

## Information Sharing Concerning Lifeline Utilities on the Mitigation Information Sharing Platform

*Yasunori Hada<sup>1</sup>, Suetomi Iwao<sup>2</sup>, Takeyasu Suzuki<sup>3</sup> and Kimiro Meguro<sup>1</sup>*

<sup>1</sup> *Institute of Industrial Science, The University of Tokyo, Japan*

<sup>2</sup> *Japan Engineering Consultants Co., Ltd, Japan*

<sup>3</sup> *Interdisciplinary Graduate School of Medical and Engineering, University of Yamanashi, Japan*

### Abstract

It is well known that the information sharing is effective to mitigate damages due to disasters. Such a lesson learnt from the past events of disaster, however, was not necessarily reflected in actual operation of disaster countermeasures. In order to get rid of a lack of information, a research project on disaster mitigation using crisis-adaptive information sharing technology was started in July, 2004. It is a joint research of 12 different organizations funded by the Ministry of Education, Culture, Sports, Science and Technology, Japan. National Research Institute for Earth Science and Disaster Prevention (NIED) is in charge of leading the project, representing 12 organizations. The research reported here is carried out as a part of the project.

In this paper, we focus on information sharing concerning lifeline utilities. Authors have been tackling information sharing of lifeline utilities (such as power, city gas, telecommunication and road traffic) in disasters for reducing damages. When the mitigation information sharing platform is realized, contents of lifeline information to be required and implementation issue to be raised have been discussed. First, it is arranged that several information that lifeline utilities require and also can provide in disasters. Using those results, possibility for sharing information on disaster mitigation and its effects are discussed. Second, connecting between information systems of lifeline utilities and other systems is examined using the developed prototype system for lifeline utilities. Further more, issues on connecting an information sharing platform that this project has been developing to existing information systems and requirements for the platform are discussed.

**Keyword:** *lifeline, information sharing, information sharing platform*

## **1. Introduction**

Information sharing among organizations regard to disaster reduction in disasters has been raised based on lessons from past disasters. In spite of recent breakthrough of information and communication technology, it still remains significant issue. In order to solve this problem, a research project on disaster mitigation using crisis-adaptive information sharing technology was started in July, 2004[1]. It is a joint research of 12 different organizations funded by the Ministry of Education, Culture, Sports, Science and Technology, Japan. National Research Institute for Earth Science and Disaster Prevention (NIED) is in charge of leading the project, representing 12 organizations. The research reported here is carried out as a part of the project.

In this paper, we focus on information sharing concerning lifeline utilities. When the information sharing platform is realized, contents of lifeline information to be required and implementation issue to be raised have been discussed. First, it is arranged that several information that lifeline utilities require and also can provide in disasters. Second, connecting between information systems of lifeline utilities and other systems is examined using the developed prototype system for lifeline utilities. Further more, issues on connecting an information sharing platform that this project has been developing to existing information systems and requirements for the platform are discussed.

## **2. Current status of lifeline information sharing**

Current status of lifeline information sharing between lifeline utility company and other organizations, and its problems are reviewed. In this paper Tokyo Gas Co., Ltd.(stated as TG below the paper) and Tokyo Electric Power Company(stated as TEPCO below the paper) are treated as representation of city gas company and electric power company respectively. Because those two companies has done advanced activities such as online information provision to DIS (Disaster Information System) in the Cabinet Office. This information provision was operated from November 25, 2003.

### **2.1 Current status of information sharing**

**Table 1** and **Table 2** show information sharing cases in TG and TEPCO respectively. Tables are structured organizations to be provided to, contents and purpose. TG provides gas supply suspension information and observed earthquake ground motion data. Also TG gets fire outbreak information to prevent secondary damage such as fires and explosions. TEPCO provides approximate number gathered power outage customers in each city.

**Table 1 Information sharing cases in TG**

| <b>providing/receiving</b> | <b>Toward/From</b>    | <b>Contents</b>  | <b>purpose</b>               |
|----------------------------|-----------------------|--|------------------------------|
| providing/receiving        | Keiyo Gas Co.         | ground motion (SI and Gal)                                   | emergency response           |
| providing/receiving        | Chiba Gas Co.         | ground motion (SI and Gal)                                   | emergency response           |
| providing                  | The Cabinet Office    | approximate number of customers in suspension in each cities | emergency response           |
| providing                  | Yokohama City         | ground motion (SI and Gal)                                   | emergency response           |
| providing                  | Tokyo Fire Department | gas supply suspension map                                    | assistance for fire fighting |
| receiving                  | Tokyo Fire Department | faire outbreak point   | emergency response           |
| providing                  | Mass media            | SI sensor information (30 points)                            | emergency response           |

**Table 2 Information sharing cases in TEPCO**

| <b>providing/receiving</b> | <b>Toward/From</b>    | <b>Contents</b>  | <b>purpose</b>     |
|----------------------------|-----------------------|--|--------------------|
| providing                  | The Cabinet Office    | approximate number of customers in power outage in each cities | emergency response |
| providing                  | Tokyo Fire Department | approximate number of customers in power outage in each cities | emergency response |

## **2.2 Problems of providing suspension information**

### **1) Different information requirements between information sender and receiver**

Grasping number of customers in suspension is based on its provision system. GS and TEPCO grasps number of customers in suspension to gather numbers of customers belonging to low pressure distribution blocks and power distribution lines in suspension respectively. Basically area of those gathering units is different from administrative district. Therefore lifeline suspension information can be supplied is just approximate number information including errors.

### **2) Not reflecting restoration information**

GS and TEPCO don't supply online restoration information. Because lifeline suppliers had no incentive to develop information system which has function to calculate number of customers restored lifeline suspension, those current information systems don't have automatic calculation function of restoration information.

### **3) Information standardization**

Because electric power suppliers have individual information system, ways of gathering power outage data are different from each other. For realizing information sharing between suppliers, information standardization is absolutely necessary.

**Table 3 Information available in TG and TEPCO**

| Subject                | Information subject                  | Contents and Qualification  |
|------------------------|--------------------------------------|---|
| City Gas (TG)          | supply disruption information        | block unit in low-pressure distribution area                                      |
|                        | ground motion information            | SI and Gal per 50m mesh   |
| Electric Power (TEPCO) | supply disruption information        | distribution line   |
|                        | supply state on important facilities | Significant facilities such as governmental offices, hospitals, refuge and so on. |

**Table 4 Information to be required by TG and TEPCO**

| Subject                                 | Information to be required                            | Use                              |
|---|---|----------------------------------|
| City Gas (TG)                           | fire information                                      | restoration                      |
|   | leakage information                                   | emergency shut off               |
|   | arterial road information (regulation and congestion) | emergency shut off               |
|   | power supply information                              | emergency shut off               |
|   |   | prevention of secondary disaster |
|   | water supply information                              | emergency shut off               |
|   |   | restoration planinig             |
| aerial photograph                       | gathering damage information                          |                                  |
| Electric Power (TEPCO)                  | arterial road information (regulation and congestion) | restoration                      |
|   | road information around facilities                    | restoration                      |
|   | aerial photograph                                     | restoration                      |
|   | satellite image                                       |                                  |
|   | keep out information in damaged area                  | restoration                      |
| secondary damage prediction information | restoration   |                                  |

As mentioned above, various problems are raised, however information sharing requires mutual understanding of “contents, qualification and limitation of sharing information” and “who and how to use it”. On the other hand, supplying information to unspecified majority (general public), information suppliers have to be careful in order to avoid misunderstandings and abuses.

### **3. Lifeline information to be required**

According to interview investigation and brain storming with lifeline suppliers, lifeline information to be required is arranged in each subject, information subject, contents/qualification, use and time phase (**Table 3** and **Table 4**).

As the information subject, in addition lifeline suspension, arterial road, fires, gas leakage, refuge, secondary damage prediction, keeping out area, aerial photograph and satellite images are raised. Especially every organizations regard to disaster reduction requires arterial road information, however, grasping road information in large are around damaged area, supplies

have to gather related every web sites and facsimile on/from road administrators because different road administrators for road types and regions.

#### **4. Requirements for Information sharing platform**

##### **4.1 Effective operation**

- 1) Own information system can superpose at ease on GIS data provided by the others.
- 2) Data handling can be unified on the platform.
- 3) Providing information is required strongly, however, connecting own system to the platform is not clear to be able to get information to be required.
- 4) Give-and-take in information sharing is absolutely necessary. How to give connectors incentive for connecting platform is very important issue.

##### **4.2 Accuracy and contents of information**

- 1) Unreliable information is not provided to unspecified majority. Before providing information, who provide it and who get it and how to use it are understood each other.
- 2) Before connecting the platform, accuracy and contents of providing information have to be well-known.
- 3) According to unreliable information, misunderstandings and misjudgments, secondary damage must be avoided.
- 4) Keeping information update in real time (high update frequency) is very important.
- 5) Information standardization is absolutely necessary.

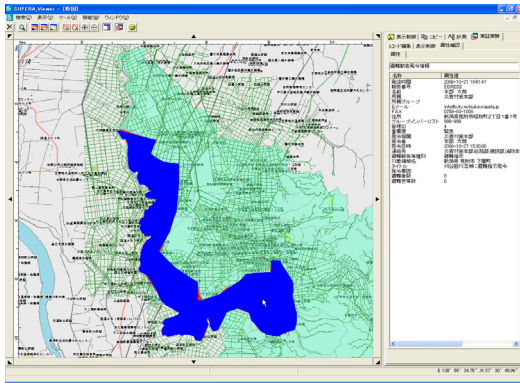
##### **4.3 Cost sharing**

- 1) Information available and information to be required are not always corresponded with each other. Therefore new system for providing information to be required has to be built. In this case, how to share cost is problem.
- 2) Without large modification of developed system, information sharing has to be realized easily and economically.
- 3) Connecting to the platform has to be done at single point. If those who require information sharing connect to information provider respectively, cost of system modification and maintenance in information provider is enormous.

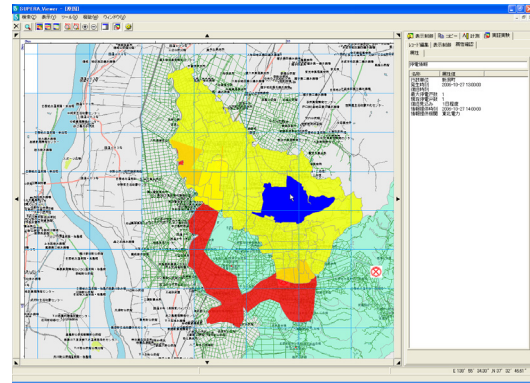
#### **5. Information sharing prototype system**

##### **5.1 Building prototype system**

Prototype system for sharing information with the other organizations is built. Prototype system is composed of database access tool for connecting the platform and GIS application to display shared information.



(i) evacuation directive area (blue zone) provided by a local government



(ii) power outage area (yellow zone) provided by a power company

**Fig. 1** Sharing information images on the prototype system

## 5.2 Demonstration test

Demonstration test for examination of connecting the developed prototype system to different systems which suppose to belong to the other organizations was done. MISP (Mitigation Information Sharing Protocol) [2] was used as a communication protocol. MISP is a standardized protocol composed of international standard such as XML, GML SOAP and WFS. **Fig. 1** shows sharing information images on the prototype system. Evacuation directive information and power outage information are provided by a local government and a power company respectively.

## 6. Conclusion

In this paper, lifeline information sharing on the mitigation information sharing platform in disasters is introduced. Lifeline information to be required is summarized and problems of the information sharing platform are arranged. According to the result of the demonstration test, the effectiveness of the Mitigation information sharing platform and its access tools are verified.

## References

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