



# Road Control and Management with ITS

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1. Background and Objectives
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3. Image sensors
4. Specific methods of use in road control and management
5. Future developments

# 1. Background and Objectives



In recent years many CCTV cameras have been installed in locations where it is necessary to observe the situation



It is necessary to efficiently and effectively use these cameras

- Efficient surveillance of many camera images
- Effective utilization of the information acquired in the management of the individual roads



It is expected that these tasks can be solved by using sensing technology (image sensors) derived in R&D of AHS



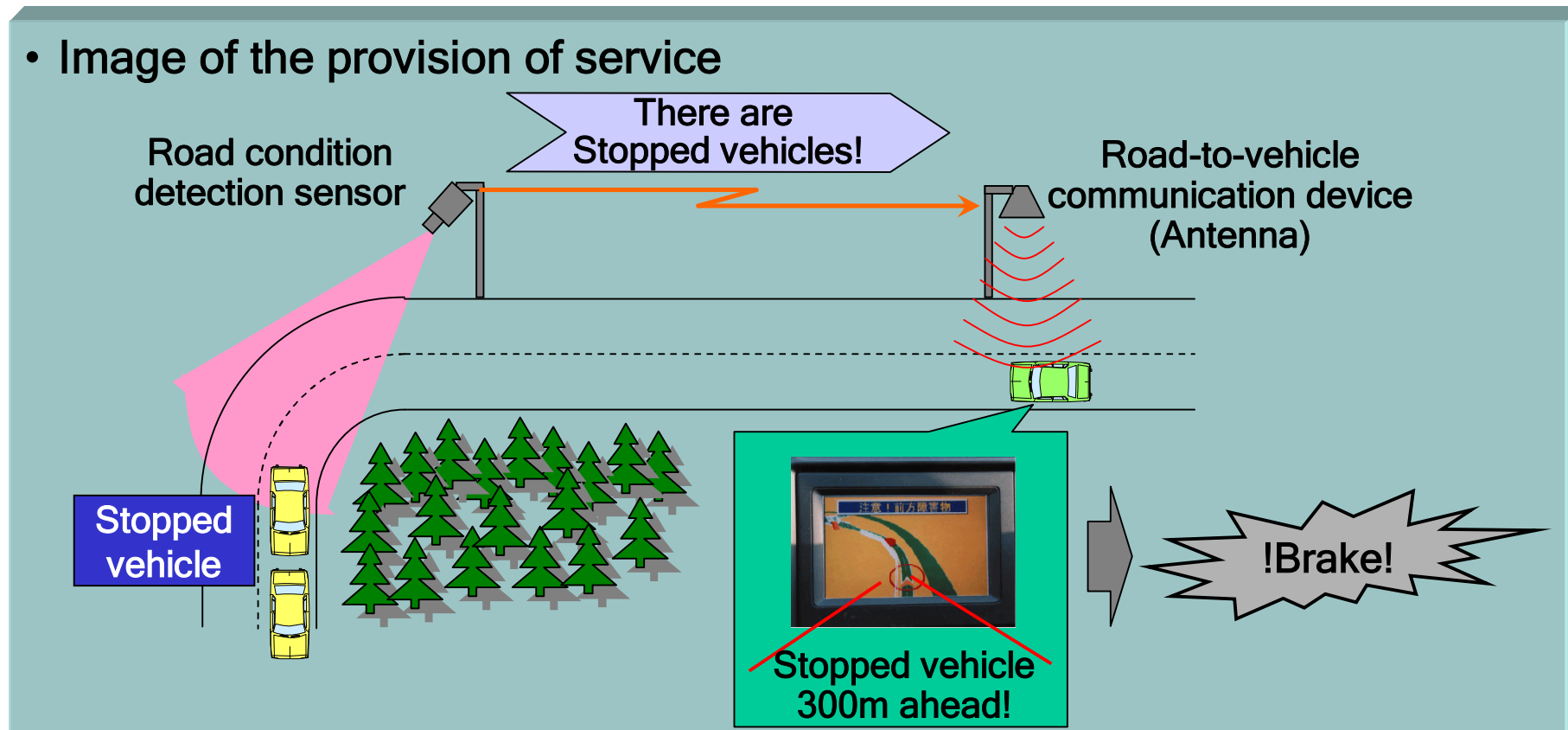
Investigation of specific methods of utilization of image sensors, from the point of view of improving the effectiveness and quality of road control and management

# 1. Background and Objectives

## What is AHS?

- AHS\* is a system in which the road and vehicle are connected, and information, warnings, and driving support are provided to the drivers in real time.

- Image of the provision of service



\* AHS: Advanced Cruise-Assist Highway Systems

## 2. Present situation with road control and management

### a. Requirement of enhancement and effectiveness

- Along with the changes in society affecting road policy, enhancement of road control and management is required.

#### Society's requirements for road policy

- Implementation of road policy based upon outcomes

- a. Lost time due to road congestion
  - Reduce by about 10% by 2007
- b. Time taken for construction work on the roads
  - Reduce by about 20% by 2007

- Effective utilization of road stocks

- Services in response to the demands of road users



Aiming to improve the quality of road control and management by applying sensing technology to CCTV cameras, as part of IT

## 2. Present situation with road control and management

### b. Tasks for road control and management

- In order to respond appropriately to the demands of road policy, it is necessary to aim for more effective road control and management and improved quality.

- Tasks for road control and management

Society's requirements for road policy



Tasks for road control and management

1. Improvement in quality of road control and management

2. More effective road control and management

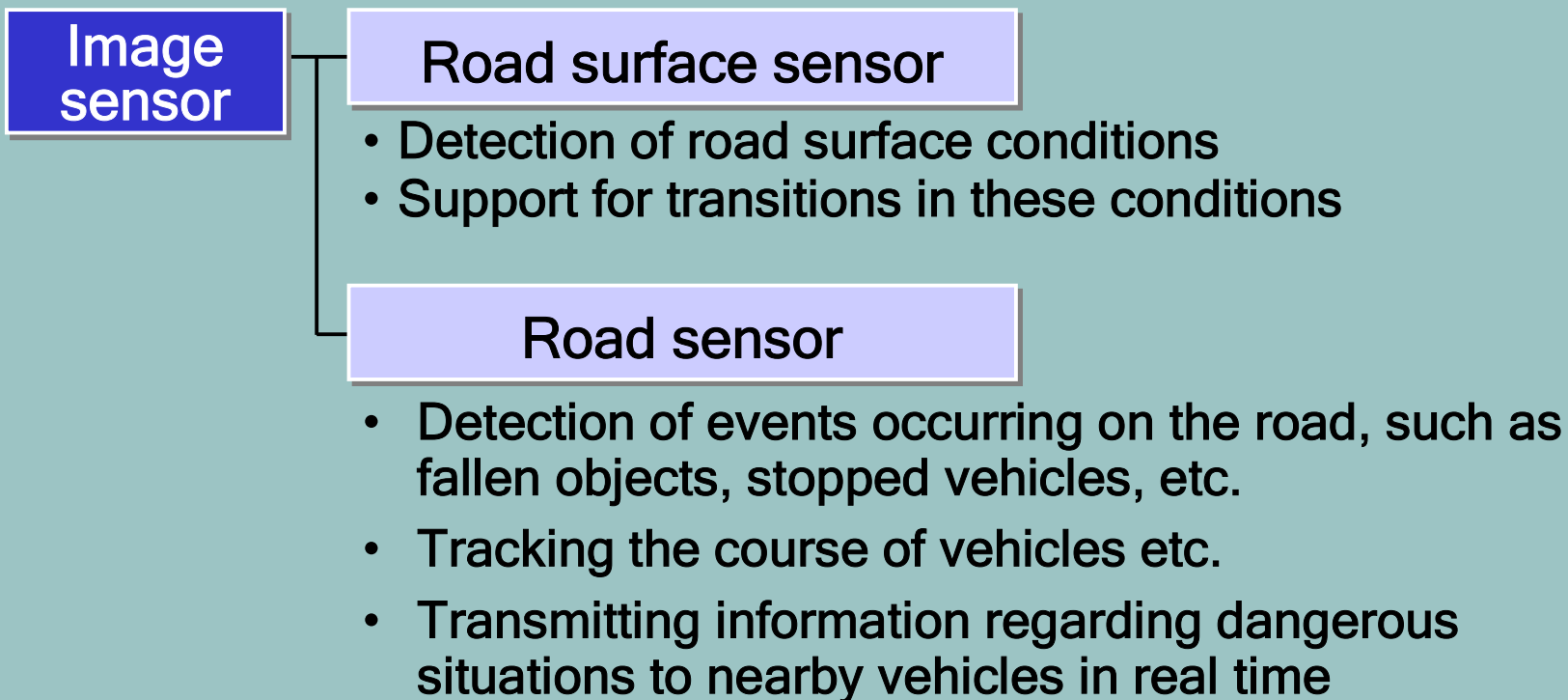
Limited budget and personnel resources

# 3. Image sensors

## a. Outline of image sensors

- There are two types of image sensor that are expected to be used in road control and management: “Road surface sensor” and “Road sensor”.

- Types of image sensor and their functions



### 3. Image sensors

#### b. What are road surface sensors?

- Detection of freezing of the road surface, etc., by constant processing of camera images by sensors

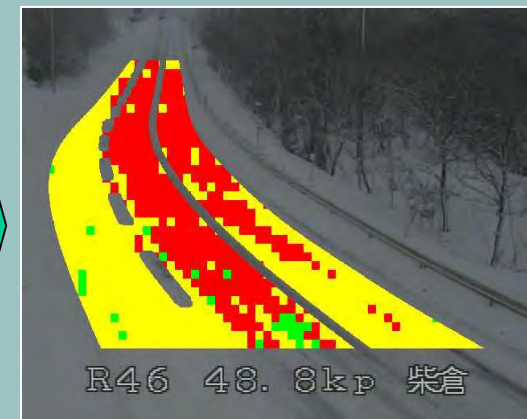
- Process of detection of the road surface condition
  - 1) Vehicles and other moving bodies are removed from the images at 1 minute intervals, to create an image of the road surface alone.
  - 2) By image processing of the image, freezing of the road surface is detected.



Raw image



Image from which  
moving bodies have  
been removed



Processed image



# 3. Image sensors



## c. What are road surface sensors?

- Five road conditions can be detected, and this is expected to be used in road surface control

- During the test period, 5 road conditions could be detected with 90% accuracy

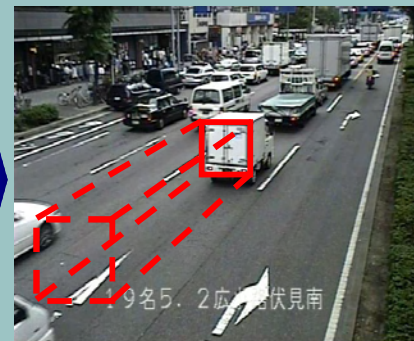
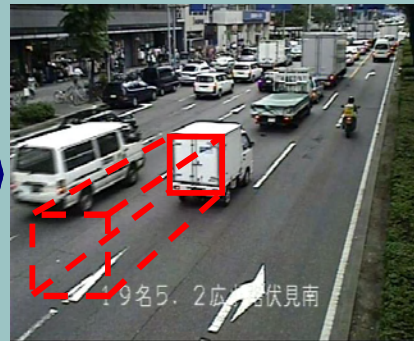
(Test results in a cold region: Data from FY 2002 to FY 2003)

		# of data	Probability of correct detection (%)				
			Dry	Wet	Covered by water film	Covered by snow	Frozen
Road surface condition	Dry	51,175	95.3	3.8	0.1	0.8	0.0
	Wet	15,931	6.0	90.5	3.3	0.2	0.0
	Covered by water film	7,196	0.2	6.2	87.4	3.3	0.0
	Covered by snow	4,042	0.1	2.9	1.6	95.4	0.0
	Frozen	2,092	1.9	9.2	1.0	0.9	87.0

### 3. Image sensors

#### d. What are road sensors?

- Detection of stopped vehicles, etc. by constant processing of camera images with sensors
- If the vehicle does not move for several seconds it is regarded as a stopped vehicle



### 3. Image sensors



#### e. What are road sensors?

- Information on stopping, congestion, swerving, and other dangerous situations can be detected, so it is expected that they will be used in the surveillance of road facilities, etc.

- During the test period, incidents were detected with an accuracy of 95% or better

(Results of tests on National Roads)

Item	Concentrated evaluation (detection of stopped vehicle, congestion)	Natural flow evaluation (detection of stopped vehicle, congestion)
# of occurrence times (actual)	50 times	15 times
# of erroneous reports	0 times	2 times
# of non-detections	0 times	0 times
Rate of correct detection (# of correct detections) / (total # of incidents)	97% $(50 + 15) / (50 + 15 + 2)$	
Rate of non-detection (# of non-detections) / (# of incidents)	0% $0 / (50 + 15)$	

### 3. Image sensors

#### f. Significance of using image sensors

- By adding an image sensor to a CCTV camera the camera can be effectively used, so that higher efficiency and quality can be achieved.

Using a CCTV camera,

- a. Detailed information at a location can be quickly confirmed without going to the location.
- b. The situation is comprehended with an image, so anyone can make an intuitive judgment regarding the situation.



However, it is not possible to have personnel constantly monitoring the camera images.

Therefore, the reality of the situation is that after occurrence of an event, it is the camera that confirms the situation.

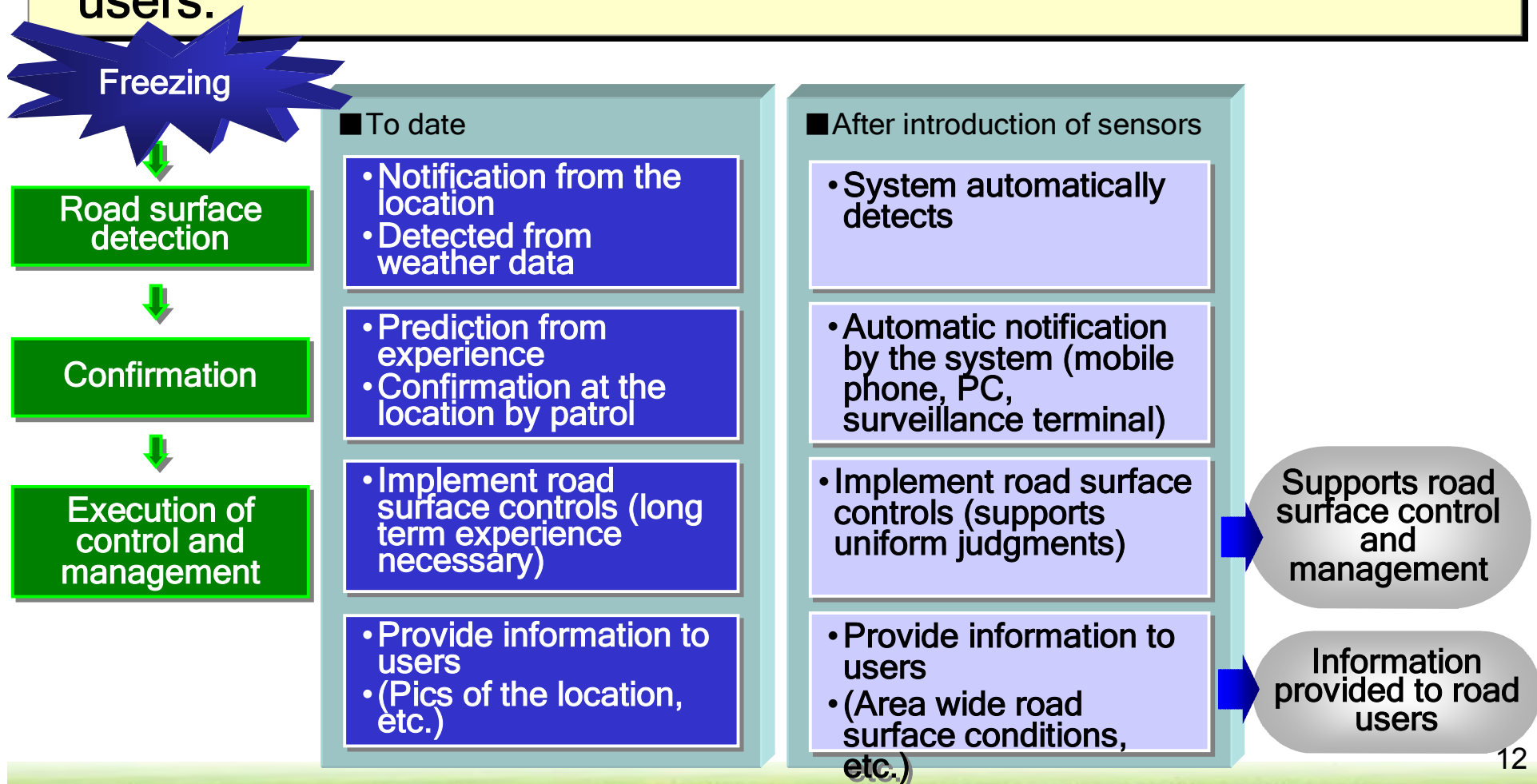


More skillful (strategic) utilization of CCTV cameras

# 3. Image sensors

## g. Use in road control and management (road surface sensors)

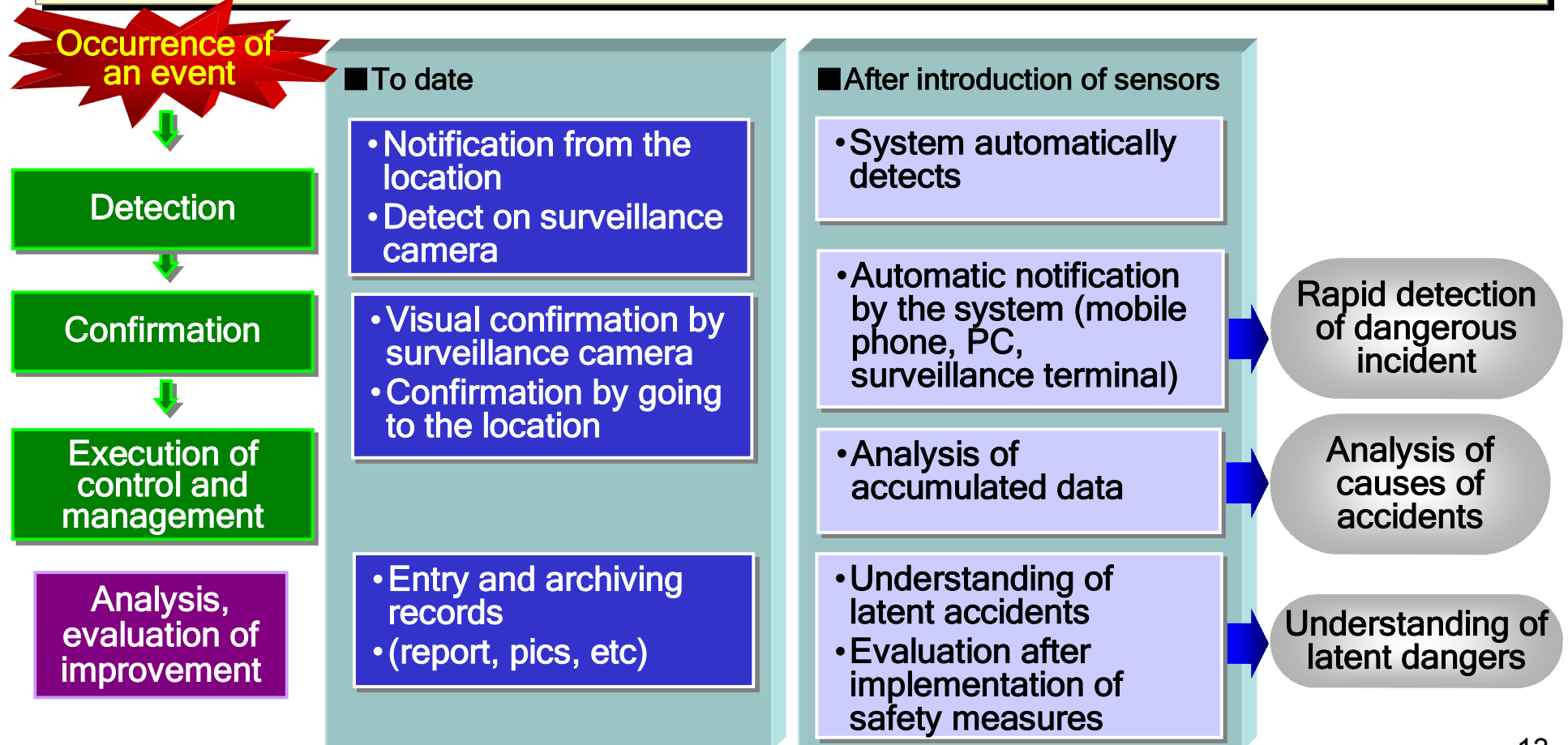
- Supports road management and control work by understanding changes and transitions in road surface conditions.
- Also, useful as information material to be provided to road users.



# 3. Image sensors

## h. Use in road control and management (road sensors)

- It is possible to rapidly and accurately detect the occurrence of dangerous situations.
- It is possible to establish effective traffic safety measures by using the data on dangerous situations.



# 3. Image sensors



## i. Status of introduction of experimental image sensors

- Image sensors for road control and management have been introduced throughout Japan for test purposes.

- Status of use of sensors according to objective

Type	Status of use (objective)	# of locations
Road surface sensor	To detect road surface conditions	18
Road sensor	Early detection of and rapid response to rock falls, landslides, etc.	9
	Early detection of accidents and rapid response	11
	Surveillance of congestion or stopped vehicles	3
	Subtotal	23
<b>Total</b>		<b>41</b>

## 4. Specific methods of use in road control and management

### a. Specific methods of use in road surface sensors

- Estimation of the potential for freezing by accumulating historical information on road conditions, and understanding the transitions in road conditions.
- Expected to result in rapid and appropriate road controls.



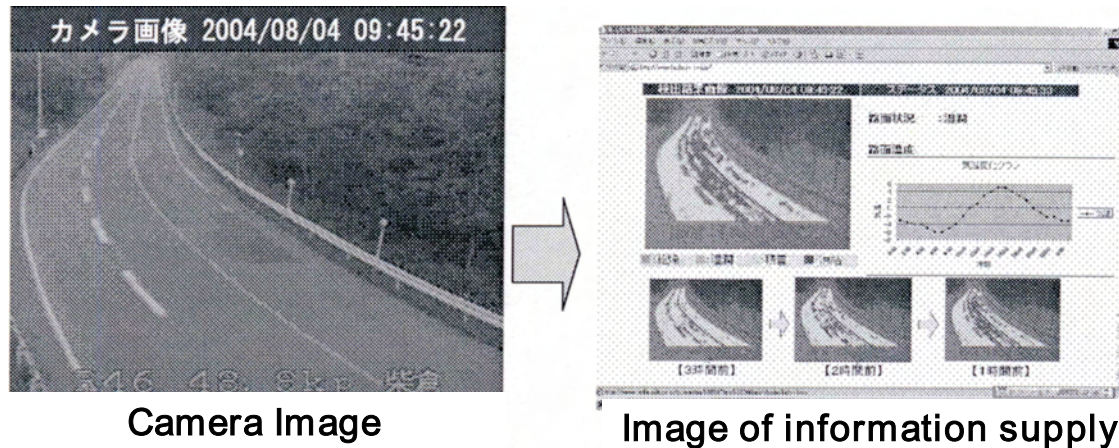
Figure : Accurate determination of road surface condition is expected to result in more efficient snow removal work.



# 4. Specific methods of use in road control and management

## b. Specific methods of use in road sensors

- Possible to provide information on road surface conditions to road users in an easy-to-understand manner through the Internet.

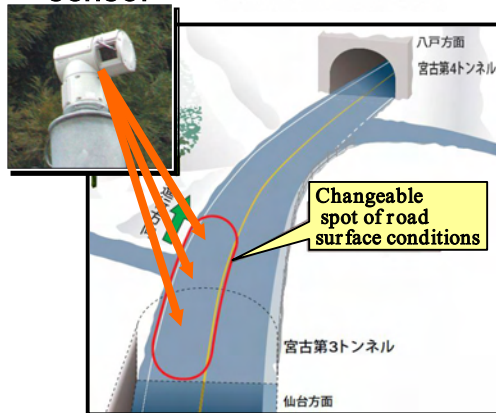


Camera Image

Image of information supply

Figure: Providing information through the Internet

Road surface sensor



Analysis of data measured by sensor



Figure: Providing information on road surface conditions at a tunnel exit

## 4. Specific methods of use in road control and management

### c. Specific methods of use in road sensors

- Create a safe road environment by providing information to drivers at locations

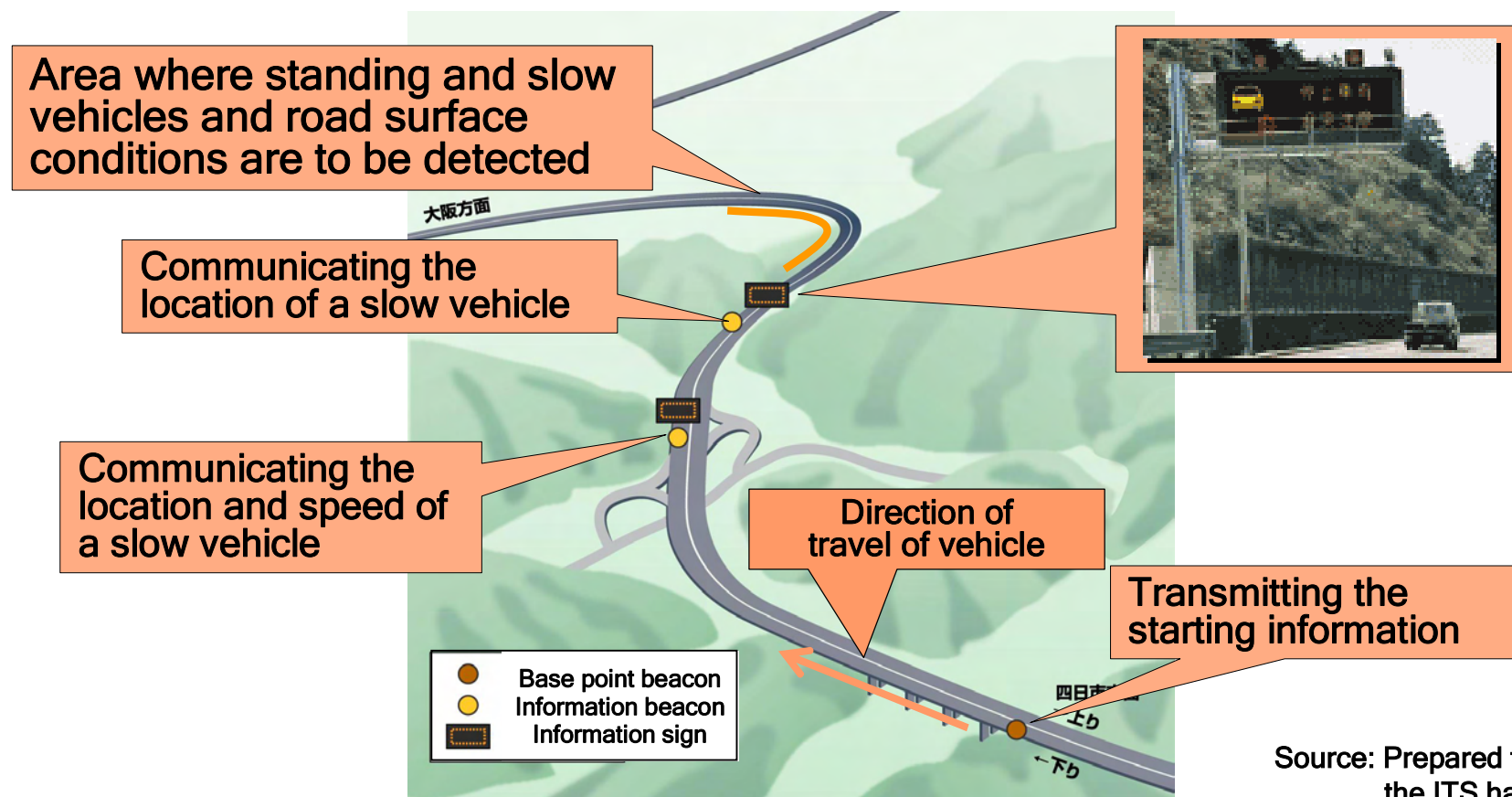


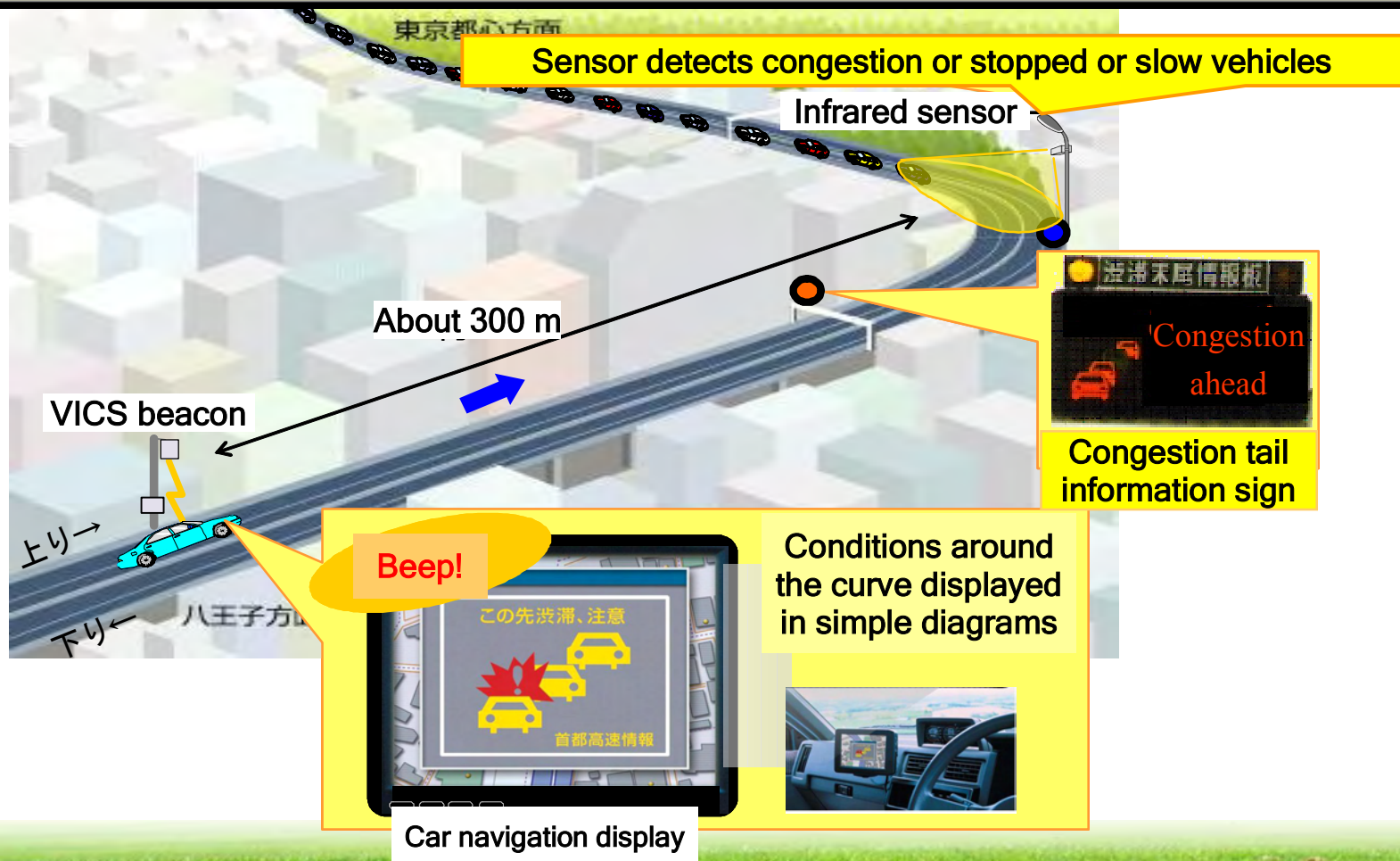
Figure: Experiment to provide information on road conditions and congestion before a curve



## 4. Specific methods of use in road control and management

### d. Specific methods of use in road sensors (combination with VICS)

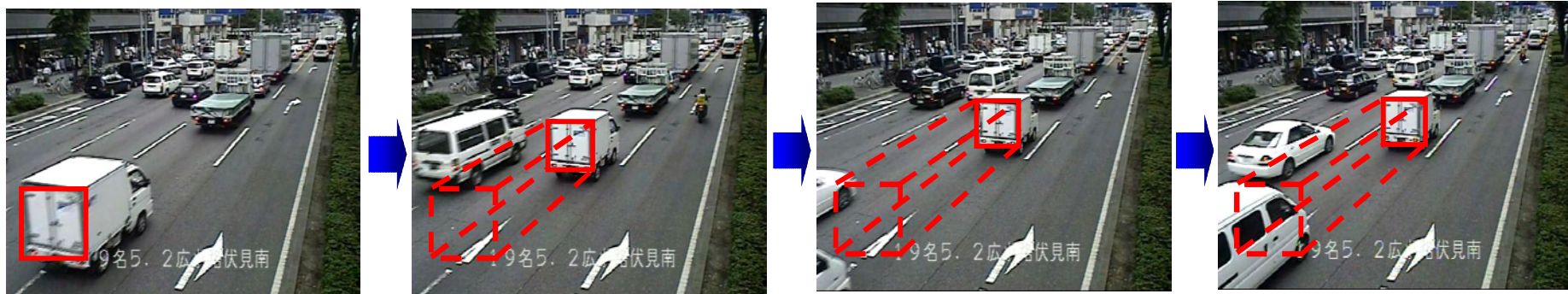
- Sensors detects congestion or stopped vehicles occurring in a curved road area.
- Transmitting the Information from a VICS beacon installed about 300m before the curve to approaching vehicle.



## 4. Specific methods of use in road control and management

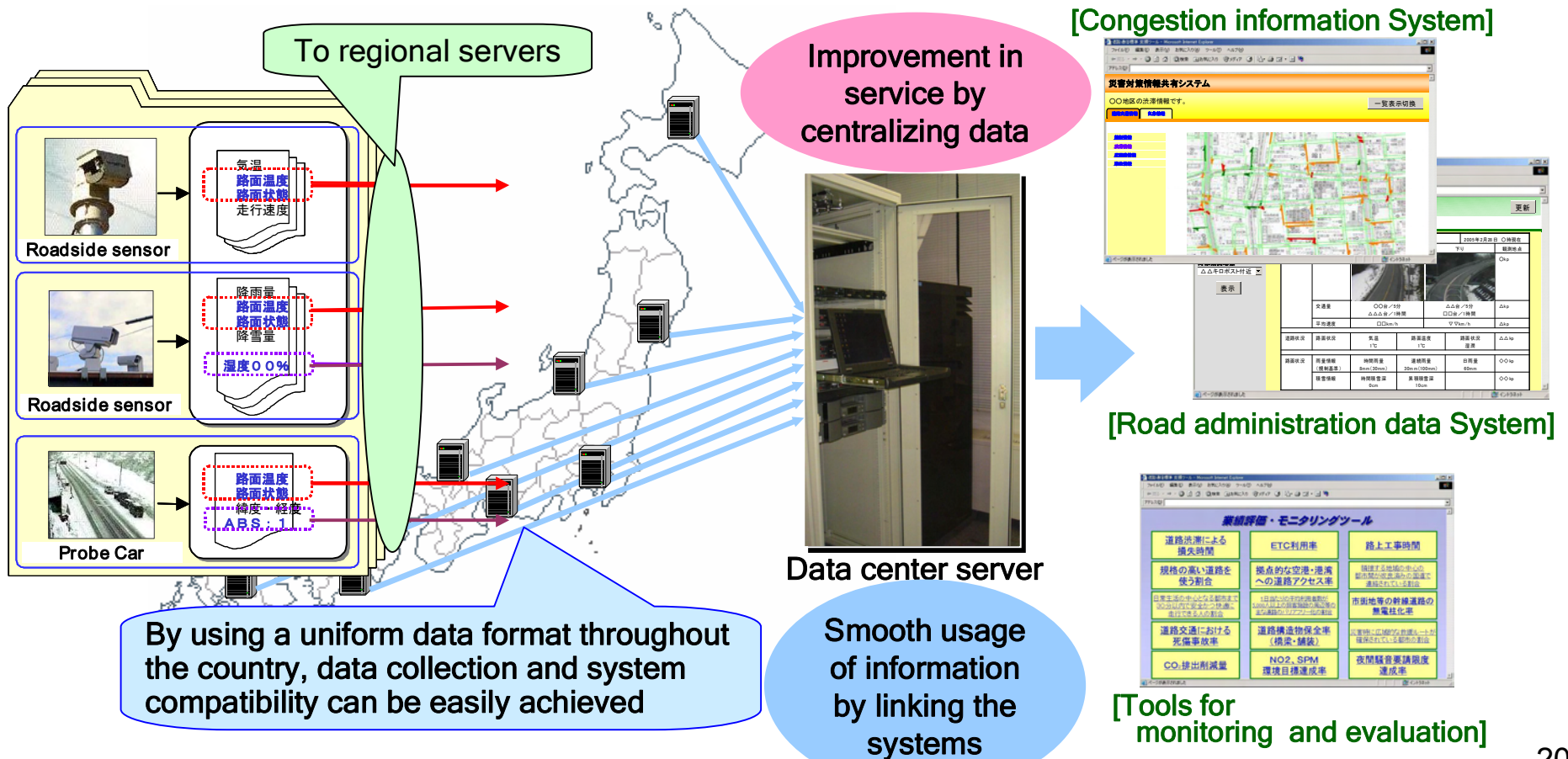
### e. Summary

- By using road surface sensors and road sensors, it is possible to determine locations where accidents may occur.



# 5.Future developments

- Provide the infrastructure for the use of detailed statistical data, and realizing efficient road control and management for higher level road policy.
- Promote disclosure and sharing of the data collected.



# 路面データ収集装置・処理の流れ

