Study for Establishment of National Basic Geographic Data in The Republic of El Salvador

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Abstract:
The Study for Establishment of National Basic Geographic Data in The Republic of El Salvador was decided to conduct by the Government of Japan in response to the request of the Government of the Republic of El Salvador and Japan International Cooperation Agency (JICA) dispatched a study team organized by Pasco International Inc. to El Salvador, several times between March 1999 and July 2001. At the beginning of the study, main final products were digital topographic data for the whole country, however disaster maps and hazard maps were additionally added because the two large scale earthquakes occurred in January and February 2001.This study was an example how the several types of digital data for GIS were actually and effectively used.

1. Background

The Republic of El Salvador was heavily damaged by the Civil War from 1979 though 1992, the large-scale earthquake in 1986, the hurricane Mitch in 1998 and so forth. For the reconstruction and development, the Government of the Republic of El Salvador has been promoting economic development, reconstruction of infrastructure and protection of the natural environment, and requested the Government of Japan to establish national basic geographic data in digital format.

Accordingly, JICA undertook "The Study for Establishment of National Basic Geographic Data in the Republic of El Salvador" (the Study) in cooperation with the authorities of the El Salvadoran Government.

Meanwhile, in the course of the Study, an earthquake occurred in El Salvador on January 13, 2001 with a magnitude of 7.6 on the Richter scale, and another earthquake followed on February 13, 2001. For the urgent aid of the earthquake disaster, the additional preparation of the disaster maps of landslides caused by the earthquakes and hazard maps for landslides and debris flows to indicate potential danger of a secondary disaster were added to the objectives of the Study. The Study was started in March 1999 and continued to July 2001.

2. Objectives of Study

At the beginning of the Study, the main objectives were to create digital topographic data covering the whole country as the national basic geographic data, and to transfer the technology about the data creation and updating to the counterpart agency, Instituto Geográfico Nacional "Ing. Pablo Arnordo Guzman" (IGN), Centro Nacional de Registros, Ministerio de Economía in El Salvador.

Due to the two large-scale earthquakes occurred during the Study period, the final products were as follows:

1) Conventional topographic maps on a scale of 1/25,000 (approx. 3,700 km^2) for the area that there was not the existing 1/25,000 scale topographic maps
2) Digital topographic data for the whole country which positional accuracy is corresponding to the existing 1/25,000 scale topographic maps (approx. 20,740 km^2)
3) Digital disaster maps of the landslides resulted from the earthquakes in January and February 2001 (approx. 5,100 km^2)
4) Digital hazard maps for landslides and debris flows to indicate the areas susceptible to a secondary disaster (approx. 5,100 km^2)

3. National Basic Geographic Data

GIS spatial digital data was created as the national basic geographic data. The existing 1/25,000 scale maps were digitized, and for the areas where does not exist the paper maps, the new aerial photographs were used to create the digital data. A flow chart of the data creation digitizing the existing paper maps is shown on Figure 1.

19 layers of the digital topographic data were defined. Their categories and types were as follows:

- Administrative area, line and polygon
- Road, line
- Railroad, line
- Built-up area, polygon
- Building, polygon
- Settlement, point
- Well/Tank, point
- Utilities, line
- River centerline, line
- River, polygon

- Cartographic point, point
- Cartographic line, line
- Vegetation, polygon
- Land form, polygon
- Contour line, line
- Spot height, point
- Terrain, line
- Control point, point
- Annotation, point

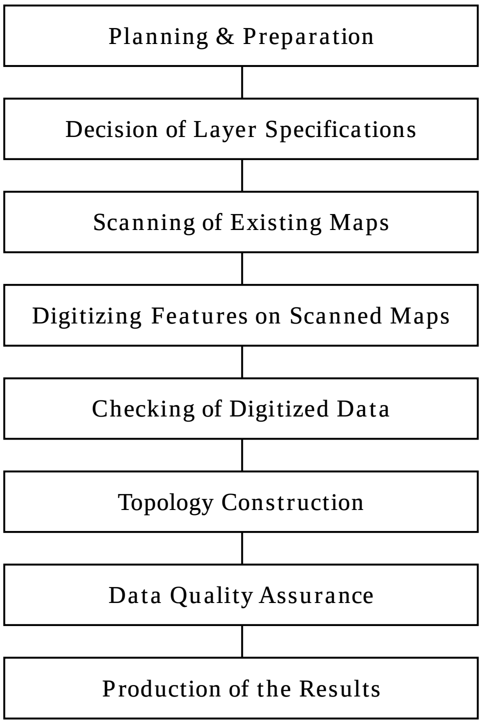

Figure1. Data Creation from the Existing Maps

4. Application to Disaster Prevention

When the digital topographic data were almost ready to be created, the two large-scale earthquakes occurred and El Salvador was seriously affected. Therefore, the urgent aid for the earthquake disaster was planed, and the creation of the following two data sets were determined as application of the digital topographic data: (i) disaster maps of the damaged areas resulted from the earthquakes and (ii) hazard maps of landslides and debris flows for the prevention of the secondary disaster.

However, there were some problems. The available digital topographic data should be updated because the data created from the existing maps had been prepared about 15-20 years ago. Moreover, there were not the recently taken aerial photographs covering the whole disaster areas and the study period left was very limited for updating the data.

4.1 Updating of the digital topographic data

Updating for limited major changes of roads, build-up areas and houses were decided and data collection was carried out in El Salvador for only three weeks.

Because the national basic geographic data created through the Study were digital data, it was rather easy and quick to update each layer , and variable reference data were used for updating by the same method. The topographic data were updated viewing the reference data like SPOT satellite images or scanned map images as background on a computer screen.

The reference data used to update the digital topographic data were the followings:
- SPOT satellite images
- Aerial ortho-photos (panchromatic, 1/5,000)
- The existing 1/5,000 topographic maps
- Tracking data of Mobile GPS

4.2 Extraction of Landslide Areas

Aerial photographs and satellite images were interpreted in order to locate landslides occurred by the earthquakes. The aerial photographs (panchromatic, 1/5,000 scale) were taken by IGN and the satellite images (panchromatic, 10 m resolution) were taken by SPOT IMAGE in France. The digital data of the landslide areas were prepared as follows:

1) The landslide areas were located by interpretation of the aerial photographs and the SPOT satellite images that were taken after the earthquakes.
2) Outlines of the landslide were plotted on the 1/25,000 scale topographic maps.
3) The extracted outlines of the landslide were converted to digital data and compiled with the digital topographic data.
4) Field survey sheets, field snapshots and the home page addresses that related to the two earthquakes were included as the digital format data.

4.3 Creation of Hazard Maps

The hazard maps for the steep slope and the debris flows were created. The existing 1/25,000 topographic maps were used to extract hazardous areas, and the extracted hazardous areas were converted to the polygon data and compiled with the digital topographic data. The extraction norms in the Study were as follows:

1) Hazardous area of steep slope

The area having the following conditions was defined as the hazardous area of steep slope:
- There is a slope of 30 degrees inclination or more.
- There are houses as protection objects on the existing 1/25,000 scale topographic maps within Area A and/or Area B in Figure 2. Here, H is the height of the slope.

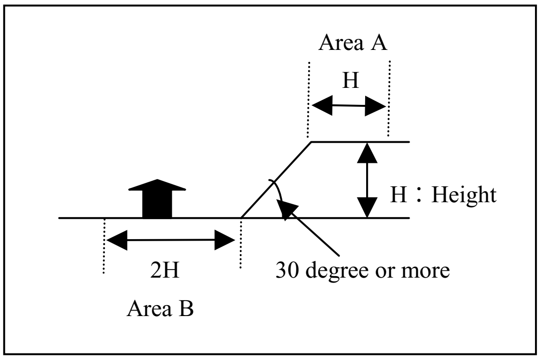

Figure 2. Hazardous Area of Steep Slope

2) Hazardous area of debris flow

The area having the following conditions was defined as the hazardous area of debris flow:

- The area from a place of 10 degrees streambed inclination to a place of 3 degrees streambed inclination (or 2 degrees streambed inclination in volcanic area).

An example of the disaster maps is shown on Figure 3, and an example of the hazard maps is shown on Figure 4.

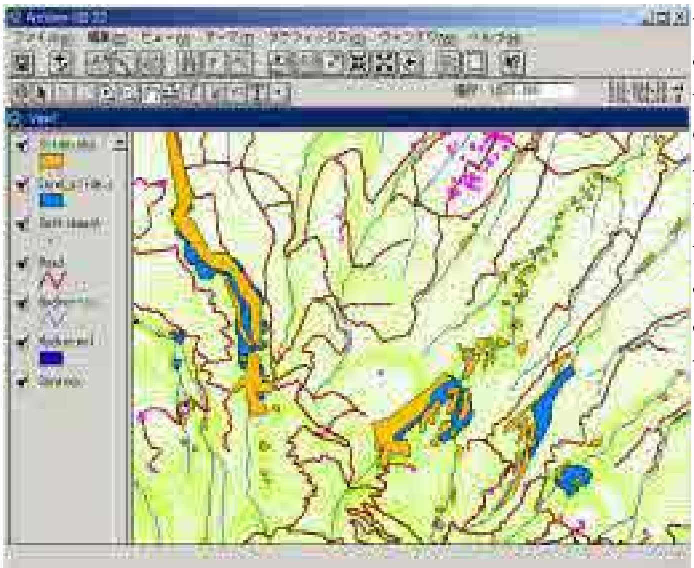

Figure 3. Example of the Disaster Map

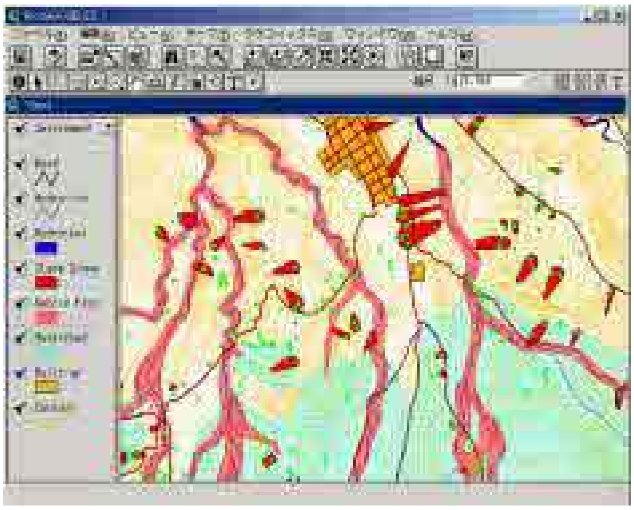

Figure 4. Example of the Hazard Map

5. Conclusion

Presentation of the Study and the products were held for related organizations several times in El Salvador, and samples of the digital topographic data were introduced worldwide through the Internet, so that the various parties can inquire for the digital data. It would be certain that the disclosed results of the Study will be effectively used by not only the El Salvadoran Government but the organizations of the countries encountering the same natural disasters. GIS digital data created as the national basic geographic data in the Study will be effectively used for variable spatial analyses and will be important for decision-making. Finally, it would be emphasized that any GIS data should be continuously updated and corrected for the use of the appropriate purposes.

Establishment of Base Map and Hazard Maps for GIS in the Republic of Guatemala

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Summary

Guatemala was hit by a large-scale hurricane in 1998 and serious damages affected the metropolitan city and its suburbs. In the aftermath of this disaster, a great number of supports for restoration and reconstruction were offered from several developed countries. The national topographic maps have not been revised and the old topographic maps have been used for the national effort to restore and reconstruct. A large segment of the population is still living in the stricken areas, as well as in other areas susceptible to similar disasters. There is a great fear that similar disasters may happen again. The Government of Japan is assisting in works for the development of a GIS database and hazard maps to be used in the national effort for restoring and reconstructing in Guatemala over the years, from 2001 to 2003.

1. Background and Outline of the Study

Some plate boundaries pass through Guatemala's national land and its periphery. The northern part of the country lies on the North American Plate, and the central and southern parts on the Caribbean Plate. Cocos Plate lies on the Pacific Ocean side in the southern part. There are many faults that run in parallel with these plate boundaries. The geological structure is thus very complicated. Furthermore, the geological features, such as volcanoes and volcanic ejecta sediments, which may cause disasters, are widely distributed in the metropolitan city of Guatemala, other main cities, and the neighboring areas of those cities. There are also many social problems in Guatemala that are caused by a weak social infrastructure resulting from the civil war that lasted for a long time, as well as from the poverty common in developing countries.

In such a fragile environment, the internal force of the earth can cause large-scale earthquakes and the eruption of active volcanoes. Meteorological disasters also have frequently occurred, such as the tremendous Hurricane Mitch that hit the Central American region in 1998. In particular, the metropolitan city tends to show high risk of disasters due to earthquakes, debris, mudflows, and volcanic ejecta.

This Study started in January 2001 with the aim to restore and reconstruct from the disasters caused by the Hurricane Mitch, develop the GIS database, create the hazard maps as basic materials required for countermeasures against such disasters, and manage and operate these resources using the GIS for national disaster prevention.

2. Details of the Study

The main items of this Study are establishments of the GIS and hazard maps. The counterpart agency for the GIS-related work is the IGN (National Geographical Institute) and that for the hazard map related work is the INSIVUMEH (National Institute for Seismology, Volcanology, Meteorology, and Hydrology). The objectives to build the GIS database and produce the hazard maps are certainly remarkable, but the final goal is to promote a disaster prevention reinforcement for each of the local governments and the residents, through an efficient use of the GIS and hazard maps, and to conduct the transfer of technologies in each stage.

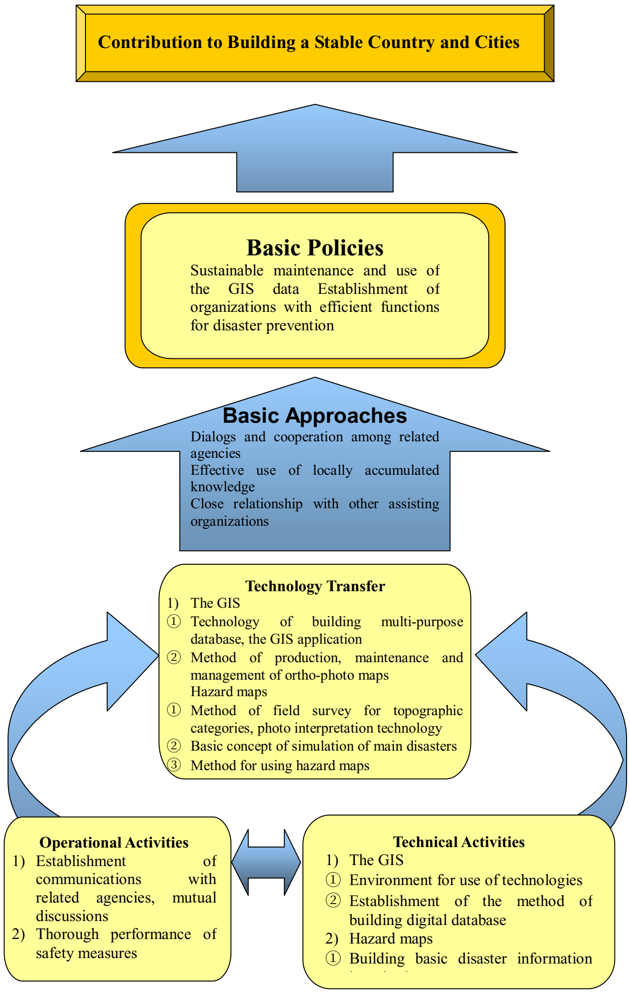

Fig. 1 Basic Policies of the Study

3. Production of Hazard Maps

The national land in Guatemala, with severe earthquake and volcanic activities, tends to be a passage for hurricanes, and cities and villages are distributed on that land. It is a well known fact that this country is prone to disasters. The demand for hazard maps is thus high and disaster prevention measures using the hazard maps must be taken.

The targets for hazard maps in this Study are earthquakes, volcanic disasters, hurricanes, floods due to heavy rain, and landslides (including slope avalanches, and debris flows).

Fig. 2 Image of Hazard Map (Assessment of risk of flooding)

4. Images of Hazard Maps

The hazard maps to be developed in this Study have not been completed yet within the fiscal year 2001, but the results obtained will be as follows. The disaster factors can be classified into those for which the dangerous districts can be predicted through simulation, and those that can be assessed statistically and qualitatively from the history of disasters, topographical and geological features.

5. Integration of Hazard Maps with the GIS and Total Disaster Prevention GIS

The basic data collected to produce hazard maps and the hazard maps are very important for the disaster prevention in Guatemala. There is a large volume of the GIS data that have been already arranged by the related agencies. The hazard-map GIS to be developed in the Study, that will be configured as a total disaster prevention GIS linking with the related GIS data, will be easier to utilize than the GIS configured as an independent system. It is thus preferable to build a total disaster prevention GIS based on technical discussions with the related agencies of Guatemala.

Items to be displayed by total disaster prevention the GIS (draft)

- Existing facilities
  Administrative organizations, police organizations, fire service organizations, military facilities, medical institutions, community centers, churches, parks and plazas, airports, heliports, highways, bridges, and ports
- Observatory facilities
  Meteorological offices, meteorological stations, hydrological stations, and seismographic stations
- History of disasters
  Chronological table of disasters, earthquake-stricken districts in 1976, Hurricane Mitch-stricken districts in 1998, volcanic ejecta distribution, past landslide points, table of damages, disaster photographs
- Disaster factors
  Topographical categories, surface layer geology, active faults, active volcanoes, and meteorological data
- Information on risks of earthquake disaster
  Districts with earthquake risks (districts in which an earthquake is easy to be amplified), districts with liquidization risks, and locations with landslide risks
- Information on risks of volcanic disasters
  Districts with risks of volcanic disasters
- Information on risks of landslide and flood
  Locations with risks of landslide and districts with risks of flood

6. Recommendations for Disaster Prevention Measures

The hazard maps should be utilized to inform the residents of the risks of various types of disaster and to take appropriate measures for their refuge in case of disaster. In addition, the hazard maps should also be drawn so that administrative officials can use them as basic materials for the area and facility development.

6.1 Promotion of Measures for Refuge using Hazard Maps

To minimize human casualties, it is most effective to establish a refuge system in case of disasters exclusive of abrupt earthquakes. First, the districts that are prone to dangers should be defined to regulate the land use in dangerous areas, and a refuge system to be applied in case of emergency should be established and the residents should be informed about it.

6.2 Support for the Establishment of Early Warning System

Various tasks are undertaken to establish the early warning system, including the installation of meteorological observatory equipment, establishment of a communication system, and development of an analysis system. For the establishment of an early warning system, it is necessary to understand well the wide-area atmospheric conditions, and it would be certainly rational to consider applying the warning system to the entire Central American area, and not only on a national level, since rivers extend across a wide region, flowing from one country to another.

6.3 Improvement of Building Standard Law and other Laws

The most serious consequences of earthquake are the collapses of buildings, especially the private houses. The structures of buildings in Guatemala are not designed to be earthquake-proof. Recent buildings use little adobe structure, but many of them are supported through lightweight blocks and reinforcing steel poles. They are thus not earthquake-proof. In case of serious earthquake, the collapse of buildings may constitute the main disaster factor. The revision of the Building Standard Law to ensure better earthquake-proof buildings is thus necessary.

In addition, laws related to river management, including construction of river structures, establishment of the flow observatory system, limitation of land use along a river, and promotion of appropriate land use, must be promulgated.

7. Conclusion

Through the arrangement of problems and tasks for the disaster prevention measures that have been evidenced by the results of this Study for three years, we can therefore recommend the kind of disaster prevention measures that is most suitable to a given disaster in Guatemala. The same technology used in Japan should not be provided, but the transfer of technology and the disaster prevention measures using hazard maps that are adequate for the local conditions of Guatemala will be recommended. In general, two methods for using hazard maps are to be considered, namely short-term use and long-term use of hazard maps.

① Short-term use
- Definition of dangerous districts requiring refuge, and provision of routes and place of refuge
- Disaster prevention training of residents

② Long-term use
- Disaster prevention facilities distribution plan
- Land use regulation
- Land use plan

In the short-term use of hazard maps, the protection of the life of the residents can be at least ensured. In the case of the long-term use, the land use regulation prohibiting residents to live in areas prone to disasters, the land use plan to reduce the eventual costs of damages, the installation and distribution of observatory equipment and the permanent disaster prevention measures such as construction of embankments and dams, should be considered not only for the protection of the residents' lives but also for minimizing the loss of property.

Disaster Information Management Activities using GIS in the Hanshin – Awaji disaster area

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Summary

The effects on use of GIS in the Disaster Information Management was proved by the Academic Volunteer Activities using GIS in the Hanshin – Awaji disaster area. This chapter introduces them and explains about the two kinds of usefulness of GIS uses in the debris removal processing and the decision support for an urban reconstruction planning.

1. Disaster Information Management Activities using GIS

1.1 Academic Volunteer Activities using GIS in Nagata ward

The Hyogo-Ken Nanbu Earthquake directly stroked under Kobe city on January 17, 1995. The damage of this earthquake was serious in Hanshin -Awaji disaster area. At the Northridge great earthquake of U.S. California in 1994, the emergency rescue operation was made on the base in GIS, but in Japan, it was not used for, although it was used for restoration works, such as the information processing for debris removal from collapsed private houses at local and regional administration office.

The Disaster Information Management Activities using GIS (DIMA-GIS), was carried out at Nagata ward Office in the western parts of Kobe city.(Kameda ,1995) The professor of the Kyoto University, Hiroyuki Kameda who is a chief of the special working group for a disaster prevention GIS in Japanese GIS Association , took the lead of this activity and Sigeru Kakumoto who is a visiting associate professor of DPRI-KU, supported the operation and development of the Disaster Management Spatial Information System (DiMSIS). And also Kansai branch director of Japanese GIS Association, Teruko Usui (professor of the department of Geography, Nara University) supported this activities by creating GIS database of damage and restoration. This chapter attempts to illustrate how GIS was socially useful for the restoration in the Hanshin – Awaji disaster area.

1.2 Disaster Information Databases and Time series Surveys by NUDPSC

Disaster Prevention Research Institute of Kyoto University (DPRI-KU),and Nara University Disaster Prevention Survey Commission(NUDPSC) created many databases of damage and restoration in the Hanshin - Awaji disaster area using GIS. The dead, building damage and the damage of a lifeline were inputted into damage information databases. (Usui,1995, 2000) And also restoration databases have a serial information on the place of the debris removal from collapsed houses and traffic impossible roads by a debris occupation which were surveyed by NUDPSC.

NUDPSC is an academic volunteer commission which is located at Usui laboratory at department of geography Nara University, and about 100 students have registered. The first survey was carried out by NUDPSC at the Hanshin-Awaji disaster area covered by 17 sheets of the map 1:10000,on February 9, 1995. NUDPIC inputted each debris removal place of houses and roads into the large scaled electronic map,1:2500, using ARCINFO. This time series surveys has been carried out at 1 month intervals from February 1995 to July 1995, and at 3 month intervals from July 1995 to April 1999, and at 6 month intervals from April 1999 to October 2001. (Iwai,1998)

2. How was GIS useful in Hanshin-Awaji disaster area ?

2.1 Situation of the Debris Removal of Collapsed Houses after the Big Earthquake

The Figure 1 shows the distribution of debris removal sites of collapsed houses in February 1995 and April 1995. The number of the debris removals at Nishinomiya City was the highest in February. It can be explained by the traffic condition or the accessibility from a large city as OSAKA. The total of the debris removals increases more at the city of the eastern parts such as Nshnomiya、Ashiya City and Higashinada ward. On the other hand, it is a few at a western area such as Nagata and Suma wards where the traffic access from Osaka is worse.

More noteworthy is that there are a few debris removals in February, and the number of debris removals increases rapidly in April, especially at Nagata ward. The processing of debris removal of many collapsed houses was unprecedented work at local government offices in disaster area. It, therefore, was gropingly started at the beginning in February which rescue activities had mostly finished. Figure 1 indicates that the processing of debris removal at local government office began to proceed in April, and increased in the number of debris removals. The rapid increase in Nagata ward is due to the use of GIS in the disaster information management for the debris processing.

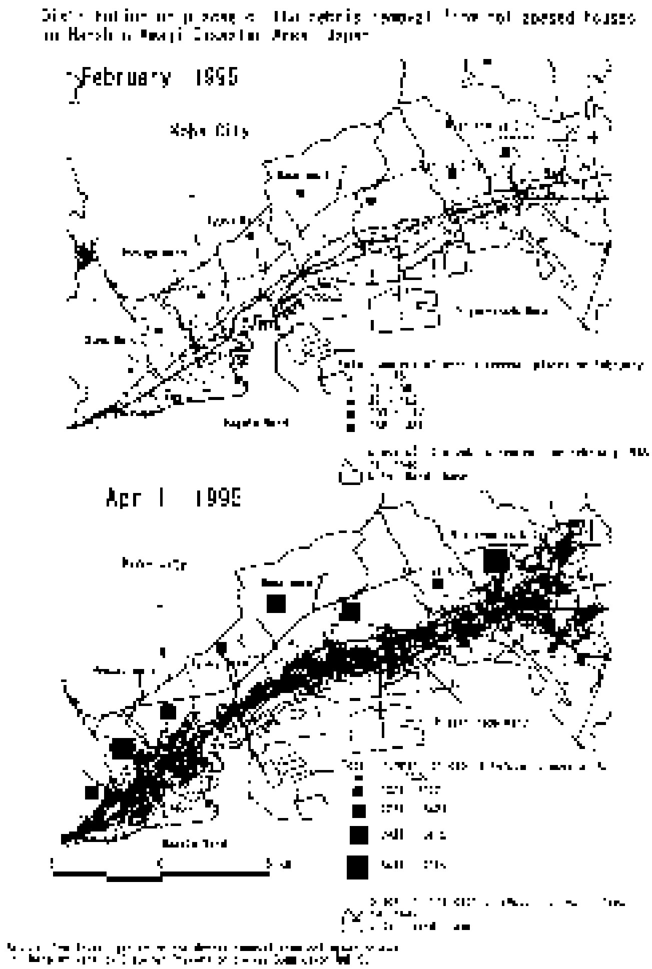


Figure 1. Distribution on places of the debris removal from collapseed houses in Hanshin-Awaji disaster area, Japan

confirming would cause a delay of the debris removal processing.

The DIMA-GIS, which was explained before, was carried out to help these office works at Nagata ward office from the beginning in March.

Nagata ward using GIS　　　Higashinada ward not using GIS

Red site:debris removal in April
Green site: debris removal in May
Blue site: debris removal in June

Fig.2 Different distribution of debris removal ites between at Nagata ward and Higashinada ward in Kobe City

The effects on use of GIS was appeared at the rapid increase in the total of debris removals in April. The two kinds of different spatial pattern on Figure 2 shows the different situation of the debris removals in Nagata and Higashinada ward respectively, which suffered the heavy strike with the almost same damage ratio of collapsed houses. It follows from this that the aggregated spatial pattern indicates the effectiveness of the debris removal processing, because local public service workers of Nagata ward could easily realize where the collapsed houses were aggregated by the map visualization of GIS. In other words, Figure 2 shows why it could be removed efficiently by the use of GIS.

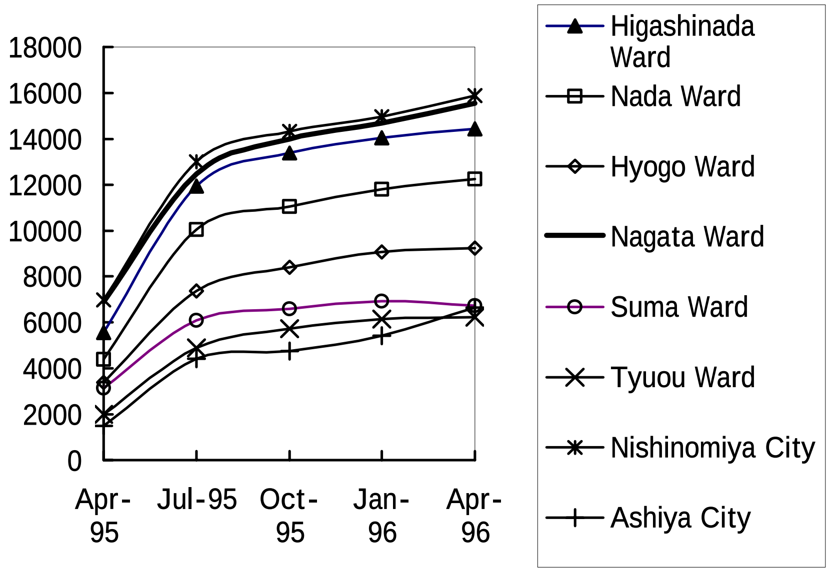
2.2 The effects on use of GIS in the office work management of debris removals

Because many houses were private properties in Japan, the procedure of a legal application for a removal properties(collapsed houses) was necessary before the debris removal of the collapsed house. A local government checked whether there was no mistake in the declaration and had to confirm that an applicant was the rightful owner of the debris removal place. The office work for owner confirming, therefore, made it spend great labor and time. It seems reasonable to suppose that office works such as the checking and the owner confirming would cause a delay of the debris removal processing.

2.3 The effects on the decision support for detailed urban reconstruction planning

One more importance of the GIS use is the effects on the decision support for detailed urban reconstruction planning. According to Figure 3, which shows the number of debris removal sites, Nishinomiya city, Nagata ward and Higashinada ward in Kobe city had large damage of wooded houses in order of number of debris removal sites. But the progress of the restoration after the earthquake in Nishinomiya city and Higashinada ward was different from the restoration at Nagata ward.

Figure.3.
Different distribution of debris removal sites between at Nagata ward and Higashinada ward in Kobe City



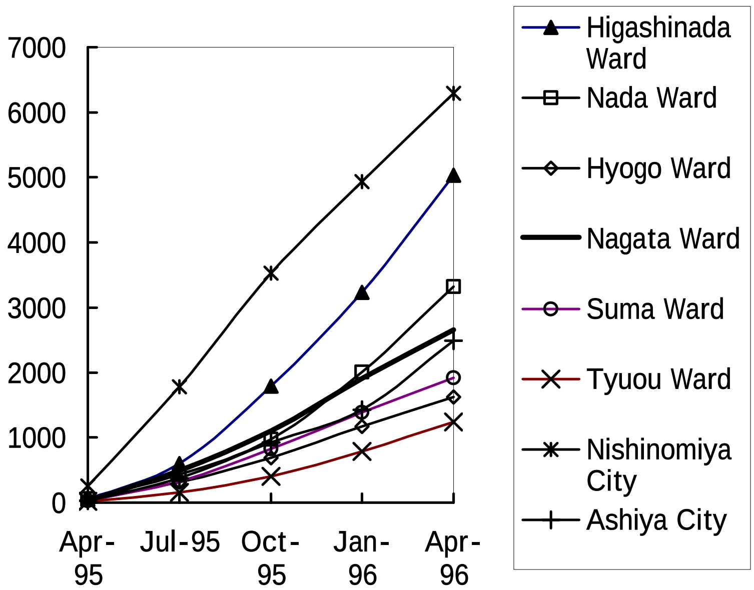


Figure 4. The numbers of places building new houses after the debris removal

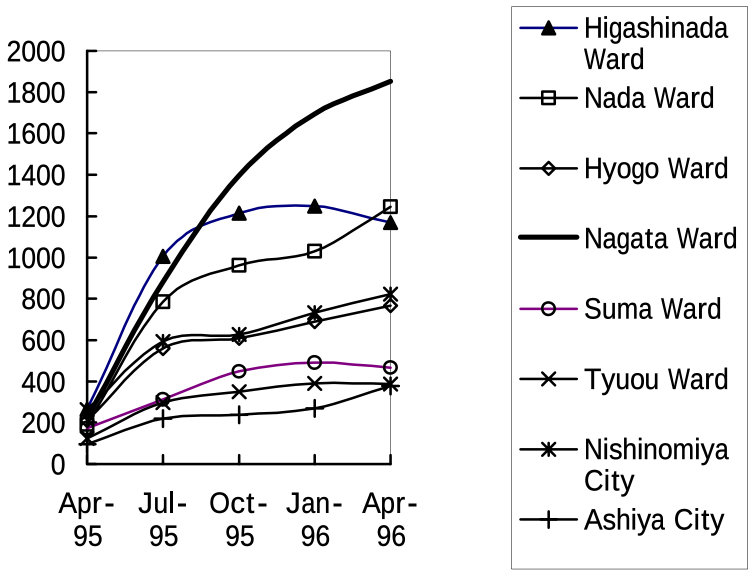


Figure 5. The numbers of places building temporal houses after debris

Figure 4 suggests that many private land owners built new own houses at debris removal site in Nishinomiya city and Higashinada ward . On the other side, Figure 5 shows the increment of the rented low price accommodations and apartments which were built temporarily in Nagata ward. The progress of housing after earthquake have varied considerably, not only by the damage, but also by region, being generally higher in Nishinomiya city and the western regions of Ｋobe city as Higashinada ward , and lower in the eastern region of Kobe city as Nagata ward.

Hyogo Prefecture home reconstruction division and Kobe City planning division used this GIS database which NUDPSC had produced, and realized the expansion of the gap of an eastern and western parts of Kobe city in the restoration progress after earthquake. It is no exaggeration to say that the local government could have produced the most suitable urban reconstruction plan for disaster area using GIS.

In other words, a more detailed urban reconstruction plan would be produced by the distribution map of the new and the temporary houses using GIS. GIS is an useful decision support system.

3, Conclusion

As mentioned before, the Disaster Information Management Activities using GIS (DIMA-GIS) in the disaster area was proved the GIS effects. Japanese GIS Association suggested the National Spatial Data Infrastructure (NSDI) to Japanese central government just after the earthquake and published a “Recommendation Paper concerning establishment of Social Infrastructure for Spatial Data” on January 31 in 1995.

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STUDY ON URGENT ESTABLISHMENT OF TOPOGRAPHIC MAPPING IN EAST TIMOR (CREATION OF TOPOGRAPHIC INFORMATION FOR ESTABLISHING CADASTRE IN EAST TIMOR)

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Abstract

- First digital topographic mapping in East Timor after the violence following the independence vote in September 1999.
- Cadastral and other necessary data for mapping were lost by the violence.
- Many houses and building were destroyed and burned out.
- Complicated land ownership and form of use of public facilities and building.
- Public facilities data using GIS.

1. BACKGROUND OF THE PROJECT

In response to a request from the United Nations Transitional Administration in East Timor (hereinafter referred to as “UNTAET”), the Government of Japan decided to conduct “The Study on Urgent Establishment of Topographic Mapping in East Timor” (hereinafter referred to as the “Study”).

This Study was carried out by Japan International Cooperation Agency, the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan. Asia Air Survey Co., Ltd. sent the Study Team to East Timor under the contract with JICA and executed field work in East Timor and office work in Japan.

The Study area covers Dili City and its surrounding area in East Timor and the total study area is 107 square km for 1:2,000 scale digital topographic mapping and digital GIS data preparation（Fig.1）. The Study was started in February 2000 and ended in September 2000. It was the first digital topographic mapping in East Timor after the violence following the independence vote in September 1999.

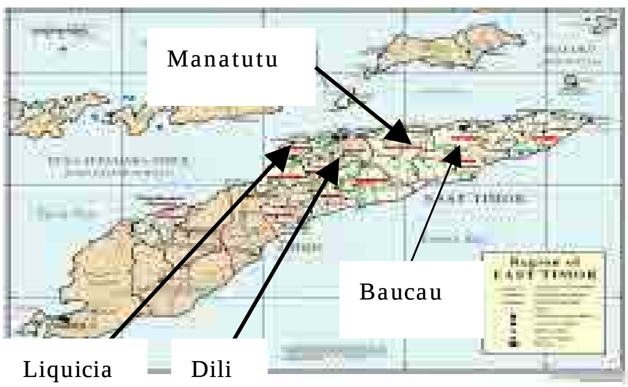


Fig.1 **The Study Area**

2. PROBLEMS IN EAST TIMOR

East Timor and Dili City have the following serious problems in the field related to topographic maps at present.

2.1 The available topographic maps in East Timor had basically been only the 1:25,000 scale topographic maps that were prepared by BAKOSURTANAL (Indonesian Survey and Mapping Authority) of the Republic of Indonesia in 1990’s (the aerial photos taken in the 1980’s and the 1990’s were used for 1:25,000 scale topographic mapping). In addition, other topographic maps of larger scale had also been partly available, but those maps had been expanded and compiled from the 1:25,000 scale topographic maps.

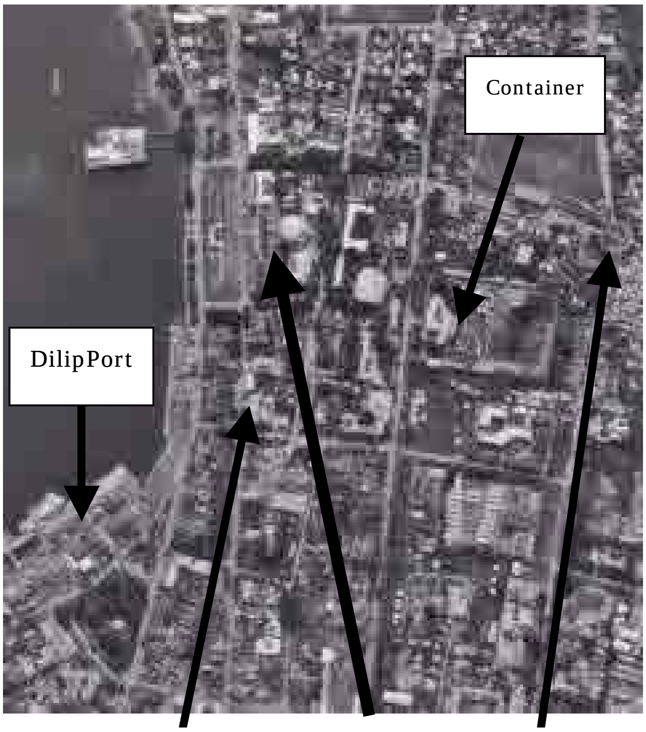
2.2 The leveling network and GPS points network had been established by BAKOSURTANAL during the Indonesian period. The concrete monuments of benchmarks and GPS points still exist in East Timor. However, the documents such as description of benchmarks and GPS points, coordinates list and so on were lost by the violence.

2.3 Furthermore, Indonesian Government’s documents such as statistic data, land registration data, resident registration data and so on were lost by the violence.

2.4 Since the land use data was damaged by the violence, many disputes have arisen in connection with land ownership within Dili City. In order to settle these disputes, it is required to develop large scale topographic maps, to make a land-use survey promptly and to build a database system ensuring the results of the land use survey to be properly arranged on the newly developed topographic maps of large scale.

2.5 The facilities and buildings owned by the former Indonesian Government belong to East Timor after its independence, but the number, nature & location of these facilities and buildings are not clear as the Indonesian Government's data was lost. Therefore, it is required to define these unclear facilities and buildings to become the national properties of East Timor, before UNTAET turns over its reins to the future Government of East Timor.

2.6 A number of public facilities, building and houses within Dili City were damaged and burned out by the violence in September 1999. Therefore, it is required to make a survey of the levels of damages and their location and to prepare the survey report promptly as the basic materials for the reconstruction plan of Dili City.



Buildinjg without roof (Destroyed and burned building)

UNTAET Central office

Open Market

(Date of photography;12:15 PM,April 2000)

Fig.2 Aerial Photograph at the center of Dili city

3. FORMS OF USE OF PUBLIC FACILITIES AND BUILDINGS

Many houses and buildings in Dili City were destroyed and burned out by the violence following the independence vote in 1999 and most of them remained as damaged at the time of map creation.

There were over 450 public facilities and buildings, and approximately 50 schools in the mapping area. Most of the facilities and buildings were owned by Indonesian Administration. Some of them were burnt, destroyed and closed down, and others were not burnt but simply closed down, or used for other purposes.

The ownership and forms of use mainly of public facilities and buildings are complicated having the past background compared with those in other areas, and the form of use of public facilities and buildings are classified into three types as follows:

a. Public facilities and buildings in the Indonesian period that remain damaged and unused since they were damaged by the violence following the independence vote in September 1999.

Example:

Indonesian Period: Office of Ministry of Public Works of Indonesia

Present time : Remains damaged and abandoned

b. Public facilities and buildings in the Indonesian period that were damaged or undamaged, but restored by any UN organization, being in use.

Example:

Indonesian Period: Indonesian Provincial Government Office

Present time : Central Office of UNTAET

c. Public facilities and buildings in the Indonesian period that were damaged or undamaged, but are now used for the same purposes as in the Indonesian period.

Example:

Indonesian Period: Elementary school

Present time : Still used as an elementary school.

Fig.3 Panoramic view of Dili city

Fig.4 House destroyed and burnt in September 1999 in Dili

4. CHARACTARISTIC OF DIGITAL TOPOGRAPHIC MAPS

In the background as described above, the Study Team determined that the 1:2,000 scale digital topographic maps to be created in this Study should be different from the general topographic maps for other areas and decided to create those maps under the following method:

Method of creating 1:2,000 scale digital topographic maps -

4.1 Damaged and undamaged buildings and houses

It is necessary to classify the damaged and undamaged buildings and houses on the 1:2,000 scale digital topographic maps to be created. For this purpose, following methods were applied

1) Ordinary houses

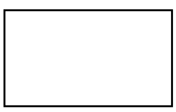
To classify those ordinary houses by photo interpretation in plotting based on whether the roofs exist or not as follows:

Example:

Ordinary houses with roofs: Undamaged houses – drawn by full lines

Ordinary houses without roofs: Damaged houses – drawn by broken lines

Damaged house



Undamaged house

2) Public facilities and buildings

To determine damaged or undamaged public facilities and buildings basically in the same way as ordinary houses using photo interpretation in plotting. However, many of those public facilities and buildings are now being used by UNTAET or PKF after they have been restored. Therefore, in addition to the ordinary field identification, further detailed data and information were required for 1:2,000 scale digital topographic maps. Inventory study data sheets were prepared to verify each of the public facilities and buildings on the spot and check whether it has a roof, whether burnt or not, its restored status and whether in use or unused. These inventory data sheets were attached to each public facilities and buildings as an attribute data on 1:2,000 scale digital topographic maps by using GIS.

4.2 Representation of symbols for public facilities and buildings

As mentioned previously, there are three forms of ownership and use of public facilities and buildings. Therefore, it is necessary to represent a facility or building in any of those forms. In the 1:2,000 digital topographic maps, the following methods of representing the public facility and building symbols were adopted.

1) If the ownership and the purpose of use of any public facility or building in the Indonesian period were same as those at present, the symbol of the currently used facility or building is used.

Example:

Indonesian Period: Elementary school

Present time: Elementary school – Use the symbol for elementary school

2) If the ownership and purpose of use of any public facility or building in the Indonesian period were different from those at present, the symbol for the currently used public facility or building is used.

Example:

Indonesian Period: Indonesian Government Office

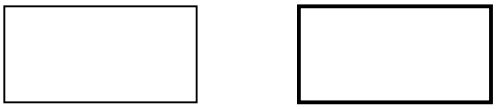
Present time: UNTAET – Use the symbol for UNTAET

3) If any public facility or building in the Indonesian period remains damaged and unused, the symbol for the public facility or building in the Indonesian period is used. However, the bold lines are used to represent the building to define that it is not classified into the present ownership and purpose of use.

Example:

Indonesian Period: Office of the Ministry of Public Work of Indonesia – Use the symbol for Government office.

Present time: Unused and abandoned



Ordinary building　Building with the symbol used in Indonesian period, but not in use now

4) For the buildings and facilities owned or related to the Indonesian military, the symbols for the facilities of Indonesian military were created.

5. INVENTORY SURVEY AND URBAN FACILITIES MAPS USING GIS

In addition to the ordinary field identification for 1:2,000 scale digital topographic mapping, inventory survey for public buildings and facilities to obtain the further detailed data and information including the former (Indonesian Administration) names of buildings and facilities, their present names, locations or addresses, conditions of damages and usability and so on were executed, and inventory survey data sheets were prepared for GIS data. The items of inventory survey were as follows:

- Bridges
- Churches, Temples and Cemeteries
- Schools
- Government Offices and Public Buildings
- Historical Sites and Objects
- Specific Crops and Vegetation; and
- Underground or Hidden Canals and Drainages

The inventory survey data sheets were attached on the urban facilities maps as attribute data using GIS software Arc View (Ver.3.1) (Refer to the attached “Flow Showing Map Features and Their Attributes Using GIS in the Study”).

6. CONCLUSION

One of the important objectives for creation of the 1:2,000 scale digital topographic maps and GIS data in this Study was that those maps and GIS data should be prepared as soon as possible for use as basic materials to promote the reconstruction of urban facilities in Dili City which is about to start and to solve the problems (especially dispute related to land ownership) that Dili City, the largest city in East Timor is facing. .

However, the existing materials necessary for creation of digital topographic maps and GIS data had mostly been lost in the violence of September 1999. Thus, the Study Team had to collect various types of information necessary for creation of digital topographic maps and GIS data through the field identifications.

In addition, many of the urban facilities, buildings and ordinary houses that had been damaged in the violence in the target areas are to be covered by the digital topographic maps and GIS data to be created in this Study. Some of the governmental facilities and buildings used in the Indonesian period are used by UNTAET and PKF, but others are abandoned.

Therefore, the specific circumstances that Dili City is currently situated and other many conditions had been considered in regard to the applications of the topographic maps and GIS data to be created. The Study had also been made through many trials and errors in determining how the information on these new conditions should be represented on the digital topographic maps and GIS data.

As described above, there were many difficulties in this Study for creation of digital topographic maps in terms of the required time and its contents compared with the works for other ordinary areas. It is also anticipated that those topographic maps will be subject to secular changes as the reconstruction of Dili City is making progress.

Dili City is in the course of rapid restoration from the disaster following the dispute in September 1999 owing to the assistance by many countries and investment by the private sector. However, the 1:2,000 digital topographic maps and GIS data created in the Study are based on the information from the aerial photos taken for a short period from the beginning to the end of April 2000 and the results of field surveys carried out for a period from the middle of April 2000 to the end of May 2000.

The restoration from the disaster in Dili City is now speeded up compared with that at the time when the Study Team started the Study in East Timor. Therefore, the digital topographic maps and GIS data will shortly have many discrepancies form the actual conditions unless they are modified continuously.