Developments of 3D Cadastre in Malaysia

Department of Survey and Mapping Malaysia
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CADASTRAL SYSTEM OF MALAYSIA
• The Malaysian cadastre is a parcel-based land information system.
• Boundaries of land disposed by the State Authority are accurately marked, measured and mapped.
The Computerized Land Registration System (CLRS or SPTB) was introduced in early 1995, in stages, to land offices at all states and districts in Malaysia.

The system was developed by the Department Director General of Land and Mines (DGLM)

To provide a cost effective and secure procedures for land registration and dealings

The CLRS contains nationwide some 7 million properties

The CLRS is at present only a textual database but with cross-references between property information and the cadastral plan.
Identification of parcels

- **Unique Parcel Identifier (UPI)** - identifying land parcel locations based on unique code that consists of state, district, county, section and lot number.

- The UPI will enable information on land parcels issued to be accessed by other users. The UPI is used in retrieving and exchanging cadastral spatial and non-spatial data.

- Three (3) categories of UPI are available for cadastral data searching:
  1. **Final Title (FT)** for surveyed land;
  2. **Qualified Title (QT)** for before surveyed land; and
  3. **Strata Title** for properties in high-rise buildings.
Geodetic Infrastructure
The Difference Between Local Geodetic Datum (MRT) and Geocentric Datum.
MyRTKnet STATIONS
National Digital Cadastral Database (NDCDB)

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

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

- Cadastral database and system that is “compatible” with GIS technology and GPS MyRTKnet system.
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
- Large Scale GIS Base Map

Survey Accurate NDCDB
3D CADASTRE
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.
The National Land Code 1965 only allows 3 types of lot/parcel, i.e.:

- Land
- Strata Parcel and Land Parcel in strata Scheme
- Stratum
The Real World Is 3D But Cadastre Is Not

3D Terrestrial Space Conceptual Diagram
3D Marine Space Conceptual Diagram
CONCEPT OF UNDERGROUND LAND (STRATUM LOT)

• Provisions inserted into NLC for alienation of underground land in 1990

• National Land Code Regulations (Minimum Depth of Underground Land) 2006 which came into force on December 5, 2006
SURFACE LAND ALIENATED UNDER SECTION 92B(1)(a) WITH MINIMUM DEPTH

- Agriculture Category: 6m
- Housing Category: 10m
- Industry Category: 15m
- Alienated land without minimum depth specified
1(a). Alienation of underground State land [section (92C)]

X – alienation of underground state land with depth specified

Remain vested in the State Authority as State land
1(b). Underground state land [S. 92B4)] below alienated land with depth specified [S. 92B(1)(a)] [S. 92C]

Alienated land with depth specified (being a depth not less than the minimum depth specified for that class/description/location)

X – alienation of underground land below alienated land (application by any person/body)

Remain vested in the State Authority as State land
1(c). Underground land below alienated land without depth specified
[S. 92B(1)(a)] [S. 92D(1)(b)]

Alienated land without depth specified

X – alienation of underground land below alienated land
(application by proprietor of surface alienated land)

Remain vested in the State Authority as State land
For 1(a) and 1(b), alienation can be approved to any qualified person/body [S. 43]

For 1(c) approval only to proprietors of surface alienated land

Title issued under Registry Title [S. 92C(1)]

Qualified Title (QT) cannot be registered
LOT STRATUM
TANAH BAWAH TANAH
DI BAWAH LOT 195
(PA 10741)
SEKSYEN 83
BANDAR KUALA LUMPUR
WILAYAH PENGSEKULTURAN

[Diagram of a building or structure with annotations in an architectural drawing format.]
LOT STRATUM
TANAH BAWAH TANAH
DI BAWAH LOT 198
(PA 10741)
SEKSYEN 93
BANDAR KUALA LUMPUR
WILAYAH PERSEKUTUAN

Menunjuk Sebagaimana Disebutkan di Bawah Ini dalam Hak Tanah Negara, baik secara langsung maupun tidak langsung, pemegang hak tanah tersebut telah terikat dengan hak pemegang hak tanah persetujuan yang telah disahkan oleh ahli atau peguam profesional kawasan yang berlaku mengenai hak pemegang hak tanah yang telah disahkan.

Sumbangan: Nama: 50

Tandatangan dan Cap Rasmi:

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EMPIRICAL CASE STUDY
Adopt existing NDCDB+CRM database is in 2D (x, y)+h or GNSS.

Study to examine the possibility of implementing 3D cadastre system in Malaysia, i.e. 3D (x, y, h) for each boundaries mark.

One of the important principles in the development of cadastral system is the fully 3D information of land surface.
a) Field Data Acquisition and adjustment calculation of observed data.
   - Field data collection to produce 3D coordinates in eKADASTER 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 eKADASTER application.
### Digital Field Book-3D

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#------------Heavily Fixed eCRM East, North & Orthometric Height (MyGeoid)----------

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# Manually Input Vertical Distance - HI & HT commented for remarks

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PROPOSED MALAYSIAN LAND ADMINISTRATION DOMAIN MODEL
Spatial Data Modelling for MY_Lot2D and MY_Lot3D

(Malaysian LADM Country Profile-Joint research JUPEM and UTM, 2013)
Proposed MY_BoundaryFace

- MY_Generation
  - name: MY_BoundaryFace
  - MY_Lateral
    - LA_AreaValue: float
    - LA_VolumeValue: float
    - geometry: GM_Surface
    - LA_Rounding: double
    - dimension: 2D
  - MY_Lateral
    - LA_AreaValue: float
    - LA_VolumeValue: float
    - geometry: GM_Solid
      - LA_Rounding: float
      - dimension: 3D

- LA_BoundaryFaceString
  - MY_BoundaryFace
    - geometry: GM_Curve
    - bearings: double
    - distances: double
    - totalLength: double

- LA_BoundaryFace
  - geometry: GM_Poly
    - coordinates: double
RECOMMENDATIONS FOR AMENDMENTS TO NATIONAL LAND CODE 1965
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 or leased -

- 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.
• 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’
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

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

- Malaysia cadastre and land administration systems should be transformed to enable Multipurpose Cadastre, 3D Cadastre, marine cadastre and LADM (Homogeneous Cadastre).
Thanks you

Department of Survey & Mapping Malaysia
http://www.jupem.gov.my