

Presented at FIG Working Week 2019,  
April 22-26, 2019 in Hanoi, Vietnam

# FIG WORKING WEEK 2019

Hanoi, Vietnam 22 - 26 April 2019

Geospatial information for a smarter life and environmental resilience



International  
Federation of  
Surveyors



Vietnam Association  
of Geodesy Cartography  
and Remote Sensing (VAGRS)

## Results of the **Public Usability Testing** of a **Web-Based 3D Cadastral Visualization System**

14-5-2019

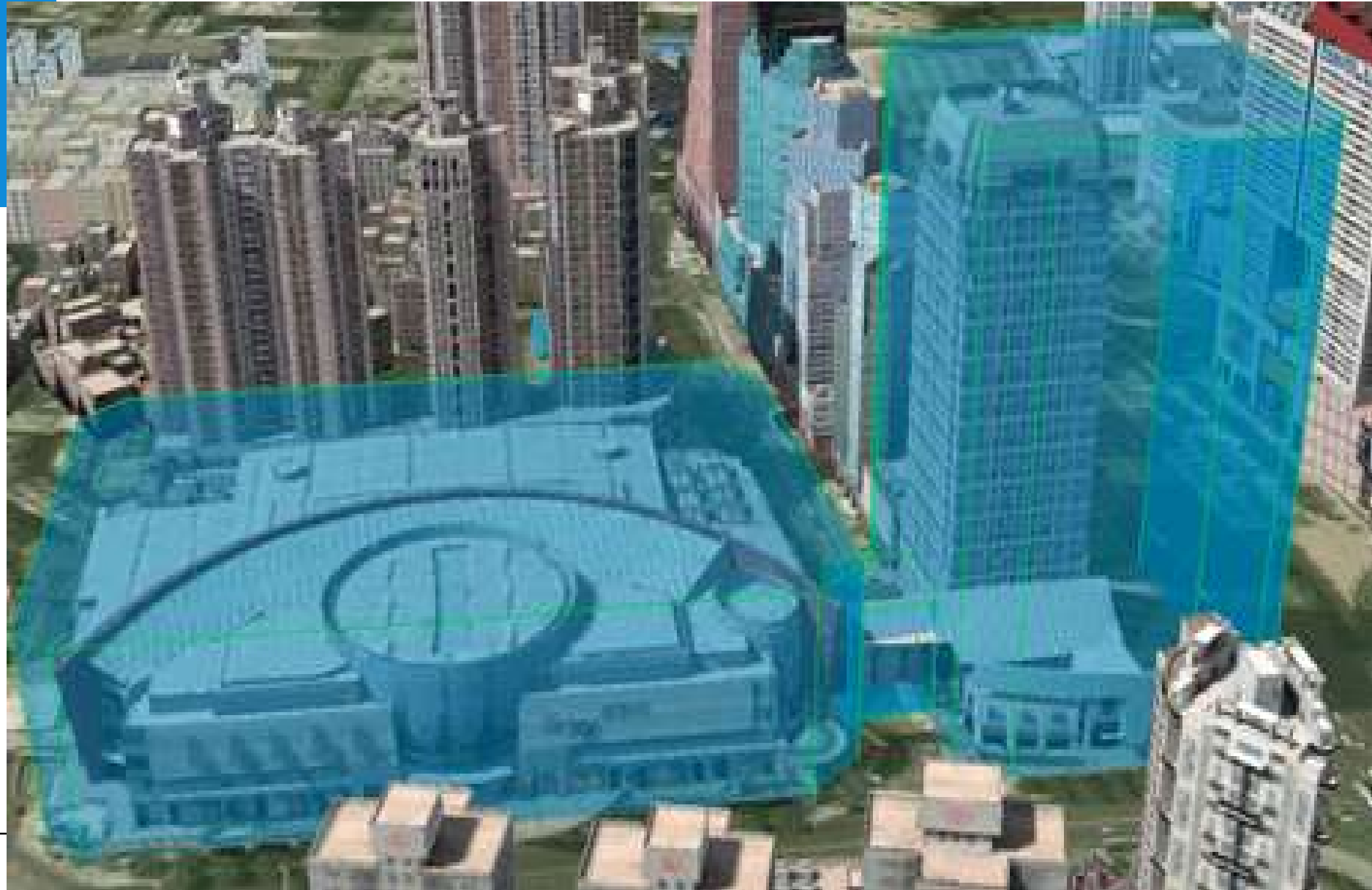
Peter van Oosterom, Marian de Vries, Barbara Cemellini, Rod Thompson

*presented by Anna Shnaidman*

TS06C: 3D Cadastre, Tuesday, 25 April 2019

FIG Working Week, 22-26 April 2019, Hanoi Vietnam

# Introduction



# The Queensland Cadastre

- Parcels with 3D geometry - since **1997**
- Cadastral **map** - 3D parcels **footprints**
- 3D survey plans are stored as **paper drawings/PDF** files

## ❖ Issues:

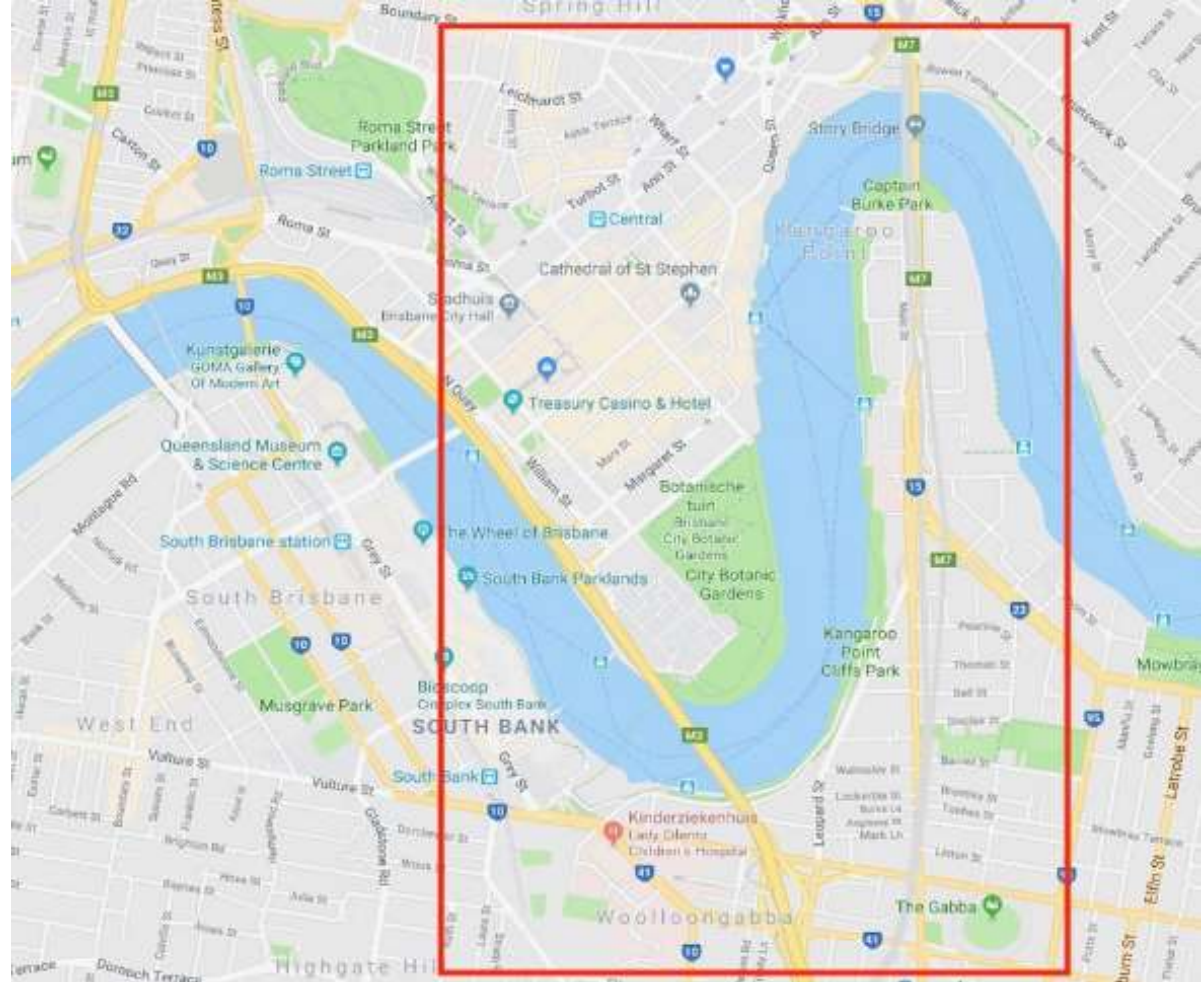
- The 3D parcels **cannot** be **interactively visualized**
- **No spatial validity** checks possible
- 3D information is **not stored together** with 2D cadastral map



# Area of Interest

- Brisbane City Center

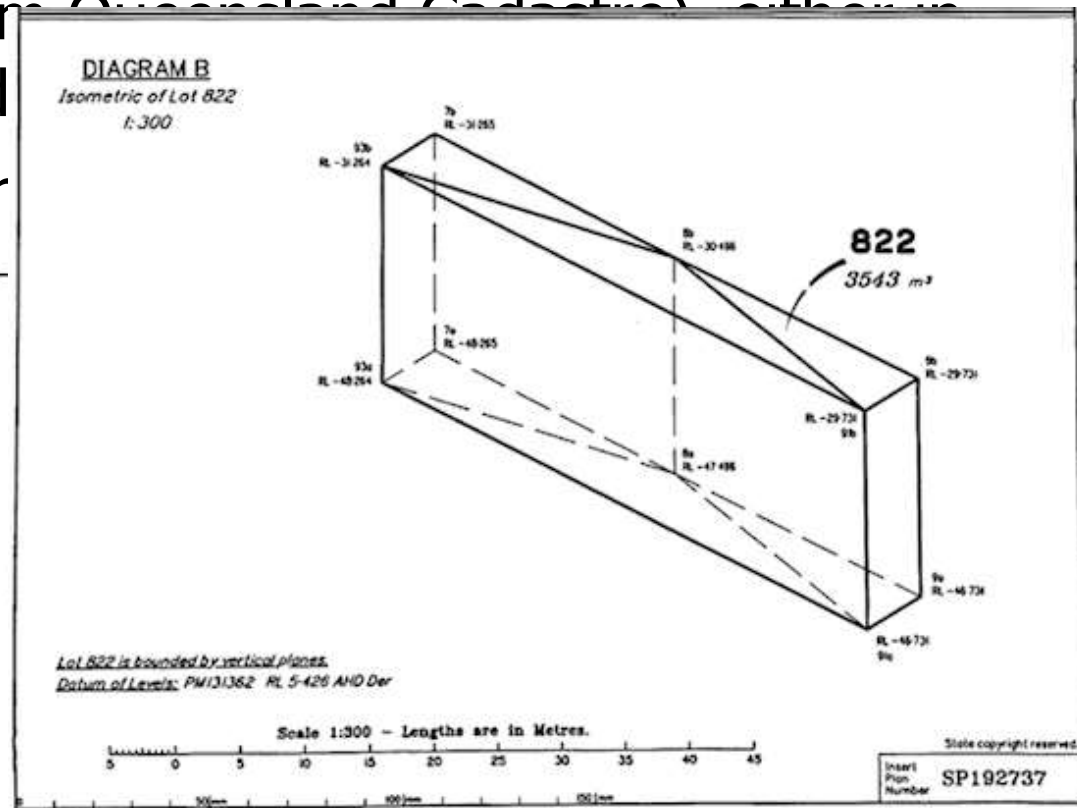
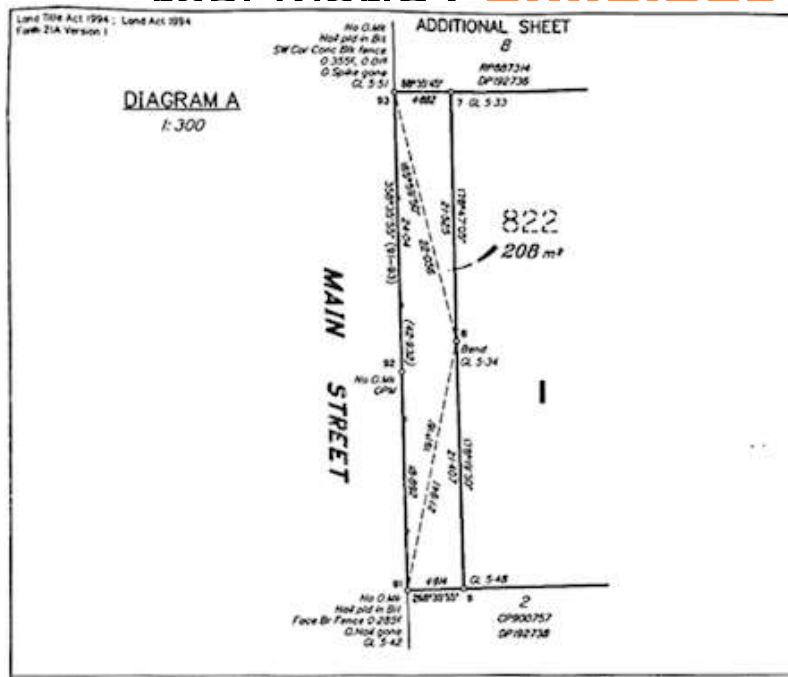
*(Story Bridge and Kangaroo Point area)*



- The **Queensland Digital Cadastral Database (DCDB)** has a long tradition and the biggest amount of data available so far

# Data

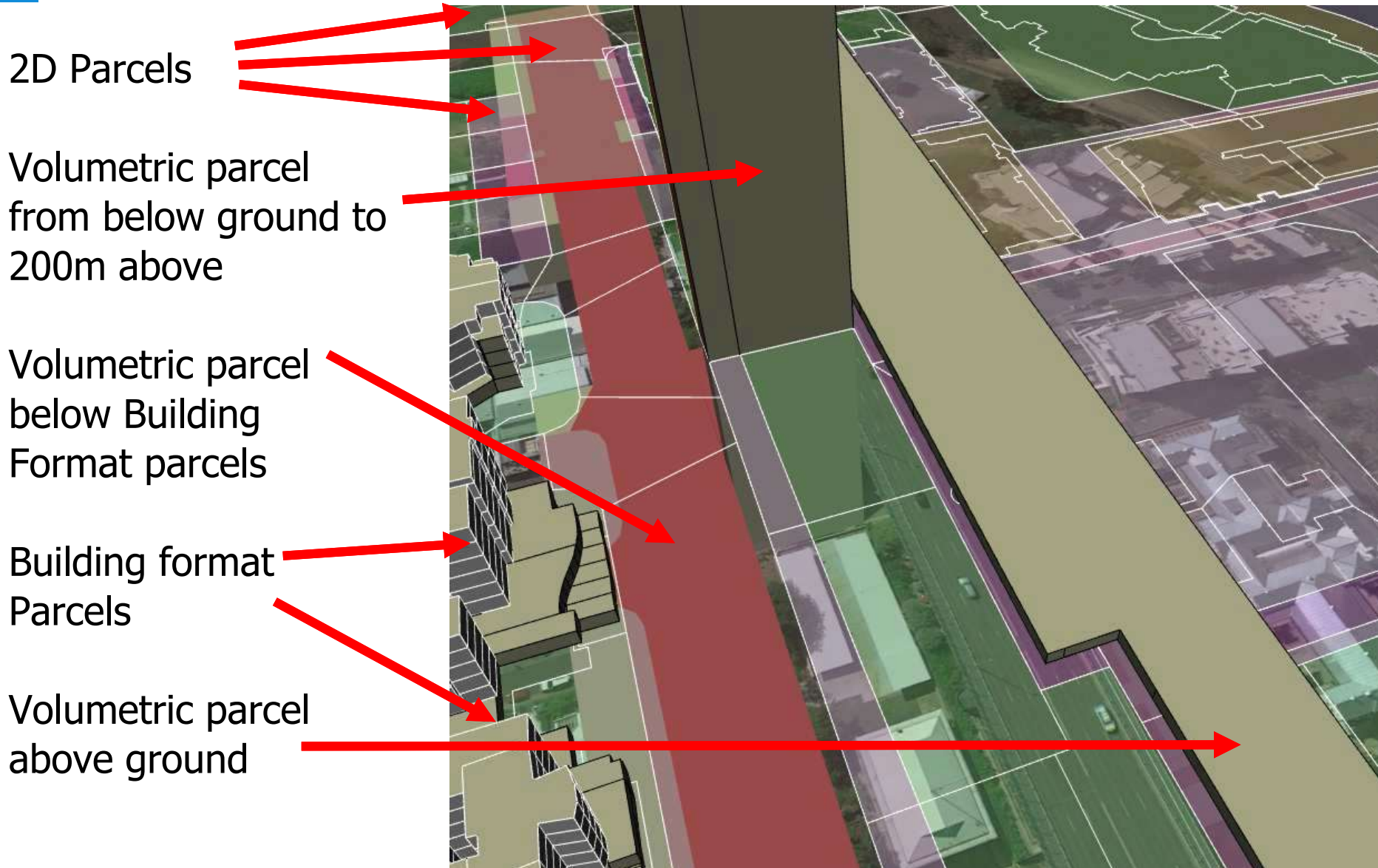
- 2D cadastral parcels (from Queensland Cadastre)
- 3D survey plans (from Queensland Cadastre), either in *'building format'* and
- The **volumes** represent *'real world buildings'*



*parties info was changed*

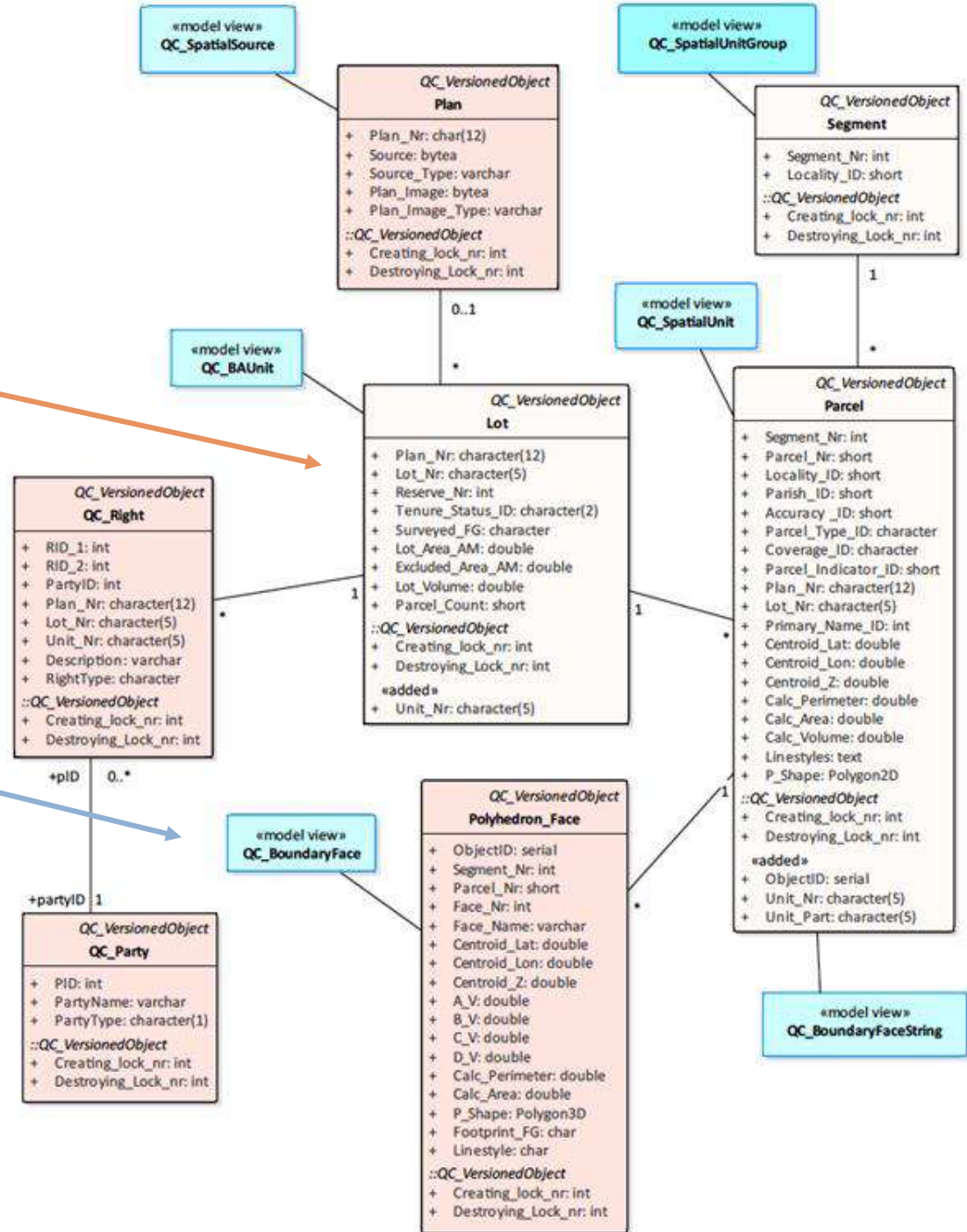
# Data Encoding Results

**3D parcels** form **building format** or **volumetric survey** plans

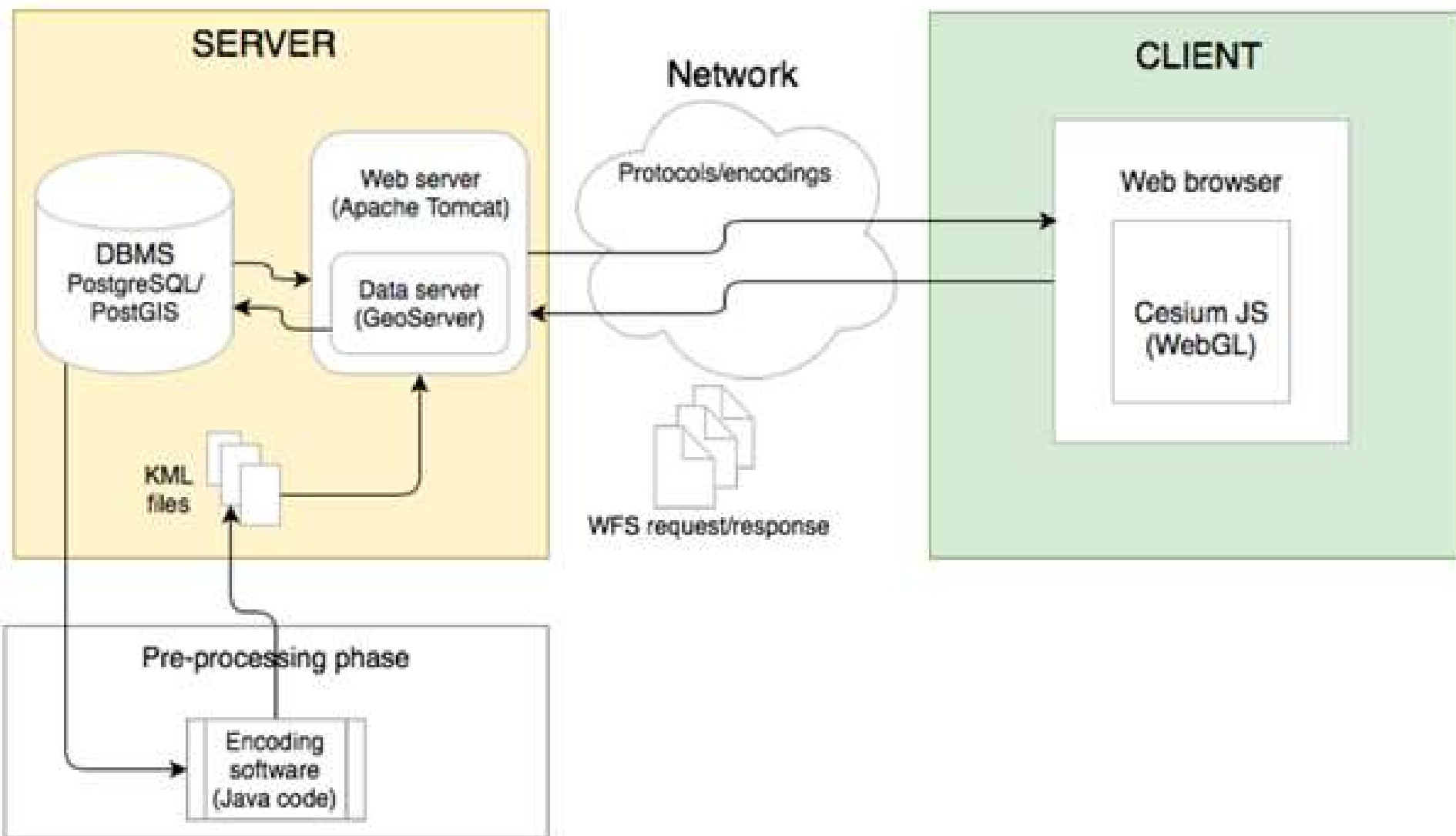


# Data model

- **light orange** = existing tables
- **red** = new
- **blue** = LADM 'views'



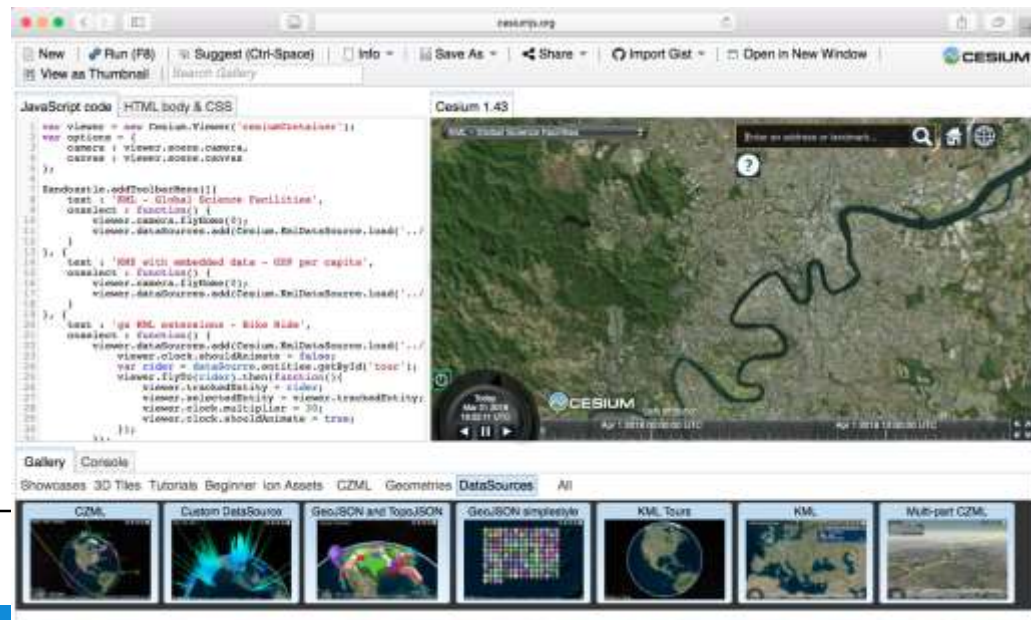
# Prototype - Current Version Schema





# Suitable Platform Selection

- **Cesium JS - WebGL** based **open-source** JavaScript library to create **3D geo applications**
- Cesium has **active forum** to help developers
- *Sandcastle*: live code editor and example gallery

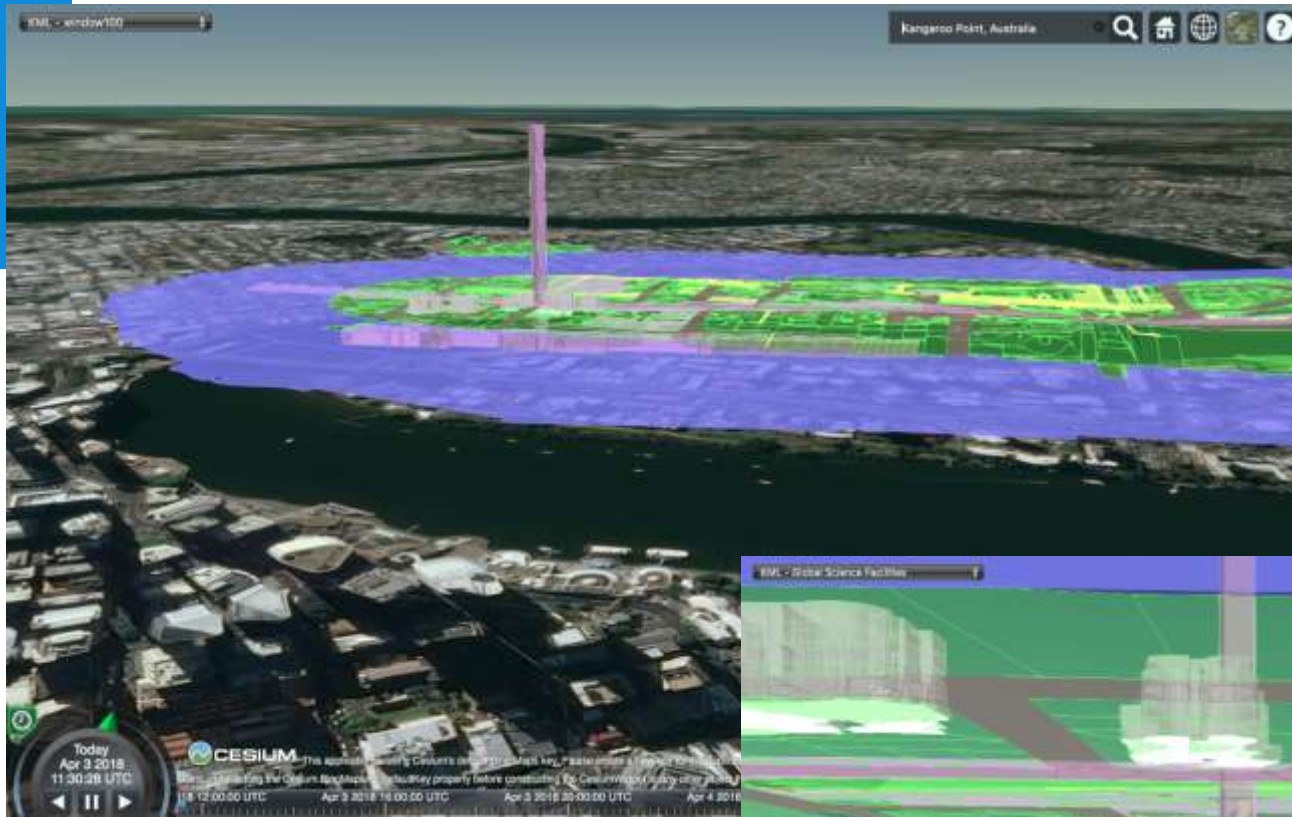


# Cesium Feature Selection *(highlight)*



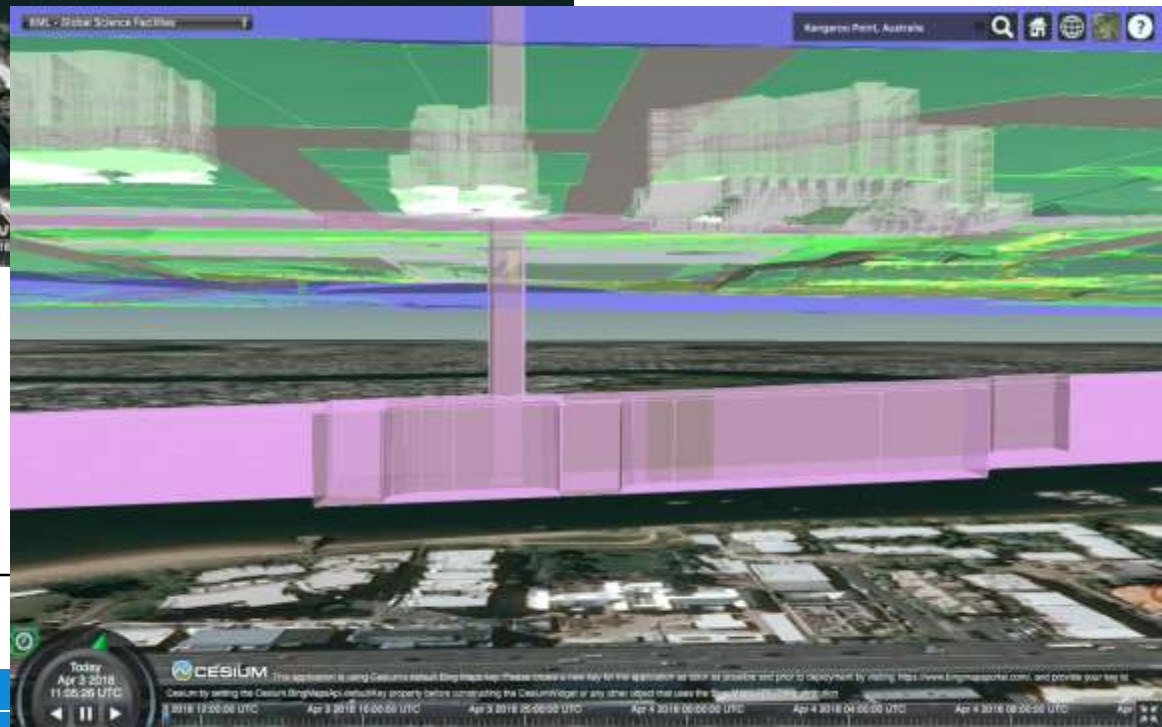
- User can click on feature and get information about it *(currently the feature does **not** get highlighted)*
- **KML** support in Cesium JS is quite limited (JSON, glTF better?)

# Visualization with Interactive Elevation



Elevated  
surface

View **below**  
surface



# Usability testing

## Four main phases

1. Define **goals** and **tasks** to be performed
2. Recruiting **users**
3. Create a **questionnaire**
4. Process **results**  
and obtain **feedback**



# Usability test:

## Tasks performed by users

1. **Navigate** through the viewer, **pan**, **zoom** and **rotate** view to get familiar with the controls
2. **Change** the **visibility** of **layers**
3. **Visualize** an **underground** parcel
4. **Visualize** information about a **single** parcel, i.e. ownership information, and unit/lot/plan number, etc.
5. **Search** for a **single owner** and **visualize** all the parcels owned by that person / party

**Initial users:** 20 MSc Geomatics students and staff  
(June 2018)

# Usability test

## Questionnaire and Results

### Section #1

Please perform the following list of tasks and give us your feedback. Note: each question involves a practical task to be carried out on the prototype itself, after that a few questions need to be answered.

Description:  
Please make sure you have a working internet connection. Open the following link on your web browser to start up the prototype: <http://pakhuis.tudelft.nl:8080/edu/Cesium/1.43/Apps/3dcad/>. Before testing more advanced functionalities, it is crucial to get familiar with the basic navigation tools and view controls.  
Note: it is suggested to use a mouse.

✓ Task: Navigate to the Brisbane Airport and check where it is located with respect to the river. You can do this in two ways, if you know where the airport is approximately located just pan and zoom to the location, otherwise click on the magnifier icon and type "Brisbane Airport, Australia". \*

- South
- South-East
- Brisbane does not have an airport
- North ✓

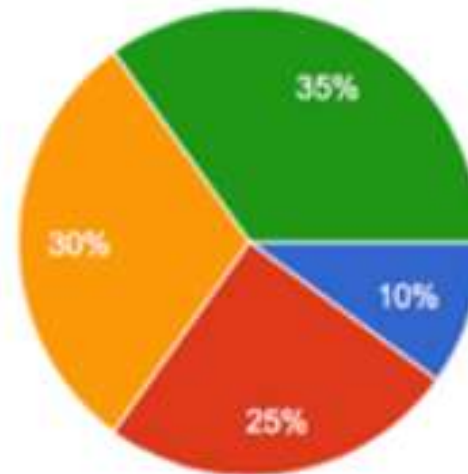
Opinion: Can you easily navigate through the viewer? Are the controls intuitive?

Yes, the controls are very similar to other CAD programs, making it intuitive to work with. However, it is difficult/impossible to understand where north is without a compass to indicate.

Please, give a grade on a scale from 1 to 10 to the usability of this functionality. \*

1 2 3 4 5 6 7 8 9 10

Extremely low usability           Extremely high usability



- Yes, I am very familiar with Cesium JS.
- I am a little familiar with Cesium JS, I have used it a few times.
- I have heard about Cesium JS but have never used it before.
- No, I do not know Cesium JS at all.

Average  
3.7 / 5 points

Median  
4 / 5 points

Range  
2 - 5 points

Total points distribution



# Implemented Improvements

1. 2D and 3D parcels **elevated together** (*not just 3D parcels*)
2. **improved** parcel **search** by **owner** (*substring allowed*)
3. multiple rights/owners per parcel (*show small table*)
4. more **direct feedback** (*e.g. "Loading ..."*)
5. back to **initial position** (*hit Home-button when lost*)
6. **improved** (slow) **responses** (*some bottlenecks resolved*)

The screenshot displays a 3D parcel visualization interface. The main view shows a 3D model of a parcel (25157\_41) in red and yellow, overlaid on a 2D map. A search bar at the top allows searching for parcels owned by a specific name. A loading state is indicated by a red circle around the text "Loading..." in the bottom left corner. A data table in the bottom right corner provides details about the parcel and its segments.

Search for parcels owned by ...

Same parcels, elevation raised 200m  Switch 2D parcels on/off

25157\_41

Lot 835 Plan SP192733  
CLEM JONES TUNNEL (CLEM7)  
seg/par = 25157/41  
Parcel type: VL  
Create = 2015-11-30 16:07:04.0 (2495105)

Get administrative info

objectid	segment_nr	parcel_nr	partyname
4678965	25157	41	SP192733835 Senior, Mr & Mrs
4678988	25157	41	Clem 7
4679034	25157	41	SP192733835 Senior, Mr & Mrs
4679035	25157	41	SP192733835 Senior, Mr & Mrs

Loading...

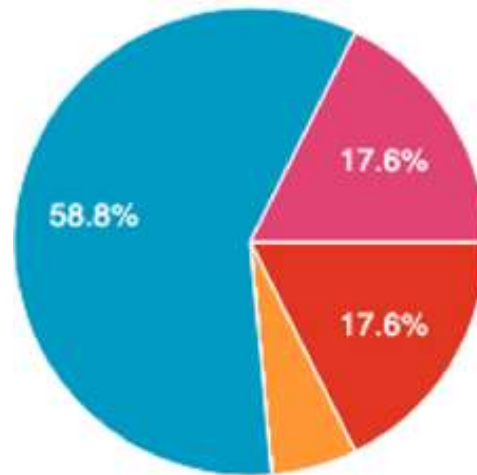
CESIUM Test data provided by Queensland Cadastre - disclaimer, ownership information is randomly generated, geometry is not up-to-date Data attribution

Feb 3 2019 12:00:00 UTC Feb 3 2019 18:00:00 UTC Feb 4 2019 00:00:00 UTC Feb 4 2019 06:00:00 UTC

# Second and Public Usability Test

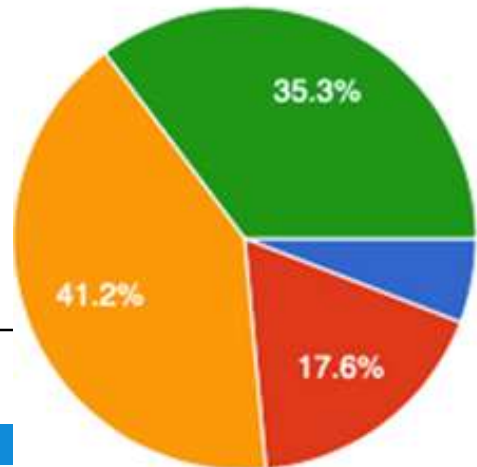
- from 8 November to 22 December 2018
- **17** members of the **FIG Working Group 3D Cadastres**

## ■ **Background** of test persons



- Spatial professionals related to cadastral applications (land surveyors)
- ICT professionals related to cadastral applications
- Researchers in the field of 2D and 3D
- Students of Geomatics/Geodesy/GIS

## ■ **Familiar** with Cesium JS



- Yes, I am very familiar with Cesium JS.
- I am a little familiar with Cesium JS, I have used it a few times.
- I have heard about Cesium JS but I have never used it before.
- No, I do not know Cesium JS at all.



# Results second Usability test

## user Appreciation and score

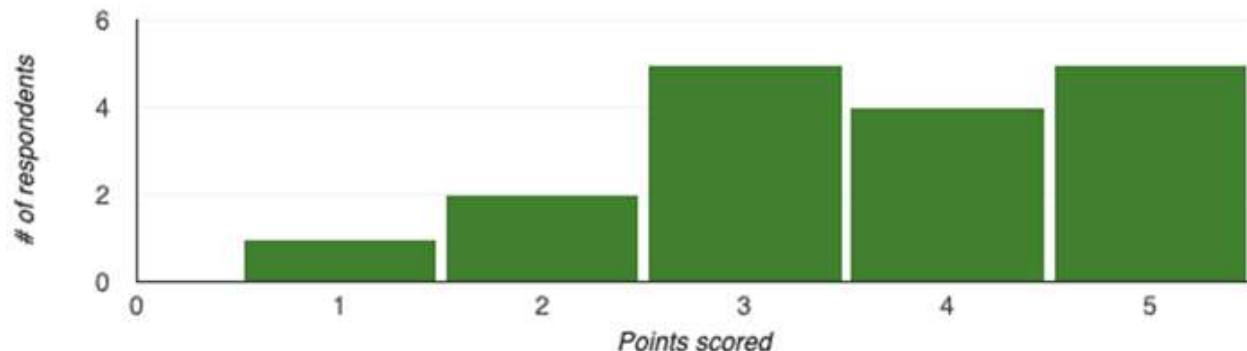
- Section #1, Navigate (pan, zoom, rotate): 7.4 (was 7.7)
  - Section #2, Switch layers on/off: 7.9 (was 7.2)
  - Section #3, Visualize underground parcels: 6.9 (was 6.2)
  - Section #4, Get parcel information: 5.6 (was 7.5)
  - Section #5, Find parcels owned by person: 8.2 (was 6.2)
- 
- On **average** users achieved **correctly 3.6** (was 3.7) out of **5** tasks

Average  
3.59 / 5 points

Median  
4 / 5 points

Range  
1 - 5 points

Total points distribution



# Evaluation by test persons

- **Negative:** *slow, confusing icons, can lose orientation, not clear why 3D parcels have different color type (volumetric and building parcels)*
- **Positive:** *search by owner, select parcel & get info, vertical shift to see underground, switch on/off layers*
- **Suggestions for improvement**
  1. *Cross-section view, a tool that cuts a slice*
  2. *Object search on either spatial and non-spatial criteria*
  3. *3D measurement tool*

# Conclusions

- ❖ Developed **3D Cadasters prototype**
  - ***LADM based***
- ❖ Emphasis on 3D web-visualization
- ❖ Comparing first and second usability test
  - ***some modest progress***
  - ***improved average appreciation 7.0 → 7.2***
- ❖ Project is very much a “***work in progress***”
- ❖ Future work
  - ***Implement more functionalities***
  - ***Improve system architecture***

# The 8th Land Administration Domain Model Workshop (LADM2019)

1-3 October 2019 Kuala Lumpur, Malaysia



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## Scope

The focus of LADM2019 workshop will be on preparing input for second Edition of the Land Administration Domain Model (first Edition published as ISO 19152:2012). It is now time to provide proposals for the new LADM parts. Based on current experiences and future expectations, the need and content of possible extensions will be addressed; eg. further modelling of LADM's rights, restrictions and responsibilities; a valuation information package, a spatial planning information package, Marine Cadastre, more explicit relations with Building Information Modelling, further modelling of LADM's survey and spatial representation and 3D/4D Cadastre. In addition, more and more attention will be paid to the Operational Standards in Land Administration. This includes addressing the technical models for LADM: INTERLIS, RDF, CityGML, IndoorGML, LandInfra, InfraGML, LandXML, and BIM/IFC. Finally, also the aspects beyond Information models will be discussed: Organization, Best practices, Legal/financial aspects, OpenCadastre approach, Crowd sourcing, Workflow modelling, Blockchain and ledger technologies.

## Submission and selection

All submissions (extended abstracts of 500-1000 words) will be peer reviewed and all accepted contributions are expected to submit a full paper, which will be included in both the on-line and printed proceedings (available at the workshop), published by the FIG with ISBN/ISSN reference. All papers must be submitted via the EasyChair online system before 1 May 2019.

## Organization

LADM2019 is organized by FIG, OGC en ISO TC211. LADM2019 is a joint event with UDMS's 4th International Conference on Smart Data and Smart Cities (SDSC2019) and Geomatics Geospatial Technology (GGT2019) as part of Geospatial Kuala Lumpur 2019.



### More information

**Website:** <http://isoladm.org/LADM2019Workshop>

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Smart Surveyors for Land and Water Management

