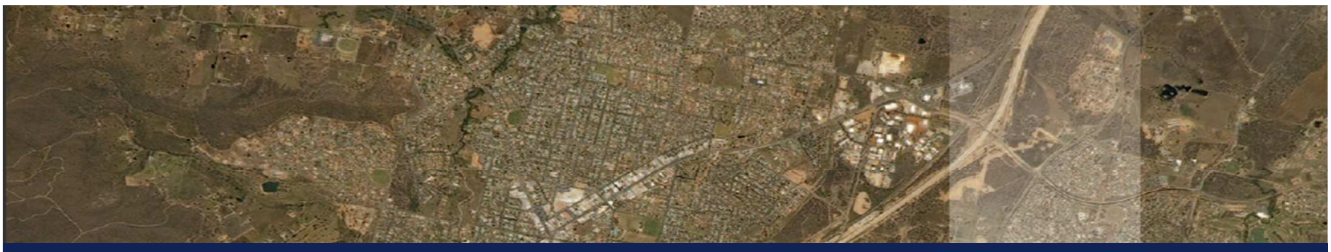

Land and Property Information in 3D

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Abbas Rajabifard
Ian Williamson
Mohsen Kalantari
Brian Marwick
Serene Ho
Davood Shojaei

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Complex structures

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Complex structures

UTS Sydney - Dr Chau Chak Wing Building
The Dr Chau Chak Wing Building is the first building in Australia
designed by Frank Gehry, one of the world's most influential architects.
http://www.uts.edu.au/partners-and-community/initiatives/city-campus-master-plan/projects-progress/dr-chau-chak-wing

ARC-Linkage Project Partners

ICSM ANZLIC COMMITTEE ON SURVEYING & MAPPING

FKA

strata community australia VIC

Australian Government
Australian Research Council

PSMA AUSTRALIA LIMITED

AAM

State Government Victoria Department of Transport, Planning and Local Infrastructure

NSW GOVERNMENT Land & Property Information

Alexander Symonds Surveying Consultants

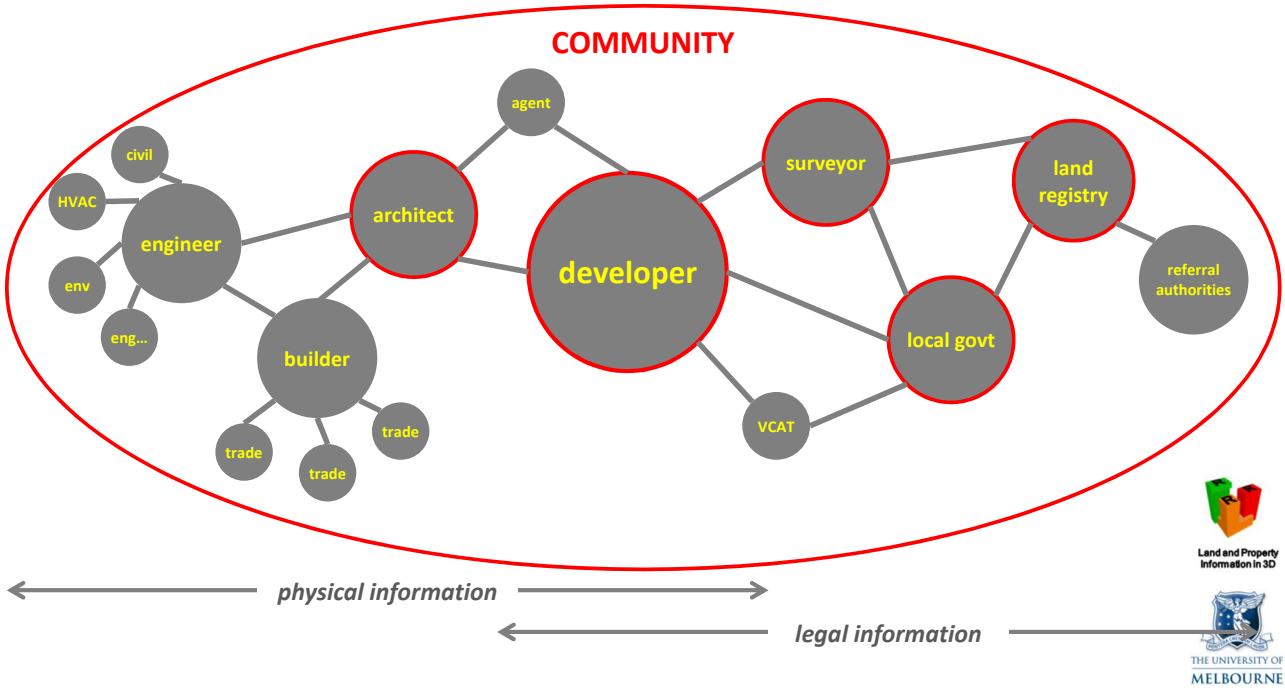
Melb Uni Team

- Chief Investigators
  - Prof. Abbas Rajabifard (Project Leader)
  - Prof. Ian Williamson
  - Dr Tuan Ngo

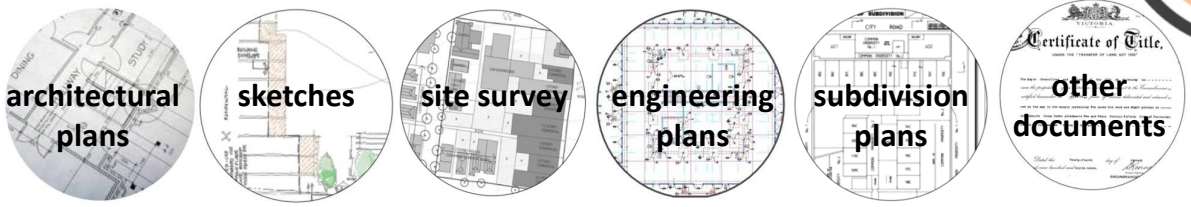
- Researchers
  - Dr Mohsen Kalantari (Research Coordinator)
  - Prof. Ian Bishop
  - Dr Ida Jazayeri (RF)
  - Mr. Brian Marwick (SRA)
  - Dr. Malcom Park
  - Alireza Jamshidi

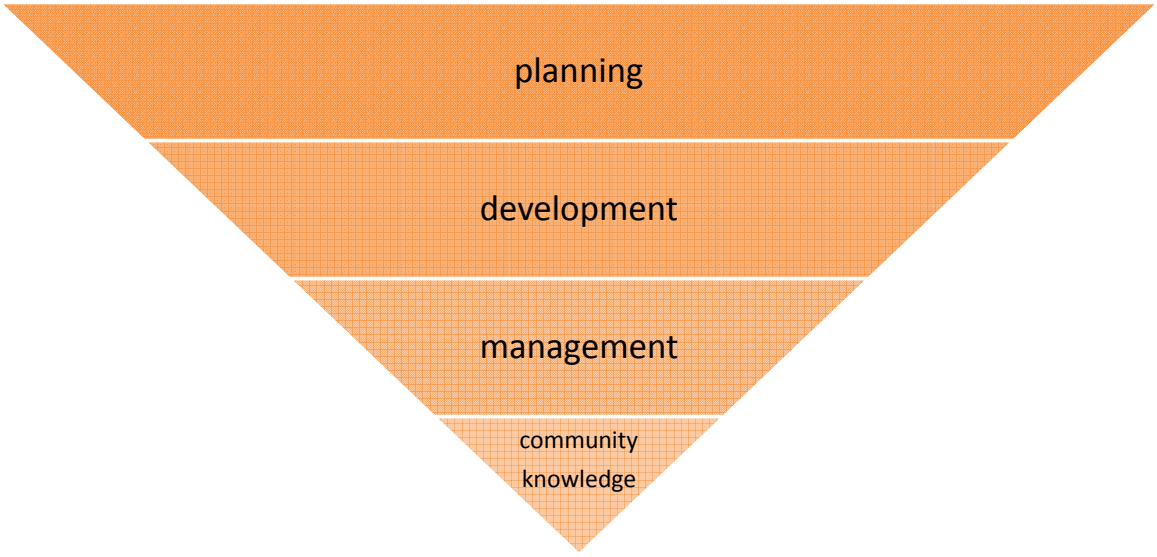
- Postgraduate Scholars
  - Mr. Ali Aien
  - Mr. Davood Shojaei
  - Ms. Serene Ho
  - Mr. Sam Amirebrahimi
  - Mr. Behnam Atazadeh
  - Dr Zhixuan Yang
  - Ms Mary Lin

Scope



Limitations of 2D information





Land and Property Information in 3D

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Objectives of the Project

1. An improved understanding of the problems and issues associated with incorporating 3D property information into land administration systems;
2. A specification of the technical, policy, legal and institutional aspects of a 3D property information and representation system;
3. Prototype 3D property information and building visualisation systems, visualisation and modelling

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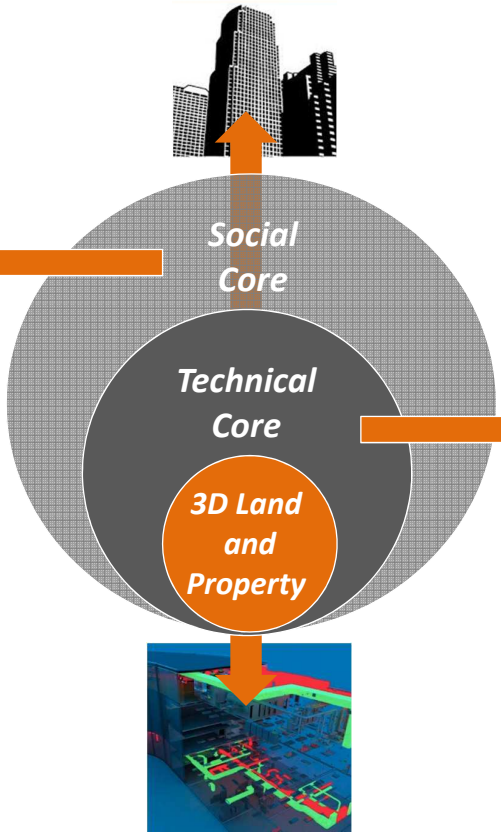
Project focus

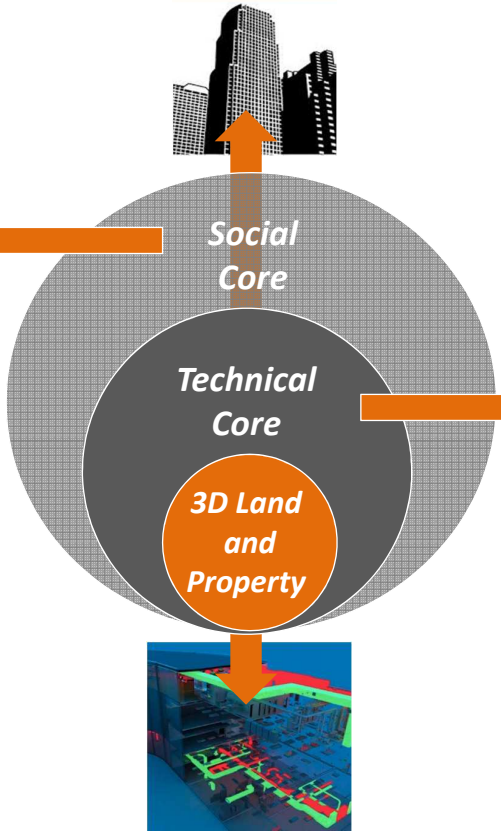
INSTITUTIONAL CHALLENGES
- Regulatory
- Social
- Cultural



TECHNICAL CHALLENGES
- Data source
- Data model
- Data visualisation
- BIM

Project outcomes

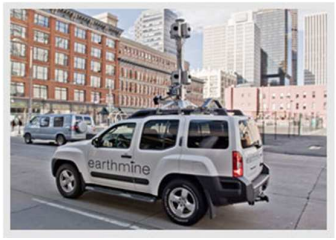
STRATEGY DEVELOPMENT
- Cultural change
- Collaboration
- Adoption
- Implementation

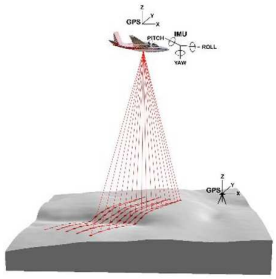


TECHNICAL TOOLS
- Data model
- Web-based visualisation platform
- Specifications

Project outcomes

Evaluation of range-based and image-based data sourcing methods for building 3D models





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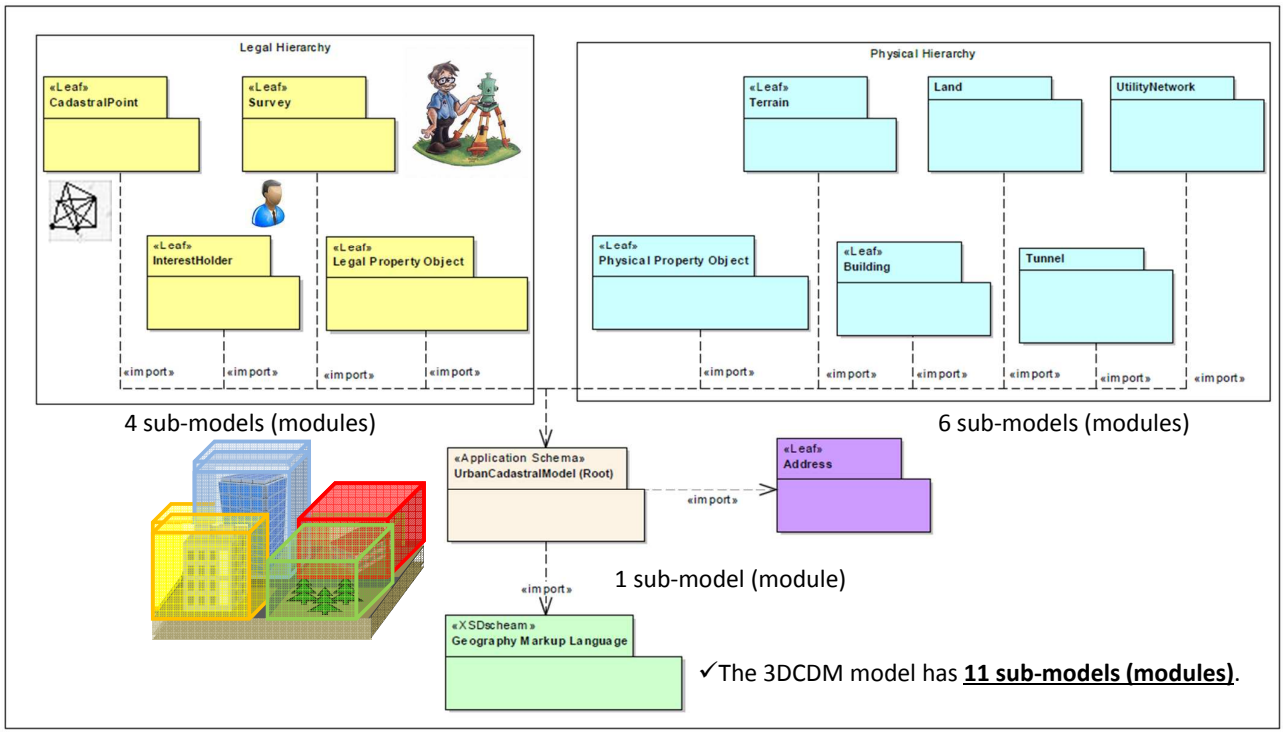
Project outcomes

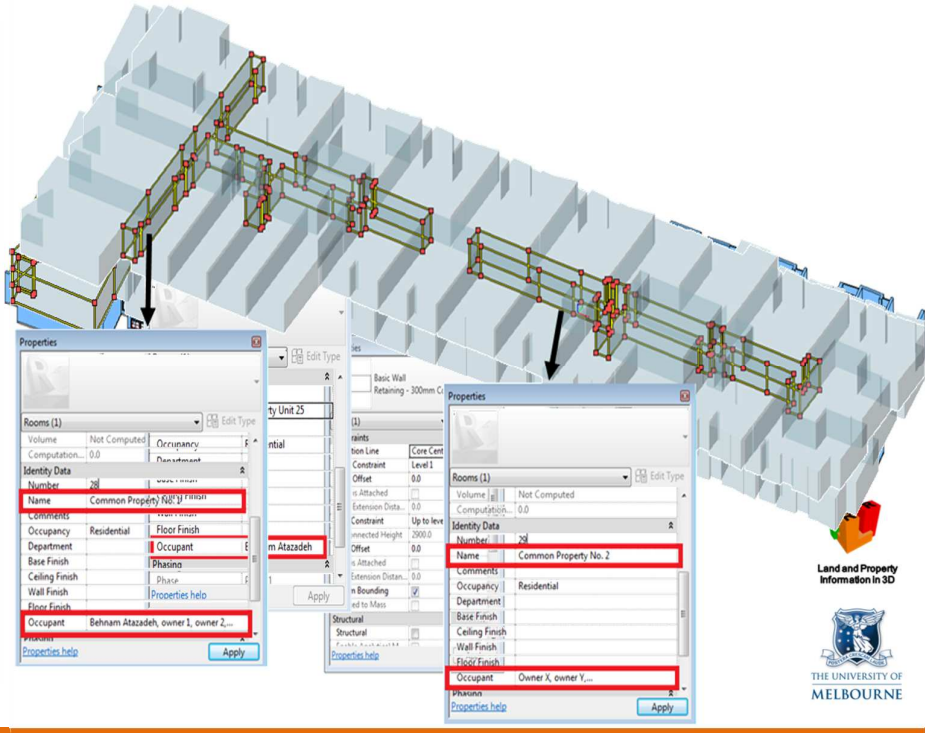
3D Cadastral Data Model (3DCDM)



Project outcomes

Development of a BIM model of a building to show potential for managing 3D land and property information (cadastral info)

- Physical Information
  - interior walls
  - exterior walls
  - sliding doors
  - single-flush doors
  - awning windows
  - fixed windows
  - stairs
  - slabs
- Ownership Information
  - ownership of property units
  - common properties



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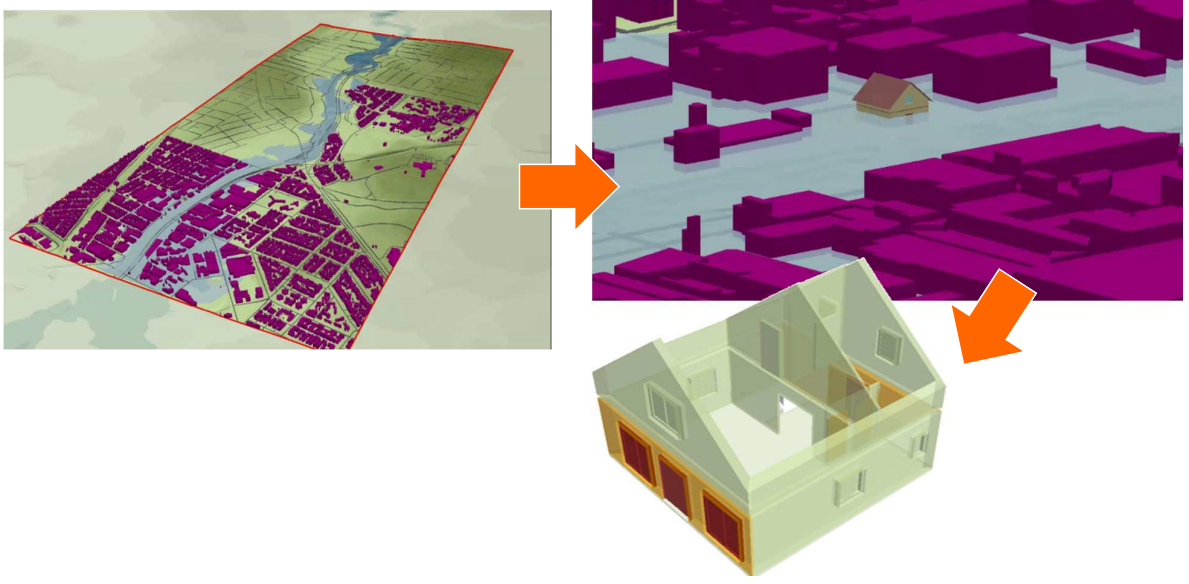
Project outcomes

3D approach to flood modelling for planning purposes in urban areas



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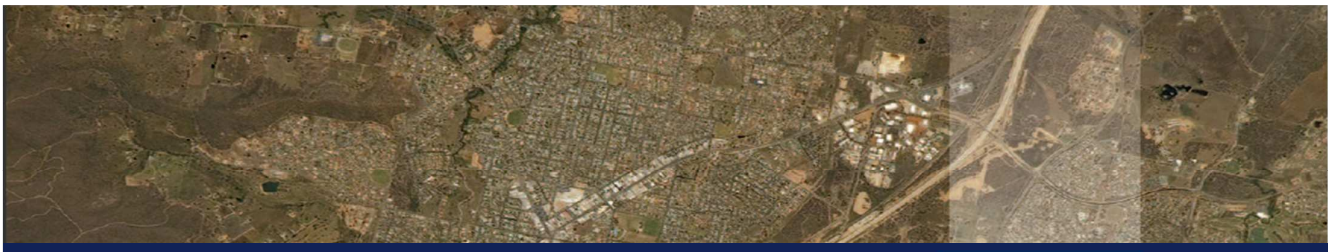

Some elements of the research in more detail

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Visualisation challenges and prototype

Institutional challenges

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Visualisation challenges and prototype

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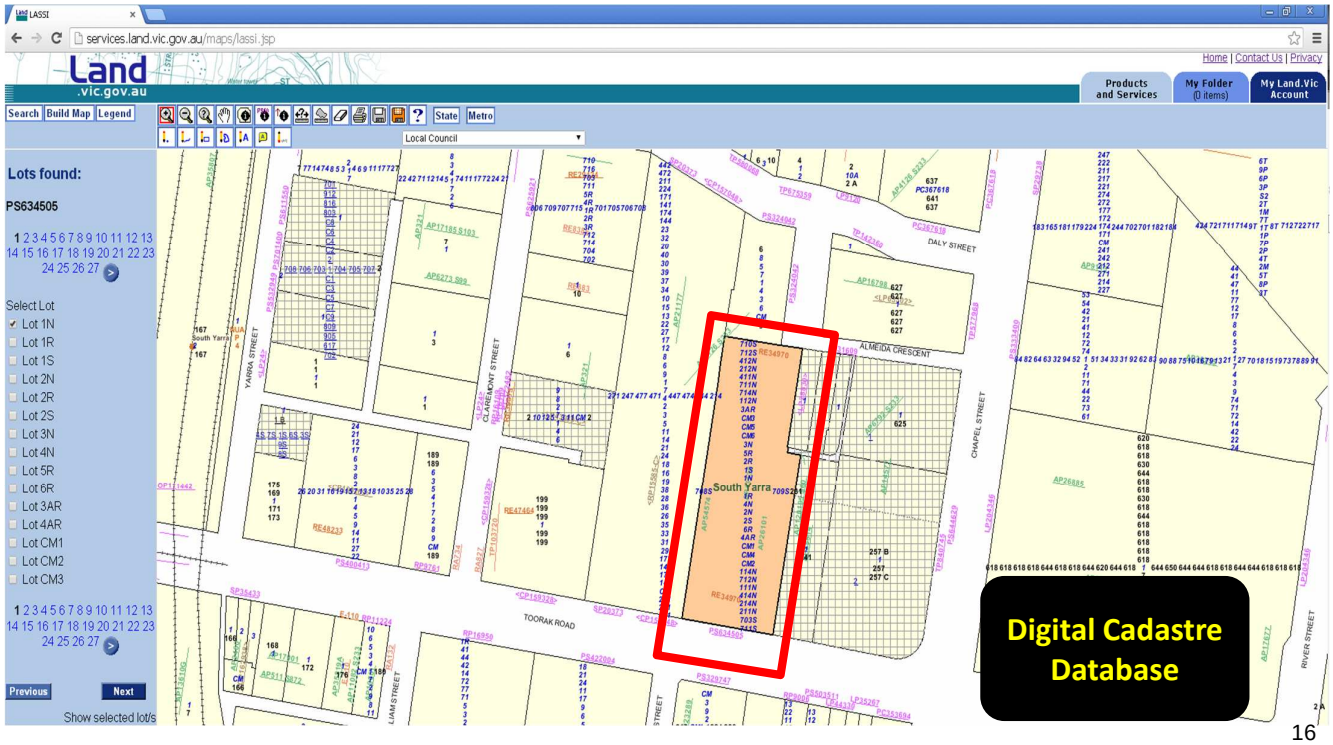
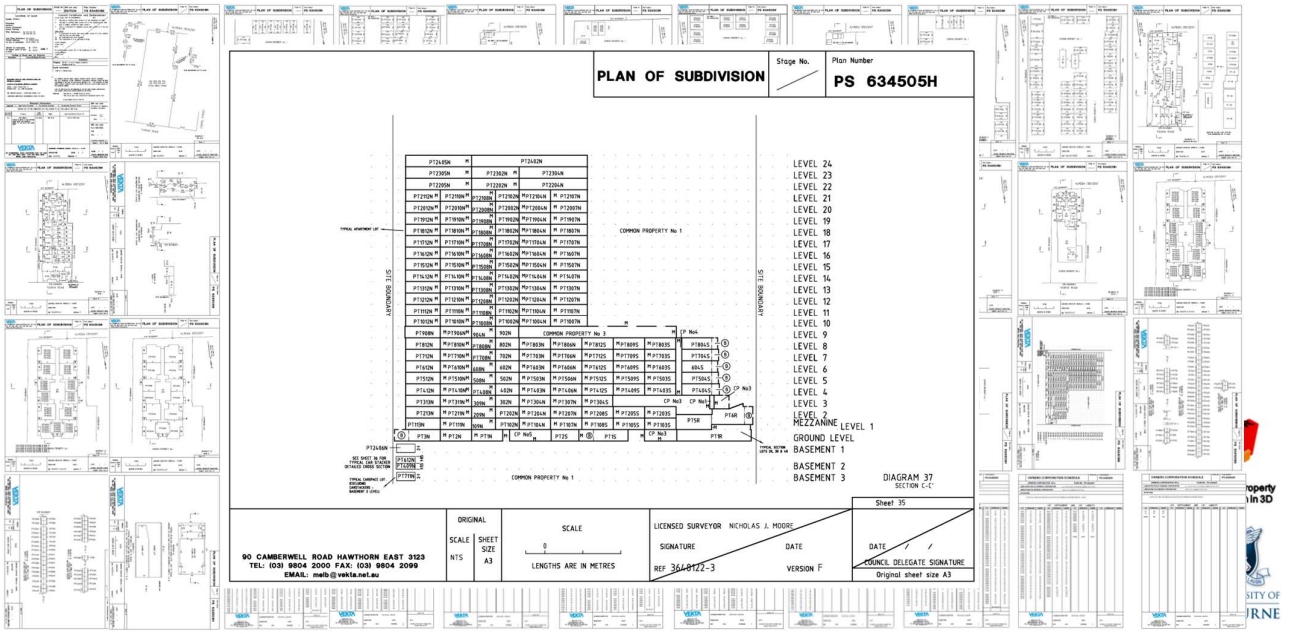
Cadastre: Current Practice in Victoria



Visualisation challenges and prototype

Cadastre: Current Practice in Victoria

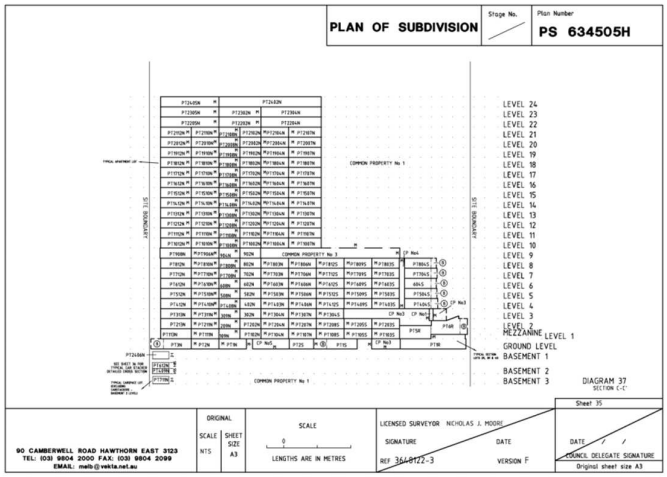
- **56 Sheets to Represent Ownership Boundaries, Entitlements and Liabilities**



Visualisation challenges and prototype

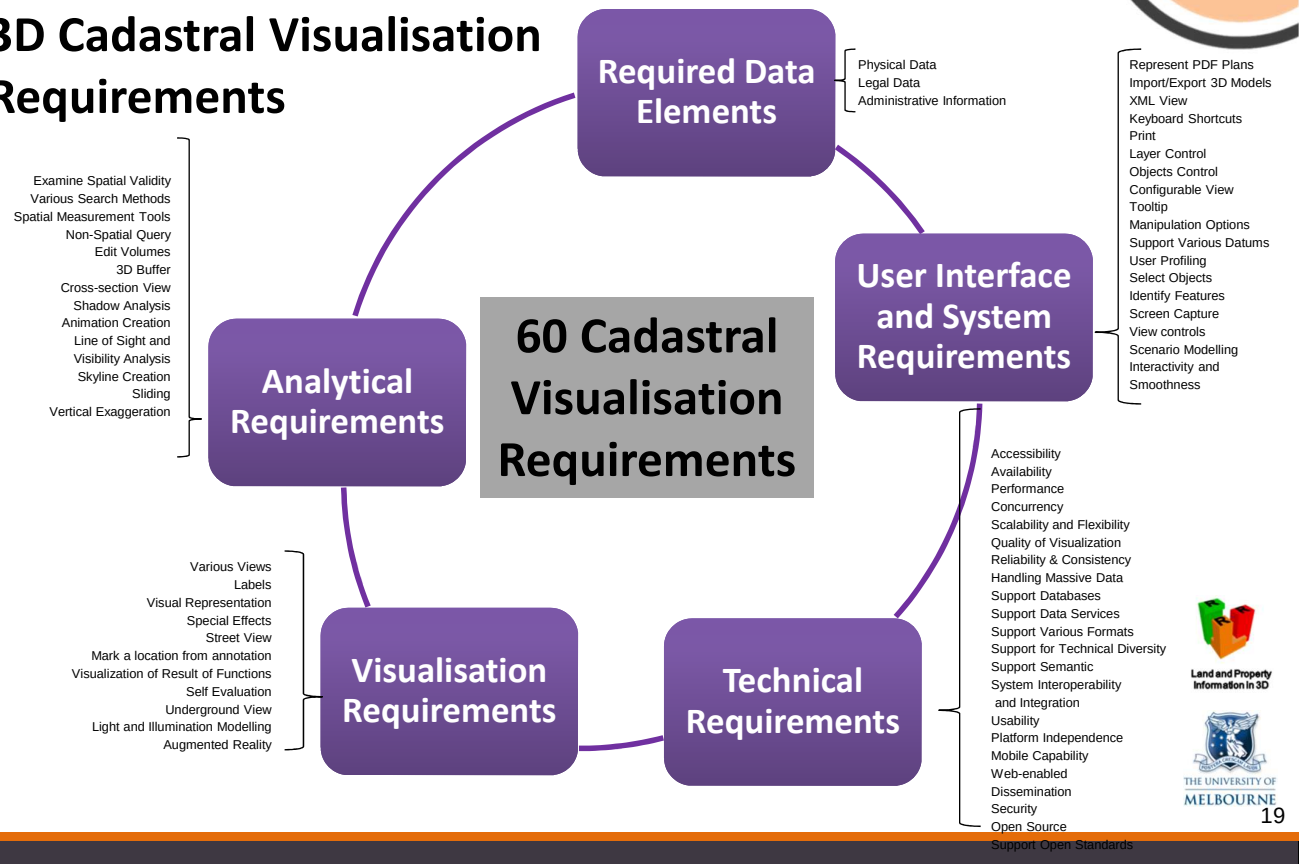
Current Challenges in Understanding Property Rights

- Difficult to understand subdivision plans
- Numerous plans and sections are required for interpretation
- Queries and analyses are not possible; and searching and measurements are not efficient
- This method of representation lacks interactivity



Visualisation challenges and prototype

3D Cadastral Visualisation Requirements



Visualisation challenges and prototype

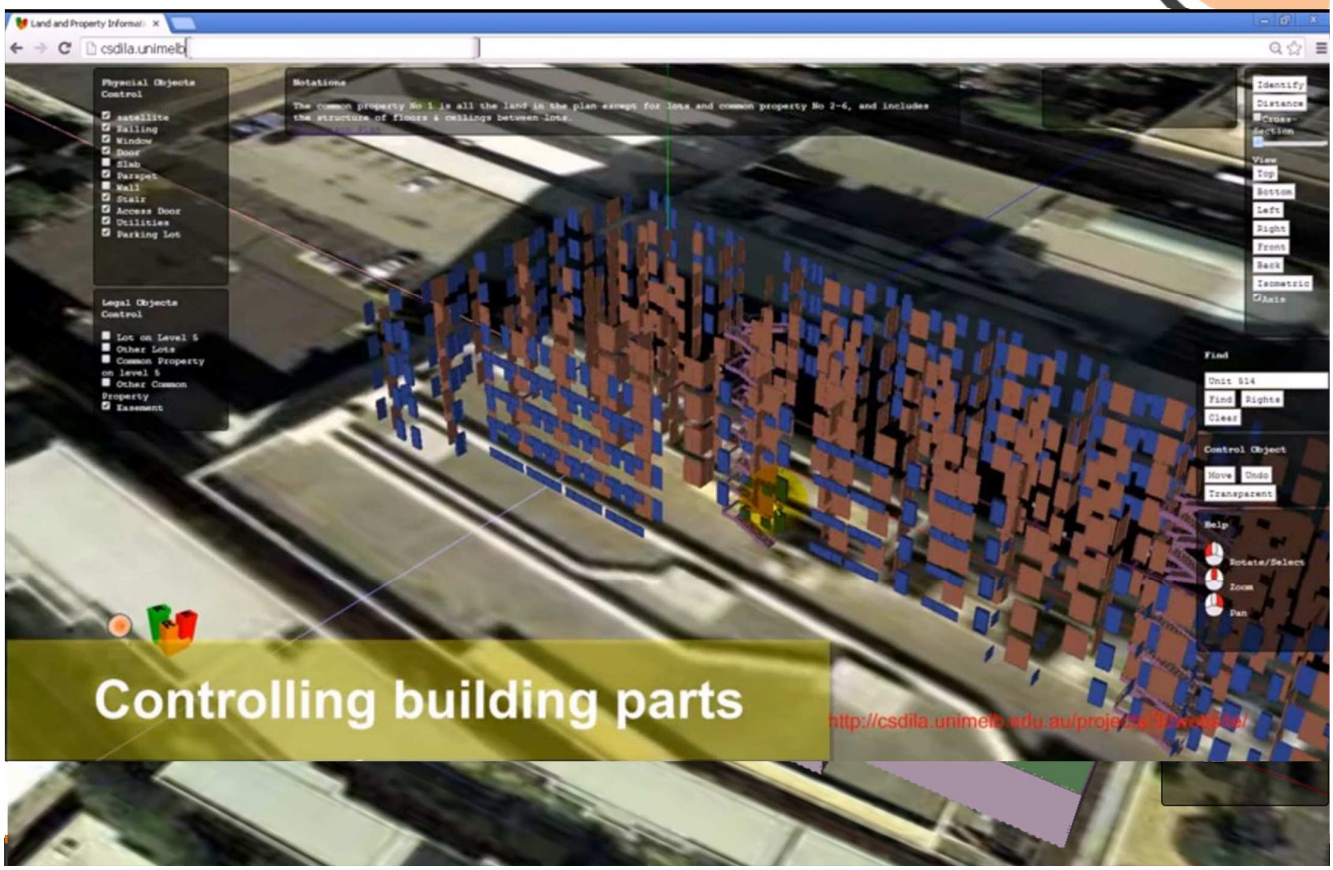
Validation of Requirements

- Questionnaire No. 1 – 3D Visualisation Specification (161 responses from 37 countries)
- Aim: Validation of identified requirements

Argentina	Brazil	Costa Rica	Denmark	Germany	Indonesia	Korea, Republic of	Mexico	New Zealand	Romania	Slovenia	Switzerland
Australia	Canada	Croatia	Ethiopia	Greece	Iran, Islamic Republic of	Latvia	Nepal	Poland	Serbia	Spain	Turkey
Austria	China	Czech Republic	France	India	Ireland	Malaysia	Netherlands	Portugal	Singapore	Sweden	Ukraine

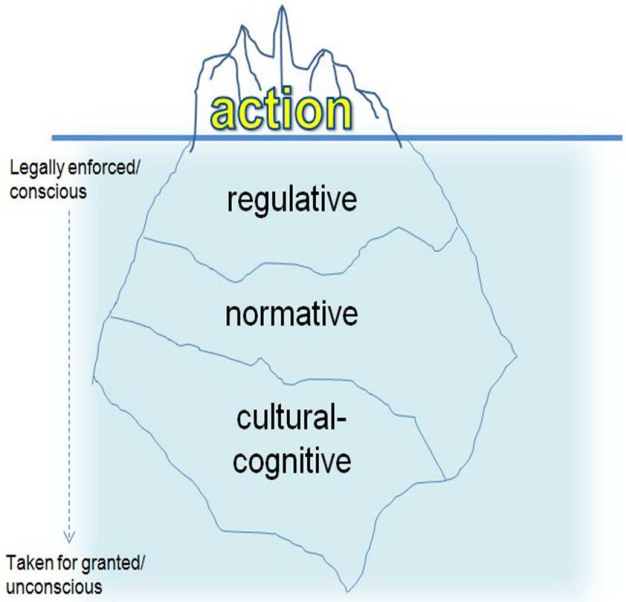
United States

Visualisation challenges and prototype



Institutional challenges

Three defining properties



1. social structures
2. these structures attain a
3. become "taken-for-

Legislation, professional standards, operating procedures, expectations, etc.

Establish "legitimacy"

and become authoritative guidelines for behaviour

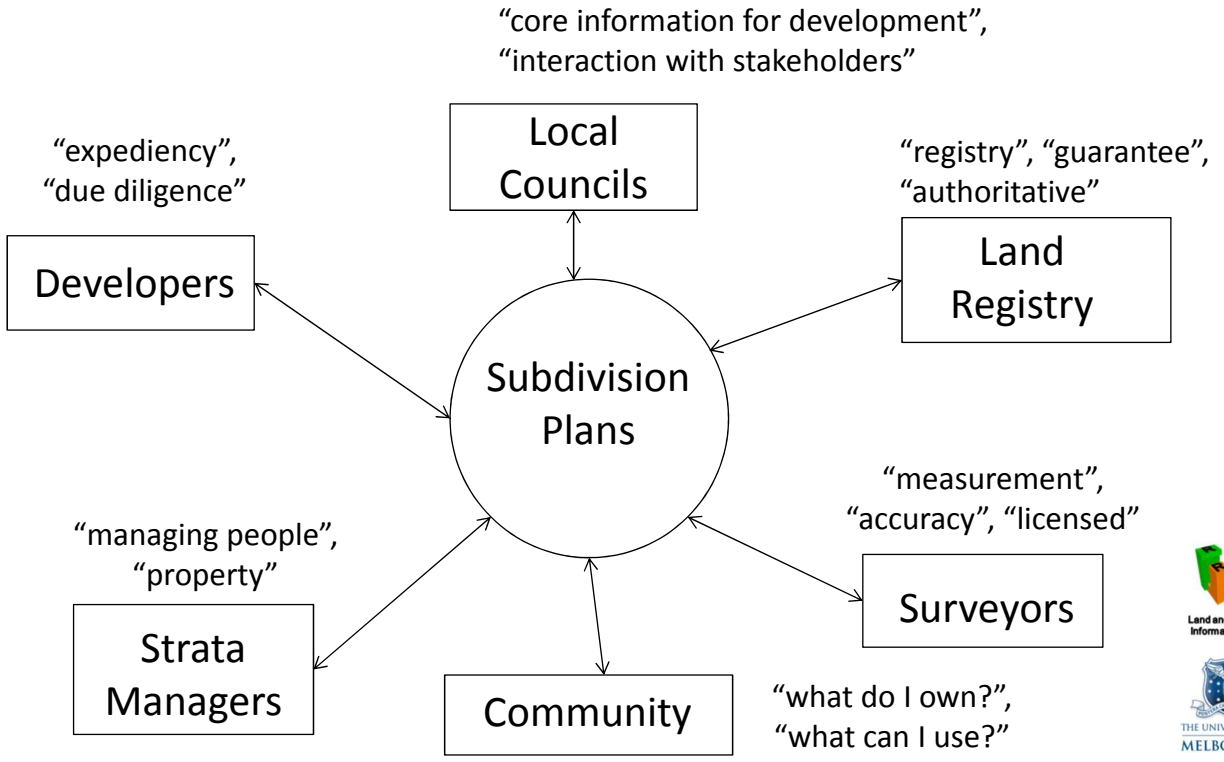
granted"

Behaviour is driven unconsciously – "invisible constraints"

Scott, 2001; 2004; 2008:

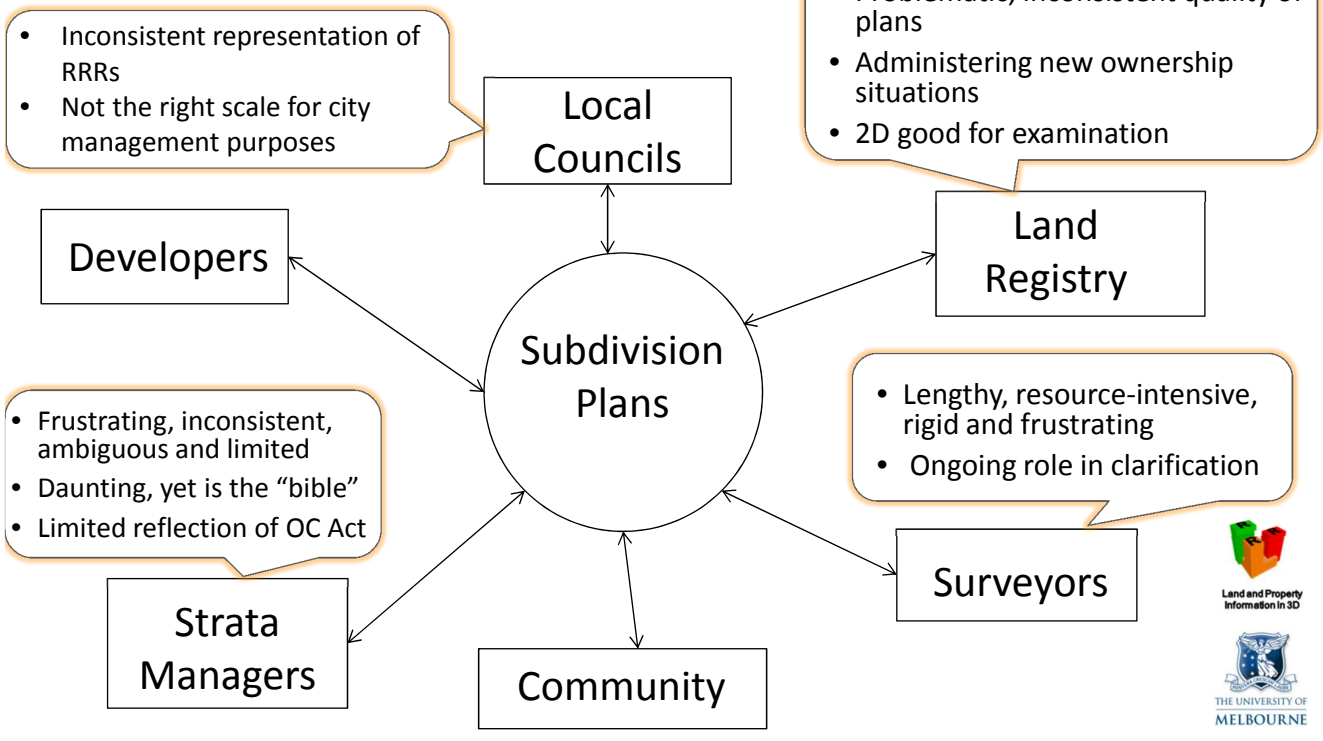
Institutional challenges

What does the Plan mean?



Institutional challenges

What does the Plan mean?

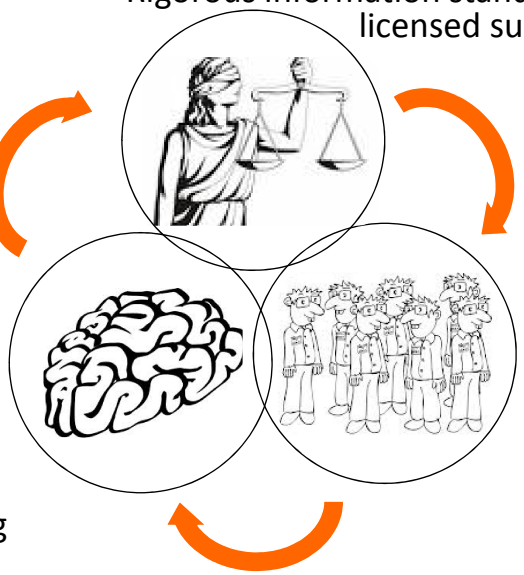


Institutional challenges

Legitimacy has been built on…

Longstanding Subdivision Act and registration process

Rigorous information standards due to licensed surveyors



2D plan is ***the*** source of information

Process works well …mostly

Dominance of surveying profession

Vertical subdivision less common

Tradition of 2D cognitive/conceptual framing for abstracting building info

Institutional challenges

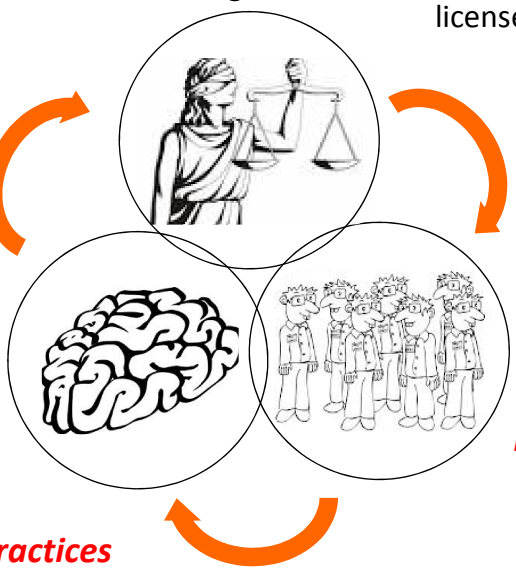
Invisible constraints on change

Perception that law MUST change first

Who owns the problem?

Longstanding Subdivision Act and registration process

Rigorous information standards due to licensed surveyors



Entrenched use of 'parcel' as basic unit

Dominance of surveying profession

Vertical subdivision less common

Tradition of 2D cognitive/conceptual framing for abstracting building info

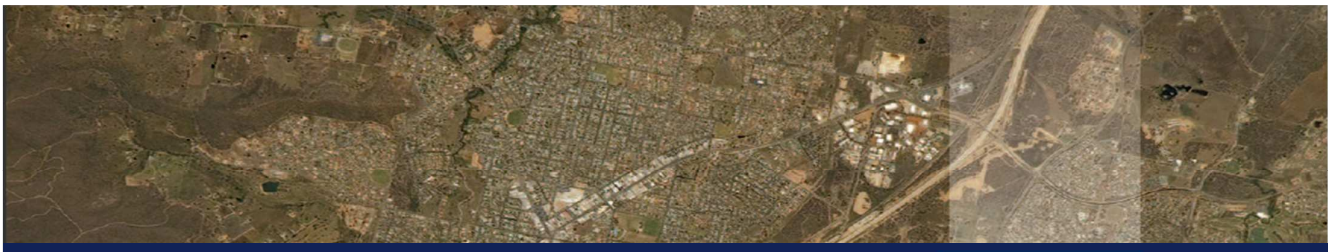
Taken-for-granted practices

Development process highly routinised

2D plan is ***the*** source of information

Process works well …mostly

Perceived difficulty of building an argument for change



Early Thoughts for Consideration as input to Roadmap

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Cadastre 2034 is ALL about institutions!

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Cadastral Reform and Innovation for Australia - A National Strategy

Cadastre 2034

Powering Land and Real Property

What is the cadastral system?

The cadastral system defines and records the location and extent of property rights, restrictions and responsibilities. It includes a geometric description

systems, and opportunities for growth; with the disruption that comes with the phasing out of one technology and the start of another, as well as industry reaction arising from doing things differently.

The final version of Cadastre 2034 will guide the evolution of jurisdictional systems and ensure a coordinated and consistent approach to future policies, legislation, standards, models and research; and provide clear direction for the sector as a whole.

The value of Cadastre 2034 is that it establishes a single point philosophy on what the community can expect and what the government has to deliver in the future.

direction for the sector as a whole.

The value of Cadastre 2034 is that it establishes a single point philosophy on what the community can expect and what the government has to deliver in the future.

Each jurisdiction will then be able to take this high level strategy and work towards achieving the identified goals from their own unique starting points. This includes New Zealand, which shares the same vision and expectations but has a different physical and administrative environment [8].

Land and Property Information in 3D

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3

Issues for consideration

Concepts developed for 'land' not necessarily appropriate for buildings

LAND

- More static entity – not much changes after registration
- Typically only development, not necessarily management
- Discrete, separate institutional arrangements
- Concept of ownership

BUILDINGS

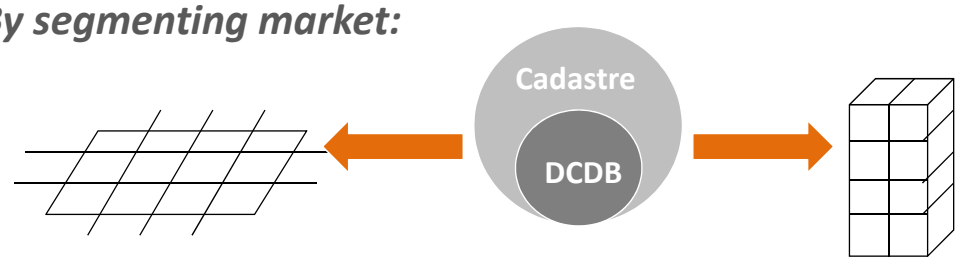
- Continually changing e.g. continuous resubdivision/ amalgamation, swapping lots, etc.
- Requires a collaborative approach to both development and management
- Requires integrated institutional arrangements
- Larger number of stakeholders per development process

Suggestion:

Segment the market: land and buildings as separate processes

Issues for consideration

By segmenting market:



LAND

- Parcel as unit of analysis
- Continue to pursue ePlan/LandXML

BUILDINGS

- Property (lot) as unit of analysis
- Invest in 3D technology appropriate for representing building information e.g. Industry Foundation Classes (data model behind BIM), gbXML (Green Building XML schema)
- Leverage other visualisation/web technologies

Suggestion:

Facilitates parallel pursuit of technological opportunities without losing current investment in ePlan

Issues for consideration

Current institutional arrangements are silo-based

- Development and management of buildings are supported by different legislation, organisations, processes, etc
- Move towards a building lifecycle approach: productivity and sustainability arguments for change

Suggestion:

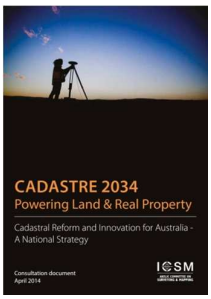
Institutional structure and organisational culture needs to change to support greater collaboration

e.g. governments legislating the use of BIM to force cultural shift

Concluding Remarks

- Increasing urban complexity
- Needs and opportunities in the context of **future cities** and **future institutional sustainability**
- 3D info to support management of urban environment (e.g. leveraging BIM)
- Future users vs current users, including wider array of stakeholders
- Making **sense of smart data** in cities eg. smart utilities, 4D data

Concluding Remarks : New connections



Collaborate. Leverage. Community-focused.