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AN OVERVIEW OF STRATA AND STRATUM OBJECTS FOR MALAYSIAN 3D CADASTRE

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ABSTRACT

Malaysia land administration traditionally base on Malaysia land law while cadastre system in Malaysia consist of land registration system and cadastral survey and mapping registration system which have different structures and authorisations, since land registration is a state government juridical while cadastral survey and mapping is under federal jurisdiction. It provides a variety of rights, depending on the traditions at the country but the legalistic cadastre system and land law are still using 2D geometric in legal and law expression for land and property tenure and have not been prepared to register in 3D situation. For example, as we notice that National Land Code 1965, Strata Title Act 1985, Survey Regulation 1976, Sale and Purchase Agreement, Property Valuation Report as well as Cadastral Map which as a binding and legal document do not give enough volume and height information for strata and stratum objects. Land use rights are one of the rights that are often based on occupation of land over a long period and can be defined in written law or by traditions. In addition, land as the fundamental or base for all forms human activities where it serves

human needs for shelter, labour, the economic needs for business, food, financial and other resources as well as the different kinds of societal needs of the community. Hence, a systematic record of lands in all matter that is registration of the detail of transaction and other things are very importance in the land administration, planning and development of land. This means that, due to more and more needs ground space, the 2D paradigm in law and legal should be changed (Nordin, 2001).

Keywords: 3D cadastre, registration system, strata and stratum objects, legal, organisational

1.0 INTRODUCTION

There are many countries all over the world as well as Malaysia facing the problems of insufficiencies of vacant land on the ground surface for rapid development in big substance and crowded cities. Many of the real estate development such as strata and stratum objects like flat, apartment, condominium, shopping and business complex and engineering construction like tunnel, underground car park, skywalk and building above road reserve still without proper registration in cadastre system for 3D purpose. In other words, to establish more secure ownership and mapping facilities of real estate properties and objects in the cadastre system, more effort, attention and interest have to be put in. Meanwhile, the sufficiently of handling the registration of the strata and stratum objects in the current cadastre system in legislative also need to be taken into consideration.

At the present time, having knowledge that cadastre plays an important role in land administration system where it should provide order and stability in society by creating security for every people in the layman (Hassan, 2008) and for landowners, investors,

moneylenders, traders, dealers, and governments (ECE/HBP/96, 1996). Meanwhile, a good cadastre system in a country can lead to the stability of social, economic and environment management and development. As pointed out by Ahmad-Nasruddin and Abdul-Rahman (2006), each country has its own authority to responsible and monitors the cadastre system while the cadastral objects can be either a lot, or land parcel, or parcel which is held under separate strata title where above or below the ground surface, so-called strata and stratum objects.

Feder and Feeney (1991 cited in Molen, 2003a) stated, “Institutional arrangements include laws, regulations and (inter alia) property right. The normative behavioural code refers to the values that legitimize the arrangements”. They conclude that property rights are an important class of institutional arrangements which implies a system of relations between individuals by creating mechanisms for the definition and enforcement of these rights both formal procedures and social customs and attitudes concerning the legitimacy and recognition of those rights. While Hassan (2008) presents that institutional issues are important as the technical aspect to make sure the implementation stage of 3D cadastre successful, he categorised the institutional issues into four main aspects, namely legal, organisational, social and financial.

There are three main organisations responsible on managing and maintaining the cadastre system in Malaysia. Department of Survey and Mapping Malaysia (DSMM) deal with the cadastral survey and mapping with high accuracy survey as well as preparing, producing and managing the spatial data while State Land and Mines Office (PTG) and District Land Office (PTD) deal with non spatial data that is the registration and the responsibility of the ownership registration. Meanwhile, there are many direct and indirect codes and acts as well as legal documents that related to cadastral survey and mapping and land registration for real estate ownership currently govern the land administration and are important towards implementation of 3D

cadastre system for strata and stratum objects in Malaysia. These legal documents are as follow:

- Sale and Purchase Agreement
- Property Valuation Report
- Cadastral Map
- Survey Regulation 1976 (Peninsular Malaysia)
- National Land code, Act 56 of 1965
- Strata Title Act 1985 (Act 318)
- Building and Common Property (Maintenance and Management) Act 2007 (Act 663)
- Uniform Building By-Laws 1984 (G.N. 5178/85)
- Street, Drainage and Building Act 1957 (Act 133)
- Town and Country Planning Act 1976 (Act 172)
- Real Property Gains Tax Act 1967 (Act 169)
- Local Government Act 1976 (Act 171)
- Federal Constitution 1957

Sale and Purchase Agreement (SPA) is a legal contract that obligates a buyer to buy and a seller to sell a product or service. Sale and Purchase Agreements are found in all types of businesses but most often associated with real estate property deals as a way of finalising the interests of both parties before closing the deal. SPA is an initial binding legal document for all dealing of strata and stratum objects property. It is also a legal document outlining all the terms and conditions of a property sale in detail, including indemnities, warranties, protections for both parties, property location plan, site layout plan as well as as-built plan showing the strata and stratum objects parcel and accessory parcel and so on.

Property Valuation Report (PVR) is an assessment of value and general condition of a property for mortgage purposes. Property valuation is an important component of a property transaction. The valuation process evaluates the market value of the property. A comprehensive PVR contains value of all the major assets of a property and also the basis and manner in which the valuation has been performed. Layout of premises is importance in a property valuation. The layout of the premises in terms of optimum space utilisation in an efficient manner helps the premises notch up valuable points.

Hardcopy and digital scanned images Cadastral Map are the media in which the information and position of lots and parcels can best be shown and described. A well made cadastral map is an accurate scale model of the lots and parcels above or below the ground surface which presented in 2D natural. There are three types of Cadastral Map, so-called Certified Plan (CP) in Malaysia. First is the CP that shows land parcel only (PA 123456), second is the CP that shows strata parcel and land parcel (PA(B) 123456) and third is the CP shows stratum parcel (PA(S) 123456).

Basically, the purpose of 3D cadastre objects modelling proposed by Stoter (2004) is to provide boundary certainty of 3D cadastre objects particularly regarding 3D strata and stratum objects ownership. 2D/3D hybrid cadastre approach is a method of 3D visualisation by uniting 3D strata and stratum objects registration and 2D parcel based cadastre system. In view of the 2D spatial objects and textual information have been commonly used by DSMM, PTG and PTD for registering strata and stratum objects, the 2D/3D hybrid cadastre approach is completely suited the Malaysia cadastre system purpose. Strata and stratum objects are basically represented by a unity of property, which is established both above and below the ground surface that could be owned by more than a person. Therefore, the

registration of strata and stratum objects could not be separated from the registration of land parcel. According to Abdul-Rahman (2006), the ideal method of visualising the physical state of 3D strata and stratum objects is by utilised the registration of 3D physical objects, which is originated from 2D/3D hybrid cadastre approach. By using this method, the geometrical shape and position of each 3D strata and stratum objects could be represented in computer graphic visualisation, including accessory parcel, common property as well as every single object that benefited from strata and stratum objects. Another advantage of employment of this method is that the ownership and 3D space utilisation could be visualised within an integrated Cadastral Map.

In conclusion, the core of this research attempt to investigate problems occurs in 2D situation and format of Sale and Purchase Agreement, Property Valuation Report and Cadastral Map for strata and stratum objects. By using the 2D/3D hybrid cadastre approach to register the 3D strata and stratum objects, a graphic and visualisation interface that consist of several strata and stratum objects technical structure volume models will be developed. The proposed conceptual models are evaluated and translated into a prototype implementations using the techniques and theories explored and developed as part of the research and by performing verification tests. Finally, this paper will end with a solid validate proposal that to amend the current legal and organisational practice as well as giving some further research suggestions.

This paper presents our research proposal of a PhD project on development of 3D cadastre system for strata and stratum objects; they are land registration system and cadastral survey and mapping registration system in Malaysia. This paper underlines how code and act as well as others legal document that related to cadastre system play an important role in the initial part of land administration. In Section 2, we draw out some problems in the current cadastre system for strata and stratum objects in Malaysia. Section 3 describes some

constraints based on problems that had been identified. Research objectives are given in Section 4, while Section 5 specifies the scope of the research. Section 6 gives an overview of the contribution of this research. Throughout the paper it becomes clear that quite a lot of research is needed to realise the 3D cadastral system for strata and stratum objects in Malaysia. Therefore, the paper concludes with in Section 7, which describes our research methodologies used in this research and addressed in future work.

2.0 BACKGROUND TO THE PROBLEM

In real world, issue of 2D legal and organisational is insufficient to cope with the advance development of the country especially information in 3D constructions and developments where land use is becoming so extreme that different types of land use and properties were placed in a complicated 3D situation. Therefore, we have to develop and implement the 3D cadastral system in such way fulfil all legal, organisational and technical aspects to solve the problem in all 3D complex situation.

The aims of cadastral is to survey, record and follow by register rights and interests to land because the law recognises these rights and interests as a legitimate relation between a rightful claimant and a certain lot of land. Therefore, without law and legally defined, the mechanisms for acquisition, transfer, protection, restriction, creation as well as recording or registration of these rights and interests is meaningless in the cadastral unless they operate within an institutional context, providing all rules, laws and regulations for those process mentioned above. One of the good examples is the Cadastral Map which provides information for identification of lots and land parcels

for survey and land registration. In addition, this valid Certified Plan depicts data like bearings, distances and the 2D coordinates and also storey height and depth information when dealing with strata and stratum objects. Although all these information have been digitised into the Digital Cadastral Survey Database (DCDB), but it is still in 2D nature and format.

There is a basic land code in many countries that includes special legislation governing the operation of the cadastre and land registration system besides defining the nature of land and real property. Every country administration should have to ensure an undisturbed performance of the ownership rights. Thus, the ability to fulfil this task show well the society has organised its legal base in this area. So the legal relations must be precisely defined in land law, and also in others law which related to lots, land parcels and buildings as well. Meanwhile in Malaysia, the comprehensiveness of legal, organisational and technical solutions is required for the development of 3D cadastre, changes in certain land law and legal document such as Sale and Purchase Agreement, Property Valuation Report, Survey Regulation 1976 (Peninsular Malaysia), National Land code, Act 56 of 1965, Strata Title Act 1985 (Act 318), Building and Common Property (Maintenance and Management) Act 2007 (Act 663), Uniform Building By-Laws 1984 (G.N. 5178/85), Street, Drainage and Building Act 1957 (Act 133), Town and Country Planning Act 1976 (Act 172), Real Property Gains Tax Act 1967 (Act 169), Local Government Act 1976 (Act 171) and Federal Constitution 1957.

According to Chong (2006), and further explain by Hassan (2008), under the Malaysia land law, lot and land parcel are the basic concept which make infinite ownership space and can be defined as a cone down to the centre of the earth, with boundaries on the surface extends vertically upwards and downwards to an extent. As a result, lot become the basic unit in Malaysia cadastral survey and mapping and together with land registry, it form a Registry Title and Land Office Title that is Grant. More detail concerning this definition of lot, land

parcel, land registry is described in ECE/HBP/96 (1996); ECE/HBP/135 (2004); and ECE/HBP/140 (2005). Furthermore, lots and land parcels adjudicative consist of two parts, firstly, the ascertaining of the physically surface boundaries by survey boundary mark and secondly the official ascertainment of rights in land via registration and issue of Document of Title (NLC, 1965). In other words, the proprietor of the above that is air space and underground land will continue to enjoy the rights to effect dealing, subdivision, partition, amalgamation and even subdivision of building if allowed by the State Authority (Chong, 2006). In order to make these rights, restrictions and responsibilities to fulfil all proprietor according to the concept of 3D cadastral which introduced by Stoter (2004), some law and legal clauses, statements in certain codes and acts will have to be changed, added, or cancelled if necessary.

According to the UN/ECE Guidelines on Real Property Units and Identifiers, condominium ownerships are formed from multi apartment buildings used exclusively for residential purposes or both residential and commercial purposes. They may extend vertically as in tower blocks or horizontally as in terraced houses. Essentially such buildings have two components; they are privately owned units and jointly owned parts (common property). For example service areas and equipment such as lifts, electricity, telecommunication and other things. The right in freehold to a separate apartment in a tower block breaches the idea that land, as real property, extends from the centre of the earth to infinite of the sky. The concept that the land is a single unitary object may work in legal theory but in practice it needs to be modified, especially for the case of ownership of individual apartments in a block of flats (ECE/HBP/135, 2004). This is similar to strata and stratum objects ownership in Malaysia where multi storeys occupancy and ownership by subdivision of land into strata and stratum as the backbone of strata and stratum objects ownership. In addition, according to Strata Title Act 1985, any buildings having two or more storeys on alienated land held as one lot under final title and

any alienated land having two or more buildings held as one lot under final title shall be capable of being subdivided into land parcels each of which is to be held under a strata title or as an accessory parcel (STA, 1985).

Although Strata Title Act 1985 (Act 318) allow land subdivide into parcel base on the area occupy, but all these still in 2D nature, therefore, it is still doubtful and facing many problems to show the legal rights of the ownership when it comes to a complicated situations cases. Also, although under National Land code, Act 56 of 1965 air space is permitted, but it is limited to the maximum of 21 years only and there are still a lot of arguments about the surface under different categories of land use. Furthermore, these 3D constructions and infrastructures generally not correspond to each other with law and legal for each organisation, which are legally registered and defined. As such, the current related land law need to enhance to suite with the related organisation in order for the cadastral survey and mapping system and land registration system can work together without any discrepancy in the process and procedure.

Today, with the advance of the technical information, there is less or in fact probably no more technical problem to integrate different land property related to legal, survey and mapping data in one computerised database, but generically legalistic and organisations that responsible for maintaining and updating above data are under different authorities and legislatures in Malaysia. Therefore, the comprehensive decision making usually is more difficult because there are multi authorities involved. Furthermore, the implementation of 3D cadastre is not easy because the full data consistency among the organisations, legal, and survey and mapping part is governed by different law, therefore the implementation of 3D cadastre is much more complicated and yet to be discussed and debated further. Currently, the organisations responsible to the survey, mapping, record and register are DSMM, PTG and PTD while the legal registration of land also different which can be categorised into lot (surface parcel),

strata parcel (multi storey parcel), stratum parcel (underground parcel), and air space (register with permit). Nevertheless, all these information are basically 2D in nature.

Until today, the legal registration process for strata and stratum objects in Malaysia is executed by the developer is extremely slow. These problems of legal registration process for strata and stratum objects probably can be solve by the approaches presented in Mariappan (2005) where he underlines the organisational, technical, data, legal and different working procedures and practices issues associated with the integration between the systems and organisations. According to Shoshani et al. (2004), and Shoshani et al. (2005), it is necessary to define a legal and cadastral solution capable of registering rights in a multi layer cadastral reality, in order to practice the 3D exploitation potential by different interested parties. Without appropriate legislative and organisational frameworks and transparent public administrative structures, cadastral system and land registry cannot operate properly. In major urban areas, the law and legal of 2D situation are insufficient to solve all problems with these 3D situations such as construction on top of each other, infrastructure above and below the ground surface, utility facilities and other things. In addition, these 3D objects generally are not corresponding with the legal aspect that are legally registered and defined. Meanwhile, Ossko (2001a) notes that the majority of countries worldwide have recognised the importance of solving above problems, looking for effective legal, organisational and technical aspects.

From the traditional paper based method of Cadastral Map, Land Office Title and Registry Title to digital based method of registration, all maps and titles have registered the legal status of parcel boundaries, land parcels and other objects in 2D space situation. As a result, problem will occur when come to the implementation of 3D cadastral because it has difficulties in legislative for registration such objects

into 3D situation although Strata Title Act 1985 allow the registration of strata and stratum objects, but in still in 2D space situation.

In conclusion, the main obstacle in adopting 3D cadastre is the legal and organisational aspects, which are slow to change. Some countries have made progress in this respect and recent laws, especially from Northern European, have made it possible to register properties in 3D situation, but still none of these laws define properly in general on 3D cadastre and only accepts that volume parcel can be established both below and above the main surface parcel (Valstad, 2006). Finally, within the excellence of knowledge and the quick development of the information technology such as hardware and software, i believe that Malaysia is ready to develop a 3D cadastre system to solve the problem in technical aspect with 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. Anyway, for the effective implementation of 3D cadastre, all these institutional issues (legal and organisational aspects) and technical aspect are equally important.

2.1 Problems with 3D Strata and Stratum Objects

The registration of strata and stratum objects is realised on the basis of the Malaysia cadastre system, it is founded on a 2D representation where lots and land parcels are represented by *X* and *Y* coordinates. It is clear and understood that the existing cadastre system is restricted in 2D, while defining and modelling the geometry or world objects, that is relevant for cadastral registration, requires the 3D (*Z*-coordinate) (Ntokou, Giaramazidou, Arvanitis et al., 2004). Together with the

legal and organisational aspects of real estate objects, thus requirement arises X , Y and Z coordinates because the construction and location of these objects causes overlapping rights in a vertical dimension.

Hence, this overlap 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. In other words, it does not give much information regarding to the X , Y , Z coordinates for Sale and Purchase Agreement, Property Valuation Report and Cadastral Map (Strata and Stratum Plan) in the parcel and accessory parcel within the parcel boundary and bear in mind that the building shape is not necessary to be uniform type. For example, assuming that balcony or bay window or slab outside the wall or skywalk to be attached in some units on the second, fourth and sixth floor in a six floors multi storey building, then the question is what happen to the space that lie in between the balcony or bay window or slab outside the wall or skywalk of those mentioned floors. So, illustrates the X , Y , Z coordinates of each unit become more significant to give evidence on ownership rights in the space.

Height reference are very importance in defining the Z -coordinate, whether the absolute heights that related to a datum or relative heights that related to the surface level should be used. Absolute heights are more stable and enable unambiguous definitions of 3D strata and stratum objects nationally whereas relative heights between properties may different.

By using common 2D objects registration, the physical boundary of strata and stratum objects could only be represented within its floor plan. Therefore, by implementing 3D cadastral objects registration, the physical boundaries of strata and stratum objects could be represented with others strata and stratum objects that are located at the different floor. Beside the hardcopy and digital scanned images 2D Cadastral Map, DSMM, PTG and PTD are yet to define a more appropriate

mechanism in handling these strata and stratum objects and records. As much more skyscrapers are being built in the urban area, apart from the 2D parcel shown on the Sale and Purchase Agreement, Property Valuation Report and Cadastral Map, the spatial information in the vertical dimension becomes even more crucial as it reflects right of a owner within the entire joint owners of strata and stratum objects.

Space out of that boundary at the left, right, top and bottom proportions are probably belongs to others owners. Also the built up volume of the strata and stratum objects is usually lesser than the parcel boundary. Inside a strata and stratum objects, it consist of several utilities like column, beam and sewerage pipe that the owner cannot has full enjoyment on it. These areas of exclusive use cannot be determined in the Sale and Purchase Agreement, Property Valuation Report and Cadastral Map as well.

Current Sales and Purchase Agreement, Property Valuation Report and Cadastral Map does not give any volume information for strata objects while the volume information given in Cadastral Map for stratum objects have some limitations and do not represent the real stratum objects. Traditionally, the value of strata and stratum is based on parcel area (length x wide) without volume (height) calculation. The parcel area in the Sale and Purchase Agreement, Property Valuation Report and Cadastral Map are based on the 2D area given in architect plan and engineer plan as well as cadastral map where parcel area was given after final survey completed. For example, the calculation of share unit in strata title for strata and stratum objects property is based on the parcel area given, surveyed and the value of the particular unit as well. Low cost flat and medium cost flat usually lower in cost than apartment and condominium, however, if the parcel areas are same, so the apartment and condominium owner are paying less and lower money on the assessment, quit rent and maintenance fee than the low and medium cost flat owner.

To conclude, the problem in 3D strata and stratum objects can be solved by proposing suitable legal and organisational methods using 2D/3D hybrid cadastral approach with an alternative of registration of 3D physical strata and stratum objects with the coordinates of parcel as the basic entity as well as height measurement of the strata and stratum objects.

3.0 CONSTRAINTS IN 3D STRATA AND STRATUM OBJECTS

Malaysia land registry system already registered many properties locating above or below the ground surface like strata and stratum objects, but there is no comprehensive solution for the land related code, act and legal document to solve the 3D situation problems. Furthermore, the current land and cadastral registration systems have several legislative and organisation limitations and require for changes.

Firstly, there are many land have been used above and below the ground surface. Therefore, there are some arguments that regards with the maximum or minimum extend upwards to the air and downwards to the underground is allowed as well as the land use category and condition. Secondly, currently cadastral lots and land parcels in Malaysia land law can be defined as a cone down to the centre of earth with boundaries on the surface extends vertically upwards and downwards to an extent. As a result, there are some arguments that regards with the parcels on the surface which have only one owner. These problems raised in multiple ownerships in 2D nature while the ownership extension from the surface upwards and downwards, and also whether they are still practical according to certain law. Thirdly,

when regulations and legislations for 3D registration do not exist, there are some arguments that occur in really define of a strata and stratum objects in a multi storeys building including an underground railway station, a complex transportation system, a commercial centre, hotel and so on.

Finally, current survey regulations which based on Survey Regulation 1976 and Survey and Mapping Director General Secular (PKPUP) enable survey and registration of lots and land parcels in 2D situation although they contains heights and coordinates information for strata and stratum objects, but it still not in 3D nature. Furthermore, the initial legal documents such as Sale and Purchase Agreement, Property Valuation Report, Cadastral Map, Land Registry as well as architect plan and engineering plan are still using parcel area as the base for property dealing. Therefore, a change in legal and organisational aspects enabling 3D cadastral surveying and 3D registration by DSMM, PTG and PTD are essential.

This means that the vertical extension of ownership is not concretely established by law but needs to be defined in each case. There are few cases of 3D strata and stratum objects that are established in Malaysia which are situated above or below the ground surface in vertical dimension with specific legislative and organisation problems:

- a) Multi storeys residential building (for example flat, apartment and condominium);
- b) Multi storeys commercial building (for example shopping and business complex);
- c) Underground construction (for example car park, transportation); and
- d) Air space (for example balcony, bay window, slab outside the wall and skywalk).

In conformity with the specified problems, this study seeks to answer the following major research questions in legal and organisational for 3D strata and stratum objects which is part of 3D cadastral:

- a) What are the problems, implications and practices of those issues and aspects in 3D strata and stratum development and how to address them?
- b) What changes to current practices and what new practices are significantly necessary, in order to achieve the succession of the implementation of 3D cadastral for strata and stratum objects in Malaysia?
- c) What are the key features in the legal documents that need to amend, in order to fulfil the objective of moving the legal and organisational expression for strata and stratum objects from 2D to 3D geometric? and
- d) What are the circumstances and specific conditions, in order to realise the implementation of 3D cadastral for strata and stratum objects in Malaysia?

From these several questions below, this study attempt to answer the specific research questions in legal and organisational for 3D strata and stratum objects:

- a) What are the 3D information needed in Sale and Purchase Agreement, Property Valuation Report, Cadastral Map, Survey Regulation 1976, National Land Code, Act 56, 1965, Strata Title Act 1985 (Act 318), planning and building regulations and practices?

- b) How this information should be collected, structured and offered to make a 3D cadastre for strata and stratum objects registration become possible?
- c) What are the advantages and disadvantages that in applying the volume parcel in Malaysia cadastre system for strata and stratum objects?
- d) Are there any technical problems instead of institutional problems?
- e) What are the new 3D cadastre legislations for strata and stratum objects properties?
- f) Are the juridical complexities to establish volume parcel higher than the benefits? and
- g) What are the problems in unified land registry system?

4.0 THE OBJECTIVES

This research attempts to investigate the legal and organisational aspects in 3D strata and stratum objects registration which mean how to reconstruct the land law, legal document and also the integration of the various authorities for implementation of 3D cadastre in Malaysia. Therefore, there is a growing awareness of the necessity for finding a legal and cadastre solution for registering rights of multi layers cadastre reality. Besides, if the legal and organisational meaning of 3D strata and stratum objects is not defined at the institutional level it serving no purpose to survey, to record and to register 3D strata and stratum objects in all 3D situations.

In the view of cadastre system, this research considers the changing in institutional aspects of cadastral registration. To realise this objective, this research concentrates on the following four objectives:

- a) To investigate, identify, review and study the weakness of executing and applying 2D natural and format Sale and Purchase Agreement, Property Valuation Report and Cadastral Map that used in different locations in the authorities in Malaysia cadastre system within legal and organisational aspects;
- b) To describe the existing 3D strata and stratum objects engineering design and to develop a prototype 3D strata and stratum objects structure model by using contemporary Geographic Information System (GIS) application and technology;
- c) To test the 3D strata and stratum objects structure model to handle, integrate, verify, displaying multi disciplinary 3D strata and stratum objects to support problem solving activities; and
- d) To propose a solid validate proposal that to amend the current legal and organisational practice which is necessary and needed.

5.0 THE SCOPE

The study of this research will base on few 3D cases in Malaysia, mainly in Georgetown city, Kuala Lumpur city and Johor Bahru city. This study is based on the existing 2D cadastral survey and mapping

and land registration framework where legal and organisational aspects are the main focus. First, this research scope focussing on identify legal documents that require the inclusive of the 3D into the current cadastre system that is strata and stratum objects in order to incorporate current and future strata and stratum objects situations ,with reference to the juridical and organisational frameworks. The second research scope is to evaluate the feasibility of including a 3D cadastre for strata and stratum objects under current frameworks by using advance GIS application and technology and later proved with verification process. Finally, it focus on finding a well fitted solutions and recommend changes the legal and organisational status if necessary by expanding into the 3D situation and format, leading to an implementation of 3D cadastre for strata and stratum objects in Malaysia.

It is not the scope of this research to fully develop a 3D cadastre, instead of develop 3D situation which involve 3D strata and stratum objects related to land in real world which on the surface, above the surface and below the surface of land parcel by using the 2D/3D hybrid cadastre approach.

6.0 SOME POSSIBLE CONTRIBITIONS

There are many groups of company, agency and people involve in land. Government authority such as DSMM, PTG and PTD, professional like land surveyor, architect, engineer, lawyer and valuer, housing developer as well as the land owner benefited from the findings of this research towards an implementation of 3D cadastre for strata and stratum objects in Malaysia.

This research and its results may assist the government authority, professional and housing developer who responsible for the cadastral survey and mapping and land registration to understand and

characterise the future cadastral. This will define proper and accurate registration of land rights in the space above and below the ground surface. A 3D added in cadastral registration in legislative form, can clearly define a gradual develop urban environment, characterised by an increasing number of multi storeys infrastructures and economic activities resulting in new constructions and complex property situations. Furthermore, this research give the explanation and structures to the national and some international discussion on the needs for 3D strata and stratum objects by providing basic overview and fundamental needs for it from the legislative and organisational points of view in land administration which influence the need for and possibilities of 3D cadastral for strata and stratum objects registration.

In conforming to these statements and understanding, the outcome of this research is expected to be an added knowledge and an optional source of reference by the decision makers from various government authorities, professionals, housing developers and land owners as well. Furthermore, the ideas and issues which discussed in this research can be used as inputs and duly referred in given to the performance of the 3D cadastral for strata and stratum objects in Malaysia. Moreover, it could be very beneficial in creating conscious towards probable implementation related stage problems and also interest and commitment in determining the solutions.

7.0 SUMMARY

A strategy was chosen to go through this research process. The detailed plan of the strategy as described in this project proposal formed the basis for writing this paper. Base on the discussion in the literature studies, several factors had been identified which enable lead to the successful of the implementation of 3D cadastral system for

strata and stratum objects in Malaysia and all these factors are able to contribute in the formulation of the theoretical framework. To achieve the research objectives, the following research methodologies are used:

a) Analysis of the background

This part focuses on investigate, identify, review and study of current cadastral registration concerning 3D situations, both in Malaysia and abroad, with the aim of getting insight into the needs and requirements for 3D strata and stratum objects registration and so as to structure the national and international discussion on 3D cadastre.

b) Framework for moving from 2D to 3D situations

This part focuses on and illustrates the weakness of executing and applying 2D natural and format of Sale and Purchase Agreement, Property Valuation Report and Cadastral Map that used in different locations in authorities. Besides, this part also focuses on institutional issues and aspects in legislative and organisational frameworks matters with the determination of probable implementation problems, implications and needs which related to their probable solutions and recommendations follow by the composition of legal documents; they are Sale and Purchase Agreement, Property Valuation Report and Cadastral Map, based on district, state and national level land related management organisations and the needs for succession of the establishment, and later

implementation of 3D cadastral system for strata and stratum objects in Malaysia.

c) Models for 3D strata and stratum objects

This part focus on describing the existing 3D strata and stratum objects engineering design and developing a prototype for 3D strata and stratum objects structure model by using CityGML. Here, a survey work will be carried on for data collection, hence, topology, geometry and level of detail (LoD) will be illustrated and taken into consideration when using a GIS application and technology, for example the LandXplorer Studio.

d) Testing and verification

This part focus on testing and verification of 3D strata and stratum objects structure model to handle, integrate, displaying multi disciplinary 3D strata and stratum objects and to support problem solving activities. Here, suggestions will be given to land related management organisations on how to conduct instrument test and what are the calibrations procedures involved in the volume calculation method as well as how much the tolerance of difference in volume that can be accepted. One of the suggestions to DSMM is to establish a solid strata parcel for instrument test.

e) Realisation of a 3D cadastral for strata and stratum objects

This part focus on finding most well fitted solutions by using the techniques and theories explored and developed in this research and these solutions will be

applied to the mentioned cases studies on how to realise an effective 3D cadastre strata and stratum objects. These well fitted solutions later on as a proposal to amend the codes, acts and legal documents such as Sale and Purchase Agreement, Property Valuation Report, Cadastral Map, Survey Regulation 1976 (Peninsular Malaysia), National Land code, Act 56 of 1965, Strata Title Act 1985 (Act 318), Building and Common Property (Maintenance and Management) Act 2007 (Act 663), Uniform Building By-Laws 1984 (G.N. 5178/85), Street, Drainage and Building Act 1957 (Act 133), Town and Country Planning Act 1976 (Act 172), Real Property Gains Tax Act 1967 (Act 169), Local Government Act 1976 (Act 171) and Federal Constitution 1957, form and schedule for strata and stratum submission, check list for DSMM, PTG and PTD submission, architecture plan, engineering plan and so on that involve 3D strata and stratum objects.

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