

3D Property Situation in Malaysia-Initiatives towards 3D Cadastre

**TAN Liat Choon, Dr. Khadijah Binti HUSSIN, Sr. ERNEST KHOO Hock Oon,
Malaysia**

Key words: land administration, 3D, legislation, cadastre, property

SUMMARY

Malaysian land administration provides a variety of rights, depending on the traditions of the country but the legacy cadastre system and land law are still using 2D geometry in legal and law expression (2D legislation) for land and property tenure and not prepared in 3D property legislation. These entire binding and legal document do not give enough 3D property legislation information for 3D property in Malaysia.

This paper describes the overview of Malaysian Cadastre System for 3D purpose and the situation in Malaysia. Some cases on 3D property will be illustrated concerning the 3D property legislation in Malaysia. This paper underlines how code, act and others legal document that related to cadastre system play an important role in the initial part of land administration. We draw out some problems and constraints in the current cadastre system for 3D property objects in Malaysia. We explain the current practice of cadastral registration in Malaysia and the Malaysian Cadastral Data Model are elaborates also. The Malaysian Digital Cadastral Database (DCDB), Computerised Land Registration System (CLRS) and Cadastral Data Management System (CDMS), the development of 3D cadastre registration and the integration of CLRS and CDMS are illustrates respectively.

Throughout the paper is become clear that quite a lot of study will be needed to realise the 3D property legislation for 3D property in Malaysia.

3D Property Situation in Malaysia-Initiatives towards 3D Cadastre

**TAN Liat Choon, Dr. Khadijah Binti HUSSIN, Sr. ERNEST KHOO Hock Oon,
Malaysia**

1. INTRODUCTION

A systematic record of lands matters involving registration of the details of transaction such as transfer of land and interest, lease, charge, releasing of easement and change of condition of land is very important in the land administration, planning and development of land. As stated in ECE/HBP/96 (1996), land administration consists of Cadastral Survey and Mapping Registration System, and Land Registration System. Both systems contain different sets of records about land. These two systems are very important for the formation of a good cadastre system. A cadastre system is an information system consisting of a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. This 2D cadastre system is adopted by many countries in the world including Malaysia because the system provides essential information about land and property such as ownership of the lot and land parcel for the country.

One of the important issues with regards to land is the inadequacy of vacant land for development. There are many countries from all over the world including Malaysia who do not have enough vacant land on the ground surface to cater for the rapid development, particularly in big cities. In densely developed area and crowded cities, many of the real estate developments are either above or below the ground surface such as apartments and business complexes and engineering constructions which could be underground car parks, skywalks and buildings above road reserve. These new types of development not listed in the conventional developments are in need of a proper registration in land registry and cadastre system for 3D purpose. This is to make sure owners of those properties not subscribed by the conventional definition of ownership, could fully enjoy the ownership rights of their real estate properties. This is crucial to establish a more secure ownership and mapping facilities of real estate properties and objects in the cadastre system and land registry. Thus, more effort, attention and interest have to be put in to formalise the land registration meant for 3D purposes. Furthermore, the current cadastre system is not able to handle the registration of 3D property within the legislation and this problem in the system needs to be addressed and taken into consideration to avoid complications in the land registry system.

2. OBJECTIVES

In view of the Malaysian Cadastre System that is based on the 2D cadastre system, this research proposes that changes be made in the legislation of cadastral survey and mapping as well as registration of a 3D property. The objectives of the research are to review literature associated with the execution and application for feasibly the legal status of the various 3D property real estate objects, to establish the fundamental principles in the field of 3D property legislation that was matched the need of Malaysian Land Law and to investigate and make

recommendations for changes, if necessary of the Strata Title Act 1985 (Act 318) and National Land Code 1965 (Act 56) that would facilitate the Malaysian Cadastre System practices.

3. 3D CADASTRE & 3D PROPERTY

At present, there is a lot of development taking place that is not covered in the 2D cadastre system as there is a lot of interest in utilising land and space above and below the ground surface. Thus, there is a necessity to find a suitable cadastre solution for multilayer constructions. Therefore, the proposed 3D cadastre system should be able to represent the actual real world situation and not the surface parcel. The traditional cadastre system and land registry based on 2D have not been prepared to register these utilisation of land in a 3D situation. The implication of these new ways of land use due to a high demand for ground space means that, there must be changes made to the 2D paradigm in law and legal aspects.

An earlier paper by Tan, Hussin and Ernest Khoo (2009a) did describe that today's property situations often occur whereby the third dimension play a significant role in determining the legal status of such property, especially in areas with multilayer use of space. Examples of such property unit can be found in the following situations, (a) above surface constructions, such as apartments, constructions on top of each other, overhead infrastructure and utilities & Use of air space and (b) below surface constructions, such as underground constructions, infrastructure and utilities, region of polluted area & geological activities

3.1 3D property cases in Malaysia

In Malaysia, public road i.e. state roads and municipal roads belong to state government while federal roads belong to federal government. When a private property is constructed above the public road, the cadastre system should recognise two or more different owners at the same time. An earlier example of some cases for 3D property above the ground surface of public road in Malaysia was presented by Tan, Hussin and Ernest Khoo (2009b, 2009c) determined it into three categories, i.e. private properties (building structure) over a public road, public properties (transportation network) over a public road and Overlapping private properties.

4. PROBLEMS AND CONSTRAINTS IN CURRENT MALAYSIAN CADASTRE SYSTEM FOR 3D PROPERTY

The current 2D Malaysian Cadastre System is insufficient to meet the changes brought about by the booming yet complex high density developments in urban areas. Furthermore, there is a growing interest and need for using space above or below the ground surface for construction real estate property objects especially in metropolitan areas. In such developments, some of the buildings have been built on top of each other or crossing boundary edge (Hassan, 2008; Hassan, Abdul-Rahman and Stoter, 2006; Chong, 2006 and Ossko, 2005), but the legal changes in the land registry has not been made in accordance with the complexity of the developments that are taking place. The growing request for changes mentioned earlier is bogged by constraints and difficulties to register the ownership of real

estate properties created above or below ground surface. These problems need to be addressed and there is a need for a legal registration status of such property, so that one would be able to define and manage the juridical situation satisfactorily. Thus, information based on 3D is becoming absolutely necessary for land administration in Malaysia.

The Malaysia legal cadastre system and land law are still using 2D legal and law expression for land and property tenure, for example in Strata Title Act 1985 (Act 318) and National Land Code 1965 (Act 56). As there is a growing need for ground space, the 2D paradigm in law and legal should be changed. But, the question is how does one determine and define the current legal practices meant for complex development situations. There is also the issue that the traditional cadastre maps, survey regulation and land registry which are still in 2D are no longer technically, legally and organisationally adequate to cater for these 3D situations.

The current legal registration process for 3D property in Malaysia is very slow. This is due to the problems associated with the legal registration process for 3D property. There is a possibility that they can be solved by adopting the approaches presented in Mariappan (2005), where he underlined the organisational, technical, data, legal and different working procedures and practices issues associated with the integration of the various systems and organisations. Therefore, the comprehensive decision making usually is more difficult because there are multi authorities involved.

The increasing number of multi- storeys and underground properties as well as other types of constructions has led to the urgency of implementing a 3D cadastre in Malaysia. Thus, this study on the institutional issue is urgently needed to be in tandem with the technical development issues. Furthermore, the implementation of a 3D cadastre for 3D property is not easy due to the different database compiled by the different organisations involved. Besides that the legal, survey and mapping part is also governed by different laws which makes the implementation of a 3D cadastre for 3D property much more complicated and this will be one of the aspects to discussed and debated further in this research.

5. MALAYSIA SITUATION

Peninsular Malaysia (hereinafter called as “Malaysia”) land administration is traditionally based on the Malaysian land law and this provides a variety of rights that are dependent on the traditions of the country. In Malaysia, land use rights are often based on occupation of land over a long period and this is defined in the written law or set by traditions. As the context of land use is no longer confined to the conventional definitions, the application of Malaysian legalistic land law of Malaysian Cadastre System for property which consists of Land Registration System and Cadastral Survey and Mapping System using 2D geometry in legal and law expression for land and property tenure is no longer adequate.

Traditionally, the Malaysian Cadastre System has different structures and authorisations whereby the jurisdiction for land registration is under the administration of the state government while cadastral survey and mapping is under the federal government. Both the systems deals with properties located on and above the surface level, as well as the ones

below the surface level. Ahmad-Nasruddin and Abdul-Rahman (2006) has highlighted that each country has its own authority that is responsible for managing and monitoring the cadastre system and the cadastral objects can be either lot, or land parcel, or parcel which is held under separate Land Registry, i.e. strata title. However, the system practised in Malaysia is the parcel bounded system with a 2D nature only provides essential land and property information about the lots and land parcels (Hassan, 2008). This, however, does not include the 3D object registration and 3D rights as this current system only apply to the ordinary Land Administration System. For example, the digital cadastral map, registry title, content survey and mapping as well as textual record information about lots or land parcels are still using 2D natural for registration of 3D object rights is not comprehensive enough for 3D objects.

Furthermore, the utilisation of land for various purposes in Malaysia has not followed the process of the ideal Malaysian Cadastre System. It would be more practical if the Malaysian Cadastre System includes relevant information such as foundation of buildings, underground utilities, skywalks, using of air space, transportation services, and underground construction or whenever a situation arises for the need of exploiting a lot or land parcel for different activities.

5.1 Related legal documents

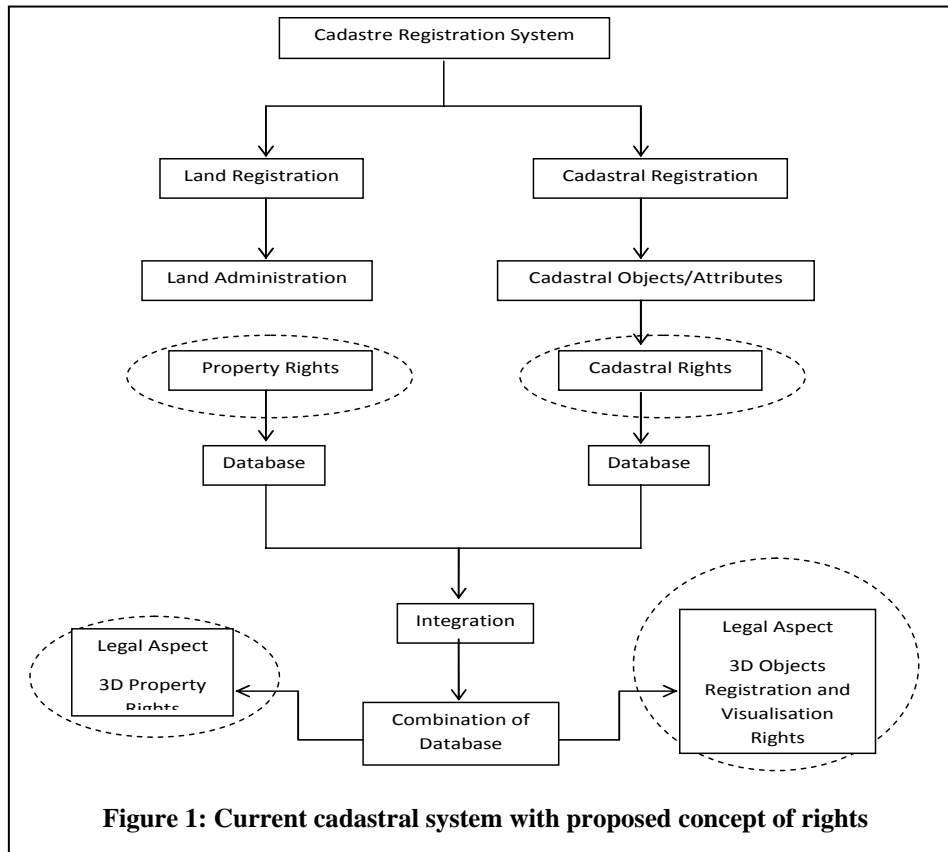
The present scenario is that the rights, restrictions and responsibilities of the proprietor of the surface parcel shall also apply to the proprietor of properties above and below the ground surface, however, it have not been fully regulated and legalised by the Malaysian Cadastre System. In order to comprehend further these related matters, the legal documents which are related to lot, land parcel and land registry such as Registry Title, Land Office Title, Cadastral Map, so-called Certified Plan (CP), National Land code 1965 (Act 56) (NLC 1965), Strata Title Act 1985 (Act 318) (STA 1985), Survey Regulation 1976 (Peninsular Malaysia) (SRG 1976), Federal Constitution 1957, Survey and Mapping Director General Secular (PKPUP), Uniform Building By-Laws 1984, Street, Drainage and Building Act 1957, Building and Common Property (Maintenance and Management) Act 2007, Town and Country Planning Act 1976, Local Government Act 1976 and States Land Code, Act and Rule should be used to make the legislation feasible for all proprietors on the surface, above and below the ground surface (Tan, Hussin and Ernest Khoo, 2009d).

5.2 Cadastre registration system in Malaysia

The traditional cadastre registration system that is practiced in Malaysia are parcel bounded system with 2D nature and provide essential lands and properties information of the lots and land parcels (Hassan, 2008). Furthermore, Valstard (2006) points to the fact that traditionally land has been described and registered into 2D and all cadastre systems of the world are in fact 2D nature. The existing traditional Malaysian Cadastral Survey and Mapping Registration System and Land Registration System deals with properties not only located on the surface level, but above the surface level and also below the surface level. Therefore, the rights, restrictions and responsibilities (RRR) of the proprietor of the surface parcel shall also apply to the proprietor of the above that is air space and underground land as well.

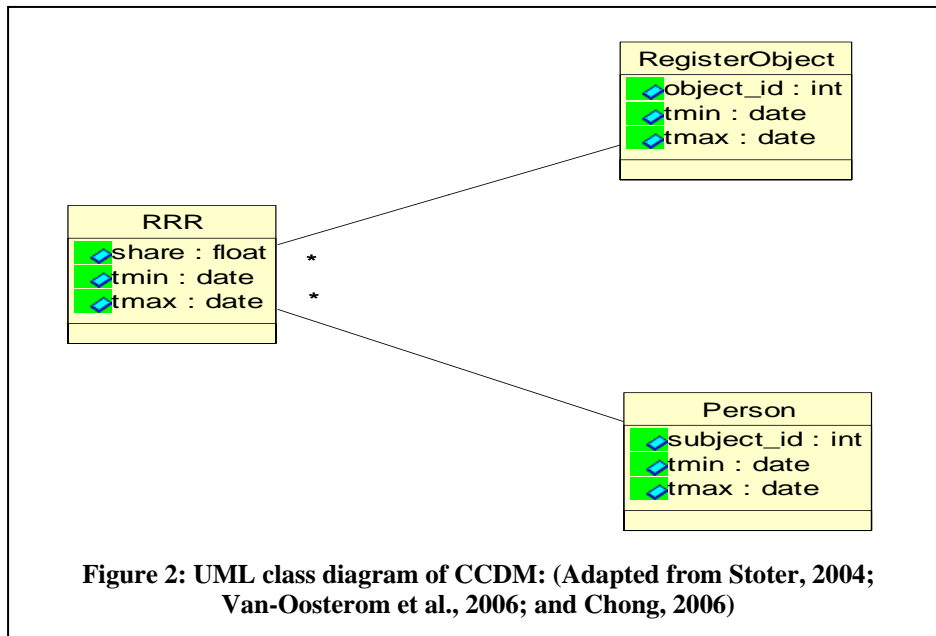
The current Malaysia Cadastre Registration System does not consist and includes 3D objects registration and 3D rights as well, but this current system is more similar to land administration system. As stated in ECE/HBP/96 (1996), land administration consists of Cadastral Survey and Mapping Registration System and Land Registration System where both of them contain a set of records about land. This type of 2D cadastre system being practice in Malaysia for a period of one hundred years and it provides essential information about land and property like ownerships of the lots and land parcels for the country. In Malaysia, the cadastre system is managed by three main authorities namely Department of Survey and Mapping Malaysia (DSMM), State Land and Mines Office (PTG) and District Land Office (PTD). In general, cadastral survey and mapping is under the jurisdiction of DSMM where it responsible for carrying out land survey and mapping, then follow by registration of cadastral objects there are lots and land parcel boundaries while PTG and PTD are responsible for the land title registration (Registry Titles and Land Office Titles).

In Malaysian Cadastre System, there are two systems namely Cadastral Database Management System (CDMS) and Computerised Land Registration System (CLRS) which operated by DSMM and PTG as well as PTD. The CDMS database stored land attributes, spatial objects and other things while the CLRS database stored land ownerships, land tenures and so on, but these two systems works separately in each organisation with difference legal aspect and still in nature of 2D. This mean, there are no 3D object property rights as well as 3D cadastral rights. These two systems later on can be incorporated in the registration form with the present advance and modern technologies such as GIS, internet, web based and e-commerce applications. Figure 1 shows the current system with the proposed concept of legal aspect for 3D objects registration and visualisation rights as well as 3D property rights. For more discussion and detail on 3D property rights, see Paulsson (2007).



5.3 Malaysian Cadastral Data Model

The CCDM which introduced in the current version of model (Van-Oosterom et al., 2006) mentioned that this data model is the foundation of most land administration. Which means that, this foundation of core cadastral data model is designed for various land registration system and cadastral system all over the world and as a base for all cadastral registration, therefore, in other words, the relationship between the three core classes in the UML diagram as in Figure 2, there are Person (subject), RRR (right, restriction, responsibility) and Register Object (real property objects), can used to illustrate Malaysia Cadastral Data Model.



5.4 Malaysia Cadastral Database

The arrival of computer and the rapid development of Information Communication Technology (ICT) has resulted widespread technological reforms in the field of cadastral system and in line with the government objective of providing efficient and quality land administration services to the public. Realising the importance and potential of this new technology, DSMM and PTG had initiated their computerisation programme in the early 1980's and 1990's respectively. The most significant change that ICT has brought about is that the shift from conventional analogue data to digital data and consequently the introduction of the concept of digital database which forms the base component of a Land Information System (LIS) which in turn has been identified as having an indispensable role in the process of decision making in resource management and planning. For example, PTG has computerised two of its main operations in land administration named Computerised Land Registration System (CLRS) and Land Revenue Collection System (LRCS) to cater the land registration and revenue collection activities. On the other hand, DSMM has implemented a data collection and processing facility named Cadastral Data Management System (CDMS) for cadastral activity, the Computer Assisted Topographic Mapping (CATMAPS) for mapping activity and also the Automated District Survey Office System (ADSS) for district survey office activity, and then both CLRS and CDMS enabled the process of land registration and measurement of ownership to be accelerated (Chong, 2006).

The Cadastral Data Management System (CDMS) will provides a network for the survey department to access the DCDB and the digital image library from any personal computer within the network, with a single window and single point of access. DCDB holds digital cadastral base maps that are used for building up GIS and land related applications, while the

image library holds scanned and indexed certified plans stored in the disk arrays at every state survey departments. CDMS is also capable of receiving orders from clients through remote access, e-mail, dial-up and other things as well as providing an automatic invoicing, billing and accounting system and it also cater for remote access to and from the District Survey offices (JUD). A system which forms part of the CDMS that is Quality Assurance System (SPEK) is a module to preserve the integrity, and accuracy of the DCDB.

With the implementation of the CLRS, a system to modernise and to facilitate the registration of land title and dealings, data are extracted from both the documents of title and other land related documents. Meanwhile, the information in the CLRS database are based on the records kept in the land registers and relevant files with include information on ownership (Person), land identification (Register Object), restriction (RRR) and record of dealings. As mentioned by Chong (2006), the register furnishes all information pertaining to the ownership (person), the land (object, through description of area and location and boundary limits from the Certified Plan and rights (details of encumbrance, expressed conditions, caveats and prohibitory orders and other things). However, not all restrictions are stated in the register, some are implied by law for example National Land Code 1965 (Act 56), planning control and so on.

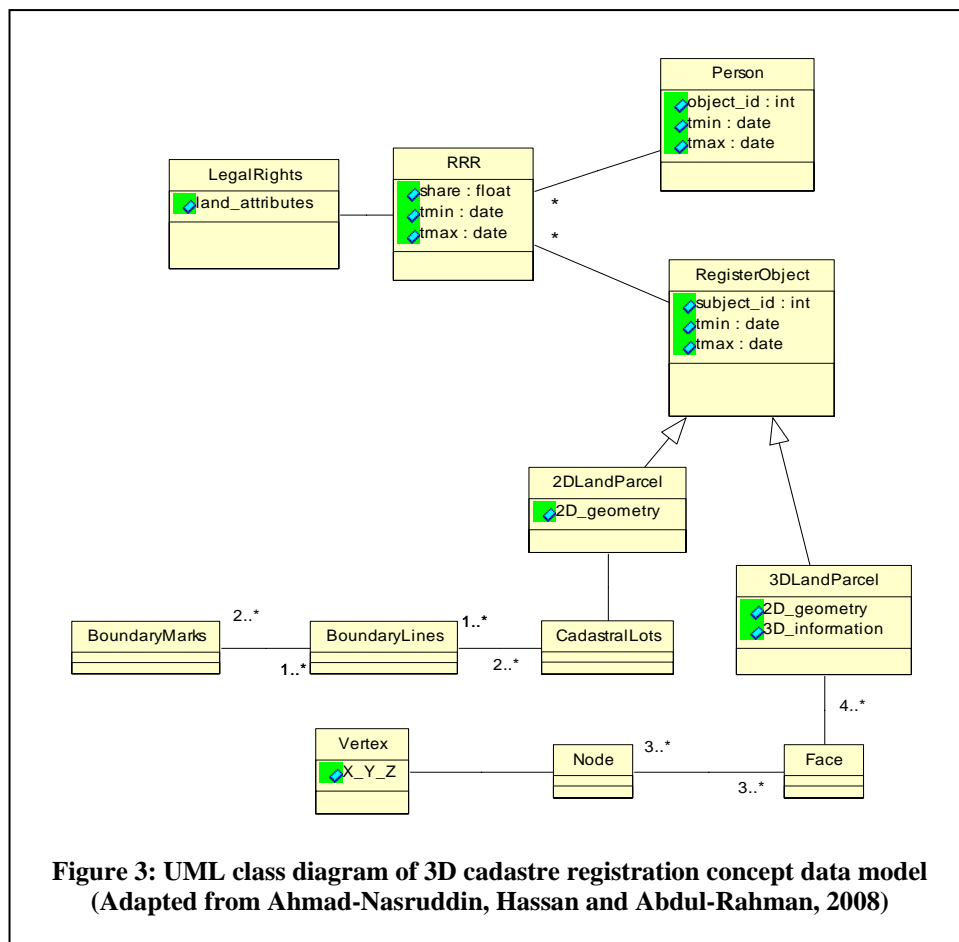
5.5 3D Cadastre Registration Development in Malaysia

The development of 3D cadastre registration are more on technical part where researchers study on the process of adding 3D cadastre objects in the current cadastre data model and information accessible among DSMM, PTG and PTD, unfortunately the two state database which are DCDB and CLRS database works separately in different authorities and still in 2D situation. As mentioned in this research previously, Malaysia land administration are based on the Torrens system where Cadastral Map and legal document with spatial and textual information as a legal evident under the rules and regulations are needed in order to have fully institutional coordination. Therefore, a good institutional is very important, so as to achieve an excellent and wonderful cadastre registration system. However, due to too many historical constrains, it seems quite difficult to realise this unless with fully cooperation from various legislative agencies, technical agencies, organisations and other land related government and private sector as well. Recently, the 3D cadastre proposed registration model focused on the combination of these two different databases mentioned above and these two cadastre registration databases namely the legal rights land attributes and the spatial objects geo-data. These three authorities, DSMM, PTG and PTD that are mentioned above are the main government agencies that responsible for the cadastre registration system where they will integrate and coordinate each other, in order to have an integrated and fully cadastre system in Malaysia using the 2D/3D hybrid cadastre approach (Stoter, 2004).

The 3D cadastre objects such as strata building, construction on, above and below the ground surface, i.e. underground tunnel, metro station, skywalk and other things is a real property object that being built on the 2D land parcel, which are the responsible by PTG, PTD and DSMM on the ownership registration and object registration respectively. Apart from this 2D land parcel, there is also a 3D land parcel, which is similar to 3D physical object based on the

hybrid solution by Stoter (2004), together form from the Register Object, where the 2D land parcel is represented as a 2D geometry while 3D land parcel is form with 2D geometry and 3D information. Furthermore, the 2D land parcel is inherited from the current registration system that is the cadastral lot that consists of boundary lines and boundary marks. On the other hand, 3D land parcel is projected with the 3D bounded space that consists of face, node and vertex with list of coordinates that form flat faces and forming of 3D objects which so-called 3D cadastre object later.

To sum up, 3D cadastre registration is a combination of land registration with 2D and 3D land parcel of cadastral registration. There are combination of legal rights of land attributes, 2D cadastral objects and 3D information. The combination of this concept data model can be shown in Figure 3.



5.6 Integration of Computerised Land Registration System (CLRS) and Cadastral Data Management System CDMS)

There could be extensive benefits if these two systems, which are CLRS of PTG and CDMS of DSMM, are linked together. For that reason, a pilot project being started in Kuala Lumpur in 1st April 1995 to electronically connect and integrate the CLRS with the CDMS for the whole Kuala Lumpur then to develop the operational systems that can subsequently be implemented throughout the country in Peninsular Malaysia. Therefore, with the integration of attribute data from CLRS and spatial data from CDMS and through identified application, efficiency of land administration can be greatly improved. Nordin (2001) stated that the envisaged applications include on-line registration for survey and preparation of title, extending DCDB enquiry module to the land administrators and on the hand, linking the Qualified Title (QT) information to the DCDB. Although conceptually tenable, the eventual implementation would need substantial negotiation and compromising in between PTG and DSMM.

With the vast changing in the ICT, such as GIS, internet and web based application and together with the initiative of Malaysian Geospatial Data Infrastructure (MyGDI) National Spatial Data Infrastructure (NSDI), e-Tanah of Ministry of Natural Resources and Environment (NRE) and e-Cadastre, Electronic Strata Module of DSMM, CLRS and CDMS database could be integrated electronically. In order to achieve the goal of comprehensive Land Information System from district level up to state and eventually at the national level, the integration of spatial CDMS database with the textual CLRS database play a preliminary requirement of all these. Moreover, Mariappan (2005) introduced a mechanism to integrate these two standalone databases. Coordination among DSMM, PTG and PTD can be provided by the installation of centralised server or distributed server at each of their office which act as the transporters and bridges in exchanging data between CLRS and CDMS. Figure 4 illustrates the conceptual integration of cadastral survey and title registration databases. Although there are a lot of benefits from an integrated textual title registration database and the graphic as well as spatial cadastral database, but there are still many hurdles to solve at this stage.

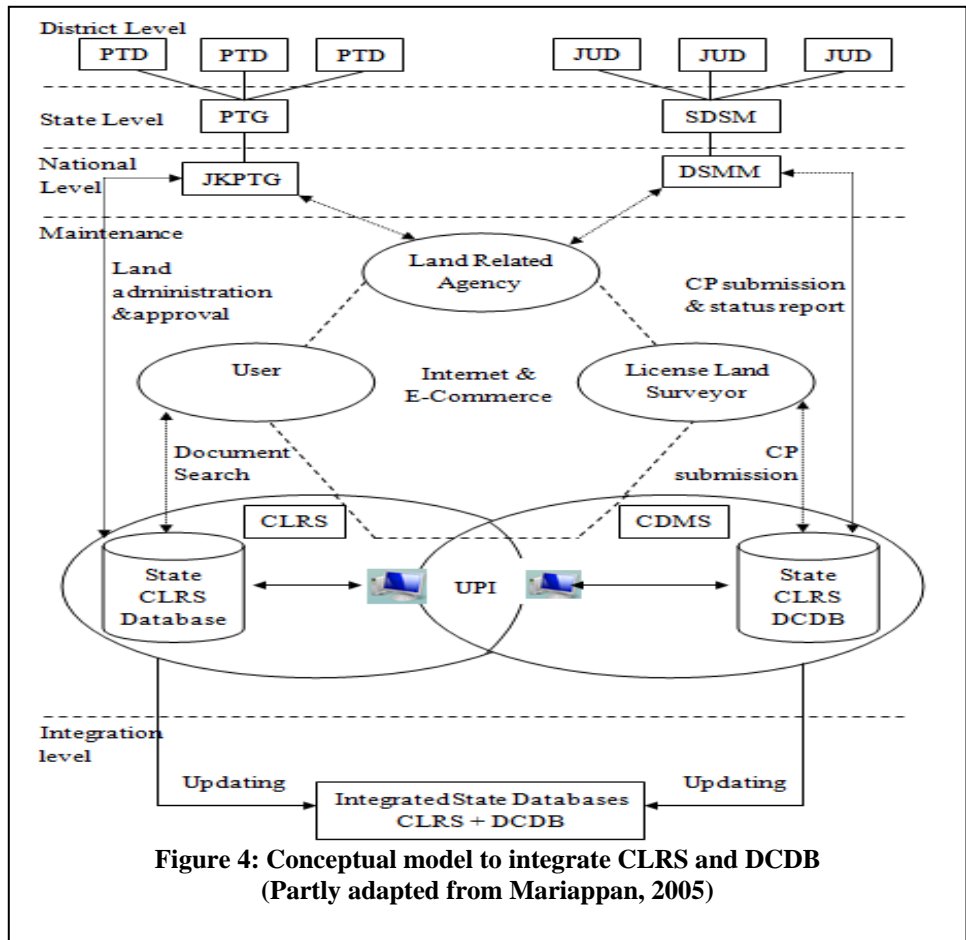


Figure 4: Conceptual model to integrate CLRS and DCDB (Partly adapted from Mariappan, 2005)

6. CONCLUSIONS

In Malaysia, the main thing that hinders the progress has been the national legal system because there are no provisions and there is a lack of proper Malaysia cadastre law to cater for the registration of legal and organisational aspects for 3D property in full 3D cadastre as described by Stoter (2004). Therefore, the legal profession is always very conservative because they are attached to the old and traditional land registry law and legal changes generally take quite a long time to change.

Malaysia adopts a title registration system where the register contain information about the proprietor, encumbrances, express conditions, implied conditions, restrictions in interest, caveats and prohibited orders if any. However, not all imposed conditions and restrictions are stated clearly in the register as there are some that are provided by law and have to be complied by the proprietor. Meanwhile, the land register can be considered as the pillar of the record machinery in the Malaysian Registration System. The hardcopy land registry is now replaced by computerised land registry which enables the proprietor to transfer, lease and change the land or grant rights of easement.

The rights associated with this registration would be clear in the registry titles issued as well as that provided for under legislation. For example, Strata Title Act 1985 (Act 318) (Strata Title Act, 1985) allows land to be subdivided into parcels or land parcels based on the area occupied. Besides that in National Land Code 1965 (Act 56) (National Land Code, 1965), air space is permitted up to a maximum of 21 years only, and there are still a lot of arguments about the surface under different categories of land use, subdivision, partition, amalgamation as well, because all these are still in 2D nature. However, these arguments would clearly be different if they are used in the case of 3D property alienation, although the mode of registration being quite similar. It is important to note the fact that there is provision of volumetric parcel alienation, in particular for underground land alienation under the said legislation.

An example of the situation, this overlap multilayer construction causes interdependence among these objects which must be taken into account for the land management and cadastral survey of above and below the ground surface which should be included in the 3D cadastral registration. Furthermore, these construction are not necessary be uniformed and many of these are buildings or parcels built on top of the road reserve make the situation more complicated.

Finally, within the availability of the latest knowledge and information technology such as hardware and software, I believe that Malaysia is ready to develop a 3D cadastre system to solve the problems from the technical aspects taking into consideration the complexity of cadastre registration of 3D property situations. On the other hand, the changes of the land law in legal and organisational aspects probably should come first, or later, or maybe concurrently with the technical aspect development will be the main issues for further discussion. An effective implementation of 3D cadastre inclusive of all institutional issues (legal and organisational) and technical aspect are equally important.

REFERENCES

- Ahmad-Nasruddin, M. H. and Abdul-Rahman, A. (2006). *Developing 3D Registration for 3D Cadastre*. In Abdul-Rahman, A., Zlatanova, S. and Coors, V. (Eds.) *Innovations in 3D Geo Information Systems* (pp. 535-546). Berlin, Heidelberg, New York: Springer-Verlag.
- Chong, S. C. (2006). *Towards a 3D Cadastre in Malaysia-An Implementation Evaluation*. M.Sc. Thesis. Delft University of Technology, Delft, the Netherlands.
- ECE/HBP/96 (1996). *Land Administration Guidelines: With Special Reference to Countries in Transition*. In: *Economic Commission for Europe*. Geneva, Switzerland.
- Hassan, M. I., Abdul-Rahman, A. and Stoter, J. E. (2006). *Developing Malaysian 3D Cadastre System-Preliminary Findings*. In Abdul-Rahman, A., Zlatanova, S. and Coors, V. (Eds.) *Innovations in 3D Geo Information Systems* (pp. 519-533). Berlin, Heidelberg, New York: Springer-Verlag.

- Hassan, M. I. (2008). Malaysia 3D Cadastre: Legal and Organizational Aspects. *In: Geoinformatics Postgraduate Seminar 2008*. Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
- Malaysia (1965). *National Land Code (Act 56 of 1965)*. As at 15th January 2008.
- Malaysia (1985). *Strata Titles Act 1985 (Act 318) & Rules and Order*. As at 10th July 2007.
- Mariappan, G. (2005). *Isu-isu Pengintegrasian Pangkalan Data Ukur Kadaster dan Sistem Pendaftaran Tanah Berkomputer*. M.Sc. Thesis. Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
- Nordin, A. F. (2001). *Institutional Issues in The Implementation of a Coordinated Cadastral System for Peninsular Malaysia : A Study on The Legal and Organisational Aspect*. M.Sc. Thesis. Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
- Ossko, A. (2005). Condominium Registration in the Unified Land Registry in Hungary Towards the 3D Registration. *In: TS 6-3D Cadastre, from Pharaohs to Geoinformatics, FIG Working Week 2005 and GSDI-8*. 16-21 April 2005. Cairo, Egypt.
- Paulsson, J. (2007). 3D Property Rights-An Analysis of Key Factor Based on International Experience. Ph.D. Thesis. Royal Institute of Technology, Stockholm, Sweden.
- Stoter, J. E. (2004). *3D Cadastre*. Ph.D. Thesis. Delft University of Technology, Delft, the Netherlands.
- Tan, L.C., Hussin, K. and Ernest Khoo, H.O. (2009a). Making 3D Property Legislation Feasible in Malaysia. *In : Proceedings of 8th International Symposium and Exhibition on Geoinformation 2009 (ISG 2009)*. 10-11 August 2009. Kuala Lumpur, Malaysia.
- Tan, L.C., Hussin, K. and Ernest Khoo, H.O. (2009b). Making 3D Property Legislation Feasible in Malaysia. *In : Proceedings of TS 2A-Legal Aspects in Land Administration, 7th FIG Regional Conference, Spatial Data Serving People: Land Governance and Environment-Building the Capacity*. 19-22 October 2009. Hanoi, Vietnam.
- Tan, L.C., Hussin, K. and Ernest Khoo, H.O. (2009c). Malaysian 3D Property Legislation: A Preliminary Approach. *In: Proceedings of ISPRS International Workshop on Multidimensional & Mobile Data Model (ISPRS WG II-5)*. 21-22 October 2009. Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
- Tan, L.C., Hussin, K. and Ernest Khoo, H.O. (2009d). Towards 3D Property Legislation in Malaysia. *In: Proceeding of FKSG Postgraduate Seminar 2009*. 14-15 July. Universiti Teknologi Malaysia, Skudai, Johor Malaysia.

Valstad, T. (2006). Development of 3D Cadastre in Norway. *TS 14-3D and 4D Cadastres, In: Shaping the Changes, XXIII FIG Congress*. 8-13 October 2006. Munich, Germany.

Van-Oosterom, P. J. M., Lemmen, C., Ingvarsson, T., Molen, P. V. D., Ploeger, H., Quak, W., Stoter, J. and Zevenbergen, J. (2006). The Core cadastral Domain Model. *Computers, Environment and Urban Systems*. 30(2006), 627-660.

BIOGRAPHICAL NOTES

TAN Liat Choon is an assistant director at Department of Survey and Mapping Malaysia. He began PhD in July 2008 at Department of Land Administration and Development, Universiti Teknologi Malaysia (UTM). He has studied on “3D property legislation-A study on legal and organisation aspects” as his PhD thesis. His research interests are cadastre and land administration systems.

Dr. Khadijah Binti HUSSIN is university senior lecture at Department of Land Administration and Development, UTM. She received her PhD. (Law of Apartment Ownership) at University of Aberdeen, Scotland, UK in 2006. She experience and specialise **in law on apartment ownership, property law, land law, housing law and cyber law.**

Sr. ERNEST KHOO Hock Oon is a Licensed Land Surveyor and Land Administration and Development Consultants and Geoinformation Consultants. He experience and specialise in land & strata title, hydrographic, topographical, mining, photogrammetric, engineering, satellite positioning and remote sensing survey.

CONTACTS

TAN Liat Choon
Department of Land Administration and Development
Faculty of Geoinformation Science and Engineering
Universiti Teknologi Malaysia
81310 Skudai, Johor
MALAYSIA
Tel. +6075530802
Fax + 6075566163
Email: tanliatchoon@gmail.com
Web site (Faculty): <http://web.utm.my/fksg/>
Web site (Personal): tanliatchoon@yolasite.com/