

#### UNIVERSITAS GADJAH MADA



#### **3D MODELLING, VALIDATION AND VISUALIZATION OF 3D PARCELS IN FIRST REGISTRATION FOR 3D CADASTRE - INDONESIA CASE**

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Keywords: 3D modelling, field validation, 3D visualization, first registration





7<sup>th</sup> International FIG Workshop on 3D Cadastres 11-13 October 2021, New York, USA

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- Technical Framework: First registration for 2D & 3D parcels
- Pilot Study at MRT Objects: 3D Reconstruction, Field Validation, Data Integration/Visualization
- Technical Issues & Guidelines
- Discussion

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# 3D Cadastre : Legal Framework

- Initial legal framework (Law 20/2011 jo 16/1985)→ 3D registration for Appartment Units but No 3D respresentations
- Omnibus bill ("Jobs Creation Law" No. 11/2020) is official.
  - covers many clusters, including business licensing, investment ecosystem, workforce, forestry, environment, taxation and land administration.
  - A new legal framework that support reforms on land banks, rights to manage, strata titles and land registration for 3D parcels below and above ground (Article 146).
- Government Regulation Number 18/2021 on Rights to Manage, Land Rights, Strata Title and Land Registration
  - regulating 3D cadastral objects, types of rights (including their required permits and approval), parties and administrative arrangements (Article 74 to 83)



### First Registration for 2D & 3D Parcels: Technical Framework

✓ 2D parcels registration : ~ 80 million/126 million land parcels registered



- 1. Boundary Marking
- 2. Contradictory Boundary Delimitation
- 3. Boundary Survey & Mapping (Geopackage/CAD Points)

4. CAD for LIS (Geo- KKP): Parcel Plotting & Spatial Cleaning5. Linking to Legal & Administrative Data



6. Map & Register Publication (cadastral DB as geometries)

✓ 3D parcels registration : will apply a similar workflow to 2D registration!

# The Pilot Study

The Surveyor (Universitas Gadjah Mada/UGM)

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The Government Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (MoASP/BPN)

AN PERTANAHAN NASI

A pilot study July to August 2020 to implement 3D Cadastre in Indonesia (Atunggal et al. 2020)



The user (PT Mass Rapid Transit Jakarta/MRT)

Two newly built Mass Rapid Transportation (MRT) terminals in Jakarta City overlaid above/below the (2D) parcel map.



#### The Pilot Study – Hotel Indonesia Terminal



## The Workflow Test



#### Data Modelling

The compilation of digital version of the As Built Drawing (ABD) plan in CAD format

3D Models of IFC 2x3 format using eveBIM



Reconstruction of 3D Geometry of walls, floor, and ceiling using Autodesk Revit 2019





## Geometry Validation (& Legal Boundary Verification)

The reconstruction of floors, walls, ceilings and room interiors using ABD plans and sections. The results of 3D models were integrated existing 2D with parcels, which were then exported and taken to the field to validate distances, areas and volumes of individual units.



#### **3D Field Validation**

Prepare the working map (2D plan or 3D cross section views of spatial units) Assess the differences between survey and computation results



Check the points and boundaries of 3D spaces to be registered



The results of the field validation should be documented into a measurement plan (Gambar Ukur/GU)



#### Validation Results

The field check were done to 35 units of rooms in the HI station and 48 units of rooms in the Blok M station. From the field check to the total of 83 units in two terminal stations, it was found that the distortion of 3D model areas and volumes in average was **no more than 2%** from the field check.

	Nomor Ruang Baru	Nama Ruang	Keterangan Ruang	Perbandingan TS - Model		Perbandingan Disto - Model		
No.				Luas (%)	Volume (%)	Luas (%)	Volume (%)	
35	n/a	WC (Female)	Agak Rumit			0,023	0,022	
36	n/a	Nursing Room	Sederhana			1,223	1,222	
37	n/a	Pray Room	Agak Rumit			1,220	1,219	
38	n/a	WC (H) Difabel	Sederhana			0,310	0,299	
39	n/a	WC (Male)	Agak Rumit			1,672	1,672	
40	n/a	Storage Barat	Agak Rumit			0,256	2,860	
41	n/a	StorageTimur	Agak Rumit			0,163	1,590	

No	Nomor	Nama Ruang	Keterangan	Perbanding	an TS - Model	Perbanding	an Disto - Model
	Baru	Nama Kuang	Reterangan	Luas (%)	Volume (%)	Luas (%)	Volume (%)
20.	1-37	Ruang Patra	Sederhana			0,124	0,165
21.	1-42	Transformer Room 1	Rumit			1,411	0,879
22.	1-43	Transformer Room II	Rumit			1,620	0,851
23.	2-13	Kantor Peron	Sederhana			0,104	0,336
24.	n/a	Commercial Area (Alfa Express)	Rumit			46,423	13,827
25.	n/a	Station Front Office 1	Rumit			0,142	1,685
26.	n/a	Station Front Office 2	Agak Rumit			0,306	0,235
27.	n/a	Nursing Room	Sederhana			0,422	0,576
28.	n/a	Kamar Mandi Disabilitas	Sederhana			0,608	0,994
29.	n/a	Male Public Toilet	Rumit			1,183	0,600
30.	n/a	Electrical Room	Sederhana			1,545	2,887
31.	n/a	Signal and Telecom Room	Sederhana			1,091	0,648
32.	n/a	Pump Room	Agak Rumit			3,349	4,083
33.	n/a	ECS Control Room	Rumit			0,097	1,050
34.	n/a	Lorong Service Corridor 1	Sederhana	0,329	0,647	0,474	0,397
35.	n/a	Lorong Passage Way 1	Agak Rumit	0,113	0,785	6,402	7,116

# *The comparison between models from field measurements and from the ABD*



#### 3D Plan of Field Validation

# The results of the field validation are documented as a measurement plan



#### **3D** Visualization



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Convert 3D models from IFC 2x3 format into CityGML 2.0 using eveBIM

Select & edit the 3D legal spaces & registration links using eveBIM via IFCSpaces Ensure the validity of the system coordinates, the geometry content and the semantic information of the converted geometry using CityGML Tools and val3dity

The results of data modelling and field validation were visualized as a tileset on the Teria Map.



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#### 3D Geometry & Legal Data Integration on The Web Map



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#### Technical Issues & Guidelines

- The Pilot has contributed to the development of Ministry Regulation No. 16/2021 on Implementing Rules for Land Registration (3<sup>rd</sup> Revision) which also includes 3D cadastral registration and revised Strata Title registration.
- New Identification Number standard were changed from 13 digits to 15 digits to include 3D unique number.
- First registration for 3D parcels under the new legal framework is operational with IFC/BIM format but the data management and integration with existing 2D cadastral databases are still underdeveloped.
  - Full integration of 2D and 3d Tiles
  - Separated 2D & 3D databases with 3D visualization streaming using 3D tiles from IFC/BIM
  - Separated 2D & 3D databases with 3D visualization streaming using 3D tiles from City models (as the Pilot study did)

#### **Concluding Remarks**

- Legal and Institutional Frameworks for a 3D parcel registration are ready
- Technical Framework & Workflow for First 3D Right Registration has been tested, but compliance to the other 2 Rs - 3D restrictions and responsibilities are still just on papers and not has been tested in 3D representations
- A comparison of data sharing and visualization performances between 3D tiles from IFC format vs 3D tiles from CityGML needs to be explored.



# Thank you

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