TOWARDS MALAYSIAN MULTIPURPOSE 3D CADASTRE BASE ON LAND ADMINISTRATION DOMAIN MODEL (LADM)- AN EMPIRICAL STUDY

International FIG workshop on the Land Administration Domain Model
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Sr Dr. Tan Liat Choon

Sr Looi Kam Seng

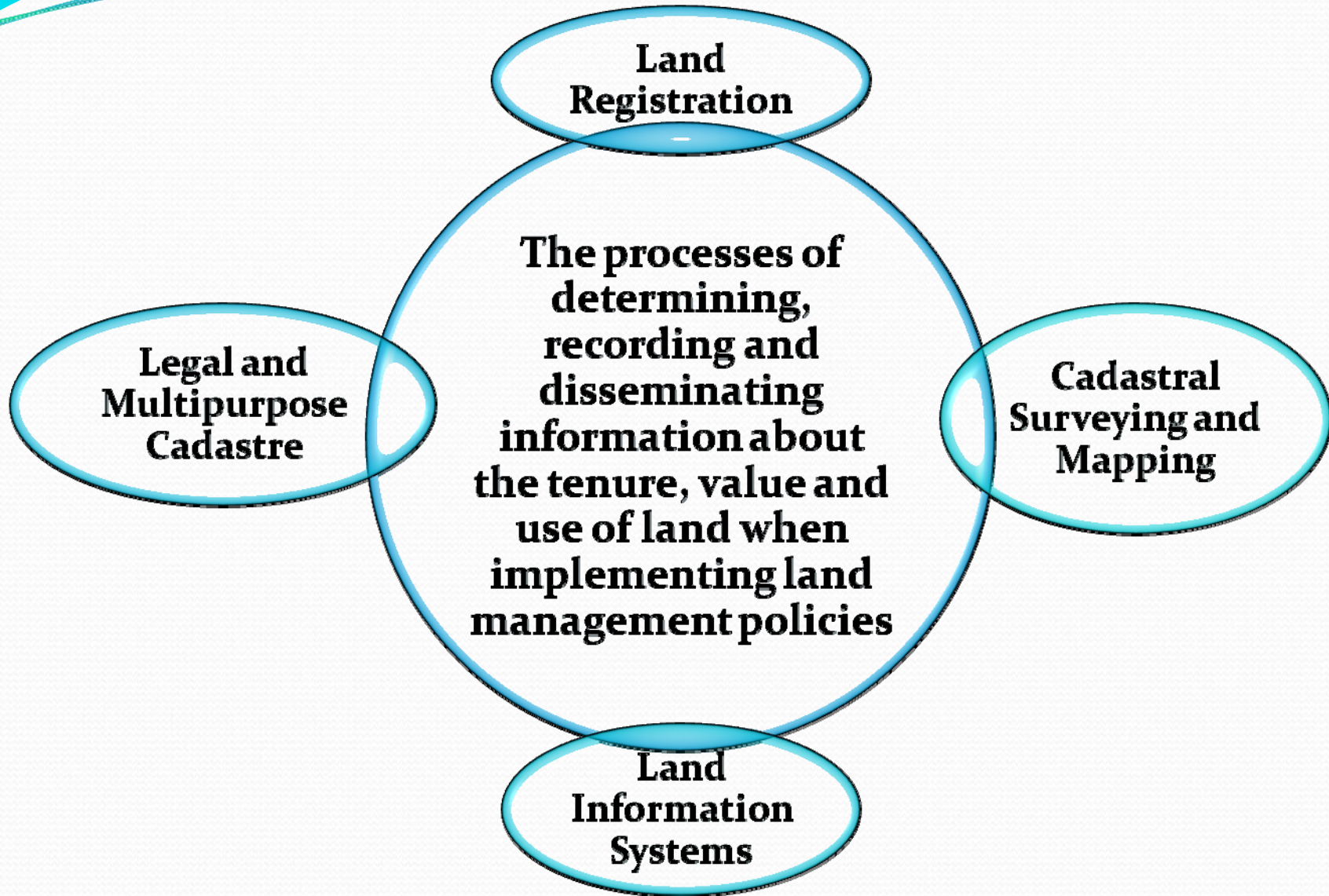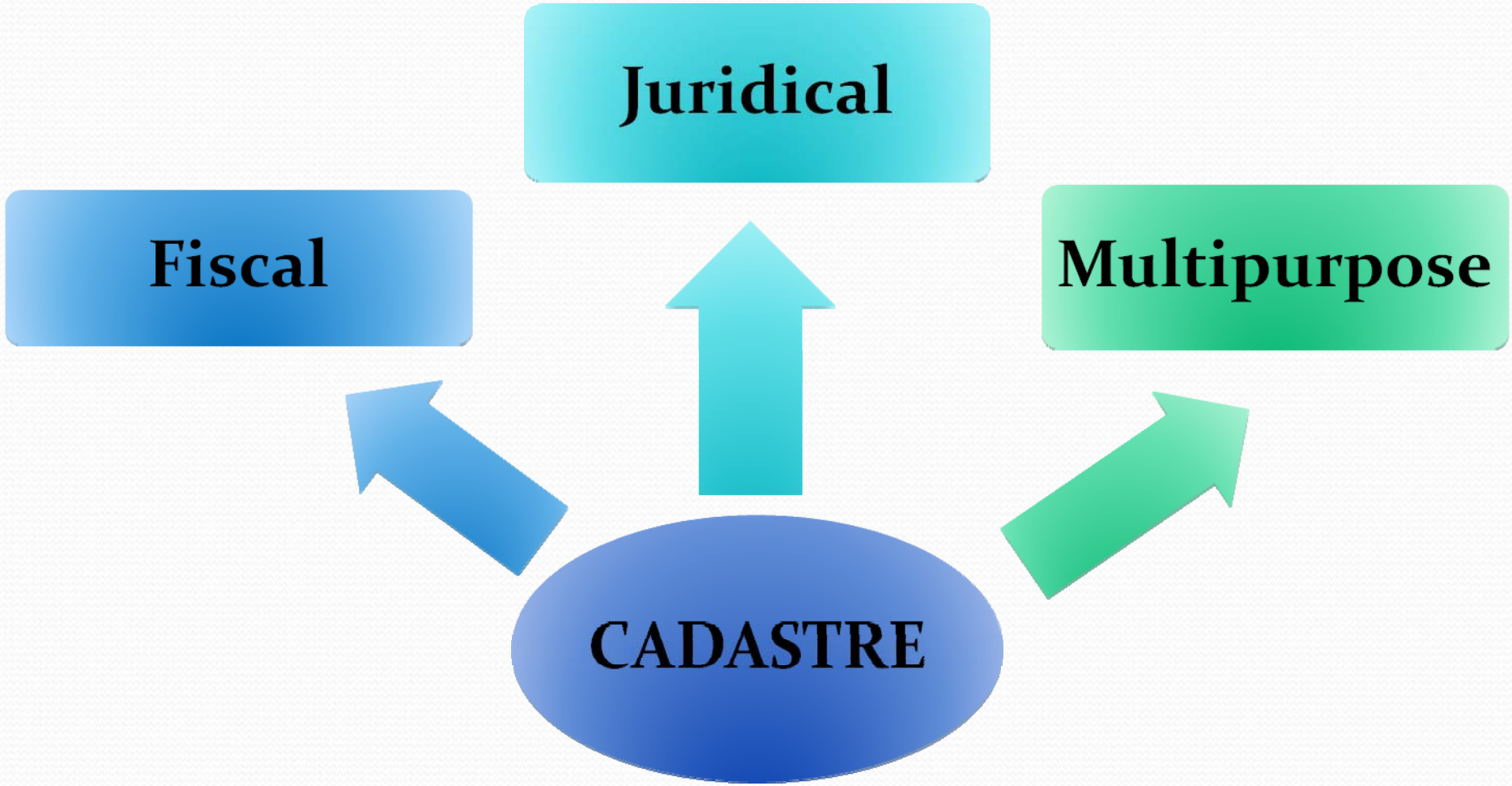**Department of Survey and Mapping Malaysia**

OUTLINE

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- **CURRENT MALAYSIA CADASTRAL PRACTICE**
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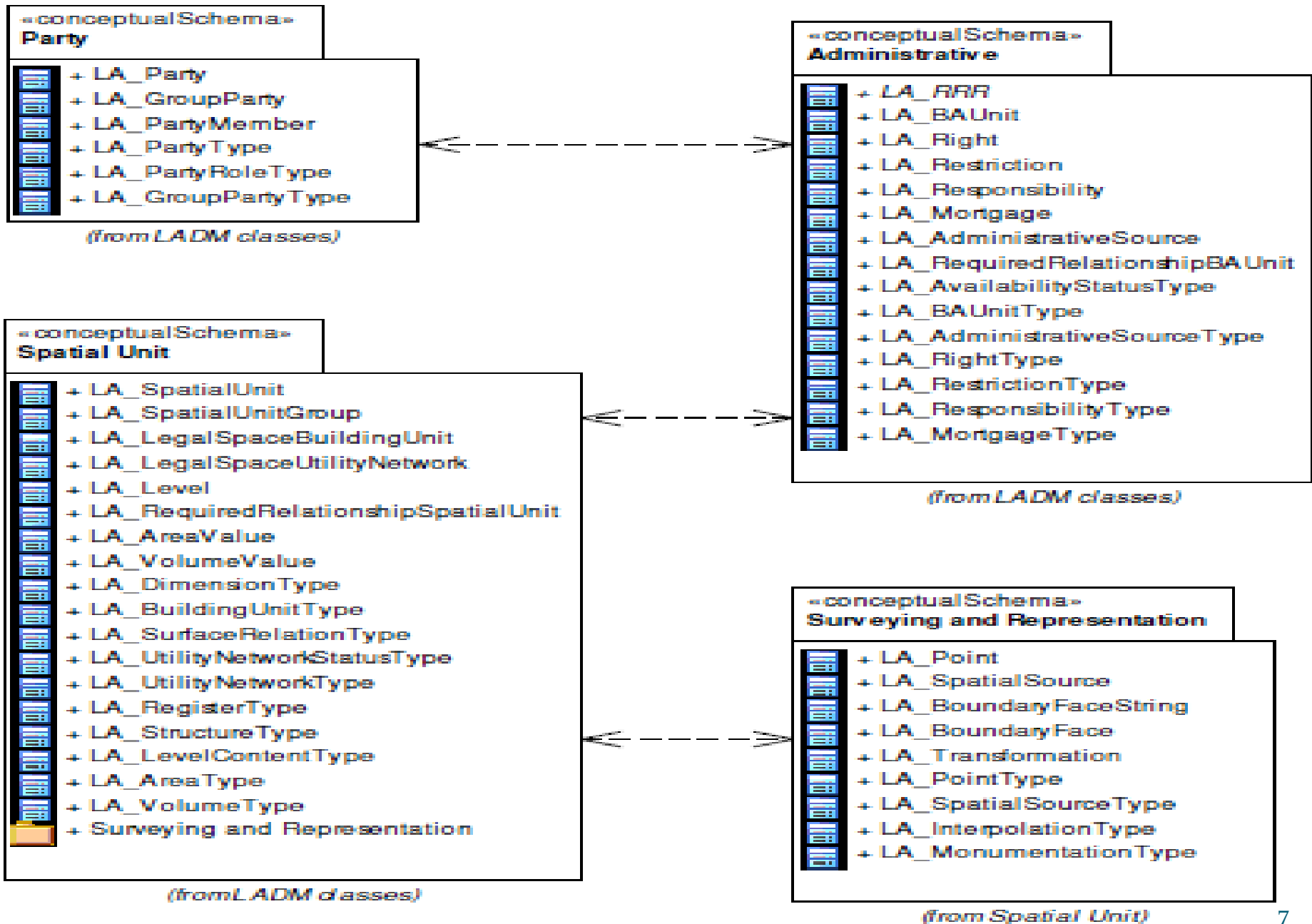- **CONCLUSION**

INTRODUCTION

LAND ADMINISTRATION

Land Registration

Legal and Multipurpose Cadastre

The processes of determining, recording and disseminating information about the tenure, value and use of land when implementing land management policies

Cadastral Surveying and Mapping

Land Information Systems

Fiscal

Juridical

Multipurpose

CADASTRE

Land Administration Domain Model (LADM)

«conceptualSchema»
Party

+ LA_Party
+ LA_GroupParty
+ LA_PartyMember
+ LA_PartyType
+ LA_PartyRoleType
+ LA_GroupPartyType

(from LADM classes)

«conceptualSchema»
Spatial Unit

+ LA_SpatialUnit
+ LA_SpatialUnitGroup
+ LA_LegalSpaceBuildingUnit
+ LA_LegalSpaceUtilityNetwork
+ LA_Level
+ LA_RequiredRelationshipSpatialUnit
+ LA_AreaValue
+ LA_VolumeValue
+ LA_DimensionType
+ LA_BuildingUnitType
+ LA_SurfaceRelationType
+ LA_UtilityNetworkStatusType
+ LA_UtilityNetworkType
+ LA_RegisterType
+ LA_StructureType
+ LA_LevelContentType
+ LA_AreaType
+ LA_VolumeType
+ Surveying and Representation

(from LADM classes)

«conceptualSchema»
Administrative

+ LA_RRR
+ LA_BAUnit
+ LA_Right
+ LA_Restriction
+ LA_Responsibility
+ LA_Mortgage
+ LA_AdministrativeSource
+ LA_RequiredRelationshipBAUnit
+ LA_AvailabilityStatusType
+ LA_BAUnitType
+ LA_AdministrativeSourceType
+ LA_RightType
+ LA_RestrictionType
+ LA_ResponsibilityType
+ LA_MortgageType

(from LADM classes)

«conceptualSchema»
Surveying and Representation

+ LA_Point
+ LA_SpatialSource
+ LA_BoundaryFaceString
+ LA_BoundaryFace
+ LA_Transformation
+ LA_PointType
+ LA_SpatialSourceType
+ LA_InterpolationType
+ LA_MonumentationType

(from Spatial Unit)

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CURRENT MALAYSIA CADASTRAL PRACTICE

Federal Department of Survey and Mapping

Land Office

Cadastral Survey

State

Torrens System

eLand

eCadastre

3D & Data Integration

Land & Mines Office

Data Integration

| Physical Cadastre (Certified Plan)	Legal Ownership (Document of Title)	Land value (Taxation)	Land Use (Planning)
- Area - State name - District name - *Mukim* name - Town name - Current land/parcel number - Date of Certified Plan approve - Current Certified Plan number - Land office file number - Document of Title number - Strata scheme number - Standard sheet number - Existing Certified Plan number - Master title lot number - Survey fail number - Scale	- Area - State name - District name - *Mukim* name - Town name - Current land/parcel number - Plan of the land/parcel - Date of title registration - Category of land use: Agriculture; Building; Industry - Implied condition - Express condition - Restriction of interest - Current Certified Plan number - Land office file number - Ownership number - Strata scheme number - Standard sheet number - Premium - Quit Rent - Owner name - Type of grant - Management Corporation name	- Area - State name - District name - *Mukim* name - Town name - Current land/parcel number - Address - Date of payment - Type of property: Agriculture; Building; Industry - Premium - Quit Rent/Assessment - Owner name	- Area - State name - District name - *Mukim* name - Town name - Current land/parcel number - Date of approve - Category of land use: Agriculture; Building; Industry - Type of mineral - Zoning - Assessment

National Digital Cadastral Database (NDCDB)

♦ Based on a uniform coordinate system, i.e. GDM2000 Cassini Soldner system.

♦ Uniform spatial accuracy of about 5-10 cm throughout Peninsular Malaysia.

♦ Cadastral database and system that is "compatible" with GIS technology and GPS MyRTKnet system.

Old And New Geodetic Infrastructure
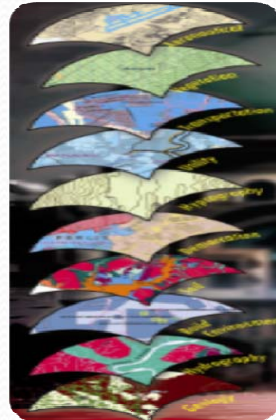
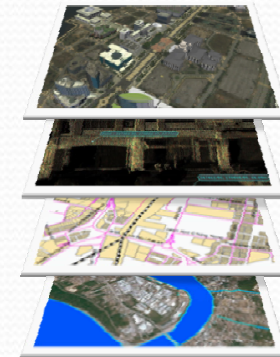**GEODETIC TRIANGULATION PENINSULAR MALAYSIA**
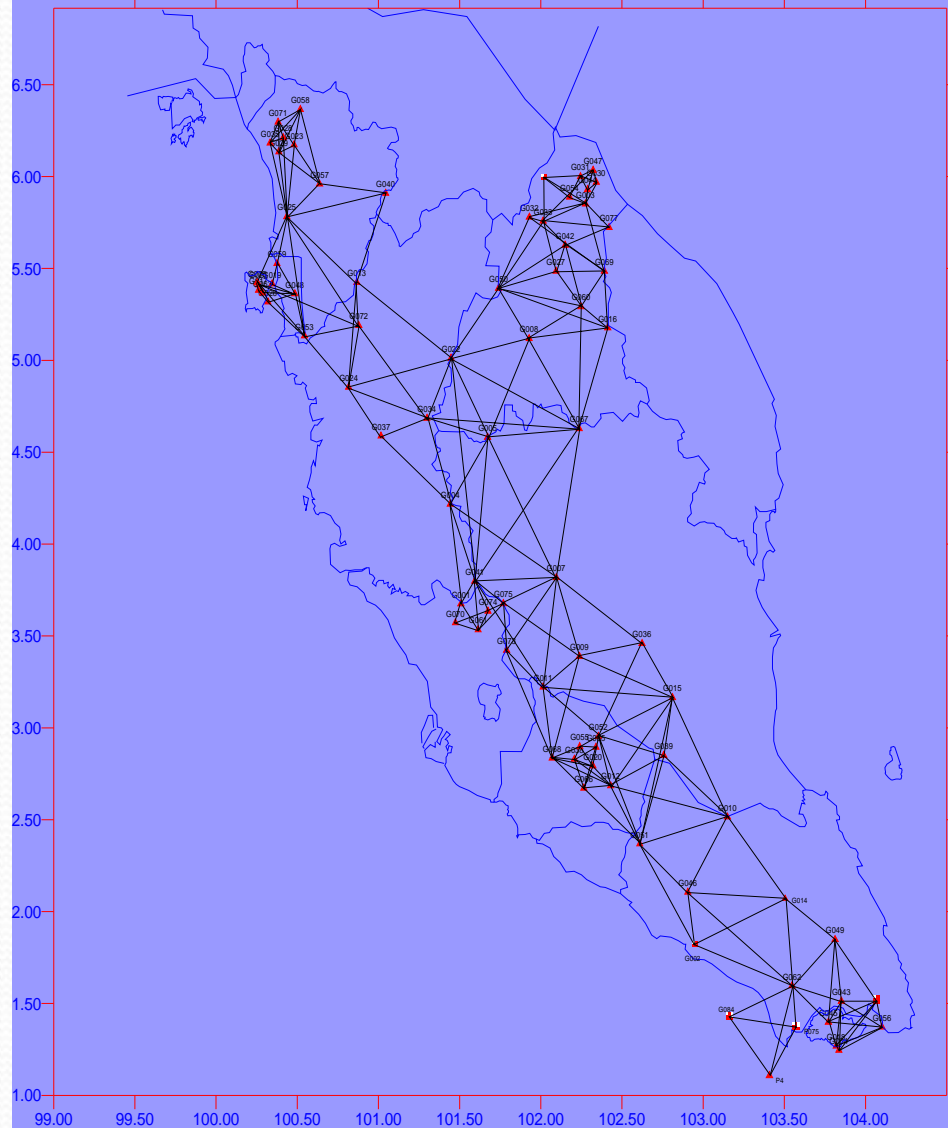
GPS BASED REFERENCE SYSTEM
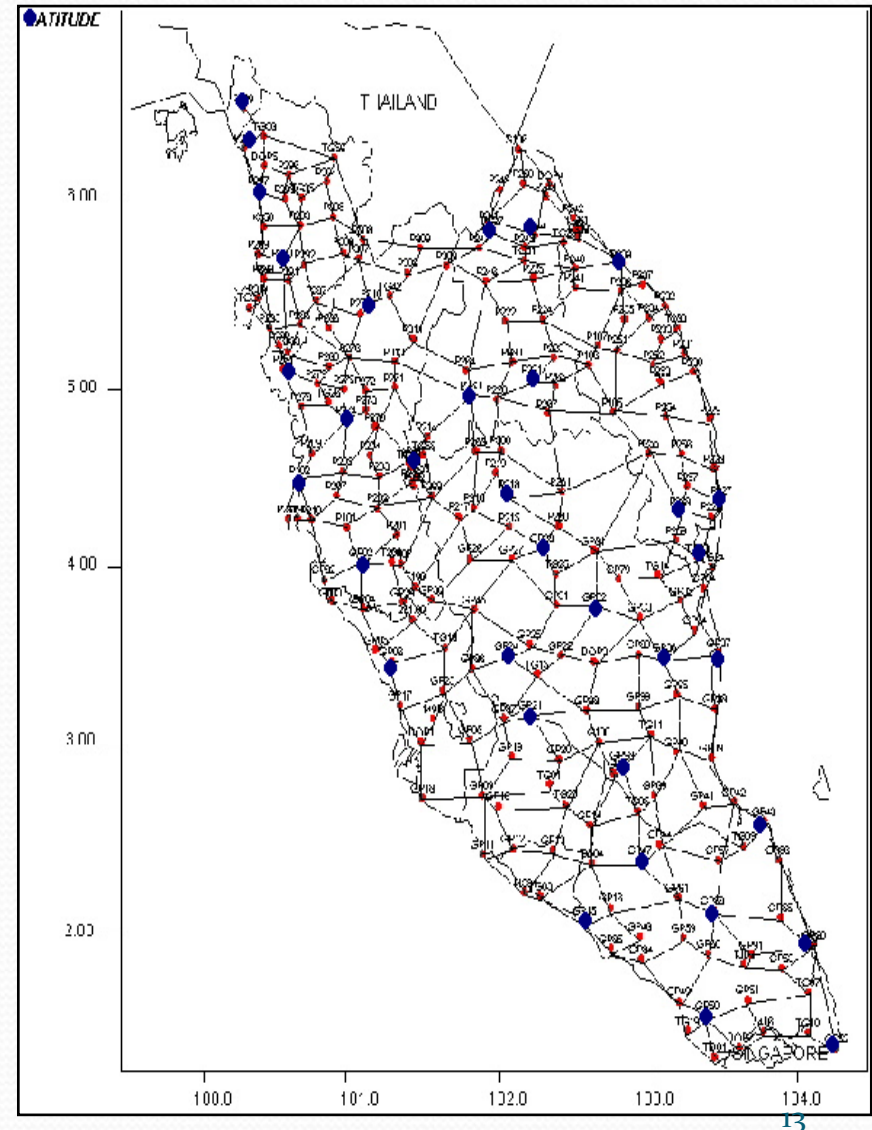
Multipurpose Cadastre

Multipurpose Cadastre Components

NDCDB + LARGE SCALE GEOSPATIAL DATA + NON-SPATIAL DATA = MPC

Valuation
Ownership
Geonames
Land value
Land use

3-Dimensional City Model

MTLS

Street Address

Building / facilities

LGDC/SGDC — Large Scale GIS Base Map

NDCDB — Survey Accurate NDCDB

Towards 3D Cadastre

Constraints In 2D Cadastre (Legal Aspect)

Situations have emerged where the dimensions above and below the ground surface, besides those on the ground, are important considerations in property ownership.

❖2D cadastre assumes the earth as flat which is unable to represent the real world, especially overlapping and interlocking mix development.

❖The existence of overlapping and interlocking constructions called for the ability to establish multilevel ownership.

National Land Code 1965

➢ The National Land Code 1965 only allows 3 types of lot/parcel, i.e.:

- Land (2D)
- Strata (2D+1D)
- Stratum (3D)

➢ The more efficient of cadastre system in future is to allow 3D lot/parcel including air space and marine space.

The Real World Is 3D But Cadastre Is Not
3D Space Conceptual Diagram
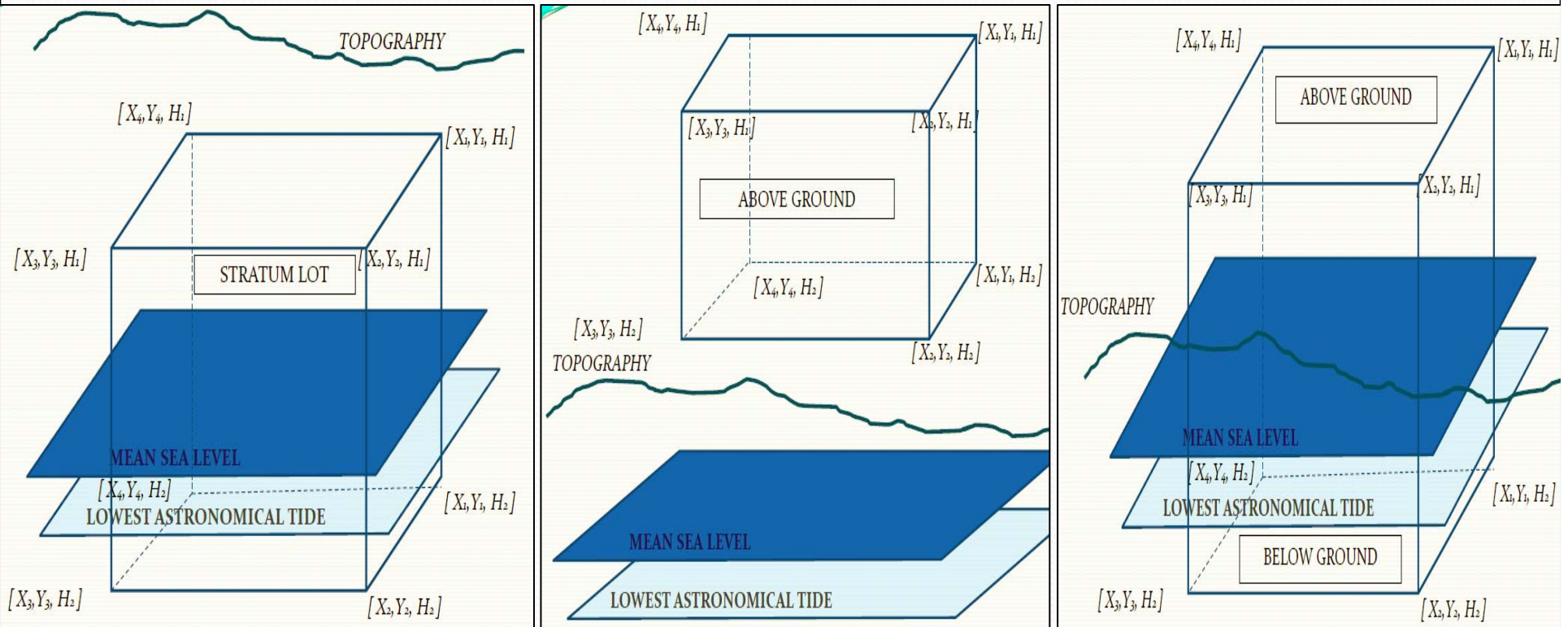
Marine Space Conceptual Diagram
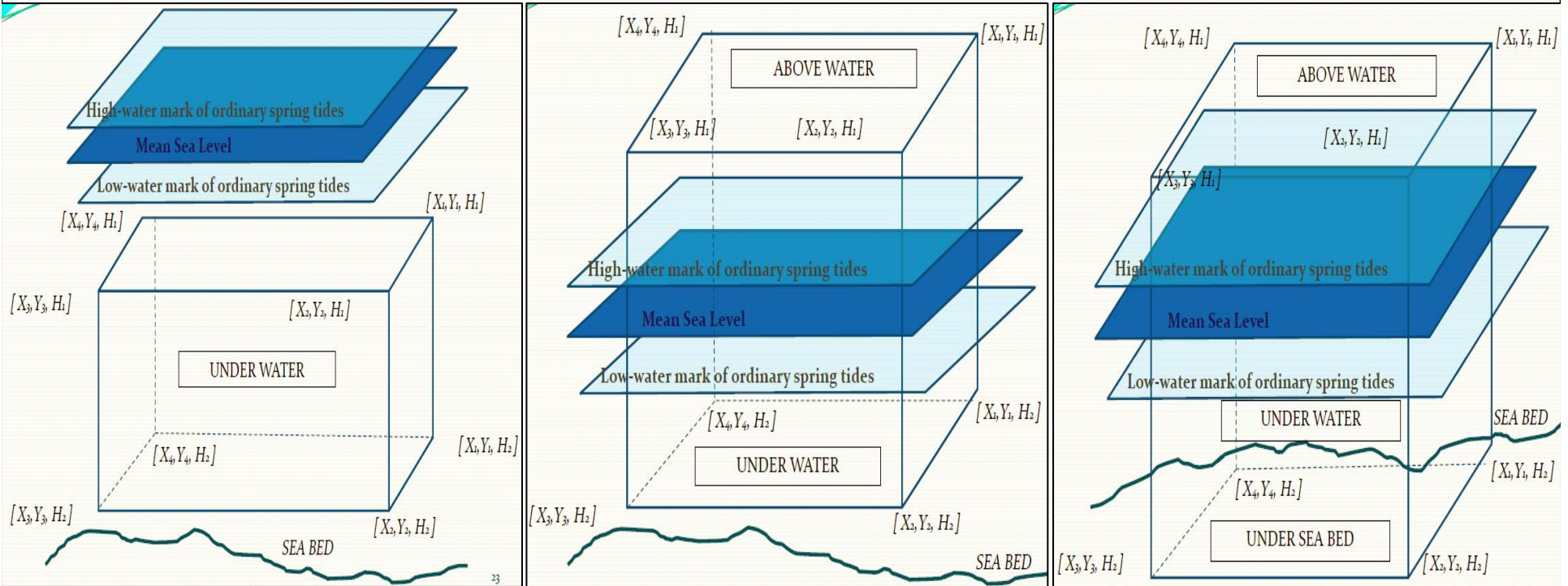
Empirical Case Study

Introduction

➢ Existing NDCDB database adopted is two-dimensional (2D) (X, Y).

➢ The purpose of this paper is to examine the possibility of implementing 3D cadastre system in Malaysia, i.e. 3D (X, Y, Z) for each boundaries mark.

➢ One of the important principles in the development of cadastral system is the fully 3D information of land surface.

Matters To Be Addressed

a) Field Data Acquisition and adjustment calculation of observed data.

- Field data collection to produce 3D coordinates in eCadastre and MyGEOID using Digital Field Book interface with LSA, i.e. bearing, distance and height.

b) Changes of survey procedures, output structure format, adjustment methodology, NDCDB structure and eCadastre application.
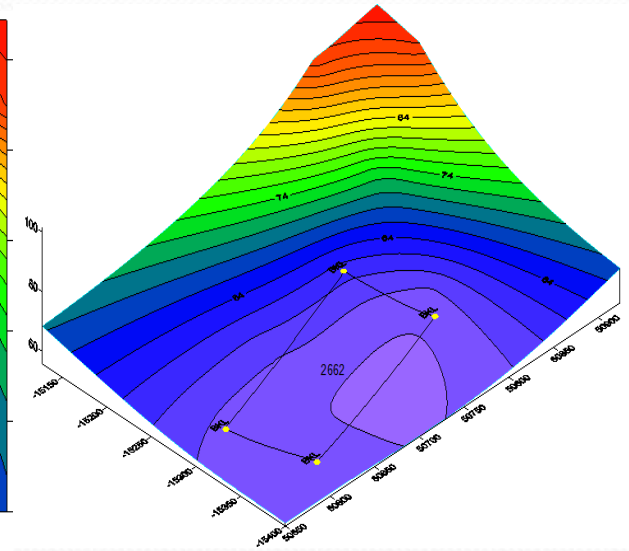
Height information of each boundary mark
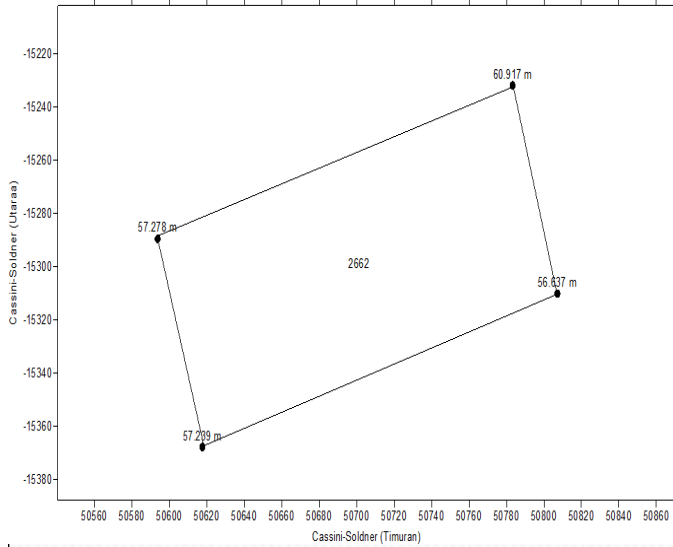
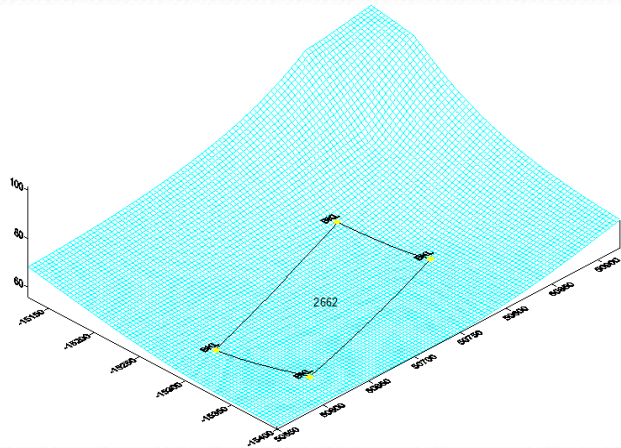## 3D Certified Plan- Contour information for each lot
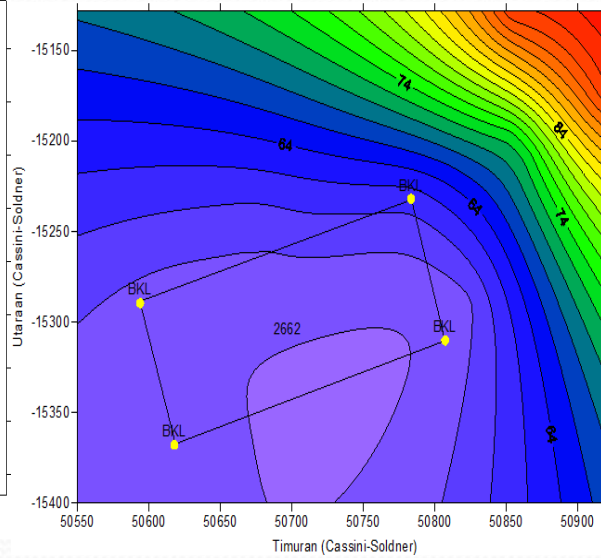
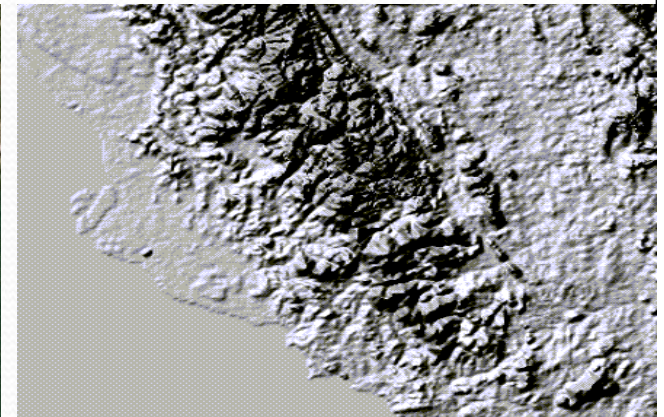## 3D Certified Plan-3D plot

3D Certified Plan-3D wireframe plot

Certified Plan with Satellite Image

Produce Digital Terrain Model (DTM) which is more accurate for use in the field of geodesy
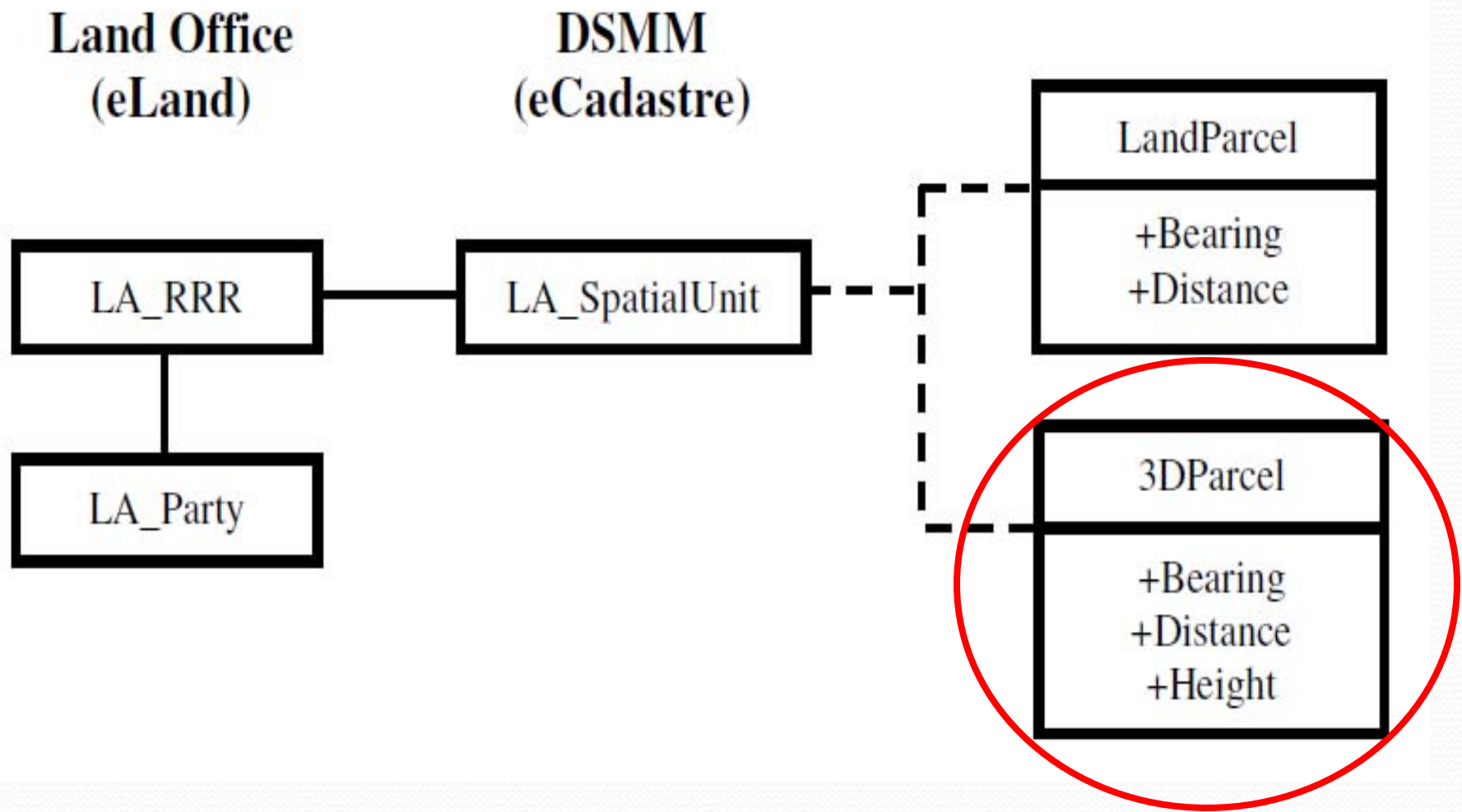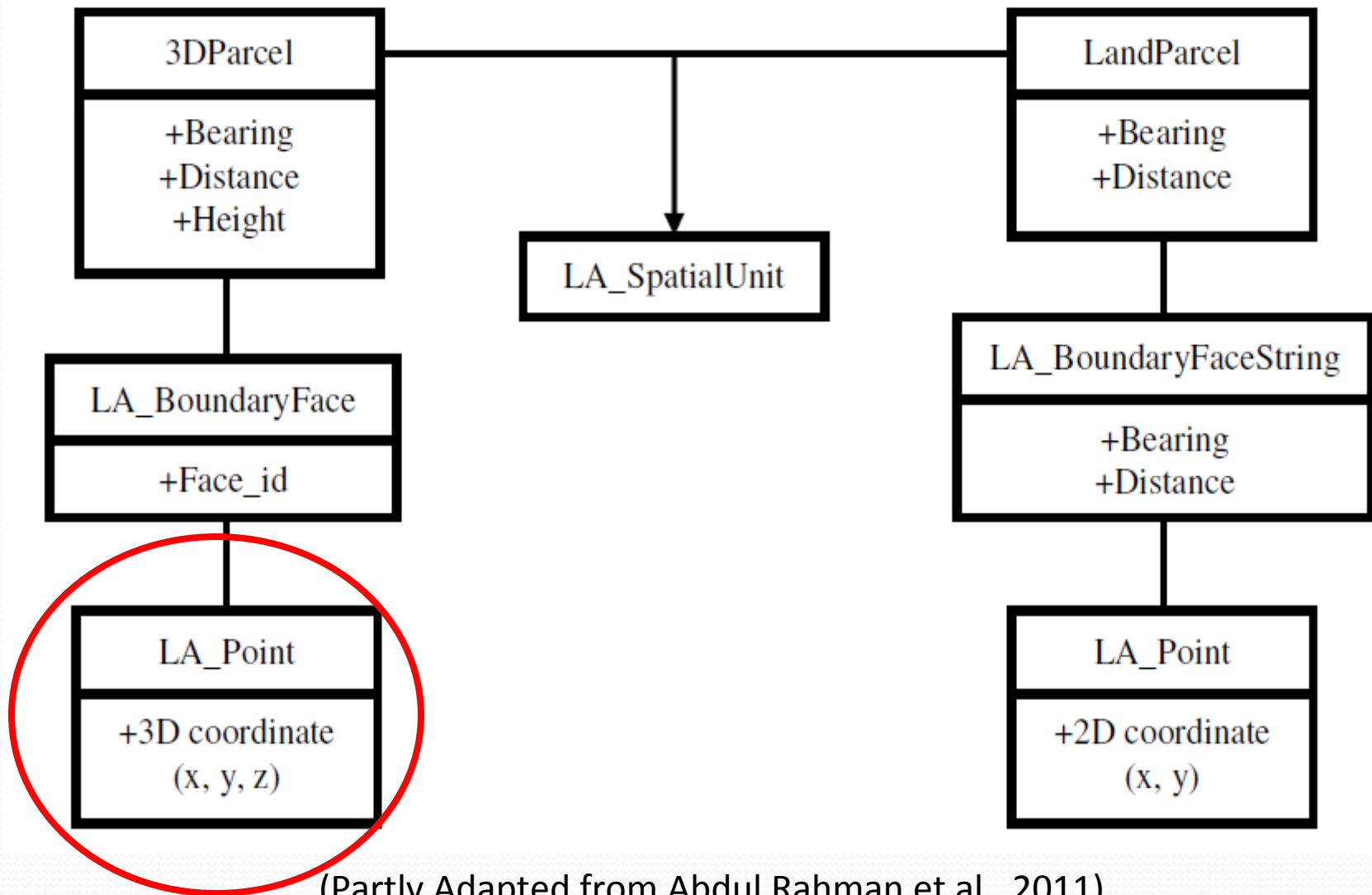
FINDINGS

Proposed Malaysian Land Administration Domain Model

Adaption of LADM into 3D Cadastre Model for Malaysian LandParcel and 3DParcel

(Partly Adapted from Abdul Rahman et al., 2011)

The data model for LandParcel and 3DParcel as LA_SpatialUnit

(Partly Adapted from Abdul Rahman et al., 2011)

Data model for Malaysian LADM ? How to do ?

To develop the LADM for data information integration among various State and Federal Government Agencies, especially the Survey and Mapping Department, Land Offices, Valuation and Property Services Department, and Town and Country Planning Department.

Which are:

➢ Physical Cadastre – National Digital Cadastral Database (NDCDB)

➢ Legal Ownership – Document of Title

➢ Land Value – Taxation

➢ Land Use – Planning

Data model for Malaysian LADM ? When ?

How to do :

1) Analyse and assess status of ongoing Malaysian LADM activities.

2) Description of current main important 2D and 3D use cases for Malaysia.

3) Analysis of specific 3D aspects involved.

4) Perform a conversion of conceptual model to technical mode.

5) Development of prototype dataset/convert existing sample data.

Proposed Legislation Aspect To Accommodate
3D Cadastre

Proposed Interpretation On Alienation Of State Land

State lands which are alienated or otherwise disposed of, or in respect of which a lease or license to occupy is issued, under this Act may be alienated, leased or licensed-

- As a parcel of the surface earth, all substances thereunder and so much of the column of airspace above the surface as is reasonably necessary for the use and enjoyment thereof;

- As a parcel of airspace or underground space or marine space whether or not held apart from the surface of the earth; and

- Only down to such depth below the surface earth or to such a height above the surface earth as the State Authority may by order direct.

National Land Code 1965

Basic Legislation

- Further explain on the definition of 'land'
- Further explain on alienation of '3D lot'
- Further explain on 'right to access' and 'right to support'
- Recognise access established through 'easement'

National Land Code 1965

Proposed Amendment of section 5 NLC:

Land includes:

a) The surface (including air space) of the earth and all substances forming that surface;

b) The earth below the surface and all substances in the surface;

c) All vegetations and other natural products, whether or not requiring the periodical application of labour to their production, and whether on or below the surface;

d) All things attached to the earth or permanently fastened to anything attached to the earth, whether on or below the surface;

e) Land covered by water; and

f) Airspace or marine space whether or not held apart from the surface of the earth.

Proposed Amendment of section 396(1)(b):

Its boundaries as so determined have been demarcated on the surface of the land, below surface of the land, air space and marine space by boundary marks or, if by reason of the configuration thereof or for any other cause the placing of boundary marks on the actual line of the boundary is to any extent impossible or impracticable, boundary marks have been so placed as to enable that line to be ascertained

Proposed Amendment of section 396(1)(c):

The area and volume enclosed by its boundaries as so determined has been calculated

CONCLUSION

Conclusion

❖ The current Malaysian NDCDB and land legislation do not provide 3D information and do not allow registration rights for overlapping properties except underground land respectively.

❖ It is believe that the eCadastre and eLand will make a paradigm shift and able to improve the current land title registration and cadastral survey practice.

❖ Malaysia cadastre and land administration systems should be transform to enable multipurpose cadastre, 3D cadastre, marine cadastre and LADM (Homogeneous Cadastre).

THANK YOU

A More Friendly Cadastre