

# Structure of Web-Based Victims Master Database of the Life Rebuilding Process -A Study of the Great East Japan Earthquake of 2011-



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### **SUMMARY: (10 pt)**

The Great East Japan Earthquake occurring on March 11th in 2011 has two serious issues; one is many local governments were affected at once which means “wide-spread catastrophe”, the other is the earthquake caused not only ground-shaking but also huge tsunami, liquefaction and explosion accident of nuclear plant which means “complex catastrophe”. These caused that the criteria and workflow to certificate the qualification for support programs differ in each local government. Against this issue, we proposed the development of Victims Master Database (VMDB) that can manage the real-time situation of victims’ life rebuilding progress. In this research, we designed the system requirements investigating their actual response flow in affected governments, and developed the standardized management system of VMDB. Now, we installed this developed system into Iwate prefecture, and local responders at affected governments in Iwate have utilized this system aiming to support victims’ early life rebuilding effectively and fairly.

*Keywords: Victims Master Database, Life Rebuilding, Integrated Database, Work Flow Analysis*

## **1. Introduction**

### **1.1. History of the Victims Master Database (VMDB)**

The Great East Japan Earthquake occurred on March 11, 2011 at 14:46. In contrast to previous disasters, a variety of factors contributed to the damages observed in this earthquake. These factors included seismic vibration, a tsunami, liquefaction, and a nuclear disaster, which resulted in building damages, building losses, ground damages, and environmental damages, respectively. Afflicted areas span multiple prefectures, and 241 cities, wards, and “cho” districts. In fact, villages in 10 prefectures received aid based on Disaster Relief Act.

Experiences from past disasters have lead Japan to establish a variety of well-organized support services to help victims rebuild their lives. However, the current standardization of workflow needed to effectively offer these support services and build support tools are not sufficient. The amount of work required is extremely large because the disaster area is widespread and a large number of people require support services. Therefore, the establishment of a workflow and support tools would be beneficial. Herein, we describe the generation of a VMDB to improve the efficiency of providing support for victims.

The building of the VMDB system has been an ongoing effort in conjunction with municipalities that have experienced previous disasters. The history of the VMDB system is detailed below.

#### *a) The 2004 Chuetsu Earthquake*

We developed a Disaster Victims Certificate application and issuance system to efficiently provide

support to disaster victims. An industry-academia support team coordinated the governmental activities in the City of Ojiya, Niigata Prefecture, and issued a large number of certificates over three days immediately following the disaster. Our system was utilized in city hall.

*b) The 2007 Chuetsu Offshore Earthquake*

Upon request from the City of Kashiwazaki, Niigata Prefecture, we provided support for life rebuilding initiatives as an industry-academia team. Our support spanned the following areas concerning life rebuilding of disaster victims: (1) building damage certification survey, (2) generating digital data of building damage certificates, (3) building a database to issue disaster victim certificates that encompassed a support system to receive applications and to issue certificates, (4) managing disaster victim certificates issuance, and (5) building a management system of disaster victim support initiative. The City of Kashiwazaki utilized this system to realize the goal of "life rebuilding activities that leave no one behind."

*c) Survey that lead to the launching of a system to issue Disaster Victims Certificates — Tokyo, 2010*

In FY 2010, Tokyo launched an initiative to build a system that "consistently conducts life rebuilding support activities from building damage certification survey to life rebuilding using a disaster victims database in a proactive manner," based on experiences from past disaster sites including Kashiwazaki City and verification that took place afterwards. Tokyo evaluated the activities of the industry-academia support team and its system, and subsequently rolled-out a customized system that was appropriate for the ward and city of Tokyo. The objective of this collaborative project (Tokyo plus industry-academia support team) was to realize a standardized support system that would be effective in the event of an epicentral earthquake in Tokyo.

## **1.2. A VMDB was necessary in the Great East Japan Earthquake**

A major concern in the disaster areas of the Great East Japan Earthquake is the inability to share a big picture of life rebuilding support initiative. To be specific, this is largely due to three issues: (1) Each municipality department is unable to view the activities of the other departments, (2) they are unable to determine how much support each victim is receiving, and (3) they are unable to determine how much support has been provided to the disaster areas. As a solution to these issues, our research developed and implemented a disaster victim life rebuilding support system that facilitated a timely recovery process.

This VMDB system differs greatly from past systems in four specific aspects: (1) The master database schema is standardized, (2) the system is implemented in a stable network, (3) common and necessary applications are developed through disaster victim support service provisioning, and (4) the system is compatible with other activities because it utilizes an Excel format (CSV) for the import and export of data. We believed that these four improvements would enable utilization of the system by multiple municipalities, thus supporting life rebuilding processes in the entire disaster area.

## **2. Work Flow Analysis of the Administrative Support for the Life Rebuilding Process**

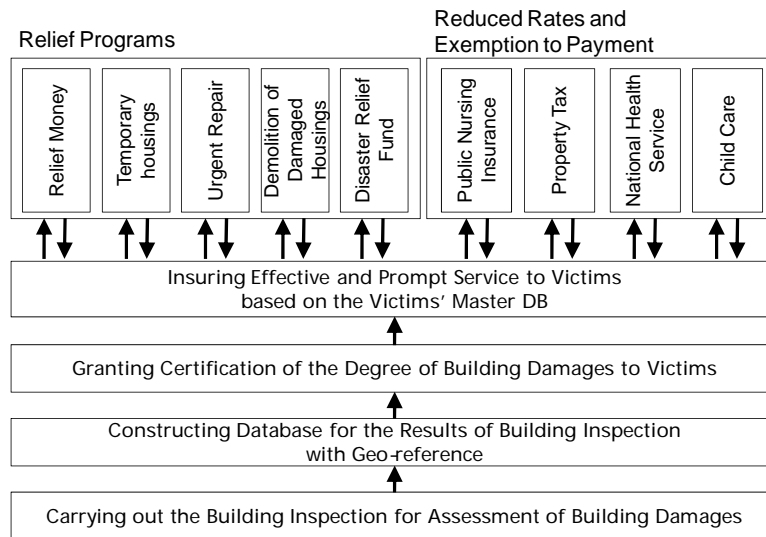
In our design of a standardized VMDB, we analyzed various work flows using the system. This work flow analysis highlighted the fact that the system could be deployed by municipalities at different stages of support activities to deploy the system in the mid-flow. In addition, the record data that is generated is made available for review in real-time.

In the event of a disaster in Japan, local governments provide many types of administrative services to victims. Before the provision of these services, victims have to be identified and apply to the support programs. Victims are identified on the basis of building inspections for the assessment of building damages. The results of the building inspection are compiled in a database and certification of the degree of building damages are in turn granted to the victims.

Previously, a basic database was constructed to manage the certifications for the degree of building damages. However, this database did not contain geo-reference information. Therefore, this database has limited utility for providing basic information for providing subsequent support services to victims.

In order to circumvent these issues, in this research we decided to develop a database to house the

results of building inspections with geo-reference, and to grant certification of the degree of building damage based on this geo-database. Furthermore, we proposed to develop the VMDB to store a variety of victim information that can be used in concert with the geo-database of building damage certification to facilitate effective and prompt support services to victims. Local responders can also use the VMDB to provide a plethora of administrative support to victims. The proposed effective work flow is shown in Figure 1.



**Figure 1.** Work Flow of Administrative Support

### 3. Four Viewpoints in the System Design

#### 3.1. Standardization of the Database Schema

Data schema used in the system should be standardized in order to facilitate sharing among multiple municipalities. The database table entries are dependent on the type of work. Moreover, the system has applications that allow for the conducting of searches and the consolidation of these table entries. It is important to note that work flow analysis results described in the previous chapter clearly demonstrate the need for each disaster victim life rebuilding support service to individualize their table design to meet the wide variety of information processing needs. Additionally, as the life rebuilding support phases progress, new support services and services from different municipalities can always be added. This makes it difficult to standardize the database schema to support all disaster victim life rebuilding support services.

We provided a solution through this research by constructing the VMDB with a group of tables that are described in the following paragraphs:

##### a) User Manager Tables

This group of tables manages user login. A municipality is identified for a logged-in user and searchable range of information is determined. The logged-in user is also has the right to browse, update, export, import, and other operations.

##### b) Master Information Tables

This group of tables manages basic information regarding individual victims and households. In addition to basic identifying information such as names, addresses, dates of birth, and family member, these tables contain data regarding ownership of real properties, degree of damages, and vital status of individuals (alive, dead, or missing). These pieces of information dictate which support services should be provided.

##### c) Work Information Tables

This group of tables manages support processes for various services. These tables have entries that are shared among all types of work, including name of activity, support recipient unit, progress of

support, and remarks. Support recipient unit is described as individual, household, or common-law household, with the management of common-law households being based on the way that the individuals lived at the time of disaster that are different from household constituents as listed in the Basic Resident Register. There are four major phases in terms of support progress, which can be further subdivided into ten steps. These four phases are color-coded for easy recognition on application screens as: 0, not applicable; 1, support initiated; 2 to 8, support in progress; and 9, support completed. In particular, the category, "support in progress" can be further divided into seven steps for each type of work. There are also other provisions for flexible data management including the organization of information using XML, thus allowing municipal employees to manage data using Excel.

### 3.2. System Implementation in a Stable Network Environment

The VMDB contains a large quantity of personal information. This necessitates implementation of this system on a stable network environment that ensures security. All municipalities in Japan share the closed network Local Government Wide Area Network (LGWAN). LGWAN is used to provide municipal services in normal time over a secured environment. Access from outside the network is restricted, which limits the threat from unauthorized users. It is important to note that LGWAN has different communication bandwidths between major cities and rural cities, small "cho" districts, and villages. The smallest bandwidth is 1 Mbps. If municipalities are the only users of this VMDB, then it is practical to implement it on the LGWAN. Because this system does not exist during normal times and it is instead deployed after an occurrence of a disaster, we limited the number of communication ports over a network to minimal.

### 3.3. Development of Common and Necessary Applications for Disaster Victim Support Services

In order to provide services effectively, a dedicated application that is customizable for each service needs to be developed. However, life rebuilding support services cannot be predefined, which means that new services are created as support services are being provided. To accommodate this situation, we listed features common and necessary to all services. Screens are also designed so that common information that is necessary to all services is displayed as an individual ticket. Information that is necessary for each service is displayed in a window that is dedicated to each service. (Figs. 2 and 3)

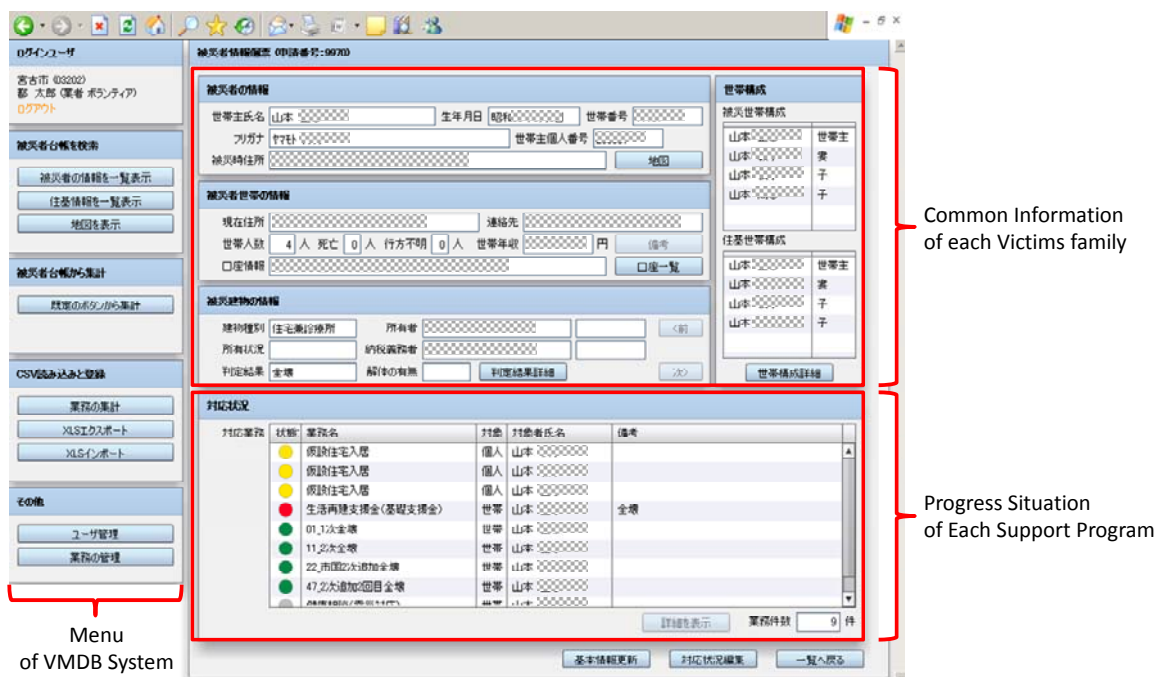


Figure 2. Screenshot of Common Information for Providing Support Services to Victims

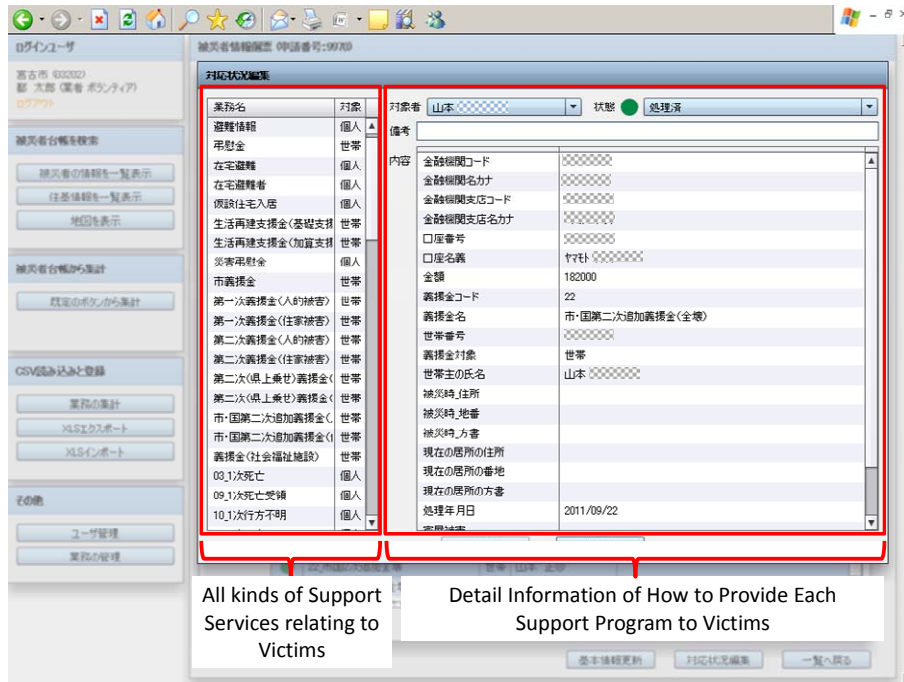


Figure 3. Screenshot of Detail Information about How to Provide Each Support Program

### 3.4. Interoperability with Excel

Many of municipal employees use Excel to manage their support activities. Excel is easy and useful to use because of its simple filtering, charting, and aggregating features. However, Excel is not appropriate to build a dataset because it is not bound by a concept of field and record like database tables.

Our system is designed to allow downloading data in Excel format so that municipal employees can work on the Excel files. It is also possible to read Excel files that contain service provision data using the system, so that these pieces of information can be consolidated. If municipal employees add or delete information in their Excel files, these modifications will be reflected in the system to be shared by other departments. An application of this system is schematically depicted in Figure 4.

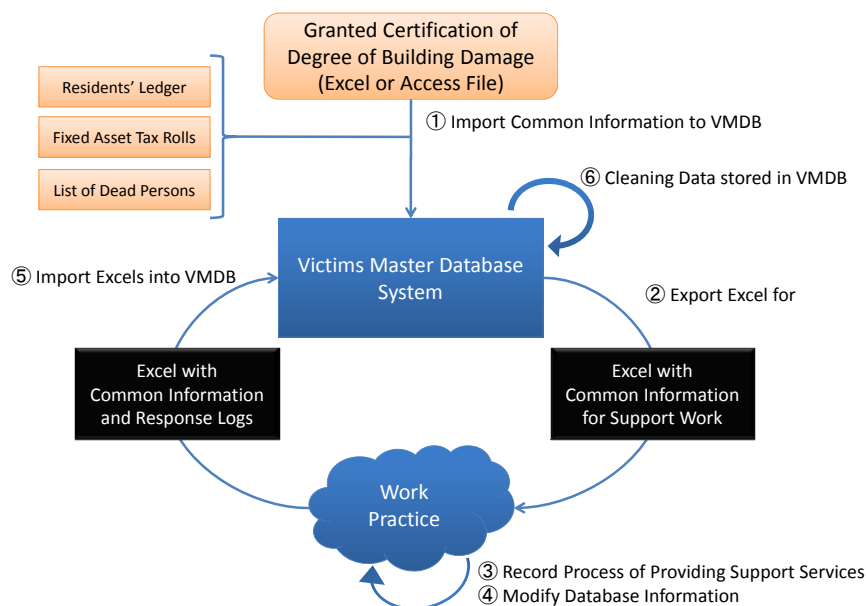


Figure 4. How to interoperate with Excel

## 4. Implementation and Operation of the System

### 4.1 Development of the VMDB System

We developed the system to be used in disaster areas of the Great East Japan Earthquake based on the system requirements as described in the previous Chapter. We used the configuration shown in Table 2 to develop this system to realize a stable operation in a short development period.

**Table 4.1.** Development environment of this system

Development Language		Adobe Flash Builder 4.5
Middleware	OS	Windows Server 2008 R2
	DBMS	SQL Server 2008 R2
Client	cross-platform browser plug-in	Adobe Flash Player
	Internet Browser	Internet Explorer

### 4.2. Implementation of the System

In Iwate Prefecture, 12 cities, "cho", and villages along the coast suffered damages, and many victims are currently trying to rebuild their life. As a shared infrastructure for all these cities, "cho", and villages, we installed a server within the Iwate prefectural office to implement the VMDB system. We have selected a server driven by a 20-core CPU with 128 GB memory and a 4 TB HDD, based on an assumption that a 6/12 of the municipalities will simultaneously access the database with at least ten employees.

This server was installed on a LGWAN (also called Iwate Information Highway) that connects cities, "cho", and villages in Iwate Prefecture. This enabled network access from information terminals at each municipality in a closed environment with a high level of security, and safe and stable system operation.

The server data is regularly backed up so that the system can be recovered to the state immediately before a system fault. Access from terminals in each municipality is always monitored with an access log. This enables identification of person(s) that make an unauthorized access.

### 4.3. Operation Verification of the System

This system was installed on the server at the Iwate prefectural office, and to date it is delivering the stable services. As many as twelve municipalities in Iwate Prefecture suffered damages due to tsunami along the coast, and three cities inland suffered damages due to vibration. Out of these fifteen municipalities, seven of them have registered their data and started using the system.

The City of Miyako was the first to deploy this system. They registered as many as 64 operational data from five departments that share the duty of life rebuilding support services for victims in an integrated manner. Moreover, Excel data that have been downloaded from this system are used to visualize rebuilding processes on maps, which in turn are used to identify new issues and generate initiatives. Other municipalities are expected to follow Miyako City to enter a full-fledged deployment of the system.

## 5. Conclusions

In this research, we designed and developed a VMDB system to facilitate the provision of effective life rebuilding support services in the aftermath of the Great East Japan Earthquake. This system has been designed to allow ease of use by multiple afflicted municipalities. Furthermore, the interoperability using Excel makes the database accessible to multiple municipal service providers.

The operational stability and security of the data is maintained using the LGWAN, which is a closed network among municipalities. This system is currently installed on a server at the Iwate prefectural office, and is being used by afflicted municipalities.

Although the system developed through this research is based on experiences from past disasters, knowledge about wide-area, complex disasters such as the Great East Japan Earthquake is not adequately incorporated. We are planning to make revisions to the system in order to combat the challenges that will surface as this system is continually used. Earthquakes are expected to occur in Tokai, Tonankai, and Nankai regions around Japan in the middle of the 21st century. We would like to further improve this system to aid in the early recoveries from these potential future earthquakes.

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