



Advanced Principles of 3D Cadastral Data Modelling

2nd International Workshop on 3D Cadastres
16th – 18th November 2011



Agenda

- Introduction to the project
- Drivers for land and property information in 3D
- Aspects of land and property information in 3D
- Advanced Principles of 3D Cadastral Data Modelling
- 3D prototype system
- Discussion and project directions





Introduction to the project and partners



Objectives

The project aims to achieve:

- An improved understanding of problems and issues associated with the incorporation of a third dimension in cadastre
- Specification of policy, legal, institutional and technical aspects
- A 3D data model for land and property information in 3D
- A 3D cadastral database management model
- A 3D land and property information representation model
- A 3D registration model
- A prototype 3D land and property information system



Project Partners



Team 3D

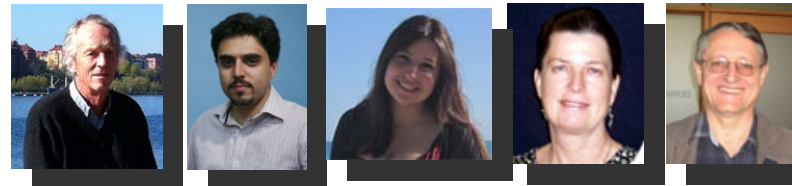
- Chief Investigators

- A/Prof Abbas Rajabifard (Project Leader)
- Prof. Ian Williamson
- Dr Tuan Ngo



- Researchers

- Prof. Ian Bishop
- Dr Mohsen Kalantari (RF)
- Dr Ida Jazayeri (RF)
- Ms. Jude Wallace (SRF)
- Mr. Brian Marwick (SRA)



- Postgraduate Scholars

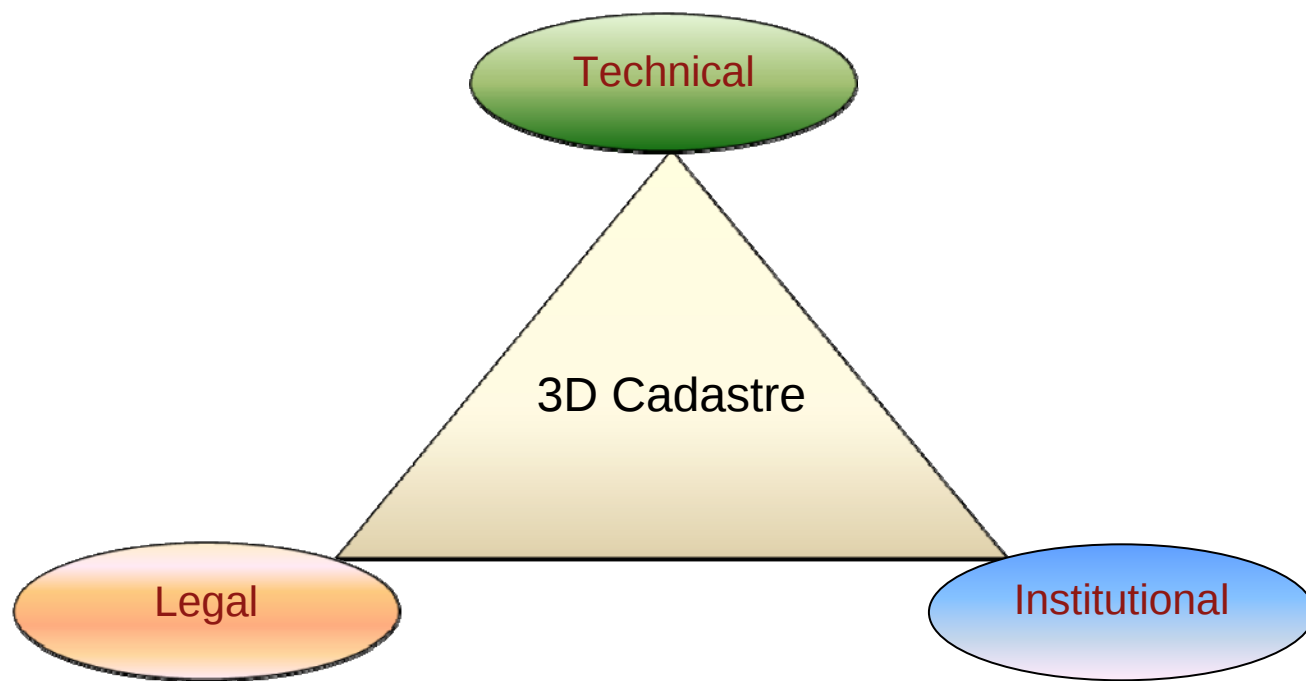
- Mr. Ali Aien
- Mr. Davood Shojaei
- Ms. Serene Ho



... and other
members of
CSDILA and the
Department of
Geomatics

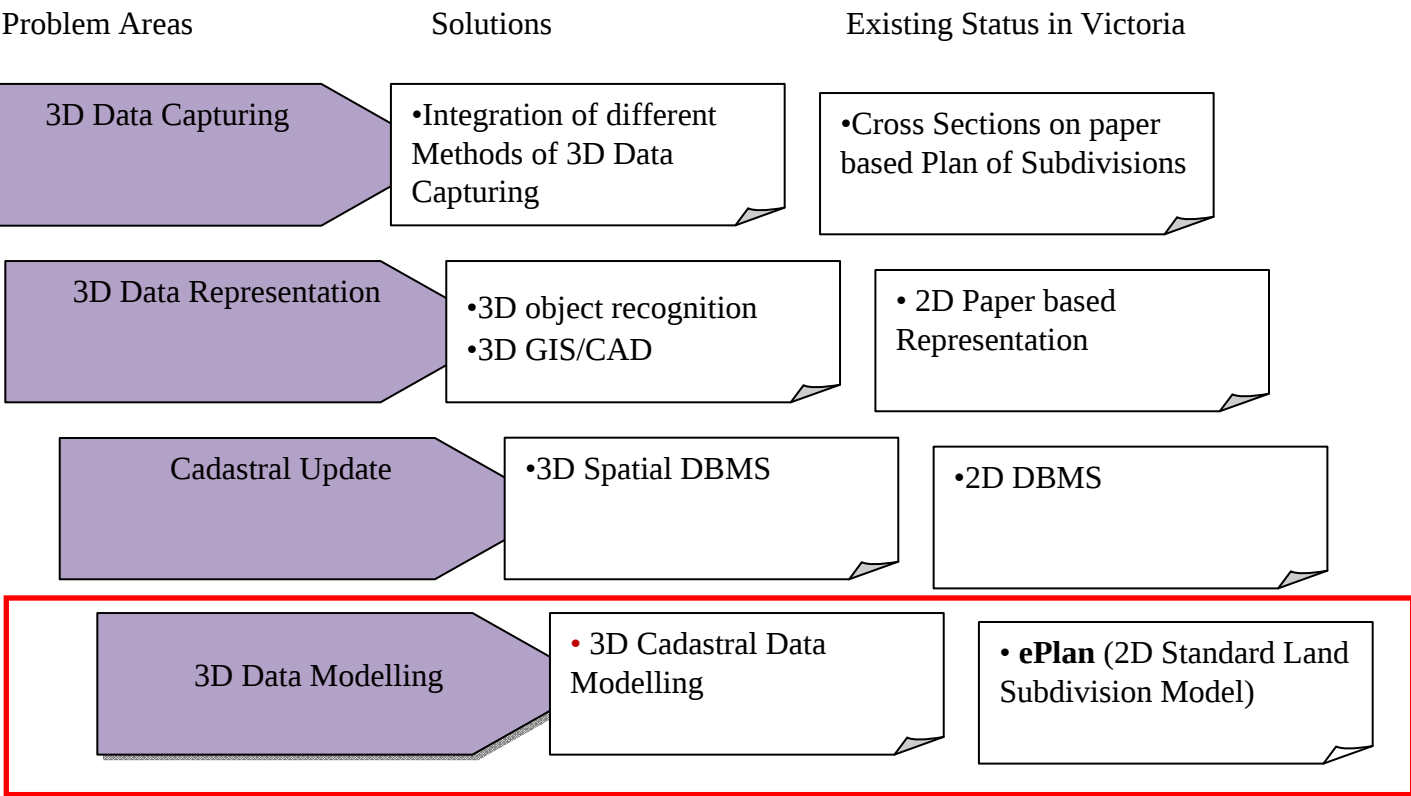


Research Design





Technical



Aien, A., Rajabifard, A., Kalantari, M., & Williamson, I. (2011). *Aspects of 3D Cadastre- A Case Study in Victoria*. Paper presented at the FIG Working Week 2011, Marrakech, Morocco. (Peer reviewed)





Advanced Principles of 3D Cadastral Data Modelling

Ali Aien

PhD Candidate



Introduction- The importance of modelling

- A Model is a simplification of reality.
- The data modelling is not optional ; no database was ever built without a model, just as no house was ever built without a plan (*Graeme Simsion, 2005*).



Introduction- Current cadastral data models

- Developed based on 3 Main components:
 - InterestHolder(Party)
 - Land (2D Land Parcel)
 - Rights (RRRs)

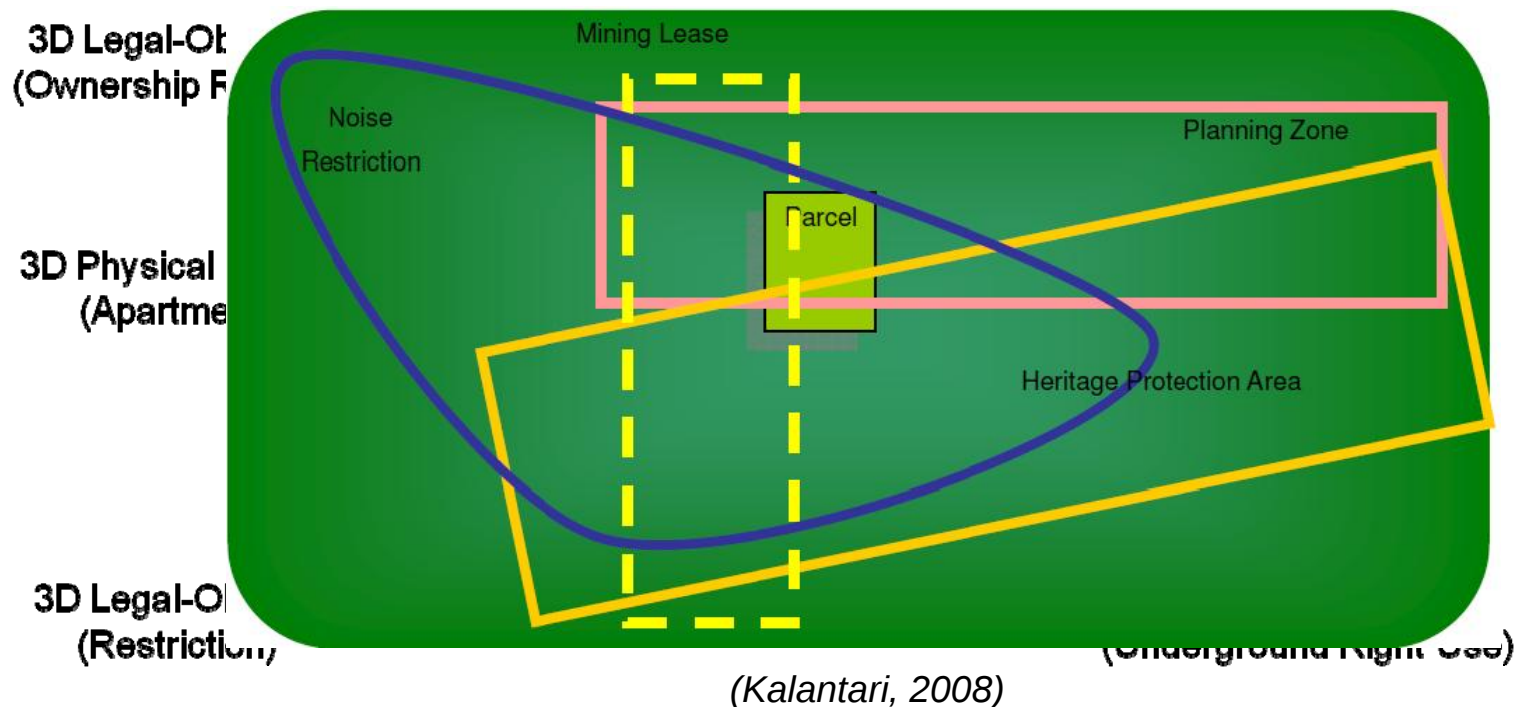


Core Cadastral Data Model



Introduction- Problems of current cadastral data models

- The use of land involves multiple dimensions.
- Increasing number of different RRRs (e.g. Ownership, Easement) intersect land parcels.



Research Problem

- Current cadastral data models use a 2D land-parcel definition and extend it to cover 3D requirements.
- This approach cannot adequately manage and represent the spatial extent of 3D land rights, restrictions and responsibilities (3D RRRs).
- A 3D cadastral data model needs to be developed to configure 3D cadastral frameworks and facilitate 3D cadastre implementation.



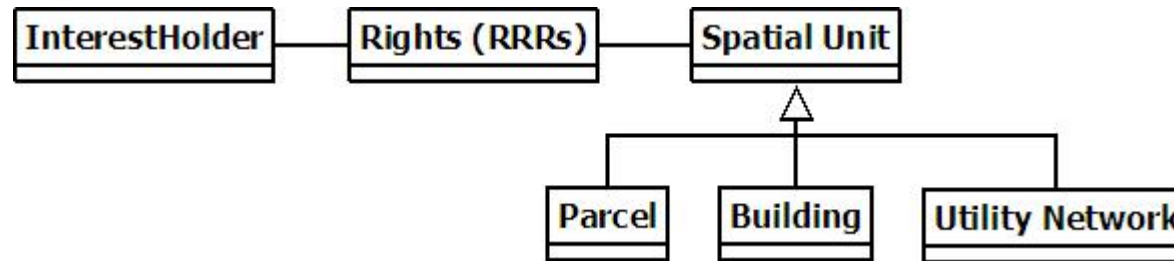
Current Cadastral Data Modelling Initiatives

- Core cadastral data model (Henssen, 1995)
- FGDC Cadastral Data Content Standard for the National Spatial Data Infrastructure (FGDC, 1996)
- ArcGIS Parcel Data Model (Meyer, 2001)
- DM.01. (Steudler, 2005)
- CCDM (Oosterom *et al.*, 2006)
- ePlan (ICSM, 2009)
- Legal Property Object (Kalantari *et al.*, 2008)
- Ubiquitous 3D Cadastre (Park *et al.*, 2010)
- LADM (Lemmen, Oosterom, Eisenhut *et al.*)
- 5D Data Modelling (Oosterom & Stoter, 2010)
- ISO 19152- LADM (ISO, 2011)



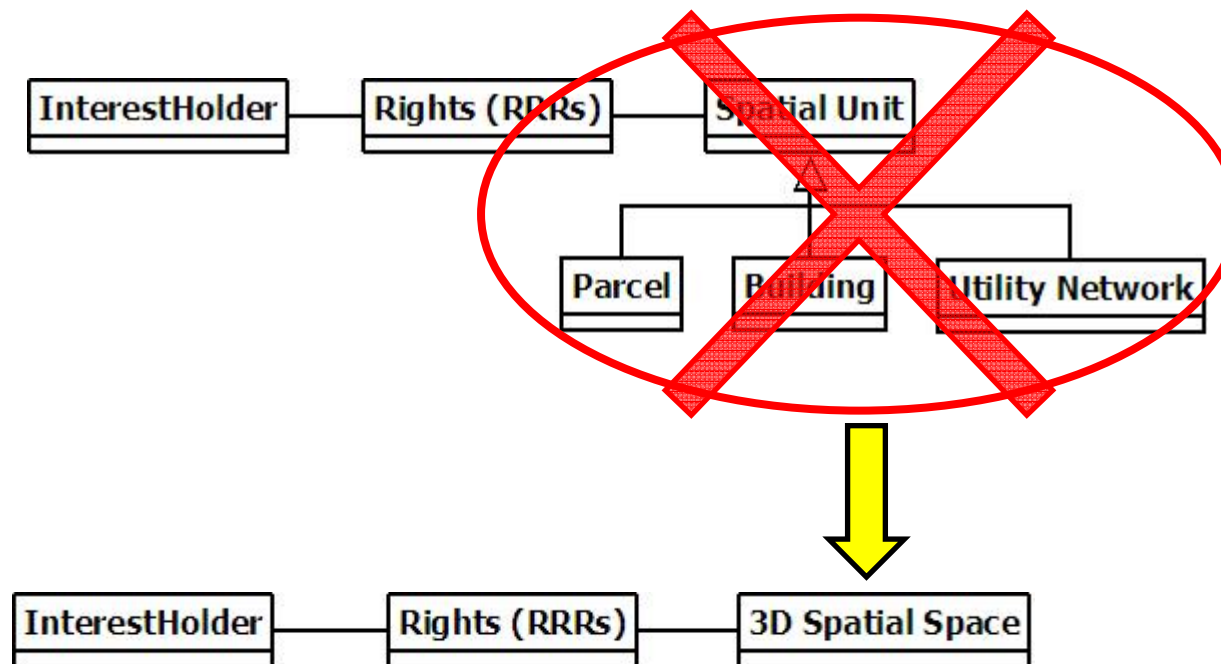
Assessment of Current Cadastral Data Models

- They still rely on 2D Land parcels for accommodating 3D Data
- RRRs are not represented along physical objects



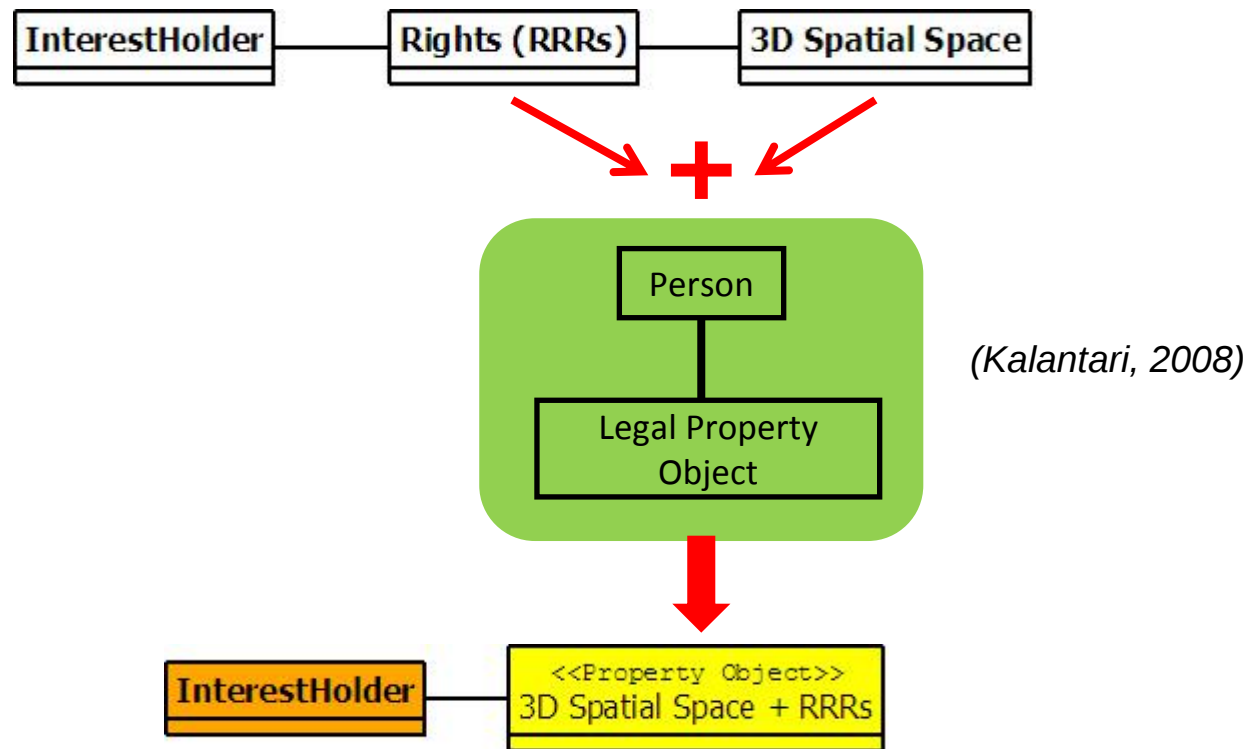
Advanced Principles of 3D Cadastral Data Modelling

Principle 1: The 2D cadastral data model is a sub-set of the 3D cadastral data model

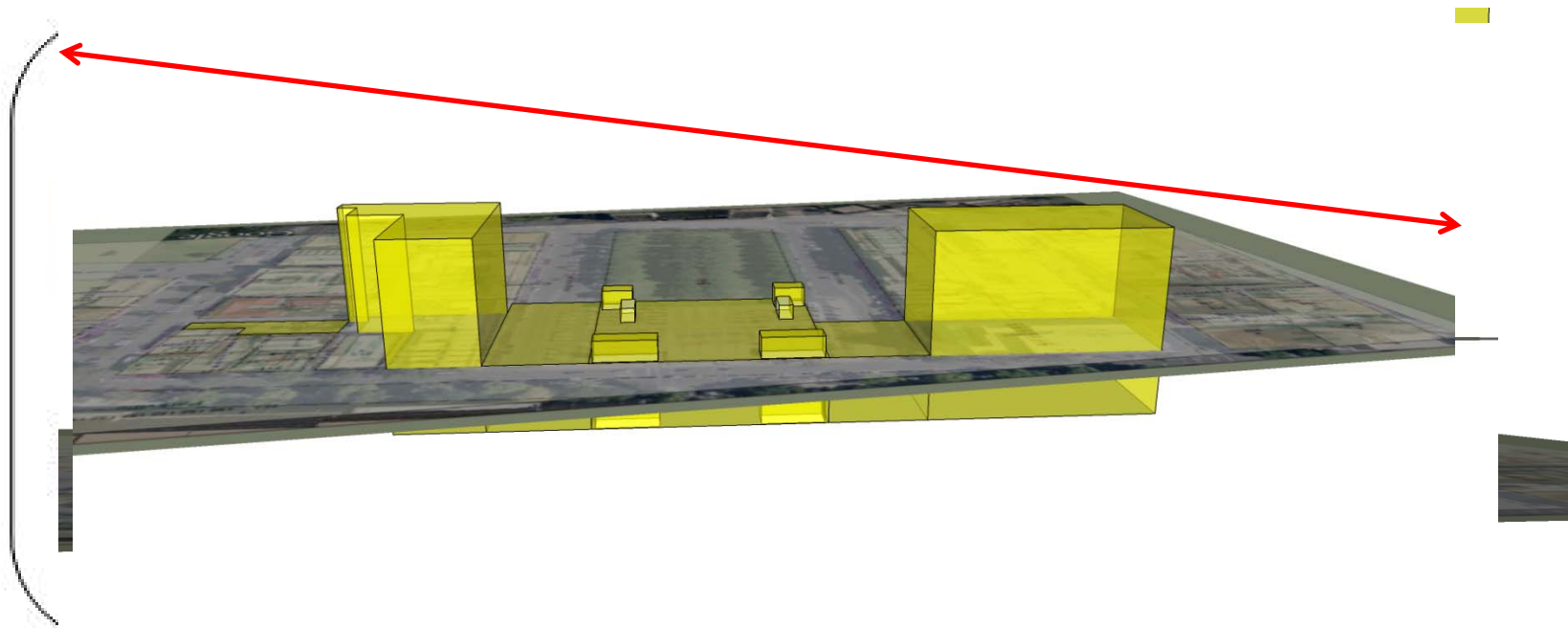


Advanced Principles of 3D Cadastral Data Modelling

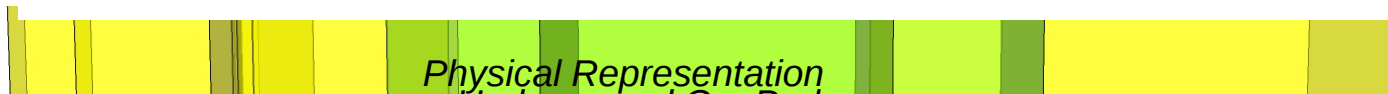
Principle 2: The 3D cadastral data model should not only accommodate 3D RRRs and their association with physical objects: the data model should also represent the spatial extent of 3D RRRs



Case Study- University of Melbourne Underground Car Park



Cross Section

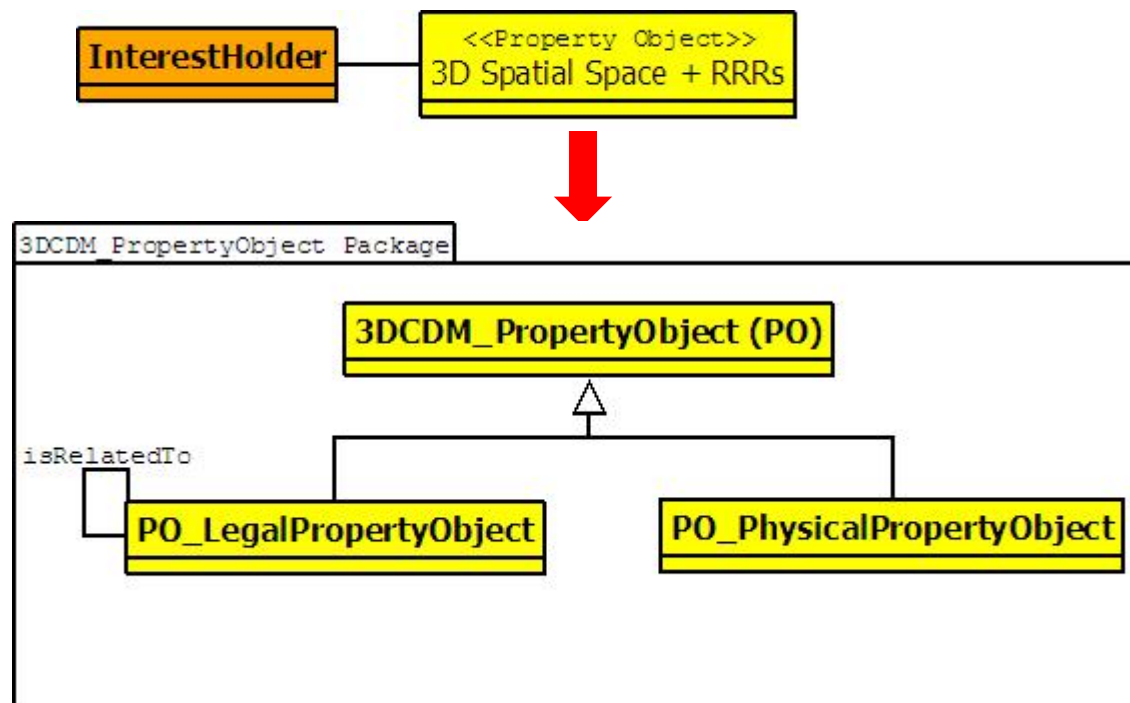


Physical Representation
Underground Car Park
Cadastral Map, Land Victoria
Unlegally Representation

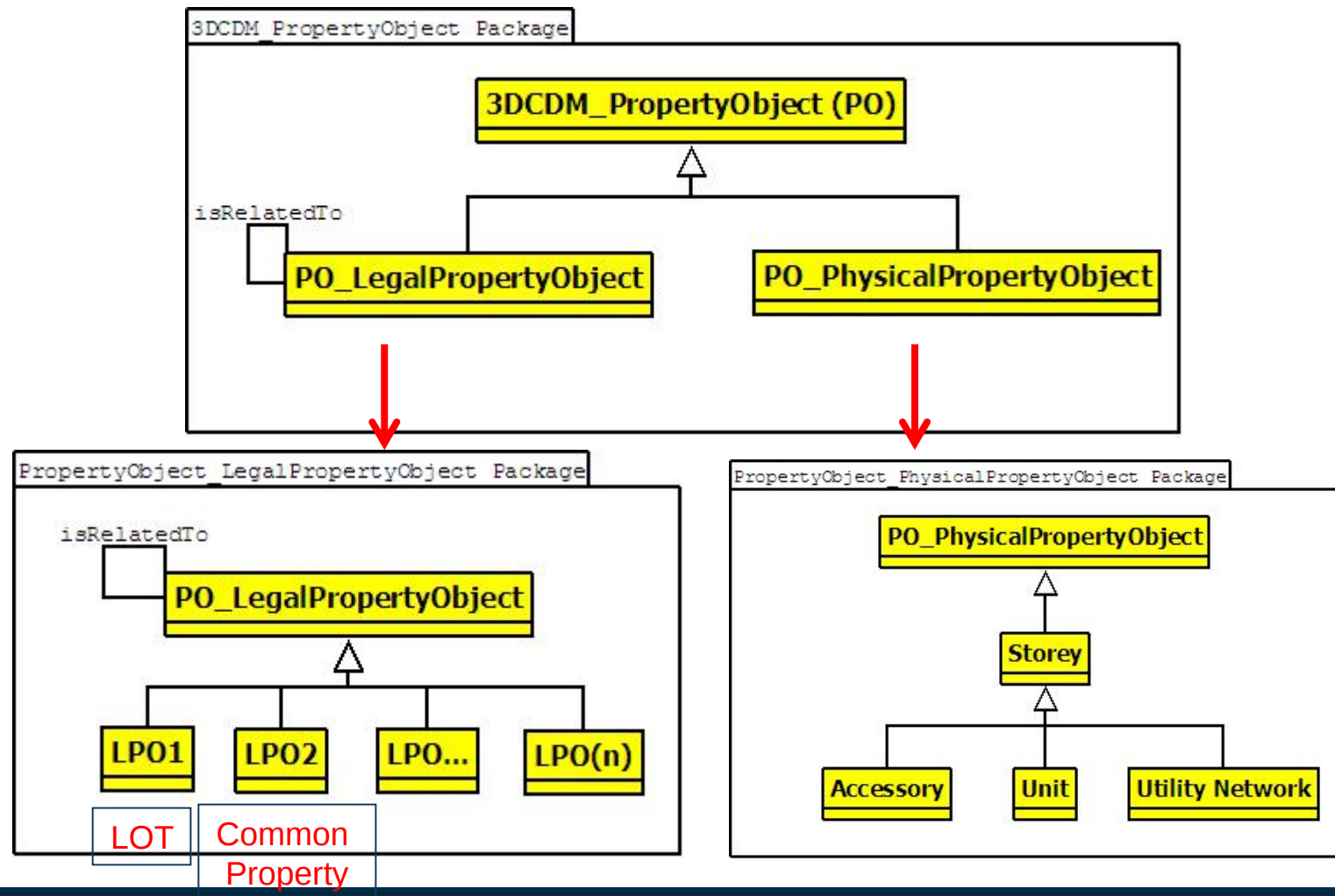


Advanced Principles of 3D Cadastral Data Modelling

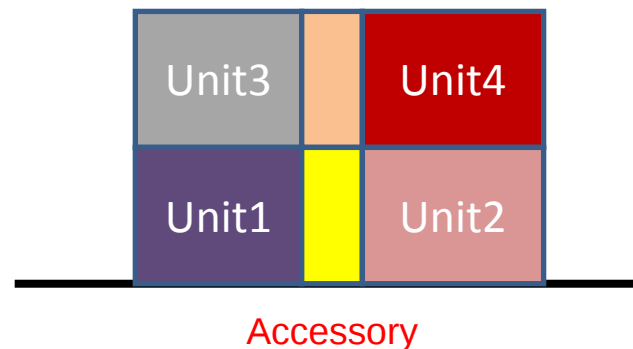
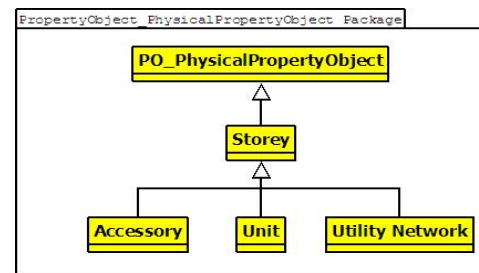
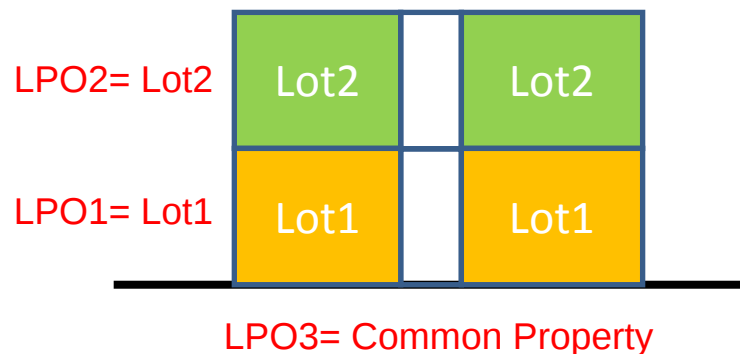
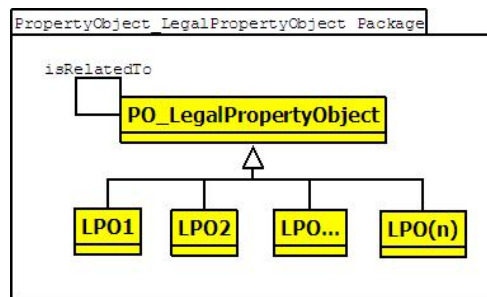
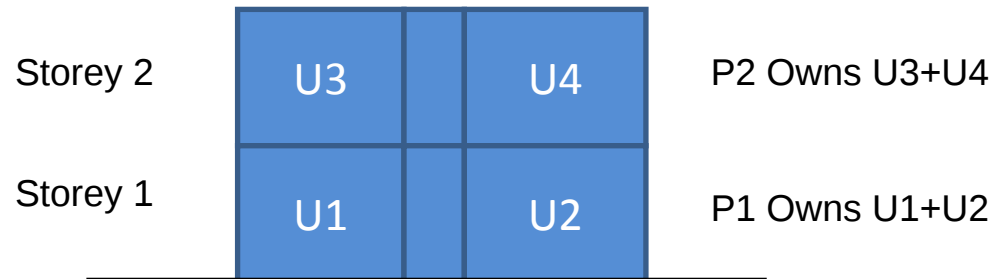
Principle 3: The 3D cadastre data model should cater for a broad range of land administration functions including land tenure, land value, land use, and land development with sufficient detail.



Developing a 3D Cadastral Data Modelling (3DCDM_First Version)

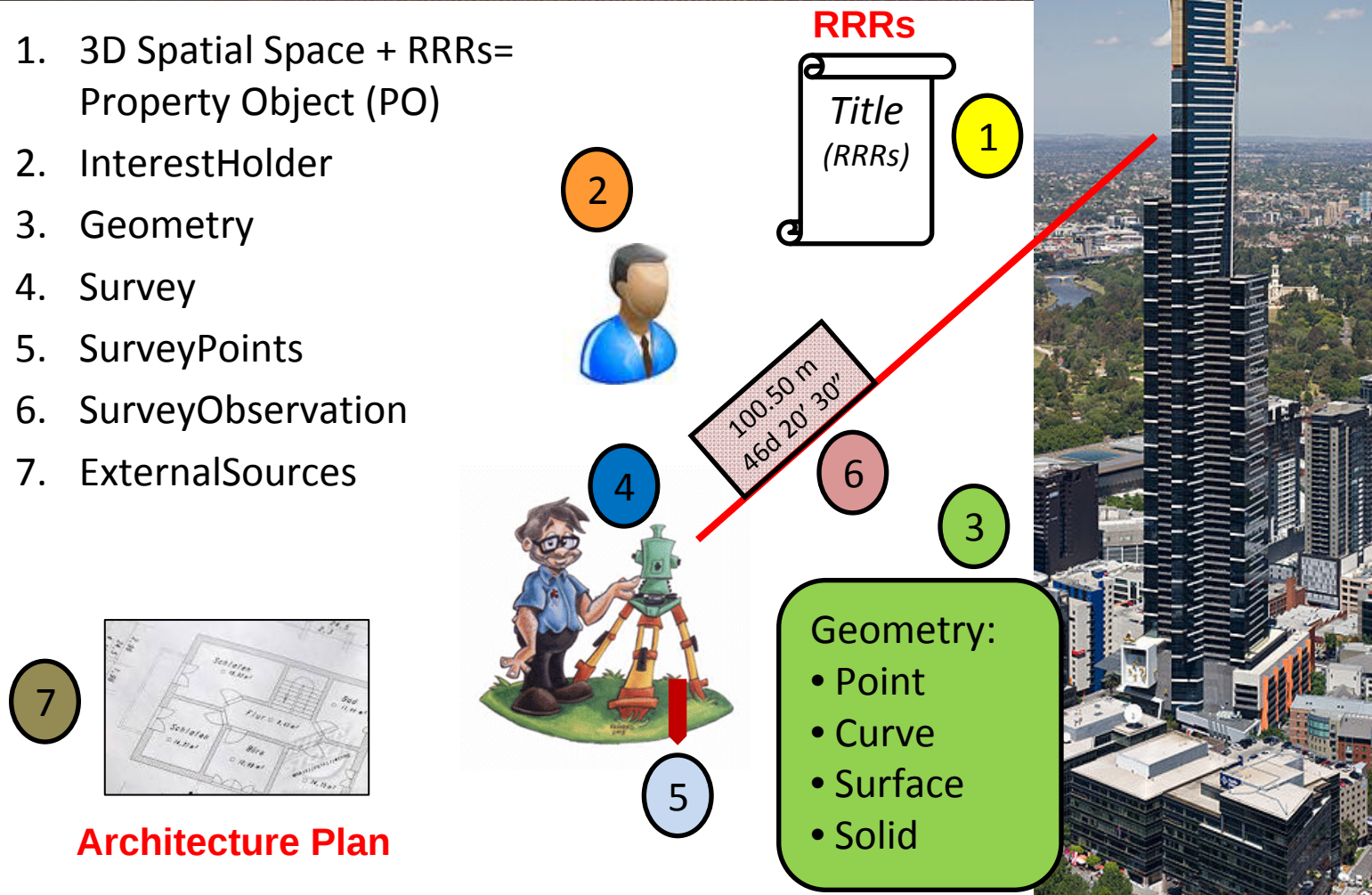


Developing a 3D Cadastral Data Modelling (3DCDM_First Version)- An Example

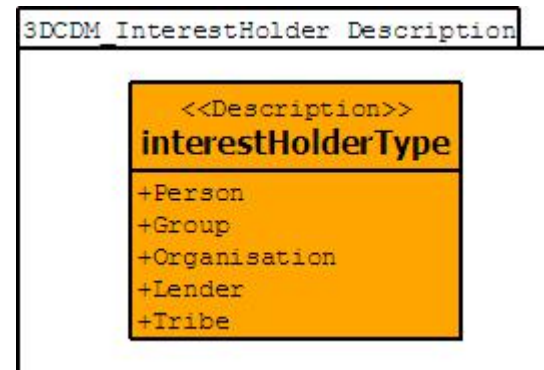
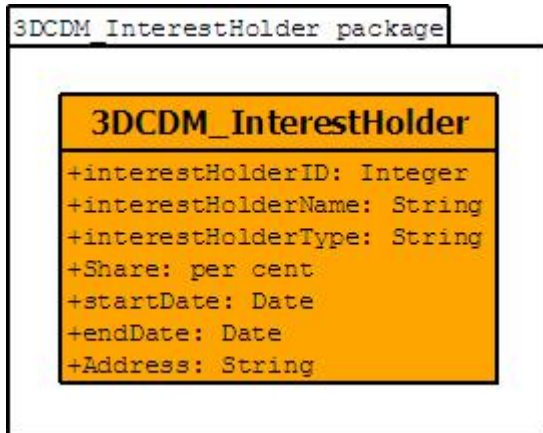


Developing a 3D Cadastral Data Model (3DCDM_First Version)

1. 3D Spatial Space + RRRs= Property Object (PO)
2. InterestHolder
3. Geometry
4. Survey
5. SurveyPoints
6. SurveyObservation
7. ExternalSources

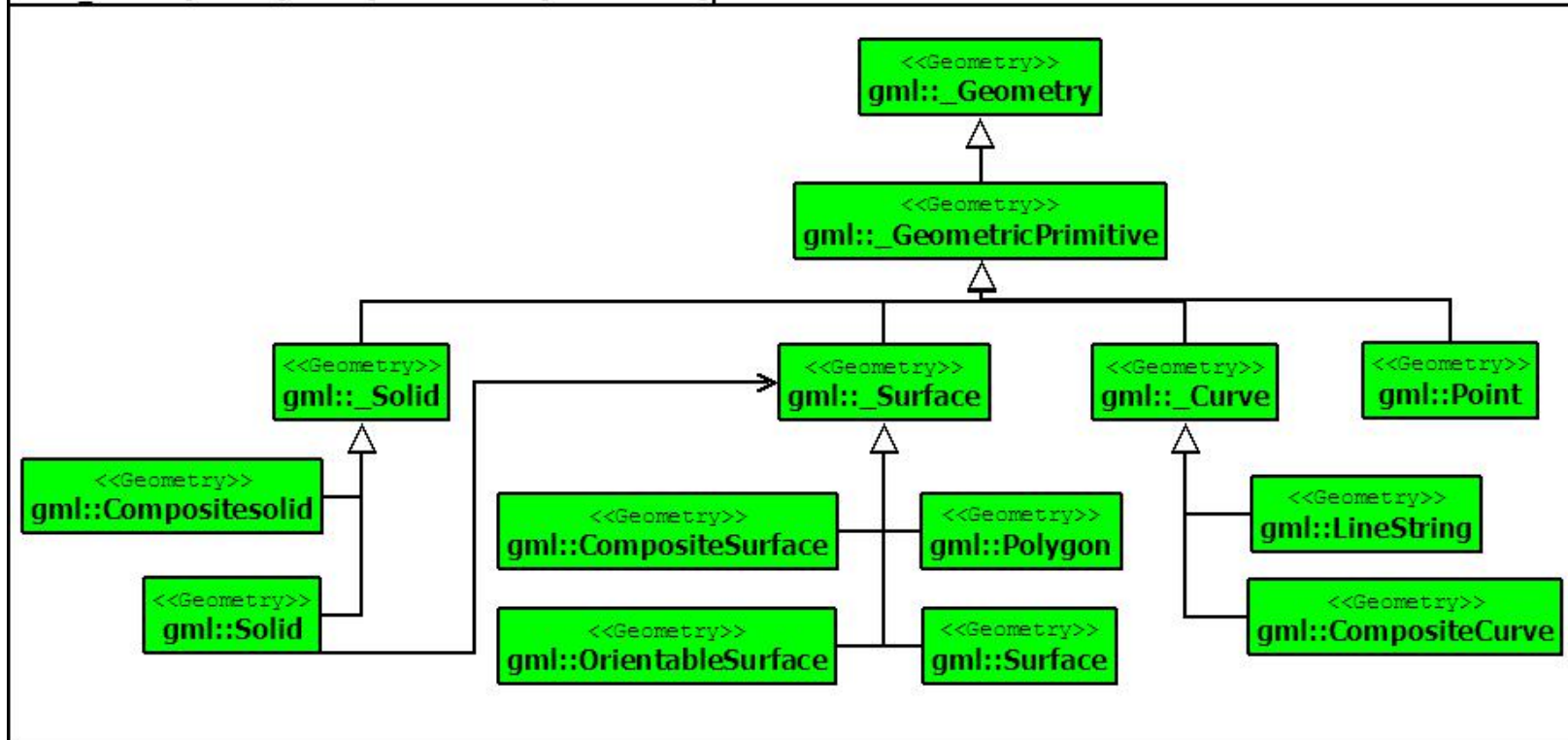


3DCDM_InterestHolder



3DCDM_Geometry

3DCDM Geometry Package- Adopted from CityGML Geometry

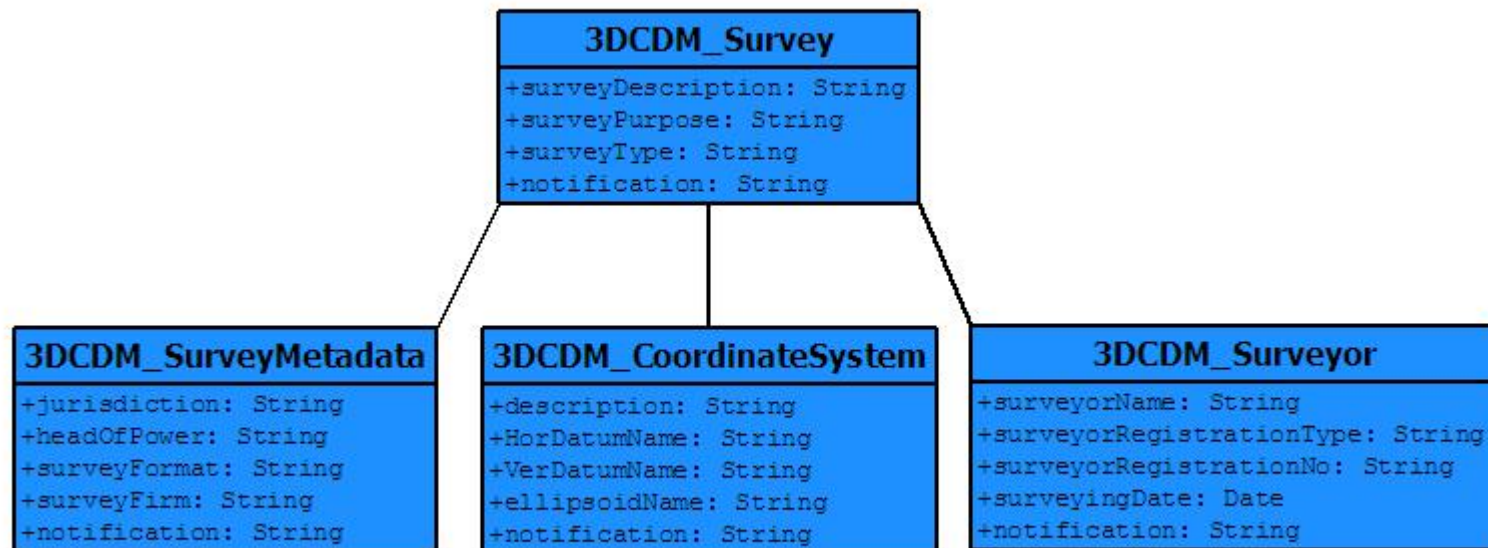


CityGML Geometry



3DCDM_Survey

3DCDM_Survey Package



3DCDM_SurveyPoint

3DCDM_SurveyPoint

3DCDM_SurveyPoints

```
+pointID: Integer  
+pointName: String  
+2DPoint: 2D  
+3DPoint: 3D  
+Lat: Double  
+Long: Double  
+Height: Double  
+type: monumentType  
+pointDescription: String
```



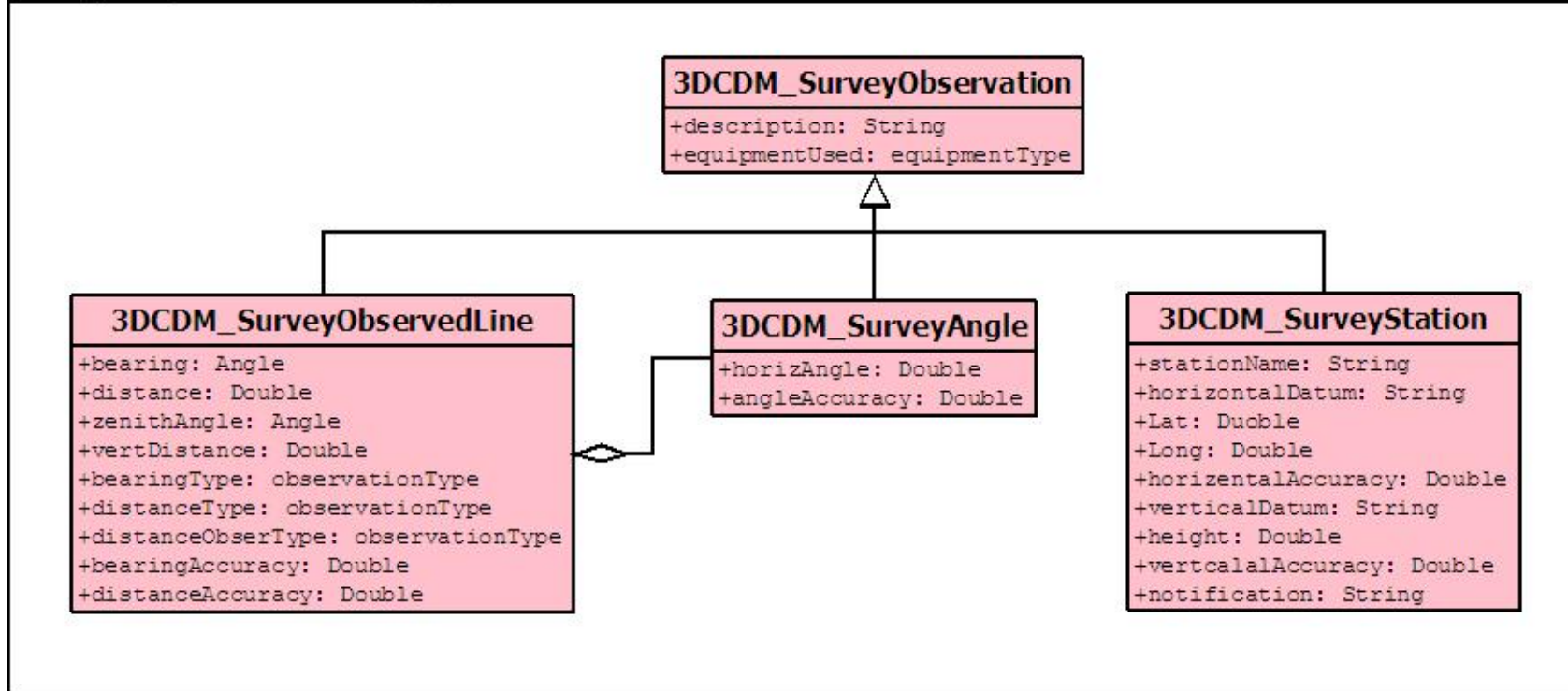
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THE CENTRE FOR SPATIAL
DATA INFRASTRUCTURES
& LAND ADMINISTRATION



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MELBOURNE

3DCDM_SurveyObservation

3DCDM_SurveyObservation Package



3DCDM_ExternalSources

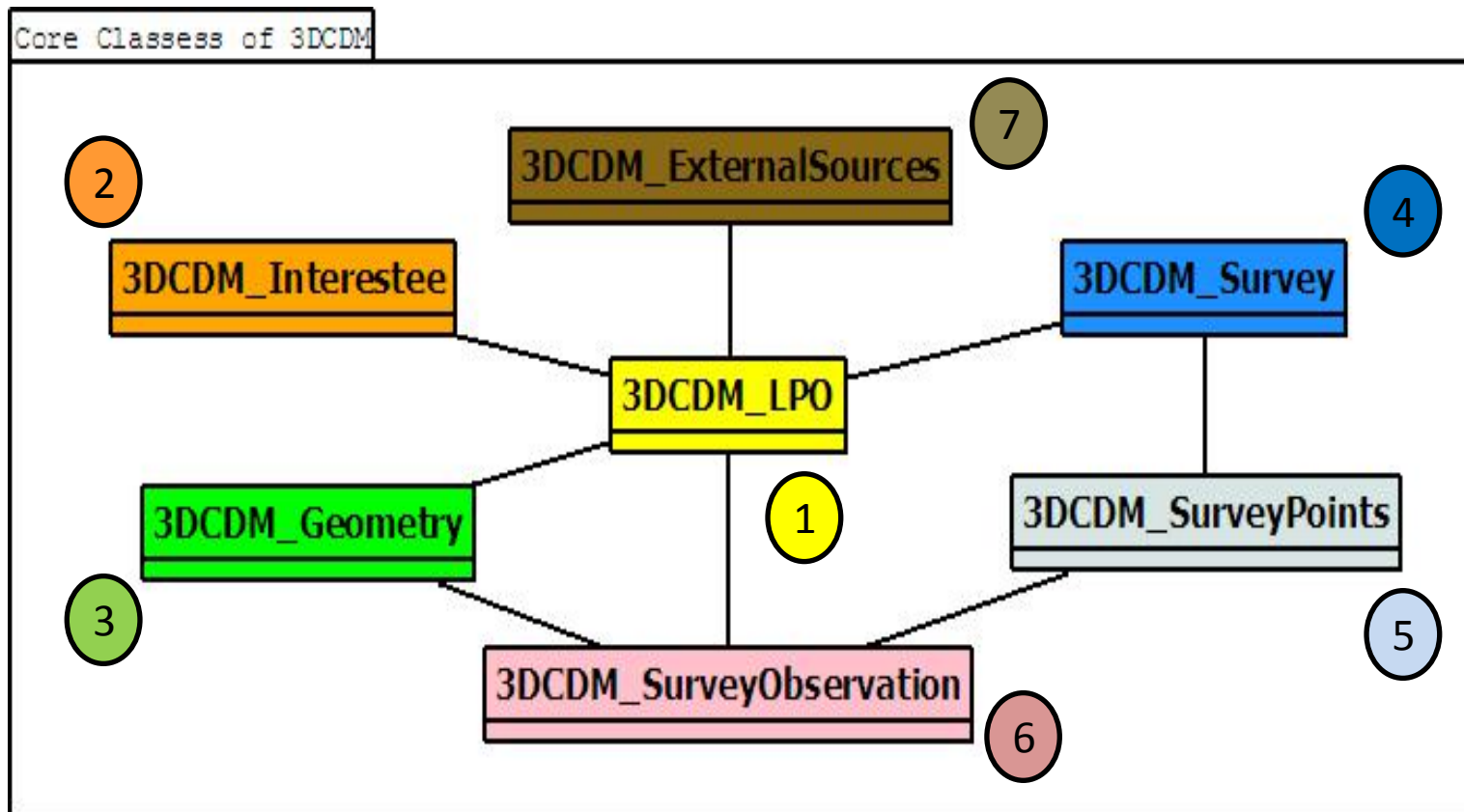
3DCDM_ExternalSource package

3DCDM_ExternalSource

```
+extSourceID: Integer  
+extSourceName: String  
+extSourceType: String  
+extSourceDate: Date  
+extSourceProvider: String
```



Core Classes of 3DCDM_First Version 1.0



Prototypes

- ▶ Web-based
 - LandXML to KML Converter
- ▶ Desktop-based
 - 3D cadastre visualization using 3D PDF



Shojaei, D. (2011)

Aien, A., Rajabifard, A., Kalantari, M., Williamson, I. P., & Shojaei, D. (2011). 3D Cadastre in Victoria, Converting Building plans of Subdivision to LandXML. *GIM International*, 25(8), 16-21.



Future Directions & Conclusions

- Test and implement the 3DCDM
- Develop LandXML schemas based on the 3DCDM
- Proposed principle will shape the cadastre concept and consequently 3D cadastral data models.
- Development of full 3D cadastre will most likely be staged processed, supported by cost/benefit analyses that demonstrate the value of each stage.
- The model presented here can be seen as part of the processes of development.





Discussion and Future Direction

<http://csdila.unimelb.edu.au/>

