# THE ROLE OF INTEGRATED CADASTRE DATABASE IN DISASTER RISK MANAGEMENT

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**Intisari**: Mengingat kompleksnya masalah bencana alam di Indonesia, pengelolaan resiko bencana yang efektif memerlukan informasi yang lebih komprehensif. Basis data kadaster yang menggunakan batas persil bidang tanah sebagai unit dasar pemetaan dapat memberikan informasi yang sangat rinci mengenai *elements at risk*. Institusi-institusi yang berwenang dalam pengelolaan resiko bencana tidak mudah dalam mengakses data tersebut. Penelitian ini berusaha untuk mengatasi masalah di atas dengan mendisain skema database kadaster yang lebih terintegrasi. Data hasil survey di lapangan digunakan untuk menguji skema *cadastre geo-database*. Evaluasi dilakukan melalui wawancara mendalam dengan *potential users*. Hasil dari evaluasi menunjukan bahwa database kadaster yang telah dibuat sudah cukup baik sebagai salah satu solusi yang dapat digunakan dalam kegiatan pengelolaan risiko bencana.

**Kata kunci**: Kadaster, Disain Geo-database, *Element at Risk*, Gempa Bumi.

**Abstract**: Due to the complexity of the natural disaster in Indonesia, the effective disaster risk management should have comprehensive information. Cadastre database using parcels as basic mapping units constitute the detailed information related to elements at risk. It is not easy for the institutions in charge with those disaster risk management to access the detailed information. The research is aimed at overcoming the above problems that is by designing the integrated cadastre database scheme. The survey results are use to test the geo-database cadastre scheme. The evaluation is done by in depth interview to the potential users. The result of evaluation showed that the cadastre database made is good enough to solve the above mentioned problems.

**Keywords**: cadastre, design, geo-database, elements at risk, earthquake.

## A. Introduction

Given the complexity of natural problems which might cause disaster in Indonesia, a more integrated database of element at risk is necessary. In disaster management activities (e.g. mitigation planning, risk assessment, loss estimation on the hazard areas, environmental protection, save lives and property effectively and efficiently due to disasters) need detailed information of the element at risk. Cadastre database which uses parcels boundary as basis mapping unit actually provides detailed information of elements at risk, but the authorities who deal with the disaster management still not use this database optimally yet. Inconsistency of geometric accuracy of spatial cadastre data, the different of coordinate systems and different format data as well as different layers of spatial data are the problems in the procedure of data exchange among the institutions.

There are two institutions provide cadastre data in Indonesia. They are BPN RI (National Land Agency of Republic Indonesia) and Tax office. BPN RI provides cadastre data that are related to legal cadastre. Tax office provides cadastre data that are related to fiscal cadastre. They provide cadastre data by using different struc-

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ture database, different level of spatial accuracy, different coordinate systems and different layers of spatial data. Those facts cause the difficulties in integration process. Ideally, legal and fiscal cadastre database should be integrated into one unit database, so the database is ready to be used not only for the cadastral purposes but also for various purposes and interest.

## B. Cadastre Data

There are several definitions of cadastre. Cadastre is *a methodically arranged public inventory of data concerning properties within a certain country or district, based on a survey of their boundaries.*(Zevenbergen, 2004)[1],. Other cadastre definition from (FIG, 1996)[2], *A Cadastre is normally a parcel based, and up-to-date Land Information System (LIS) containing a record of interest in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of interest, the ownership or control of those interests, and often the value of the parcel and its improvements. It may be established for fiscal purposes (e.g. valuation and equitable taxation), legal purposes, to assist in the management of land and land use (e.g. for planning and other administrative purposes), and enables sustainable development and environmental protection.*

Tax office uses SISMIOP (The Property Tax Information Management System) and SIG-PBB (Geographic Information System for Land and Building Taxes) to manage the database of property (Direktorat Jenderal Pajak, 2002)[3]. SISMIOP was particularly designed to handle attribute data related to land and building taxes which is managing around 84 million tax objects (parcels) in Indonesia. On the other hand SIG-PBB has been designed to manage spatial data of land and building tax objects. Each tax object is assigned uniquely with a NOP (Property Identification Number). This number has an operational advantage since there will prevent duplication of land and building tax object identity.

Very detailed information of the building (Structural and Non Structural elements of building) is developed by tax office. The Information related to the building in tax office database consists of three main data. They are main data component of building, building material component, and building facilities components. This information is very useful in determining vulnerability of buildings and calculates the value of risk of a certain building caused by a certain magnitude of earthquake.

In carrying out their duties and functions, the National Land Agency (BPN) currently has the types of database as follows:

a) Spatial data (Base map and thematic map such as Registration map/Parcel map, Land Use map, Land Value Map, etc).
b) Textual data (attribute data of land parcels consists of legal information of parcels as well as the history of the land parcel).

Cadastre database in National Land Agency (BPN RI) operationally managed by the Land Office (Local Office) in the district/city level, Provincial Office in the Provincial level and the BPN RI in the Central level (National Level) (Perpres No.10, 2006)[4]. Each level has the function and responsibilities in accordance with their respective level. National Land Agency has be-

[1] Zevenbergen. (2004). A Systems Approach to Land Registration and Cadastre. *Nordic Journal of Surveying and Real Estate Research* , Vol.1.

[2] FIG. (1996). *The Bogor Declaration.* Bogor: United Nations Interregional Meeting of Experts on the Cadastre.

[3] Direktorat Jenderal Pajak. (2002). *KEPUTUSAN DIREKTUR JENDERAL PAJAK*. Jakarta.

[4] Perpres No.10. (2006). *Peraturan Presiden Republik Indonesia Nomor 10 Tahun 2006 Tentang Badan Pertanahan Nasional*. Jakarta.

gun to construct land database since 1999 through the Land Office Computerization (LOC) (Ruhkyat, 2008)[5].

The parcel map of land office uses TM3° (Transverse Mercator 3 degrees) Projection System. This coordinate system is used as standard coordinate system in National Land Agency (PMNA/KBPN No.3, 1997)[6]. TM3° is a projection system which is derived from UTM.

The main activity of National Land Agency is land registration. There are two land registration systems in Indonesia. They are systematic and sporadic (PP No.24, 1997)[7]. Systematic land registration is an activity registration land parcels for the first time carried out simultaneously which includes all objects that have not registered in territory or part of the territory of a village, while sporadic system is the land registration activities for the first time on one or several object in the region or parts of a village in individual or mass.

## C. Geo-Database Design

Geo-database design is based on a common set of fundamental GIS design steps. GIS design involves organizing geographic information into a series of data themes layers that can be integrated using geographic location. So it makes sense that geo-database design begins by identifying the data themes to be used, then specifying the contents and representations of each thematic layer. Frequently, the geographic representations will be predetermined to some degree by the available data sources for the theme. If a preexisting data source was collected at a particular scale and representation, it will often be necessary to adapt the design to use it.

## D. Element at Risk

Element at risk are all objects, buildings, persons, animals, activities and processes that may be adversely affected by hazardous phenomena, in a particular area, either directly or indirectly. This includes Physical elements, Population, Essential facilities, Socio-Economic aspects, Transportation facilities, Economic activities, Life lines, and Environmental elements. The classification of element at risk is different depending on the countries, the setting (urban, rural, etc.), objective of the element at risk, the scale, and available resources.

Element at risk is one of the main component in risk analysis beside hazard and vulnerability. Hazard assessment quantifies the physical character of a hazard, including probability of occurrence, magnitude, intensity, location and influence of geological factors (Gulati, 2006)[8]. Vulnerability is defined as the degree of loss to a given element at risk or set of such elements resulting from the occurrence of a natural phenomenon of a given magnitude an expressed on a scale from 0 (no damage) to 1 (total loss) or in percent of the new replacement value in the case of damage to property (UNU-EHS, 2006)[9].

The interaction of element at risk and hazard defines the exposure and the vulnerability of element at risk. Exposure indicates the degree to which the elements at risk are exposed to a particular hazard. The spatial interaction between the elements at risk and the hazard are

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[5] Ruhkyat, M. (2008). *Aspek Hukum Teknologi Digital Dan Dokumentasi Pertanahan. Jakarta: Data and Information Center of National Land Agency of Republic Indonesia*.

[6] PMNA/KBPN No.3. (1997). *Peraturan Menteri Negara Agraria/Kepala Badan Pertanahan Nasional Nomor 3 Tahun 1997 Tentang Ketentuan Pelaksanaan Peraturan Pemerintah Nomor 24 Tahun 1997 Tentang Pendaftaran Tanah*. Jakarta.

[7] PP No.24. (1997). *Peraturan Pemerintah No. 24 Tahun 1997 Tentang Pendaftaran Tanah. Jakarta: Government Of Republic Indonesia*.

[8] Gulati, B. (2006). *Earthquake Risk Assessment of Buildings : Applicability of HAZUS in Dehradun, India*. Enschede: ITC.

[9] UNU-EHS. (2006). *Components of Risk, A Comparative Glossary*. Bonn, Germany: UNU-EHS No2/2006.

depicted in GIS by simple map overlaying of the hazard map with the elements at risk map.

Elements at risk study nearly always focuses on specific groups of element at risk such as buildings or population. In this research, the element at risk database will be built only base on the element at risk data derived from cadastre database.

## E. Building's Physical Characteristics and Its Response to Earthquake

Building Vulnerability of structure can be defined as probability of physical loss on building when particular shaking occur which depends on aggregate performance of its components and characteristic of hazard and of characteristic of its ground where its stands (Thapaliya, 2006)[10]. (Siddiq, 2006)[11] describe the composite building material in Indonesia and the seismic performance of construction material when earthquake happened.

Table 5-1. Building composite and structure, as the resistance to earthquake

| Type of Material and Structure System Buildings | Suitability of Lateral Earthquake Expenses | | | | Information |
|---|---|---|---|---|---|
| | Very Good | Good | Bad | Very Bad | |
| Walls Brick/Pure Brick | | | | √ | Heavy Weight, Brittle, Not Ductile |
| Brick with reinforcement (Confined) | | √ | √ | | Moderate weight, Moderate Bearing Capacity, Moderate Ductility |
| Conblock with reinforcement (Confined) | | √ | √ | | |
| Reinforce Mansonry (RM) | | √ | | | |
| Timber frame and brick wall with anchors | √ | √ | | | |
| Wood frame structure with bracing (X-Brace) | √ | | | | Minimum Weight, Moderate to high Bearing Capacity, High Rigidity and Ductility |
| Reinforced concrete frame structure with bracing | √ | √ | | | |
| Rigid Steel frame structure | √ | | | | |

Source: (Siddiq, 2006)

## F. Disaster Risk Management

Disaster Risk Management is the systematic process of using administrative decission, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural and related environmental and technological disasters. (Westen, C. V., 2009).[12] Traditionally the process of Disaster Risk Management was presented as a cycle, in which the various phases would follow each other until the next disaster event would happen. It involves several phases: Prevention, Preparedness, Relief/Response, Recovery and Reconstruction. The main point important in the disaster risk management is the use of spatial disaster risk information. Effective disaster risk management depends on the informed participation of all stakeholders. The exchange of information and easily accessible communication practices play key roles. Data is crucial for ongonging research, national planning, monitoring hazards and assesing risks. The widespread and consistent availability of current and accurate (geo) data is fundamental to all aspects of disaster risk reduction. (UN-ISDR, 2004).[13]

## G. Study area

The location of study area is Palbapang Village. The study area extent in between 110° 18' 40" and 110° 20' 15" East Longitude and between 7° 53' 35" and 7° 55' 15" South Latitude. Palbapang Village has been selected as a study area due to the densely populated mix of urban and rural communities, variation of building type, the high impact caused by the earthquake (highest number of damaged buildings among all village lies

[10] Thapaliya. (2006). *Assessing Building Vulnerability for earthquake using field survey and development control data: A Case Study in Lalitpur Sub Metropolitan City, Nepal.* Enchede: Urban Planning and Land Administration. ITC.

[11] Siddiq, S. (2006). *Bangunan Tahan Gempa Berbasis Standard Nasional Indonesia* . Vol 8: 18 p.

[12] Westen, C. V. (2009). *Disaster Risk Management, in Multi Hazard Risk Assessment* (Guide Book). Enschede.

[13] UN-ISDR (2004). *Living with Risk*, United Nations International Strategy for Disaster Risk Reduction.

in Bantul Sub-district) and the data availability. The systematic land registration has not been implemented in the Palbapang Village. The land parcel map of Palbapang Village in the land office covers low percentage of the total land parcels in the study area. The land parcel map developed by land office contains only the registered land parcels, the ones equipped with land certificates. In most of cities in Indonesia, there are many more unregistered land parcels than the registered ones. For completing the rest of uncovered parcel data, it is needed additional data from tax office, to build an integrated cadastre database. It is appropriate to choose Palbapang Village as the study area. Hopefully the result of the research is applicable for others areas.

At the study area, a deadly tectonic earthquake occurred on May 27, 2006. This deadly earthquake caused victims of people and buildings. Media Center of Yogyakarta reported on June 17, 2006, victims died in Yogyakarta and Central Java is 5.760 people, injured 37.349 people, 145.929 houses were collapsed caused by this earthquake. According to (DMC, 2006)[14], the level of building damaged in Palbapang varies from collapsed and heavy damaged. 1,784 buildings were collapsed and 1,430 heavy damaged with the total of buildings are 3,214. This is a highest number of damaged buildings among all village lies in Bantul Sub-district.

### H. Collecting Data

Quick Bird satellite image (Recorded 22nd April 2010) which covers the study area was ordered from Digital Globe. Parcel map in digital format was collected from the land office (Land Office of Bantul District). The land parcel map developed by The Land Office contains only the registered land parcels, the ones equipped with land certificates. Land Office uses this map as base map to maps or plots newest registered or certificated parcels. This map has no topology and many inconsistencies (e.g., streets are often digitized multiple times for different layers; new houses overlay old ones).The parcel maps from tax office were collected. Tax office usually calls it as block map. There are 82 block maps from tax office that were collected. These maps were updated by tax office in 1997 (after earthquake). Although tax office has block map in digital format, unfortunately the block maps that were obtained from tax office are still in format analog (Paper Map), it is because the difficulty in the data access permission. The block maps were converted to the digital format through the scanning and digitizing process. The scanned block maps were geo-referenced base on the coordinate contained in the maps. An intensively works were done to geo reference and digitize the block map. Measurements using GNSS-CORS method were conducted to obtain high accuracy GCPs. TRIUMPH-1 JAVAD GNSS receiver was used as a RTK (Real Time Kinematic) GNSS for survey measurement. The nearest GNSS-CORS base station is located at Bantul Land Office Building, approximately 1 km from the study area. This base station was used as reference station during GCPs Measurement. Ground control points are required to validate and to correct the Quickbird imagery.

Land parcel use derived from information in the tax office block map and satellite image interpretation. Land parcel use data were verified by discuss with Chief of Dusun (Kadus) and Village Officer, who know well the condition of land parcel use in Palbapang Village with interactive map on the screen computer. Field survey on the specific parcel/object also was used as a method for verified the parcel use map that was

[14] DMC. (2006). *Laporan Pendahuluan District Management Consultant*. Yogyakarta: District Management Consultant.

built base on satellite image interpretation.

The building footprint can be identified clearly on the quick bird satellite image, so in this research the building footprint was obtained base on screen digitations method on the geo referenced quick bird satellite image. Building use or in other term as building occupancy class is derived from parcel use map. The parcel use map can be used to derived the building information especially information related to the building use. *Spatial Join* in overlay analysis tools in Arc GIS program can be used to join parcel attribute and building footprint. The building use or building occupancy class and building size can be used to estimate the number of occupants in a certain individual building. Unfortunately, textual database developed by tax office which is consists of detailed information related to the buildings (structural and non structural elements of building) cannot be access during the fieldwork. To determine the building information, survey on buildings were done in this stage. In this research building inventory survey form created by (ADPC, 2009)[15] was used in the building survey. There are 500 buildings were surveyed by using Stratified Purposive Sampling. Stratified Purposive Sampling is the method of technical sampling with using certain consideration. In this approach, a number of buildings were selected in the each Dusun (Sub Village) with taking sampling about 50 buildings for each Dusun. Textual database of building aid from Java Reconstruction Fund (JRF) that was downloaded from (Rekompak-JRF Official Site, 2010)[16] is used as additional information of buildings characteristics. It consists of specific building type that was built after earthquake 27th May 2006. There are no coordinate data in JRF database. To determine the coordinate position of this JRF database, filed survey for buildings using Handheld GPS were conducted.

The quality assessment of integrated parcel map was conducted by using parcel topology validation tools in Autodesk Map Program. Customized program in Autodesk Map (Ajd-Surveyor) has been used to check and to correct the errors in the integrated parcel map. With this program, errors of layers, errors of parcel objects (duplication parcel object, short object, dangling object, crossing object, undershoot, overshoot), errors of types of entity, errors of duplication of Parcel Identification Number (NIB), errors of parcel without NIB can be identified automatically. The program may automatically correct many errors in the integrated parcel map. Additional manual correction is used to correct the rest of errors that cannot be corrected in auto correction.

## I. Design Cadastre Geo-Database

The process of designing cadastre database was conducted by using Arc-GIS Diagrammer Software. ArcGIS Diagrammer is a productivity tool for GIS designer to create, edit or analyze geo-database schema. Schema is presented as editable graphics in an environment familiar to users. Essentially Arc-GIS Diagrammer is a visual editor for ESRI'S XML (Extensible Markup Language) Workspace Documents which are created by Arc-Catalog, the management application in the Arc-GIS Desktop product suite. XML is a set of rules for encoding in machine readable form. XML is an extension of HTML (Hyper Text Markup Language) which is a standard language in internet tacking. The differences between XML and HTML are XML was

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[15] ADPC. (2009). *Elements at Risk Mapping, Basemap and General Building Stock. 4th Regional Training Course GIS for Disaster Risk Management – Level II.* Bangkok. Thailand: Asian Disaster Preparedness Centre.

[16] Rekompak-JRF Official Site. (2010). *Rekompak-JRF.* Retrieved September 10, 2010, from http://www.rekompakjrf.org/index.php?act=listkpqs&prop=34

designed to transport and store data, with focus on what data is, HTML was designed to display data, with focus on how data looks.

There are two main steps in designing cadastre geo-database. The first step is developing model diagram, and the second step is implementing the diagram that was created. In the developing model diagram in developing the model diagram created feature datasets, feature classes, raster datasets, tables, relationships between features, and the relationship between features of the table. In the implementation of the diagram that was created, performed error checking, exported to XML and generate the ArcGIS environment by importing the XML file that was created to the Arc-Catalog. In the Arc-Catalog, a file geo-database should be created before importing the XML file. After XML file has been imported, all empty dataset (feature classes, table, and relationship) appears in catalog tree in the Arc-Catalog program. To fill this empty dataset, the files in shp format that have been prepared are loaded by using the simple data loader in the Arc-Catalog.

## J. Result and Discussion

Parcel maps from tax office uses UTM coordinate system. Parcel map from land office uses TM3° coordinate system. To build an integrated parcel map, both of them should be integrated in the same coordinate system. In this case UTM coordinate system is used to integrate both parcel map from tax office and parcel map from land office. Based on UTM zone, Palbapang village is located in 49 South and based on TM3° zone, Palbapang village is located in zone 49.1. The transformation process use the projection and transformation tools in Arc GIS software. Parameters of transformation are used in the integration process. Land use map was created in large scale (parcel based mapping unit) or it can be called as Parcel use. Parcels use map was created based on annotations described in tax office's block map and interpretation on the Quick Bird satellite image. The classification of parcel use is based on the standard classification in the Land Office.

The parcel use map can be used to derived the building information especially information related to the building use. *Spatial Join* in overlay analysis tools in Arc GIS program can be used to join parcel attribute and building footprint. Building use information can be used to estimate the number of occupants in a certain building. The study on estimating building occupants based on building use has been done by (Budiarjo, 2006)[17]. The study is the approach of architectural space requirement for estimating the number of building occupants from the area of building space using the norms or standards of architectural design.

Information of buildings is needed to determine the vulnerability of buildings against earthquake. Information of building (structural and non structural) also can be used to estimate the value of loss caused by an earthquake. Since the database related to the information of buildings in the study area cannot be obtained from tax office, researcher use direct survey to the building with stratified purposive sampling method. Stratified purposive sampling is the technical sampling with using certain consideration. The parameter used in the field are based on the house that rebuilt by JRF, POKMAS (Society Groups) and self supporting. In this approach, a number of buildings were selected in the 10 Dusun (Sub Village) with taking surveyed buildings about 50 buildings for each Dusun. So there are 500 buildings have been surveyed. The build-

[17] Budiarjo, A. (2006). *Evacuation Shelter Building Planning for Tsunami-prone Area.* Enschede: Msc Thesis. ITC, International Institute for Geo-Information Science.

ing construction type in Palbapang village can be categorized as Confined Masonry (CM), Unreinforced Clay Brick (UCB), Unreinforced Clay Brick (UCB), Wood House (W), and Steel Building (S). Confined masonry has similarity to reinforced masonry that vertical and horizontal reinforcement bars are provided to enhance the strength of masonry walls (Brzev, 2007)[18]. Unreinforced Brick is a single-story building and the main load bearing structure in this building consists of brick masonry walls built in cement mortar and a timber roof structure. This is non-engineered construction built following traditional construction practice, without any input by architects or building experts (Wijanto, 2003)[19]. Wood house were distributed only 3.2% of the surveyed building in Palbapang village. Building structural feature is repetitive framing by wood on wood walls. It is classified as not engineered building. Steel building typical of building is based on light steel building. This typical building has good quality of construction.

## 1. Result of Designing Cadastre Database

The feature dataset that has been created consists of 2 feature dataset. They are Land Base and Administration feature dataset. The Land Base feature dataset consists of Parcel Feature Class, Building Feature Class, Ground Control Points Feature Class, Road Feature Class, and River Network Feature Class. The Administration Feature Dataset consists of Sub Village and Village Feature Class. The Raster Datasets consists of 3 bands of Quick Bird Satellite Image. There are 3 relationships that have been created. They are Relationship between Parcel Feature Class and Building Feature Class, Relationship between Parcel Feature Class and Owner Table, and Relationship between Building Feature Class and Owner Table. The Relationship between Parcel and Building Feature Class is One to Many relationship. It is means that on a parcel can be built one or more buildings. The Relationship between Building and Owner Table is Many to Many relationship. It is means that a building could belong to many owners. The Relationship between Parcel and Owner Table is Many to Many relationship. It is means that a parcel could belong to many owners. The Arc-GIS Diagrammer software also is used to build reports of designed cadastre database. There are three type of report which describes the whole of structure database. They are Schema Report, Data Report and XML Report.

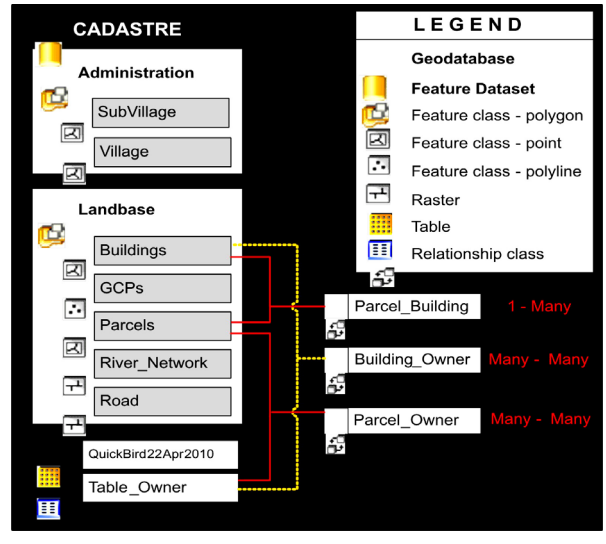


Figure 10 1: Designed Cadastre Database

## 2. Evaluation

The aims of the evaluation are to know how the designed database can be used for risk analysis especially in the earthquake risk and to find out whether the designed database is feasible or not for potential users. Question guide is used

[18] Brzev, S. (2007). *Earthquake Resistant Confined Mansory Construction*. Kanpur, India: National Information Center of Earthquake Engineering (NICEE).

[19] Wijanto, S. (2003). *World Housing Encyclopedia Report*. Eartquake Engineering Research Institute and International Association Earthquake Engineering.

in the interview with potential users to evaluate whether the designed database is feasible or not. In depth interview with the potential users or stakeholders were used to get the response and to get the critical input. The potential users were selected using simple random statistics out of the total institutions working in the related issue of disaster that using spatial data and GIS in their activities. The potential user that was interviewed can be grouped into 2 groups of potential user. The first group is local government institution, and the second is Non Government Organization (NGO) working in the related issue of disaster and deals with the disaster risk reduction. The interviewed Local Governments are: Regional Disaster Management Agency (BPBD Bantul), Regional Development Planning Board (BAPPEDA Bantul), National Land Agency of Bantul (BPN Bantul), Tax Office of Bantul (KPP Pratama Bantul). The Non Government Organizations (NGOs) that were interviewed are IOM (International Organization for Mitigation), DMC (Districts Management Consultant, HRC (Housing Resource Center) and DERU-UGM (Disaster Response Unit – Gadjah Mada University). Generally it comprised 2 sections of question. The first section is the profile of institution and the second is question of evaluation of the use of designed cadastre database.

The questions that related to the profile of institution consist of question as follow: respondent identity, spatial data access and sharing and institution activities related to disaster issue. The questions related to the evaluation of designed database consist of comments or critical input of how they use the designed database and suggestions to improve the designed database.

### 1.1. Regional Disaster Management Agency (BPBD)

Based on (Local Regulation of Bantul Regency No.6, 2010)[20], which is signed on July 22, 2010, the BPBD's tasks are to establish guidelines and directives on disaster relief effort that includes prevention, emergency response, rehabilitation, and reconstruction in a fair and equitable, set standards and need for implementation of disaster management, compile, assess, and inform the disaster-prone maps, implementation reports of the disaster management to the head of local government once a month under normal conditions and at all times in a state of disaster emergency. BPBD's functions are the formulation and establishment of prevention policies and handling of refugees by acting quickly and accurately, effectively and efficiently as well as coordinating the implementation of disaster management activities in a planned, integrated and comprehensive.

To carry out their tasks and functions, BPBD formed three organizational elements, which consists of the Chief of BPBD, steering element of disaster management and executive element of disaster management. Functions of the steering elements of disaster management are the formulation of the concept of regional disaster reduction policies, monitoring and evaluation in the implementation of disaster management. The task of executive elements of disaster management is implementing an integrated disaster management that includes pre-disaster, emergency response, and post-disaster.

There are three main sections within the executive element of disaster management, namely

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[20] Local Regulation of Bantul Regency No.6. (2010). *Peraturan Daerah Kabupaten Bantul No. 6 Tahun 2010 tentang Pembentukan Organisasi Badan Penanggulangan Bencana Daerah Kabupaen Bantul.* Bantul: Local Government of Bantul Regency.

the section of prevention and preparedness, section of emergency and logistics, and the section of rehabilitation and reconstruction.

The possibility of using designed cadastre database in BPBD's organizational activities are the spatial cadastre database that has been developed using high accuracy and large scale (Parcel base) is usable for the BPBD's task and function, whether before, during or after a disaster. For disaster mitigation planning, parcel maps can be used to determine where the exact location to assemble or set up temporary shelters. For the reconstruction and rehabilitation activities parcel map is useful for determining which buildings will be rebuilt.

The use of cadastral data will be more optimally used in disaster management, needs to cooperate or memorandum of understanding (MOU) between government agencies at the local level so that data can more easily access, such as the tax office and land office with BPBD.

**1.2. Regional Development Planning Board (BAPPEDA)**

The role of BAPPEDA in disaster management is in the making of multi disaster maps, evacuation route planning, cooperation with education departments to develop curriculum on disaster education in school, multi disasters simulation two times each year, coordination among agencies during a disaster, rehabilitation and reconstruction planning, post disaster rehabilitation planning of economic sector, social and health sector.

Cadastre data, in particular parcels map should be accessible to a limited basis by local government. Changes in land use or parcel use and ownership of land can be accessed by BAPPEDA so it can be used for planning at the village level with a larger scale, and ideally every village has a map of parcels of land, so the parcel map not only for disaster mitigation planning, but it also can be used for other purposes in Village level, such as village officer can directly monitoring the change of parcel use and the change of parcel ownership.

**1.3. National Land Agency (BPN)**

As an institution that registering, measuring and mapping parcels of land and provide land titles to communities with sporadic and systematic system, the land office have participated in disaster management. Especially the activities of systematic land registration and certification for free on the area after earthquake, as in some villages in the Sub-district Pleret which is most severely affected areas. Expected with the provision of land certificates, the certificate can be used by communities to access financing sources, for economic activities, agricultural and other businesses. The land certificate can be used as a collateral to access capital to the banks for financing economic activities.

Activities for anticipates a disaster, Land Office of Bantul Regency has been conducting systematic land registration, land titling activities, and activities of inventory of land ownership, land tenure, land use and utilization (P4T) in areas prone tsunami disaster, which in some villages in the Sub-district Sanden, Bantul District.

Given the length of the process of measuring and mapping parcels of land with a high positioning accuracy, the idea to integrate cadastral data from the tax office and land office is a matter that should be considered. This situation will be helping with the acceleration of making maps of land parcels, or in terms in the land office as a physical cadastre. But to certify those land parcels (legal cadastre), must go through the process of re-checking and measurement in more detail, depth research on historical aspects of the parcels that will be certified. Integration results are only used for information as a physical aspect of parcel, which is not as juridical aspects.

It is required special rules for prioritizing mapping parcels of land in areas prone to disas-

ters, especially disasters that may cause the loss of the signs of land parcel boundaries, loss of physical parcels of land, such as tsunamis, floods, and lava flood. For the earthquake, it is not causes the loss of ownership of parcels and land boundary markers, so cadastre data that is more needed in the earthquake disaster managenment is cadastre data related to the buildings.

**1.4. Tax Office (KPP Pratama)**

In Disaster Response, the Tax Office participated in helping the earthquake victims in Yogyakarta in 2006 by way of providing tax reduction policy for earthquake victims. For the year 2006, all victims of the earthquake in Bantul are not required to pay taxes. For 2007 and 2008 tax reductions granted only to the earthquake victims who request a tax deduction. In 2009 until now there is no tax reduction policy, because earthquake victims considered have recovered their economic activities. In the utilization of tax databases to assess the risk of disaster or other disaster management activities, now could not be granted and on access by other stakeholders except with permission of minister of finance. It is stated in the tax legislation, namely Article 34 Paragraph 1 of Law No. 6 / 1983 STTD Law no. 28 year 2007 on general provisions and procedures of taxation, which states that: "*Every officer is prohibited notify the other party everything that is known or notified to him by the taxpayer in order to carry out provisions of tax legislation*". Within paragraph 3 of Article 34 of the same law states that: "*For the sake of the country, the minister of finance has an authority to give consent in writing to the officials and experts to give testimony, to show written evidence from or about the taxpayers to designated party*". Based on the explanation above, in principle, tax database that consists of detailed building databases can be accessed by other institutions when there is written permission from the finance minister. Therefore, required cooperation among agencies at the central level such as between the Minister of Finance and National Disaster Management Agency (BNPB), so at the local level, data sharing can be made between tax offices and Regional Disaster Management Agency (BPBD). The integrated land office parcels map and tax office parcel map is very useful to get the more accurate value of parcel area that influential in the calculation of the value of Tax Object Sale Value (NJOP) and determination of property tax bills that more fair. Other critical input from tax office is need to built a database that can display 3 dimensions of buildings, so it can be used for 3D cadastre that is now as discourse at the tax office, which will also be useful to assess risk of the building against earthquake.

**1.5. International Organization of Mitigation (IOM)**

Since the earthquake struck Yogyakarta and Central Java province in 2006, IOM has provided significant capacity-building assistance. Besides emergency responses, asset replacements and support to Micro Small Enterprise (MSE) recovery, IOM has also contributed to the ongoing recovery and rehabilitation processes. The IOM livelihood project is compatible with government programs that are synergy between disaster risk reduction strategy and post disaster economic recovery. Related to the designed cadastre database, particularly parcel data, just in case, if the disaster is destroying the sign of parcel of land, the parcel boundary owner in northern, western, eastern and southern part of the particular land is needed to be recorded. This data is important to get clear clarification from other related parties and avoiding the possibility of conflict afterward. The suggestions are the whole collected data and produced spatial data (in this case cadastre data) should accessible to the parties who has aimed for the development of community, and the localization of produced data and its accessibility should be informed to the

community related party together for its improvement.

**1.6. District Management Consultant (DMC)**

District Management Consultant (DMC) is a partner organization of the Office of Public Works to carry out monitoring of implementations activities of the residential redevelopment project after earthquake in Yogyakarta and Central Java on 27 May 2006 and tsunami in West Java on July 17, 2006 by making the community as the main actors of development), where financial resources are grant from the Java Reconstruction Fund (JRF) and implementing agencies are the Directorate General of Cipta Karya, Department of Public Works based on the Grant Agreement between the Government of Indonesia with JRF signed February 6, 2007. The purpose is re-establishment of settlements that were destroyed by earthquakes in the region of Yogyakarta and Central Java and West Java through the community based. The expected result of DMC are the establishment of settlement communities that are capable of rebuilding their housing and environment, establishment houses and basic infrastructure environment according to the requirements of earthquake resistant building techniques, arrangement of settlements in accordance with the requirements of disaster mitigation.

In the case of the use of spatial data especially cadastral data has not been utilized by the DMC. In making the maps in Environmental Fund Assistance activities such as maps of land use, electricity network maps, maps of irrigation networks, irrigation networks map the road network map and clean water network map, is done with the mapping of community-based. It is feared that the resulting map is not good quality. The use of large-scale maps with more elaborate methods and using high-resolution satellite imagery can be used as a base map in the implementation of community-based mapping as supporting documentation of in DMC activities. The suggestion given is for institutions such as the Land Office and Tax Office proactively inform the availability of maps and data needed for environmental planning activities by other institutions both local government institutions and non governmental institutions that concern in disaster management.

**1.7. HRC (Housing Resource Center)**

Housing Resource Center (HRC) was established as a low income community service agencies in the field of housing, to bring them to a variety of housing resources according to their needs. HRC was conceived and realized in the memorandum of understanding (MOU) between the Ministry of Public Housing and the Yogyakarta Special Province Government in October 2006 as an initiative to fill the void the role of an intermediary to open a road, connecting and integrating resources from government, business, professional, academic, and communities in joint efforts to provide and improve housing and decent, affordable and sustainable housing. At first, the HRC is in response to the earthquake reconstruction process but later developed as an institution to address housing needs in general.

When the earthquake occurred in Yogjakarta in 2006, HRC participate in the construction of temporary houses and reconstruct of permanent buildings. It is necessary for laying out a common understanding in planning of housing and residential areas which is oriented not only to build houses, but also to put the house as a part of settlements and regions system. It is connected with the concept of regional planning by develop a model of participatory development planning that put forward the concept of environmentally friendly development. This has been implemented by the HRC in the Dukuh Serut, one of the Dukuh in the village of Palbapang.

The Planning Concept is comprehensive and refers to the possibility of the designation and the growth of the Dukuh area in the foreseeable future.

The advice given is for cadastre data, especially maps of land parcels used in the concept of settlement planning, managing ownership and boundaries of land parcels such that each parcel of land has direct access to the road or in other terms as Land Consolidation.

**1.8. DERU-UGM (Disaster Response Unit - Gadjah Mada University)**

DERU's role in disaster management is in emergency response and post disaster. When a disaster occur, DERU carrying out field assessment measures to collect the data base which is then followed up by sending aid to the victims as one of the emergency response actions. After a disaster, do reconstruction in a few spots of disaster by making the disaster victims as objects of handling the reconstruction. For example by building temporary shelters in the area directly affected by the disaster.

Some comments are given, especially regarding the standardization of data across multiple agencies related to disaster management. In data standardization in fact not been made and used as a guide to develop the data by the agencies involved in disaster management, so that existing data has different levels of validity. Access to data is a major obstacle. Whereas in the emergency response required the acquisition of data quickly and accurately. This constraint implies a delay of execution in the field.

About cadastre database that has been designed in an integrated way, in general can be quite good as one solution that can be used by agencies related to disaster managements. The advice given is, for the use of this database can be more optimal, it is needed closer cooperation among the agencies that collect data cadastre (BPN and the Tax Office) and the data user agencies involved in disaster management such as BPBD and other NGOs especially that are related in the implementation of emergency response, so that data access is no longer a major problem in the implementation of emergency response in the field.

## K. Conclusion

To improve the spatial accuracy and completeness of cadastre database, can be used Geo-referenced Quick Bird satellite image. The use of GNSS-CORS method to measure the Ground Control Points give accurate results. Integration both legal cadastre produced by Land Office and fiscal cadastre database produced by Tax Office is the solution to improve the completeness of cadastre database. Integration of coordinate systems is the main step to integrate parcel map produced by Land Office and tax office. There are two main steps in designing cadastre geo-database. The first step is developing model diagram, and the second step is implementing the diagram that was created. In the developing model diagram cadastre geo-database through the creation of feature datasets, feature classes, raster datasets, tables, relationships between features, and the relationship between features and table.

The cadastre database is needed by institutions who deal with disaster management issues, whether before, during, and after disaster. For disaster mitigation planning, parcel maps can be used to determine where the exact location to assemble or set up temporary shelters. With large-scale of road network Maps, the evacuation route can be derived easily. This evacuation route is useful for bringing the injuries victims to the first treatment quickly when disaster occur. For the reconstruction and rehabilitation activities, parcel map is useful for determining where buildings will be rebuilt. The designed element at risk database is important to get clear clarification

from other related parties and avoiding the possibility of conflict. In the concept of settlement planning, cadastre database is used in managing ownership parcel boundaries, so each parcel has direct access to the road or in other terms as Land Consolidation. It is required special rules for prioritizing mapping parcels of land in areas prone to disasters, especially disasters that may cause the loss of the signs of land parcel boundaries, loss of physical parcels of land, such as tsunamis, floods, and lava flood. It is needed cooperation among government agencies to build a memorandum of understanding (MOU) at the central and local level so the data can more easily access and the cadastre database can be use optimally in the disaster management. It is needed commitment among institutions who deal with disaster management in the data sharing procedures.

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