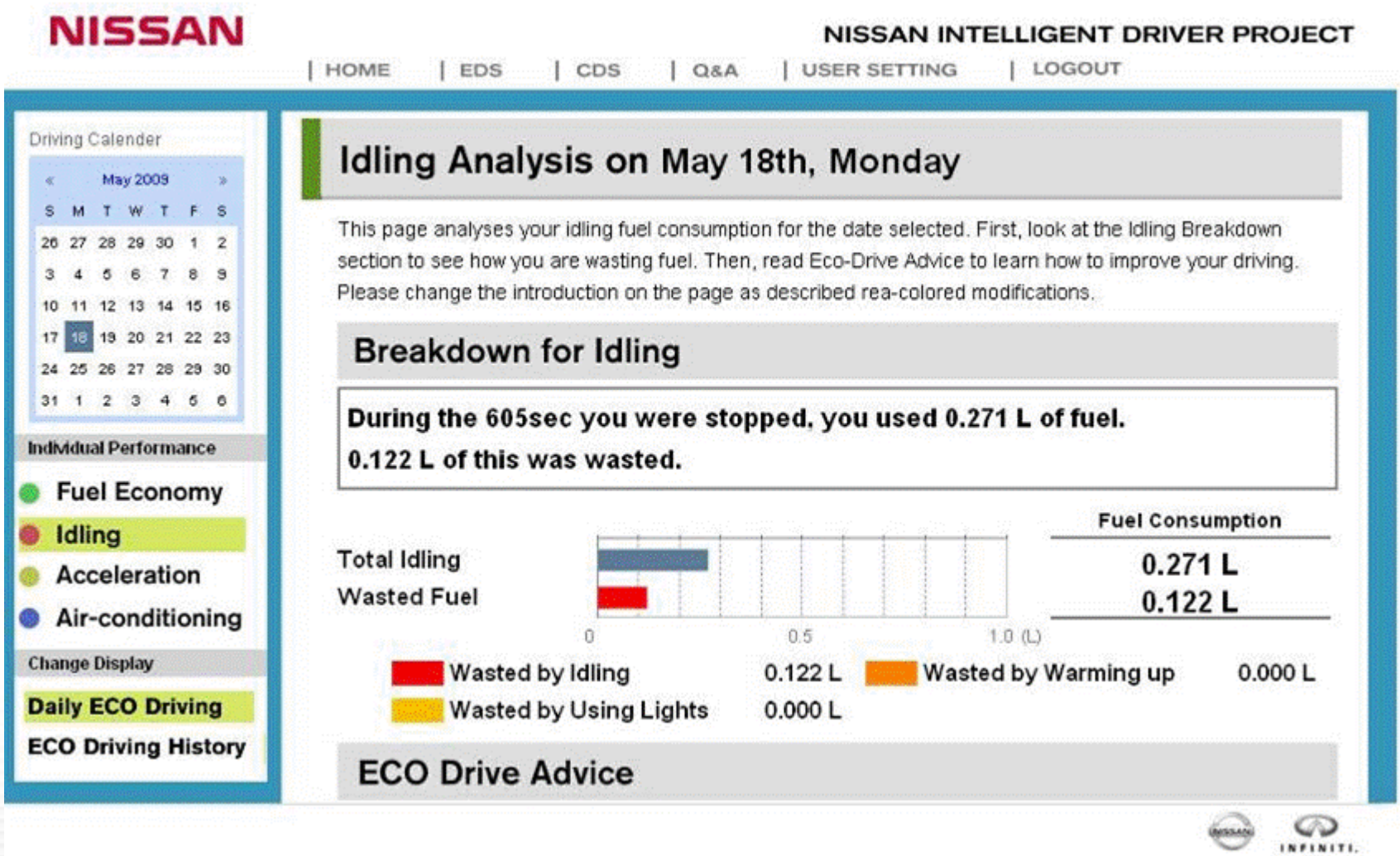
2) Check the result at CARWINGS website

3) Compare the result with other drivers in the same type of vehicle

4) Receive advice for improvement based on the result

Eco-driving Support Example (UK trial)

- Example of driving behavior feed back



Test Results Summary

< Change in Driver Behavior >

Obtained good quantitative results that information support contributes to changing driver behavior to safer driving.

Service		General vehicles	Monitor cars	Change
Stop sign recognition enhancement	Rate of overspeeding vehicles	41% →	23%	18Point
Signal recognition enhancement	Rate of overspeeding vehicles	70% →	56%	14Point

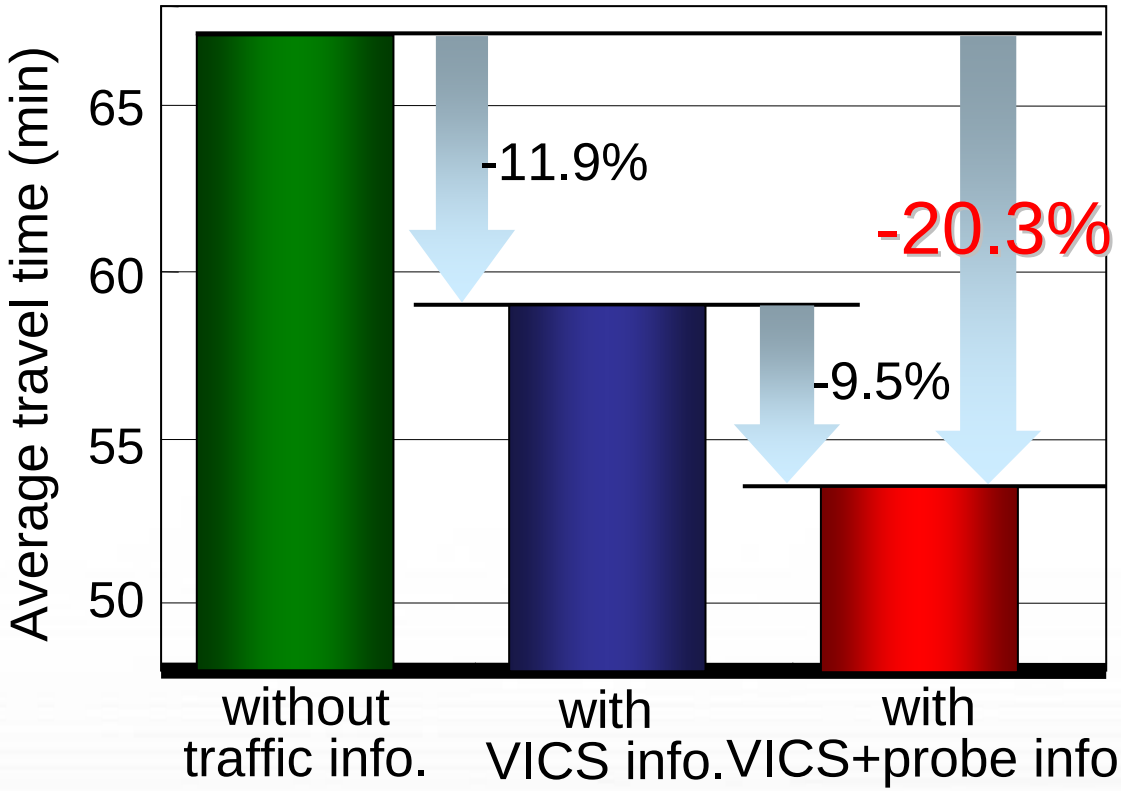
＜Other Changes＞

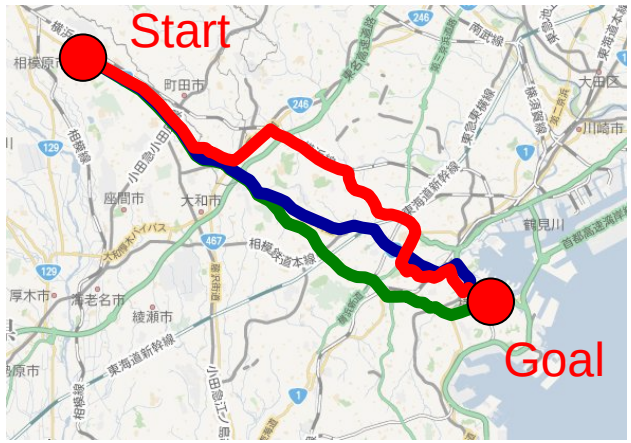
- No influence of drivers' experience.

- No influence of driver's over-trust
  → Drivers who experienced this system slow down before an intersection. (Driver's leaning adaptation)

Dynamic Route Guidance Benefits using real time probe car data

- Traveling time of SKY probe is about 20% shorter than without information.



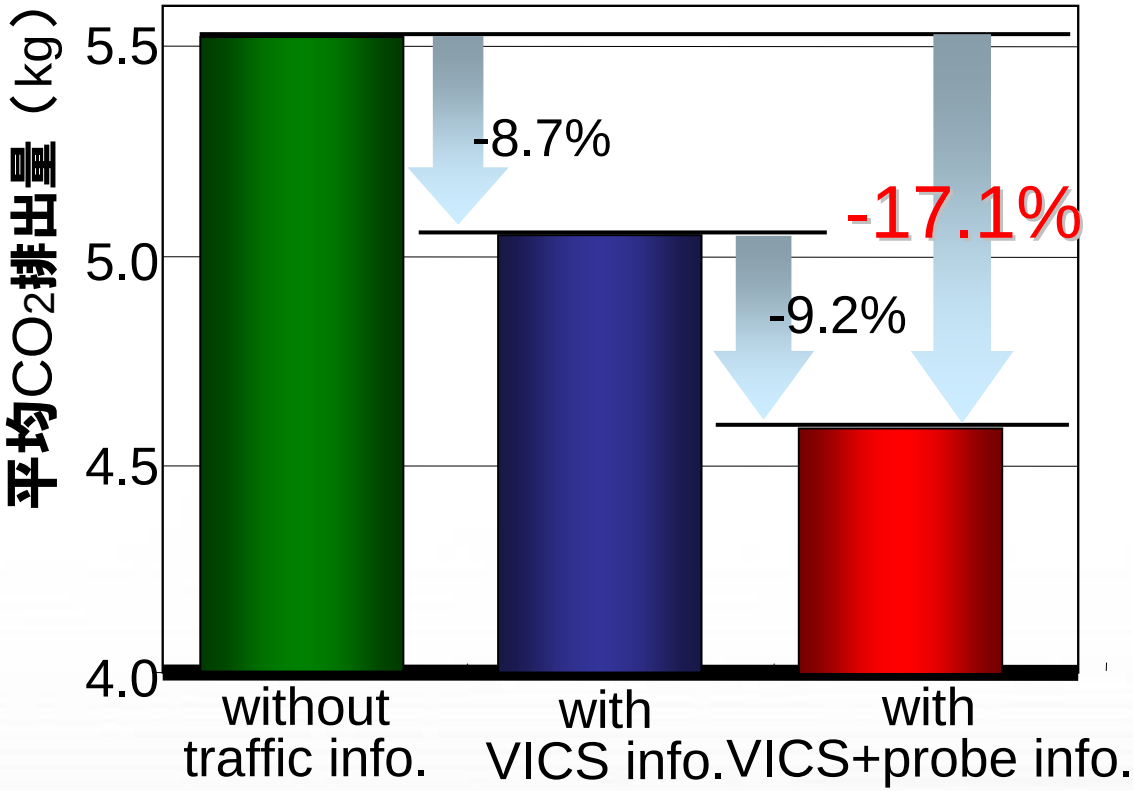


SKY test example in Yokohama city (jammed road)

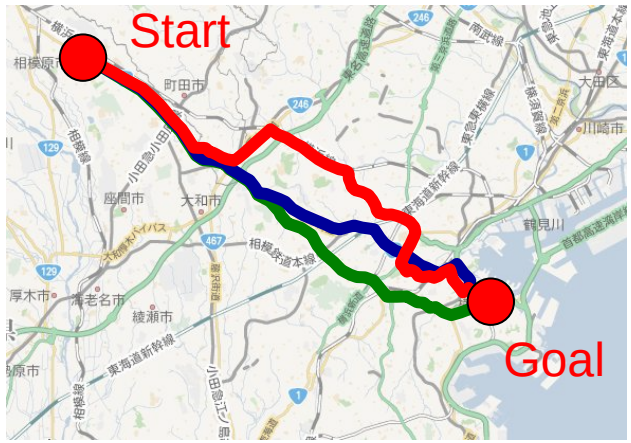
Effectiveness of travel time reduction

Dynamic Route Guidance Benefits using real time probe car data

- 17% of CO2 is expected to be reduced by SKY probe DRGS.



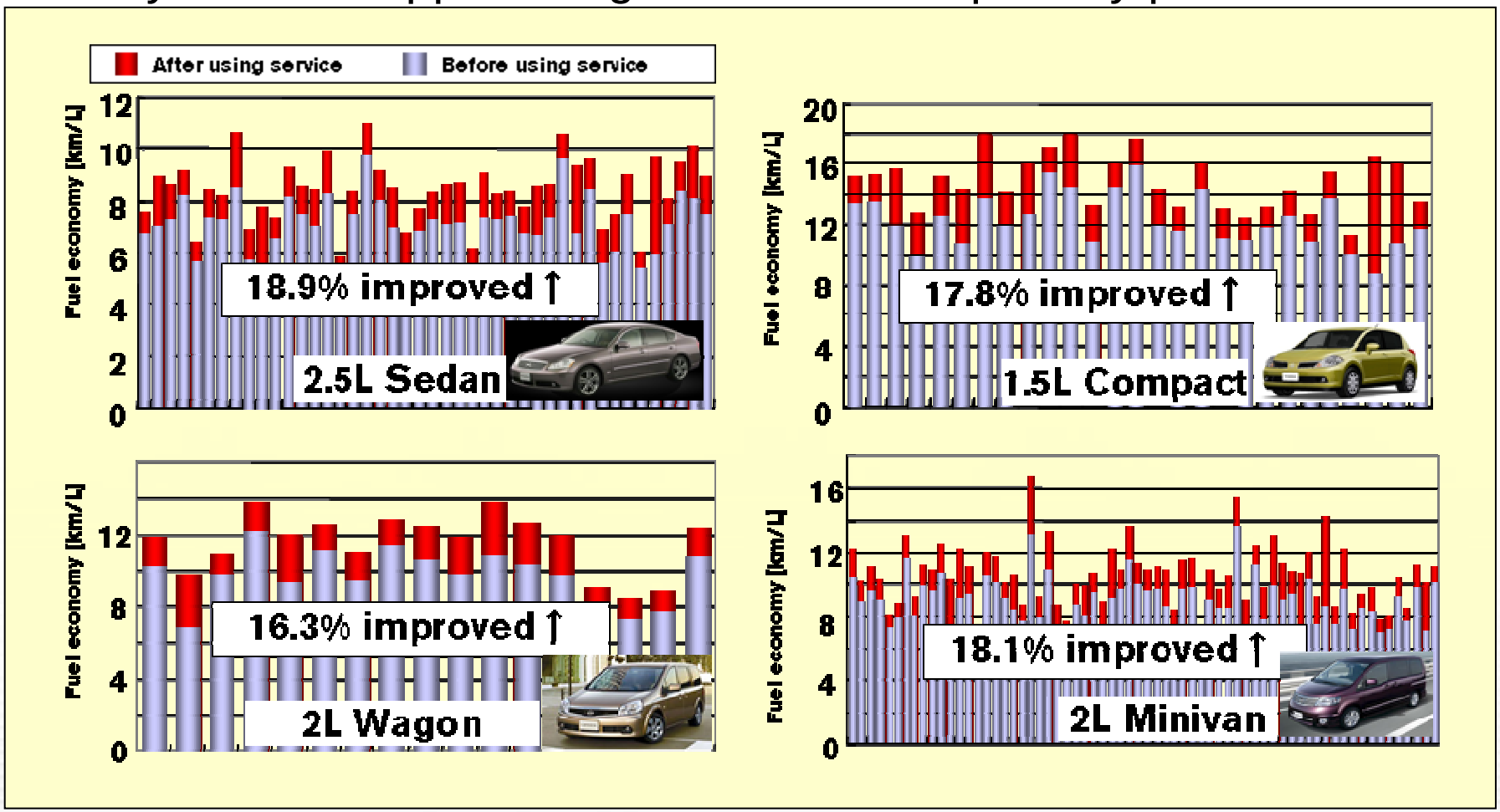
Effectiveness of CO2 reduction



SKY test example in Yokohama city (jammed road)

Effectiveness of Eco-driving Support (JPN Case)

- Fuel economy improvement: 18% average.
- Economic benefit: 153L of fuel can be saved annually. (compact-class car)
- Society benefit: Approx. 1kg CO_2 reduction per day per vehicle.



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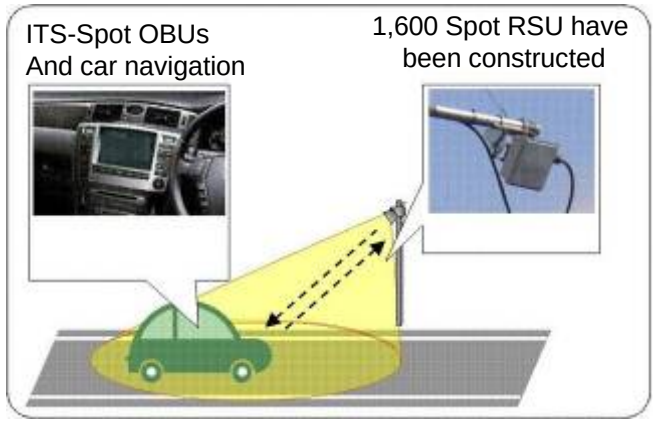
ITS-Spot Service

Deployed Apr. 2011

- Highway project using ITS-Spot 5.8GHz DSRC V-I com.

Car Navigation + ITS Spot ETC Unit

Leverages the in-vehicle ETC HW



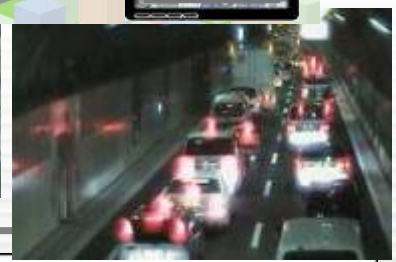
1,600 ITS-SPOT RSUs have already been constructed and are covering all highways in Japan.

<Dynamic Route Guidance>

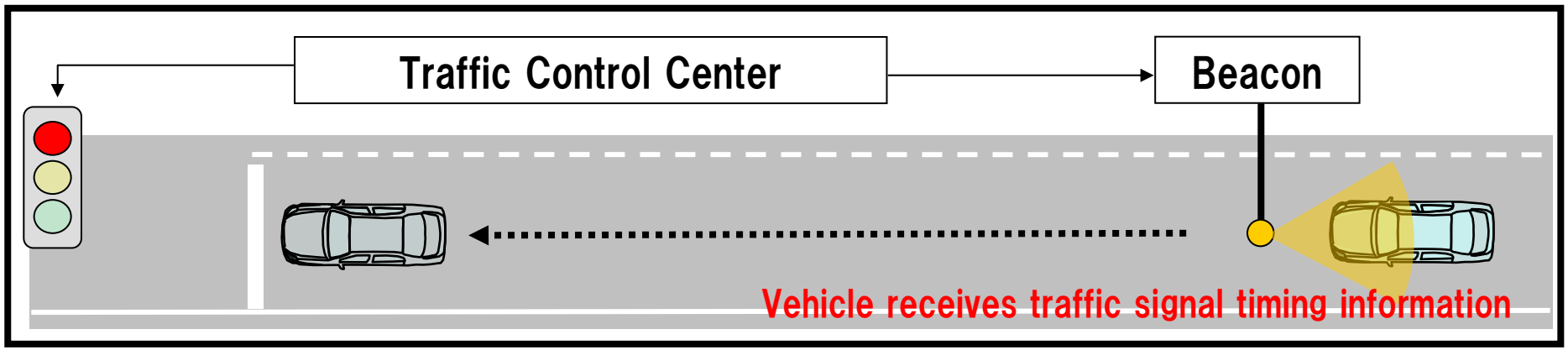
Deliver broadband traffic information.
Car-Navigation calculates suitable route

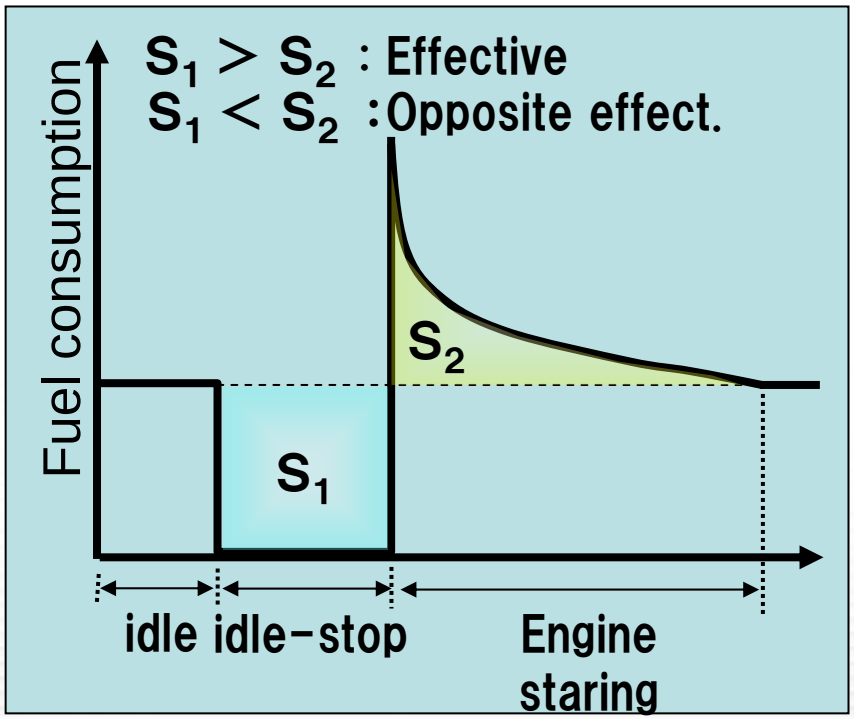
<Hazard Warning>

End of queue/Falling objects info, etc.
Severe weather conditions



Stop Start system Application

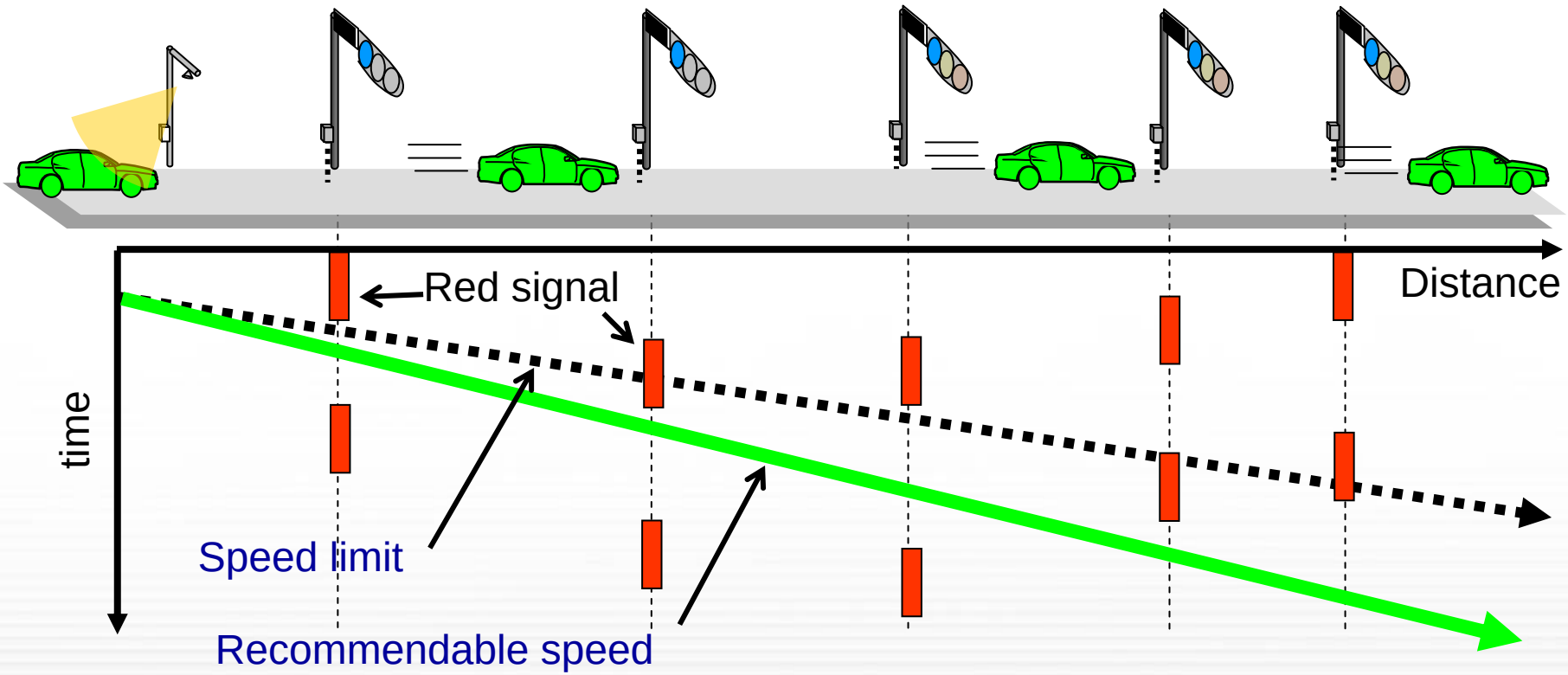




If traffic light is about to change to green after the vehicle stops, Stop Start System does not engage.

Drive Speed Synchronized to traffic Light Patterns Application

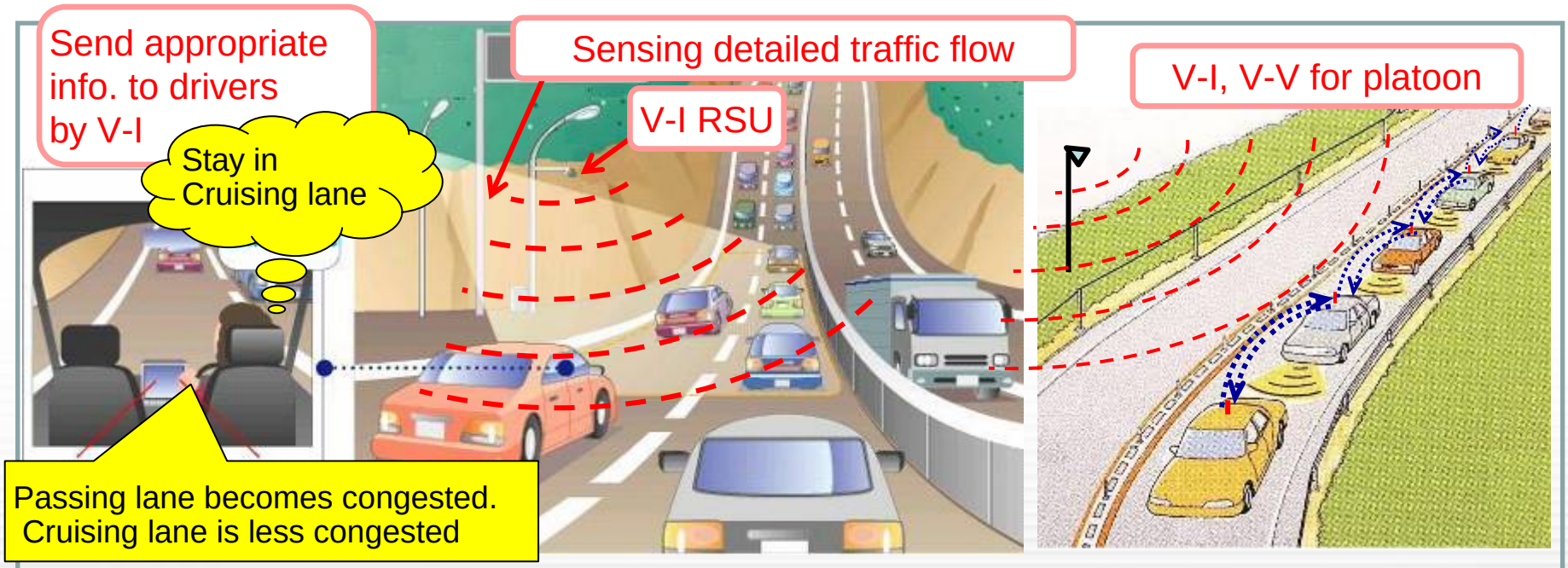
- Synchronizes drive speed with traffic signals **“Green Wave”**
- RSU send vehicles traffic signal rotation schedule.
- Vehicle system
  - Guides driver suitable speed before traffic signal
  - Controls vehicle speed suitably（ISA) Intelligent Speed Adaptation



Traffic Flow Applications

60% of traffic congestions in intercity expressway is on sags and in tunnels

- RSU sends driver lane/speed recommendation on highway sag section.
- RSU also send ACC vehicles road /traffic information.
- ACC set appropriate speed and distance, or CACC /EACC control their platoon drive.
- ACCs keep stable speed better than manual driving at highway sag point



CACC/EACC: Cooperative /Enhanced Adaptive Cruise Control using V-V com.

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Current Status of Japanese Initiatives

ITS-SPOT

- With 1600 RSUs in service, highway coverage is good throughout the country.
- The government has started additional trial using ITS-Spot communication system such as traffic jam avoidance at sag.
- Nissan offers a SPOT compatible dealer option car navigation, but sales are slow due to high cost of dealer unit+instalation.

DSSS

- There are about 50,000 DSSS compatible Nissan vehicles in service
- There are only 15 intersections equipped with the IR beacons, compared to a government target of 2000-3000 dangerous intersection coverage.

DSRC

- Only a few intersections are equipped because the system is still in the testing phase.

Assessment of Japanese Market Situation

- Some ITS cooperative systems have already been adopted in Japan as the result of the Nissan/Kanagawa SKY project and the ITS National Project.
- There are many technical and business issues still to be resolved before current technology is fully deployed to optimize traffic safety and traffic flow.
- The Japanese government and private sector have started the next stage cooperative ITS national project in order to solve the remaining problems.

How the UK government can encourage innovation

- Make a big picture of future ITS world watching the technical and government policy in EC, US, and Japan.
- Work with Brussels to expand the scope of the collaboration
- Begin a public - private sectors collaboration project like the Japanese model.
- Allocate suitable radio frequency for V2V, V2I, and V2P communication.
- Allocate budget to incentivize cooperative ITS systems by public-private sectors and to develop the enabling infrastructure.

Thank you for your attention