

Identification of 3-Dimensional Cadastre Model for Indonesian Purpose

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SUMMARY

Cadastral registration of rights and limited rights is traditionally based on parcels that are represented in two dimensions. In intensively used areas, there is a growing interest in having separate ownership of space above and under the surface.

It is difficult to reflect the spatial aspect of such rights in current cadastral registration systems. This research describes the development of a prototype registration system that accommodates spatial information in the vertical dimension.

The three-dimensional cadastre conceptual development meets the needs of clearly defining ownership while taking advantage of new technical opportunities. The concept is illustrated through a prototype implementation and is an extension of the current cadastral registration system based on two-dimensional parcels. The approach shows substantial potential for improving understanding of complex cadastral situations.

This research obtains that Hybrid Cadastre method with Registrations of Physical Object alternative agreeable to build 3D cadastre in Indonesia.

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1. INTRODUCTION

The land utilization in Indonesia for different purposes has not been followed by the process of idealization of Indonesian cadastre system. One of the examples of the idealization of Indonesian cadastre system is the exploitation of a land parcel for different activities, such as foundation of apartment, condominium, underground pipe/cable lines, skywalk etc. The previously mentioned activities have not been fully regulated by the Indonesian cadastre system, as well as the visualization of the above land utilization.

The development of a region could not be separated from the population growth, in which lead to the increasing demand of settlement and land. On the other hand, the scarcity of land will lead to the advancement of the management of the land. Even though within several jurisdictions, such as Singapore and Jakarta, have been going on reclamation projects, the land allocation will certainly decrease.

It should be underlined that the Indonesian cadastre system is still using 2D geometric for the registration of land and property tenure. This 2D paradigm should be changed, particularly due to the increasing needs of the utilization of under- and aboveground space.

The 3D cadastre has not been developed and implemented in Indonesia. On the other hand, the increasing amount of stories properties with *strata title* ownership has lead to the urgent implementation of 3D cadastre in Indonesia. Thus, the study on the implementation of 3D cadastre in Indonesia is urgently needed.

The objectives of the study that is highlighted within this paper are as follows:

- Investigation of the implementation of 3D cadastre system in abroad;
- Identification of the needs related to the establishment of 3D cadastre system in Indonesia;
- Composition of the documents for the establishment of 3D cadastre based on the needs of the stakeholders in the management of cadastre system in Indonesia;
- Development of straightforward 3D cadastre system visualization.

Additionally, the outcome of this study could provide the basic for further investigation of the formulation of 3D cadastre concept in Indonesia.

2. 3D CADASTRE

Cadastre should be able depict the property ownership as a whole, particularly the *strata title* ownership, as it correlates property owner not only with the area but the volume of her/his property as well (Stoter, 2004). This would be the initial argument on the establishment of 3D cadastre concept.

3D cadastre is defines as a cadastre that registers and gives insight into rights and restrictions not (only) on parcels but on 3D property units (Stoter, 2004). Thus, the conditions that have not allowed the property to be registered using 2D cadastre, such as overlapped building and utility, could be handled by 3D cadastre

2.1 Legal Cadastre

In the legal cadastre framework in Indonesia, the property is not considered as the registration object, except for the *strata title* ownership of apartment known as Right of Ownership of Apartment Unit (*Hak Milik Atas Satuan Rumah Susun/HMASRS*). Even though the HMASRS has been stipulated since 1985, the *strata title* ownership concept is not fully understood up to now. Thus, further consideration on HMASRS should be initiated, particularly on the apartment unit and HMASRS itself. The consideration on apartment unit should include the basic law and regulation, definition, type, requirement, part, separation and boundary of apartment unit. On the other hand, the consideration on HMASRS should include the definition of, holder of and proof of ownership recognized by HMASRS.

Legally, the property ownership within the scope of HMASRS in Indonesia is regulated by the Act of Republic of Indonesia No. 16 year 1985 regarding Apartment Unit. Within the implementation level, the Regulation of Government of Republic of Indonesia No. 4 year 1988 regarding Apartment Unit was stipulated to ensure the legal assurance of the ownership of apartment unit. By Apartment Unit Act, the Government of Republic of Indonesia (GoI) gives legal assurance, if registered, on the followings:

- Individual right of ownership of apartment unit, which is separately maintained by different person;
- Collective right of ownership of parts of apartment unit property;
- Collective right of ownership of particular common object;
- Collective right of ownership of land.

These rights of ownership are tied to each other and could not be functionally alienated.

In accordance to the Article 9 of Apartment Unit Act, the proof of ownership of apartment unit is the Certificate of Right of Ownership of Apartment Unit. Along with the certificate, following documents are attached:

- The copy of land book and cadastral survey record of the apartment property in question;
- The floor plan of the apartment unit in question;
- The description of the portion of collective ownership rights.

2.2 Fiscal Cadastre

The ownership and utilization of land and property in Indonesia are bonded with the taxation. The taxation of land and property has been going on since the Dutch Colonial Government era, which is known as Tax on Lands and Buildings (*Pajak Bumi dan Bangunan/PBB*). PBB itself is defined as the substantive taxation on land and/or property ownership and utilization.

The taxation on land and building relies on the completeness of evidence on taxation subject and object. Thus, it is necessary to have the map containing land and building information, as well as the list of taxation object and subject. The subject of PBB is a person or institution that has been granted right of management of land and/or property, as well as those who has benefited from land and/or property. On the other hand, according to Article 2.1 of Act of Republic of Indonesia No. 12 year 1985 regarding PBB and Act of Republic of Indonesia No. 12 year 1994 regarding Amendment of Act of Republic of Indonesia No. 12 year 1985 regarding PBB, the object of PBB is earth and/or property. Differing from the common definition of land, such as in Dale and McLaughlin (1999), the land in Indonesia, in which represented by the term of earth, is physically defined only the earth surface. This is due to the separation of term earth, water and natural riches contained therein within the scope of natural resources management on Article 33.3 of 1945 Constitution of Republic of Indonesia. The different definition of land in Indonesia is also supported by the stipulation of the term of airspace within the natural resources management in Act of Republic of Indonesia No. 5 year 1960 regarding Basic Regulation on Agrarian Principle known as Agrarian Principle Act. However, the PBB Act and its amendment adopt the concept vertical unification principle, which is identical to the definition of land by Dale and McLaughlin, for the taxation purpose. On the other hand, a property is defines as a technical construction that is permanently planted or attached to the land and/or a body of water. Included under the definition of property are roads in the urbanized area, pools, exclusive fences, sport facilities, piers, exclusive parks, oil refineries, oil distribution pipes and so forth.

Within the implementation level, PBB is regulated by the Resolution of Directorate General of Taxation No. Kep-533/PJ/2000 regarding Practical Guidelines of Registration, Inventory and Valuation of Object and Subject of PBB within the scope of Development and/or Maintenance of Taxation Object Information Management Information System (*Sistem Informasi Manajemen Informasi Objek Pajak/SISMIOP*). The resolution regulates the following activities:

1. Registration of PBB object and subject;
2. Inventory of PBB object and subject;
3. Valuation of PBB object and subject.

In relation to the taxation on HMASRS, the Resolution of Ministry of Treasury of Republic of Indonesia No. 1336/KMK.04/1989 regarding the Dispensation on PBB Levied to Apartment Unit Built not by National Urban Development Corporation of Republic of Indonesia, which is completed by regulation on The Selling Value of Untaxed Taxation Object stipulated on Amendment of PBB Act, PBB is levied to the following categories of apartment unit:

- Settlement structure, in which allocated for the settlement and sold to the consument;
- Collective structure, including stairs, verandas and so forth;
- Apartment unit infrastructure, such as roads, parking place and so forth.

2.3 Multipurpose Cadastre

Multipurpose Cadastre is a cadastral concept that is variedly used for different purposes. Multipurpose Cadastre is an ideal tool for the establishment of modern land administration system, which includes fiscal, legal and marine cadastre, as well as the spatial planning.

3. 3D CADASTRE MODEL FORMULATION

Within this study, Bandung Electronic Centre (BEC) in Bandung, West Java, Indonesia, has been chosen as a study site due to the following reasons:

- One of *strata title* buildings that is still in dispute while visualized by 2D cadastre system;
- Availability of 2D HMASRS data of BEC at the National Land Agency of Republic of Indonesia (*Badan Pertanahan Nasional/BPN*). Data was collected by Surveying and Mapping section of BPN on 2003, containing HMASRS from each of nine floors of BEC, using a GPS benchmark as the reference and polygonal and leveling terrestrial surveying.

AutoCAD Land Development 2005 is utilized for visualizing the 3D cadastre object. Furthermore, the Bottom-up method has been used for 3D cadastre object modeling.

4. ANALYSIS

4.1 3D Cadastre Object Modeling

Basically, the purpose of 3D cadastre object modeling is to provide boundary certainty of 3D cadastre object, particularly regarding HMASRS. The current cadastre system could not provide the boundary certainty on 3D property as it has been represented by 2D data.

Hybrid Cadastre Method is a method of 3D visualization by uniting 3D property registration and 2D parcel based cadastre system. Considering that 2D information has been commonly used by BPN and other governmental institutions for registering real estate object, the Hybrid Cadastre Method is perfectly suited the Indonesian purpose.

HMASRS property is basically represented by a unity of property, which is established both above and below the ground that could be owned by more than a person. Thus, the registration of apartment unit could not be separately done with the registration of land parcel.



Figure 1 Bandung Electronic Centre (BEC)

For visualizing the physical state of HMASRS property, the method of registration of 3D physical objects, which is originated from Hybrid Cadastre Method, is utilized. By employment of this method, the geometrical shape and position of each HMASRS property objects could be depicted, including the collective ones, as well as every subject that benefited from HMASRS property. Another advantage of employment of this method is that the ownership and 3D space utilization could be visualized within an integrated cadastral map.

4.2 Cadastral Object Registration Analysis

Using the common 2D object registration, the physical boundary of apartment unit could only be represented within its floor plan. By implementing 3D cadastral object registration, the physical boundary of apartment unit could be represented with other apartment units that are located at different floor from the apartment unit in question. See Figure 2 for the comparison of apartment unit registration in 2D and 3D. See also Figure 3 for the 3D visualization of an apartment unit in BEC.

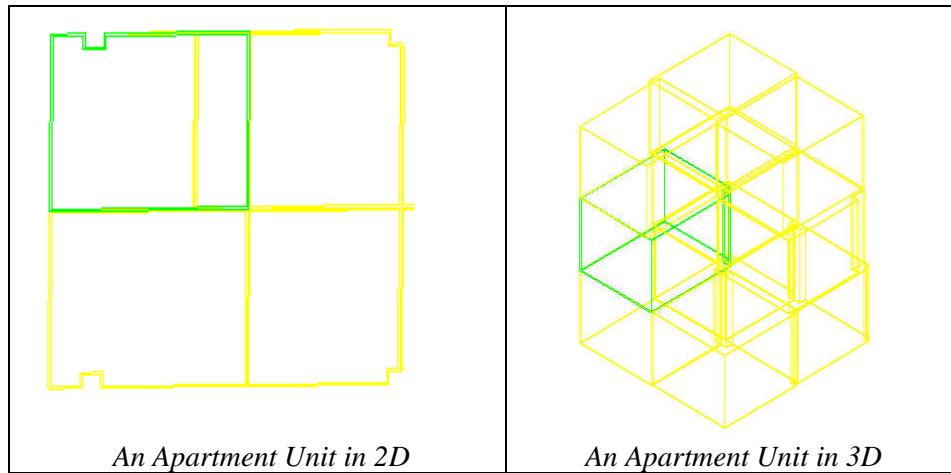


Figure 2 An apartment unit in 2D and 3D

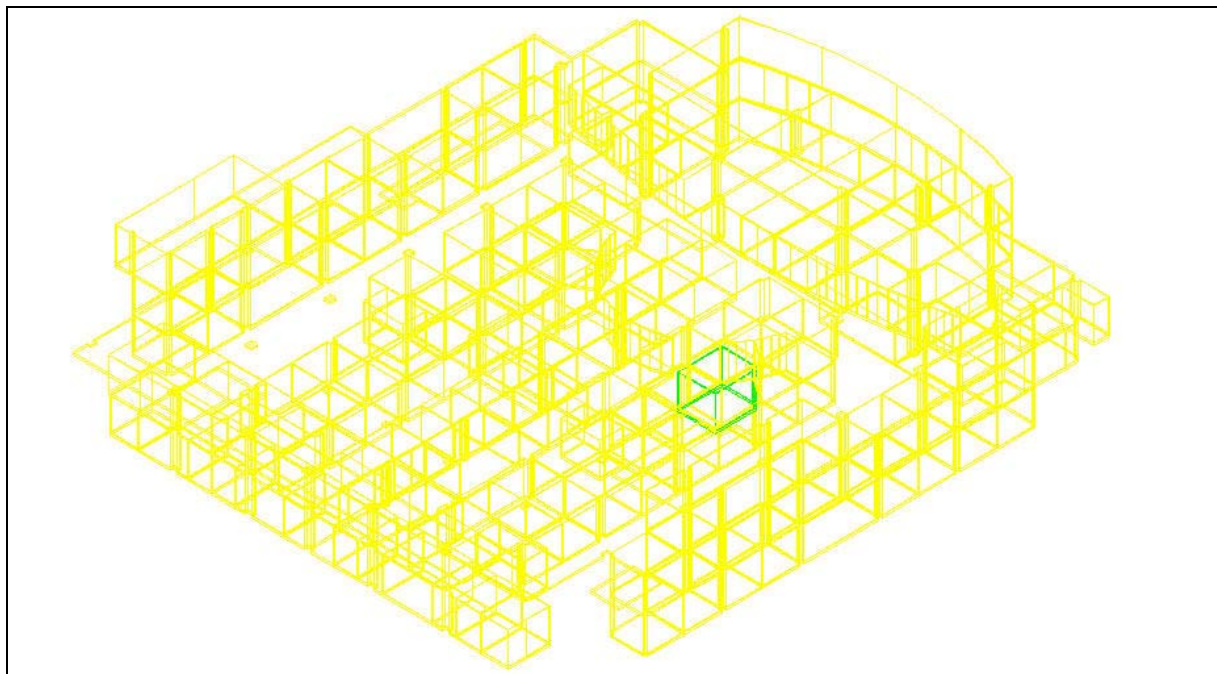


Figure 3 3D visualization of an apartment unit at BEC

4.3 Study Outcome

For modeling 3D cadastre object using Hybrid Cadastre Method with an alternative of registration of 3D physical object, the coordinate of parcel as the basic entity and height measurement of the cadastre object are needed. Thus, the 3D cadastral map in this study has already referred to Transverse Mercator 3⁰ projection system. See Figure 4 for the 2D and 3D

visualization of Underground Floor of BEC. See also Figure 5 for the 3D visualization of apartment unit at BEC from different view.

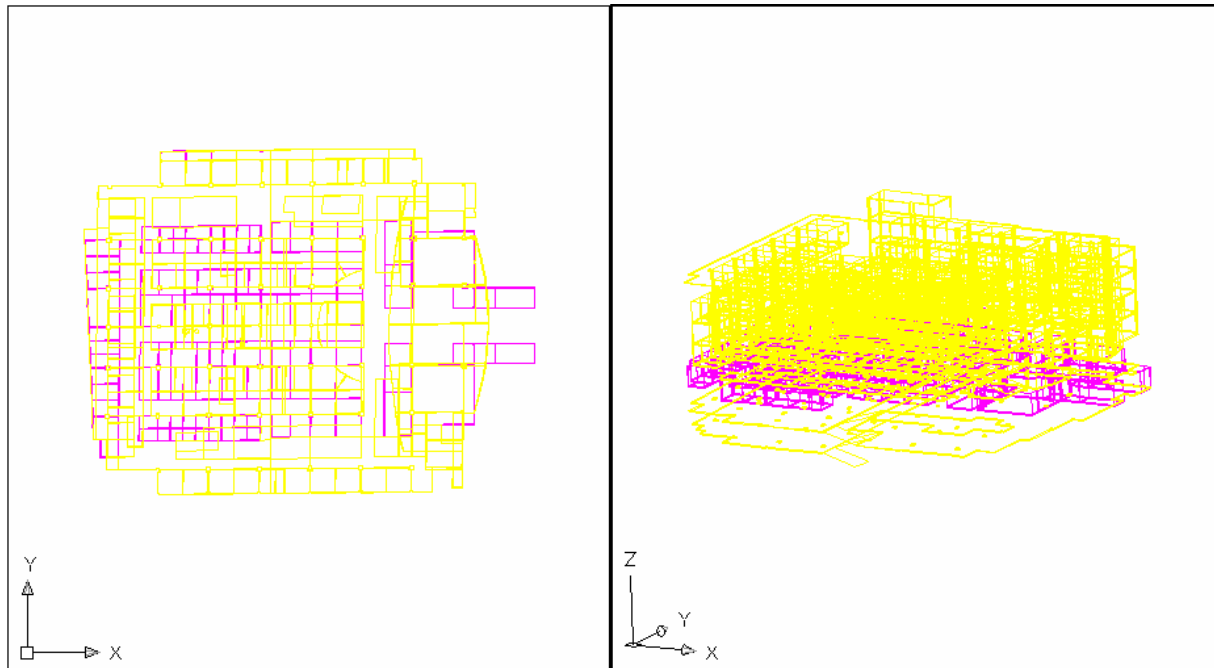


Figure 4 2D and 3D visualization of Underground Floor of BEC

5. CONCLUSION AND REMARKS

Having accomplished this study, it is concluded that:

- Hybrid Cadastre Method with an alternative of registration of 3D physical object is suited the need for establishing 3D cadastre system in Indonesia;
- The employment of height information that is georeferenced to specific coordinate system could be useful for determining the location of the property, which could support the analysis on the social purposes of the property, such as the height of the property among the surrounding parcels;
- 3D object could be visualized either in 2D or 3D, as well as from different view angle;
- 3D cadastre modeling allows a solid modeling with no intersection within each design (see Figure 2 for details).

Additionally, due to restrictions applied in this study, further studies on the development of 3D cadastre database should be initiated.

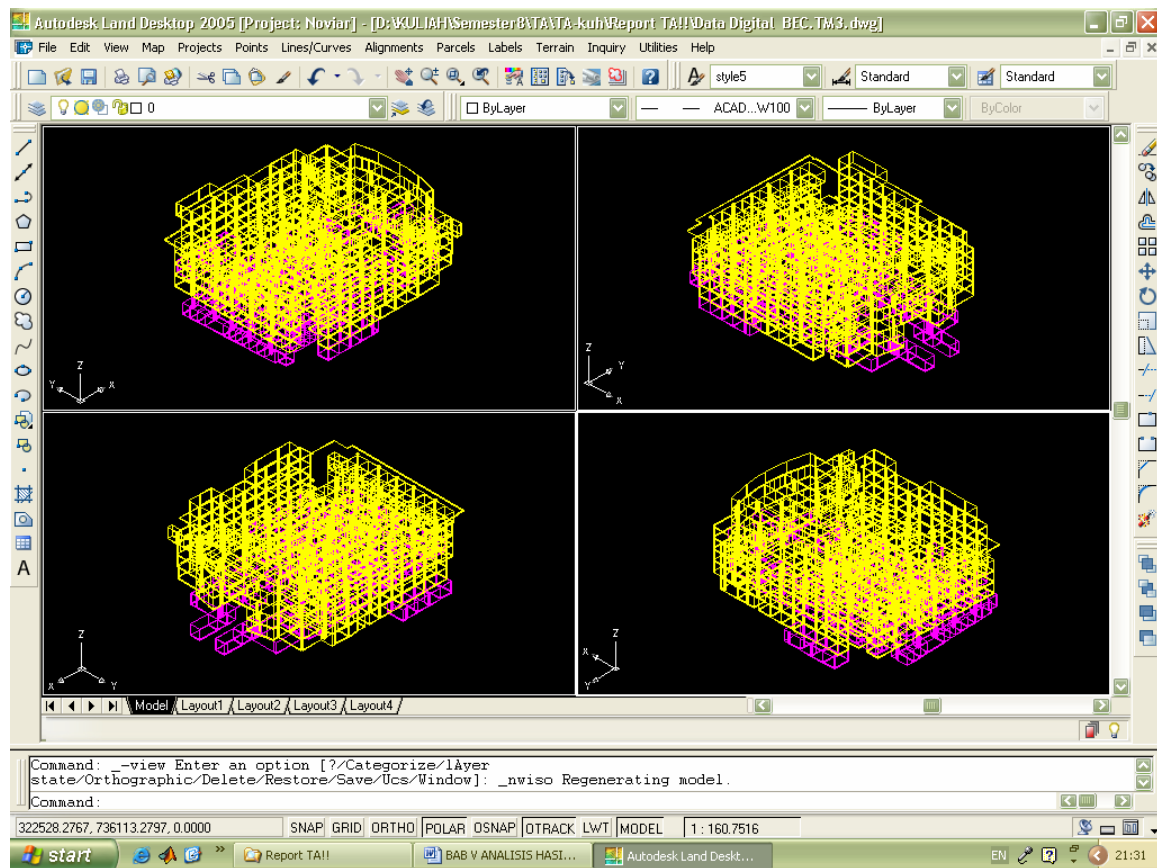


Figure 5 BEC and apartment units thereon from different view angle

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BIOGRAPHICAL NOTES

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