RESEARCH ON THE MODEL OF SHARING AND PROVISION OF ROAD ADMINISTRATION INFORMATION

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1. Outline

In addition to the conventional road management measures dealing with traffic demand, disaster from snow, freezing, typhoon and earthquake, and increasing number of stocks to maintain and manage, assignments like information disclosure, cost reduction and diversification of the needs of users became part of the consideration for the road management. Therefore, it is required to be quicker, certain and proper than conventional ways. Based on such conditions, this report is going to introduce 2 examples from the studies of constructing efficient sharing system for road management information, and the system to provide such information in various measures. Additionally, we separately stated our considerations to the ways sharing and providing road management information should be, especially from the viewpoint of winter road management.

(1) Technical Features on the Sharing System of Road Management Information

We constructed the system that enables related stations to share the road management information in real time by applying the high-speed network infrastructure, such as optical fiber cables. Also, the system applies GIS to attempt efficient information management, adopting the graphic user interface (GUI) based on map image.

(2) Technical Features on the Providing System of Road Management Information

Construction of the system enabled to provide information regarding road management, weather, public transportation system and sightseeing through various communication tools, including telephone, fax, Internet and portable terminals. The system supports users to drive safely, smoothly and comfortably regardless of the time they use it.

2. Example 1 of the System Construction Regarding Sharing and Providing the Road Management Information
-The Case of "Road Information Management System" at Wakayama Prefecture-

(1) Purpose of the System

In Wakayama prefecture, each civil work office was managing the road management information, such as traffic restriction report.   However, introduction of this system enabled the road management information to be handled and shared as a unified database for the users in entire prefecture.

(2) System Construction and Outline of the Function

① System Construction

This System is comprised of the "Management System" to accumulate the information of events occurred on roads and traffic restrictions, and "Providing System" to deliver the accumulated information through various communication tools.

<Figure 1>
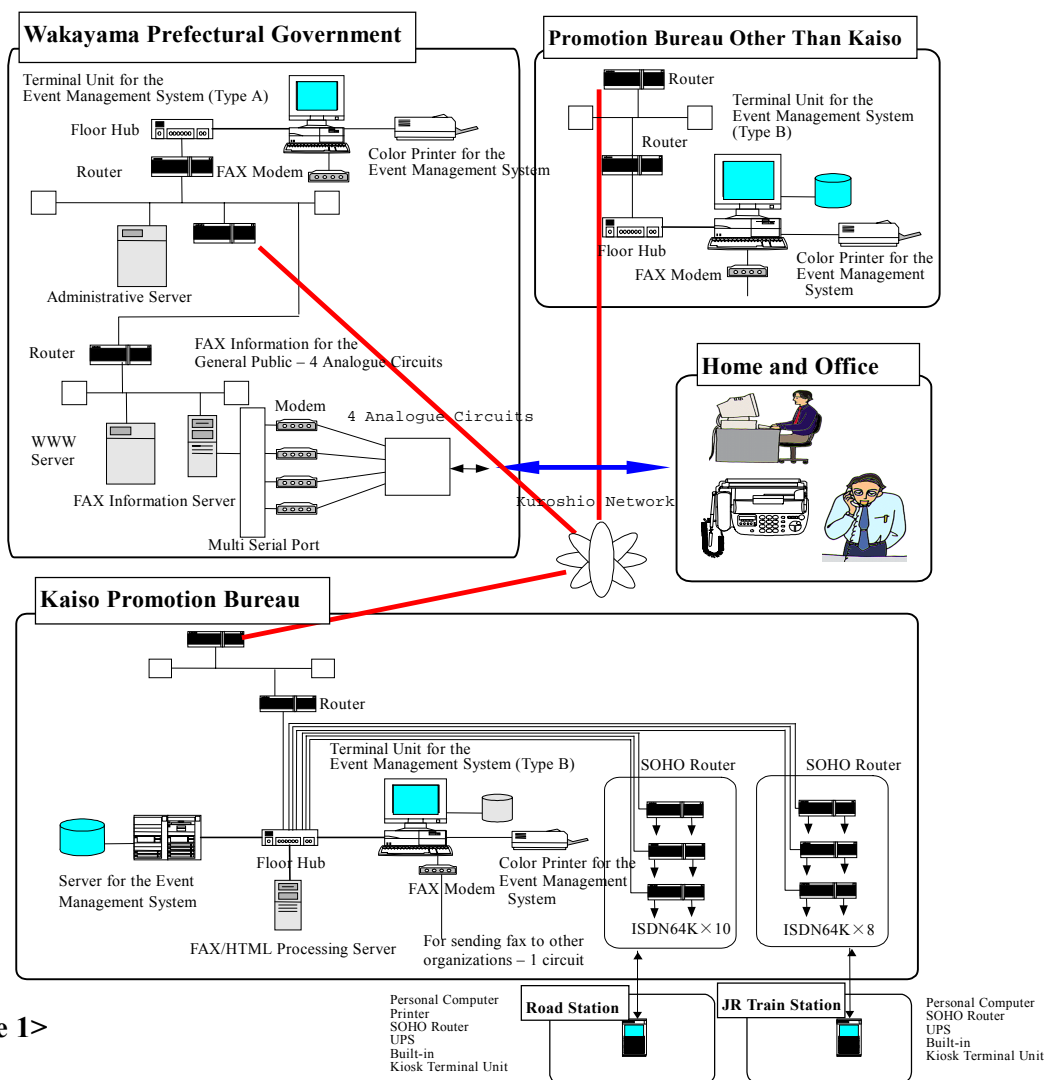
② Outline of the Management System Function

"Management System" is comprised of 4 functions shown as below:

a. Management Function for Construction/Work

    Plans for works of road maintenance, repair, cleaning, planting and felling, and management of the traffic restriction report related to these incidents.

b. Management Function for Unexpected Incident

    Unexpected road collapse and/or mudslide caused by typhoon and/or heavy rain, and management of the traffic restriction report related to these incidents.

c. Management Function for Weather Information

    Based on the warning and caution issued by the Meteorological Agency, each prefecture enters their information, then civil engineering offices can check them.

d. Management Function for System Information

    When unusual weather occurs, it supervises the operating condition of warning preparation and emergency positioning at prefectural government and civil engineering offices.

③ Outline of the Providing System Function

a. "Road Station" System

    "Road Station" system in Wakayama prefecture is composed with a main server at "Kaiso" civil engineering office and 10 exclusive terminals with touch panels that are connected with ISDN circuit (INS64).   Each terminal automatically updates its data every hour.   Similar terminals are installed at 8 main JR train stations.   "Road Station" system is composed with following menu:

● Road Information

    Providing the information related to road management and traffic restriction.   Providing the most proper route from each "Road Station" to the destination.

● Sightseeing Information

    Providing sightseeing facilities classified in each category.   Providing the most proper route to facilities in desired destination.

● Introduction of the "Road Station" in Wakayama Prefecture

    Introducing the opening hour and local products at "Road Station" supervised by Ministry of Land, Infrastructure and Transport and the prefectural government.

● Survey

    Questionnaires are given to the users to understand their trend.   (Approximately 10 questions)

● Album

    Function to enter voice message and still pictures taken by CCD camera to commemorate the visit of "Road Station."

● Other Information

    Providing other information, including events.

b. WWW

Sending out the information regarding traffic restriction and expected public work from WWW server.

c. Information Delivery Service by FAX

Sending traffic restriction information by fax on demand.   (Guidance given by automatic voice response.)

(3) Operating Method of the System

Road management information is automatically sent out to related organizations when person in charge at each civil engineering office inputs it to the exclusive terminal.   Following figure shows an example of the flow of detailed operation from the first report of a disaster to the completion of the restoration work.

<Figure 2>
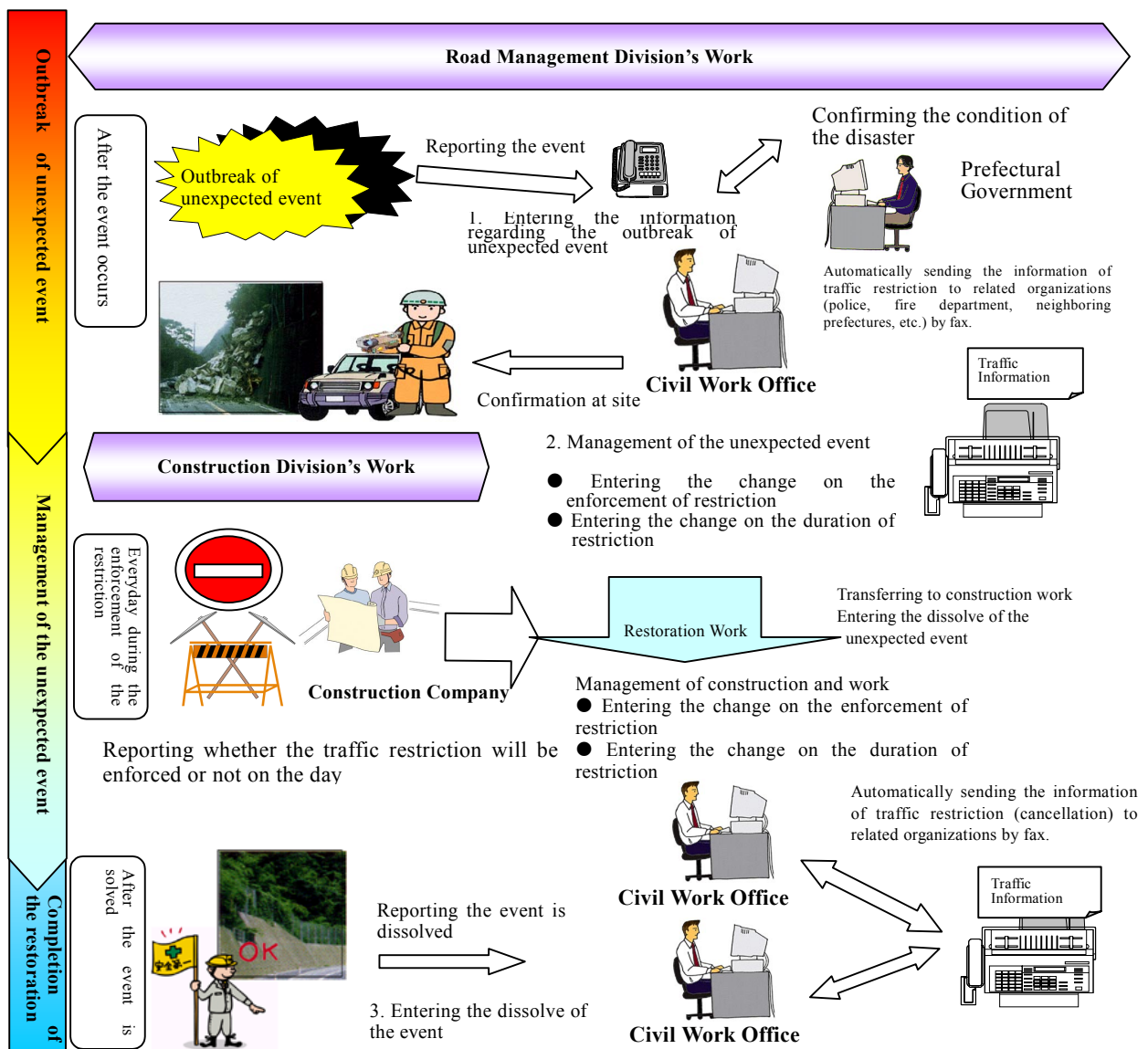
(4) User Interface

Users can handle it easier, since it adopts Graphic User Interface (GUI) based on the map image, which is made by laying DRM (position coordinate) over raster map (background chart).

DRM

Value Map (Raster)

Laying on top

Text

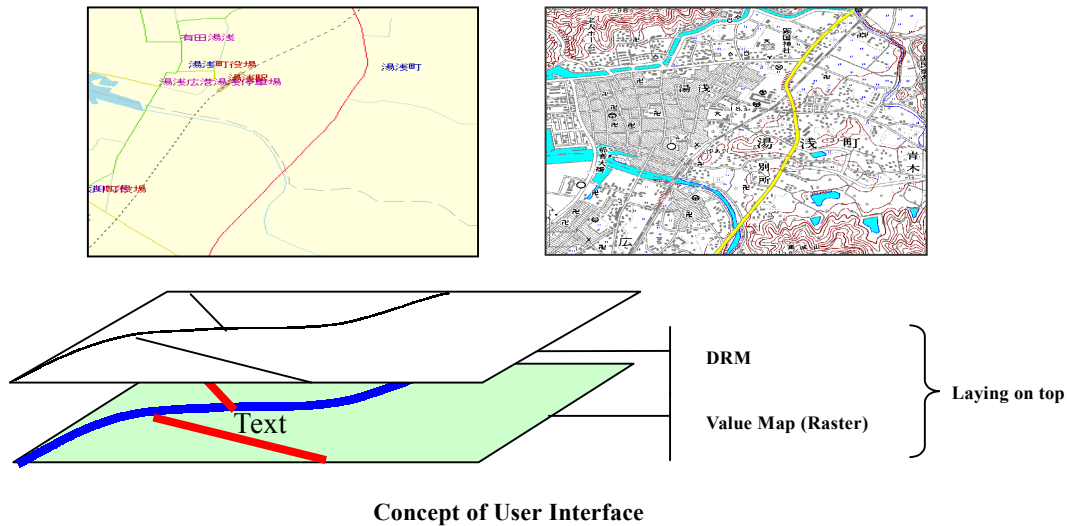Concept of User Interface

<Figure 3>

(5) Expected Future Development

① Updating Traffic Restriction Report by Civil Work Engineers

When a traffic restriction data entered by the person in charge at a civil work office changes its schedule due to the influence of weather and/or other elements, it is possible that users cannot receive correct information. Person in charge at a civil work site can provide correct information by updating the schedule with a portable phone in timely manner.

Internet

Internet

Updating the Restriction Data

Fax Information Service

Road Information
Management Server

Road Station Data Terminal

<Figure 4>
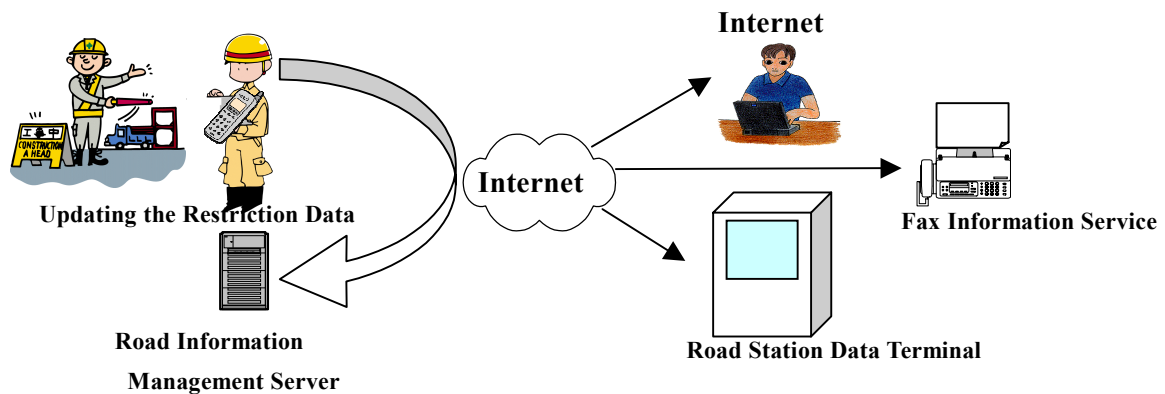
② **Expanding the Function of Providing Information**

a. Providing Road Information from Portable Phone

Road management information can be provided to more users By preparing the contents for portable phone that can use Internet (i-Mode, ezWeb, etc.).

Wakayama Prefecture Road Information	
1 Traffic Restriction	
2 Scheduled Civil Work	

Traffic Restriction Information	
1 Outskirts of Wakayama City	
2 Outskirts of Hashimoto City	
3 Outskirts of Arita City	
4 Outskirts of Gobo City	
5 Outskirts of Tanabe City	
6 Outskirts of Kushimoto City	
0 Return	

Traffic Restriction Information

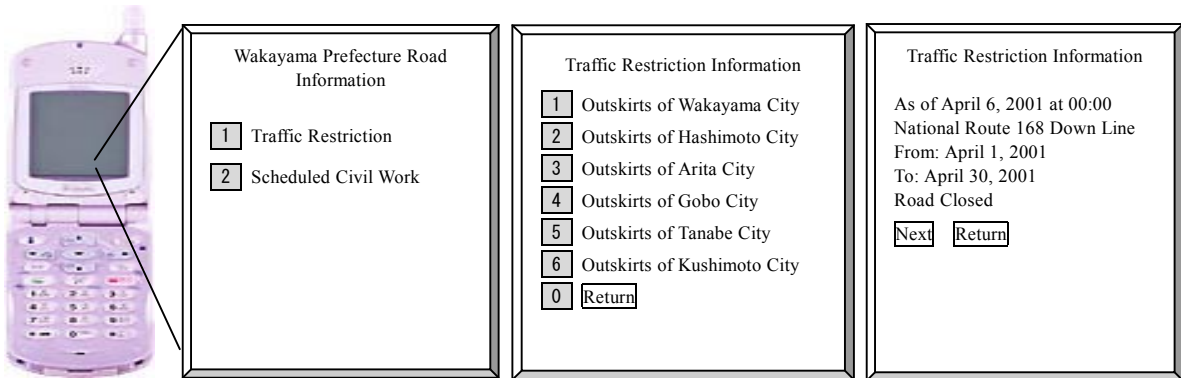As of April 6, 2001 at 00:00
National Route 168 Down Line
From: April 1, 2001
To: April 30, 2001
Road Closed
Next   Return

<Figure 5>

b. Providing Road Information for Kinetic Internet

Current road management information provided for Internet is the hourly updated data by the "Road Information Management Server."   Therefore, it is not able for user's terminal to change the display and other elements.   However, installation of an exclusive server makes it possible to build the structure to create kinetic contents, which is more suitable for Internet delivery.

Road Information Management Server

WWW Server for Road Information Management System

Internet

Displaying the real time data

Extracting data from the database and create contents in kinetic manner.

<Figure 6>
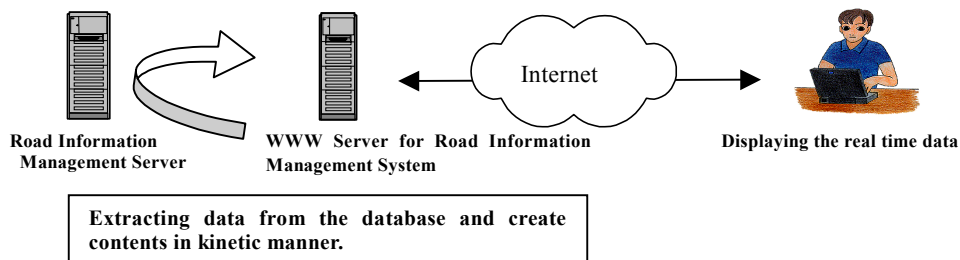
3. Example 2 of the System Construction Regarding Sharing and Providing the Road Management Information
-The Case of "Hiroshima Triangle System" at the Hiroshima Highway Office of the Ministry of Land, Infrastructure and Transport, Hiroshima Prefecture, Higashi-Hiroshima City, Kure City and Hiroshima Prefectural Road Corporation -

(1) Target Information and the Way to Collect Them

Information regarding weather, road management, facilities and roadside condition are subject to be gathered in this system. Types of information and the way they are gathered are individually set in detailed manner as shown below, depending on the difference of maintenance condition and the degree of penetration of information at each management office. Additionally, information of public traffic system, considering modal mix as a measure for traffic demand, is included to a subject to gather.

1.Hiroshima National Route
2.Hiroshima Prefecture
3.Hiroshima Expressway Corporation
4.Hiroshima City
5.Kure City
6.Higashi-Hiroshima City

A. Online
B.Input

Subject Information Items and How to Collect Them

Data Item		Collecting Method	Main Body						Entry	
			1	2	3	4	5	6	A	B
Weather Data	Precipitation	Collecting the data on telemeter on-line	●	●	●				●	
	Snow Accumulation	Collecting the data on telemeter on-line	●						●	
	Temperature	Collecting the data on telemeter on-line	●						●	
	Temperature of Road Surface	Collecting the data on telemeter on-line	●						●	
	Icy Road	Collecting the data on telemeter on-line	●						●	
	Precipitation Data from Radar	Collecting on-line data from the radar image	○						○	
	Other Weather Information	Seismometer, images from Himawari weather satellite, direction and speed of wind, sunlight, visibility meter, caution and warning	○	○	○	○	○	○	○	
Road Management Information	Inputting Construction and Work Data	Content of the work is previously input as master information. Only the actually enforced restrictions on the day are entered	●	●	●	●	●	●		●
	Inputting the information regarding unexpected event	When unexpected accident and/or natural disaster occur, content, cause, location and possible restrictions are entered	●	●	●	●	●	●		●
	Inputting and Displaying Caution/Warning	Entering, deleting and referring to the information regarding caution/warning. This function operates both input and display	●	●	●	●	●	●		●
	Inputting and Displaying Disaster Prevention System Data	The detail is input and displayed when such system is issued by each organization at the event of unusual weather, such as heavy snow and typhoon	●	●	●	●	●	●		●
	Remotely Inputting the Restriction Data	The person in charge at site connects i-mode operating portable phone to the Internet and inputs the data of commence, suspension and completion of the restriction through web	○	○	○	○	○	○		○
	Inputting the Traffic Condition Data	Traffic condition data is gathered from the VICS server installed by Hiroshima Highway Office. Other administrators collect the traffic condition data in their area	○	○	○	○	○	○		○
Information of Facilities, Roadside and Environment	Facilities	CCTV image, collected by Hiroshima Highway Office, is converted to MPEG file. 1.5 hours amount of data is constantly accumulated.	●						●	
		Content of the display on the information board, traffic information (transferred from the Road Information System on-line).	●						●	
		Data from the vehicle sensor installed by Hiroshima Highway Office	●						●	
	Environmental Data	Radiation detector, density of CO_2, Nox, SPM (density of floating particle materials), etc.	○	○	○	○	○	○	○	
	Structure Detecting Data	Including detection of falling rocks, excessive scale of wave and mudslide plus automatic observation of landslide	○	○	○	○	○	○	○	
	Public Transportation	JR trains, planes, commercial boats, busses, etc	○	○	○	○	○	○	○	
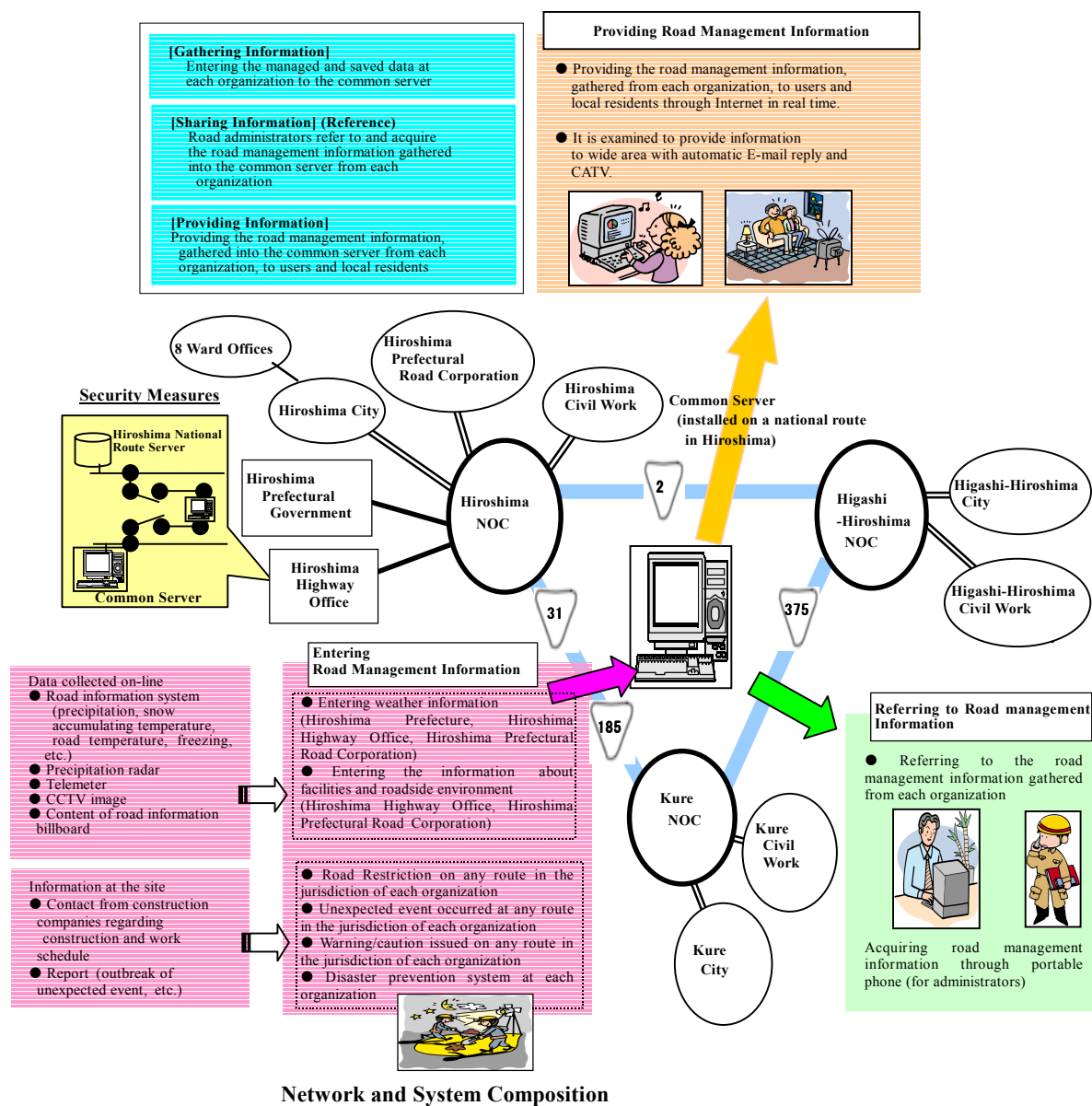
<Table 1>

(2) System Construction and the Network

This system's backbone is the network infrastructure with G-bit level speed provided by the optical fiber cable buried in National Route 2, 31, 185 and 375.The system connects 3 hub points, Hiroshima, Higashi-Hiroshima and Kure, therefore, named "Hiroshima Information Triangle."

At each hub, Network Operating Center (NOC) is installed to control communication between the hubs and to provide gateway service to connect outside network to this system.

It is automatically handled to share the road management information by sending requests, such as entry and reference from each client, to the server installed on a national highway in Hiroshima. To confirm the system security, measures shown in Fig.7 are taken.

Network and System Composition

<Figure 7>

(1) System Function

The method of providing road management information is categorized into before/during driving and on demand/broadcast system.

① **Before Driving**
- On Demand System – WWW, CTI, CATV, etc.
- Broadcast System – Television, Radio, etc.

② **During Driving**
- On Demand System – Kiosk Information Terminal, Cellular Phone, etc.
- Broadcast System – Road Information Board, Radio, Electric Billboard, etc.

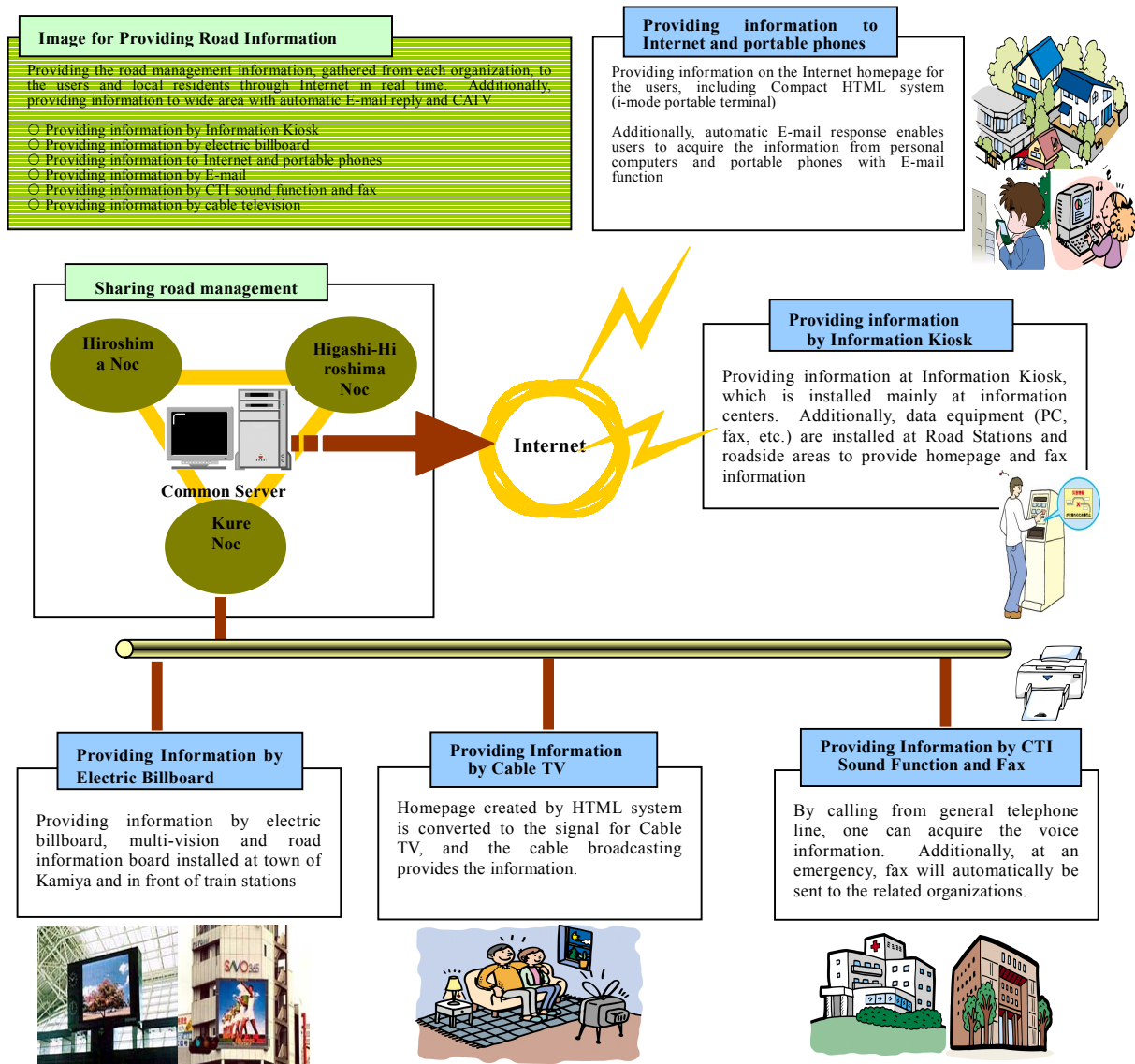Figure 8 shows the outline of the on demand system.

Image for Providing Road Information

Providing the road management information, gathered from each organization, to the users and local residents through Internet in real time. Additionally, providing information to wide area with automatic E-mail reply and CATV

○ Providing information by Information Kiosk
○ Providing information by electric billboard
○ Providing information to Internet and portable phones
○ Providing information by E-mail
○ Providing information by CTI sound function and fax
○ Providing information by cable television

Providing information to Internet and portable phones

Providing information on the Internet homepage for the users, including Compact HTML system (i-mode portable terminal)

Additionally, automatic E-mail response enables users to acquire the information from personal computers and portable phones with E-mail function

Sharing road management

Hiroshima Noc

Higashi-Hiroshima Noc

Common Server

Kure Noc

Internet

Providing information by Information Kiosk

Providing information at Information Kiosk, which is installed mainly at information centers. Additionally, data equipment (PC, fax, etc.) are installed at Road Stations and roadside areas to provide homepage and fax information

Providing Information by Electric Billboard

Providing information by electric billboard, multi-vision and road information board installed at town of Kamiya and in front of train stations

Providing Information by Cable TV

Homepage created by HTML system is converted to the signal for Cable TV, and the cable broadcasting provides the information.

Providing Information by CTI Sound Function and Fax

By calling from general telephone line, one can acquire the voice information. Additionally, at an emergency, fax will automatically be sent to the related organizations.

Image of Providing Information

<Figure 8>

4. Study of Applicability of Road Management in Winter Time

(1) Applicability on the Actual Condition of the System

Both of abovementioned 2 example cases made actual achievements on efficient winter road management by sharing and providing road management information. (Frequent traffic restrictions are issued to the mountain areas of Kii mountainous region in Wakayama and Chugoku mountainous region in Hiroshima due to heavy snow and ice in winter.)

① Sharing Information
● As the entire area catches the progress, current condition and expected data of weather and other information, it became effective on the plan and operation for sprinkling antifreeze agent.
● In case of emergency heavy snow, it is possible to plan and operate clearing of snow within related stations.
● Any administrative division can supply quick responses to the questions came from general users.

② Providing Information
● Since portable phones became so popular, there is a higher needs to develop the system that can efficiently collect information.
● To consider the aging and decrease in population, it is important to provide information by existing communication device, such as telephone and fax, to the weak to advanced information.
● It is necessary to provide CCTV image, indication on maps and visual information.

(2) Measures for Future Winter Road Management

① Making Management Work More Efficient
Efficient management can be achieved by inputting information of weather and road condition in a database for analysis, so that snow clearing (including the arrangement of work vehicles) and antifreeze agent sprinkle plans can be drafted before the incident occurs.

② Supporting Driving Plan
It is possible to help making the most suitable driving plan by providing road information in wide area, which crosses managing districts, to the users through many communication tools. For the residents who live in the area with frequent snow and ice, traffic restriction information has higher demand than a forecast of snowfall.   However, sometimes for those who suffer from heavy snow, it is considered that the information that they can make choices, including detours, is more desired.