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OUTLINE

01. **Overview**

02. **Research Methods**

03. **Results and Discussion**

04. **Conclusion**

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01. OVERVIEW

Why is 3D Cadastre Needed?

The Limited Space & Land Use

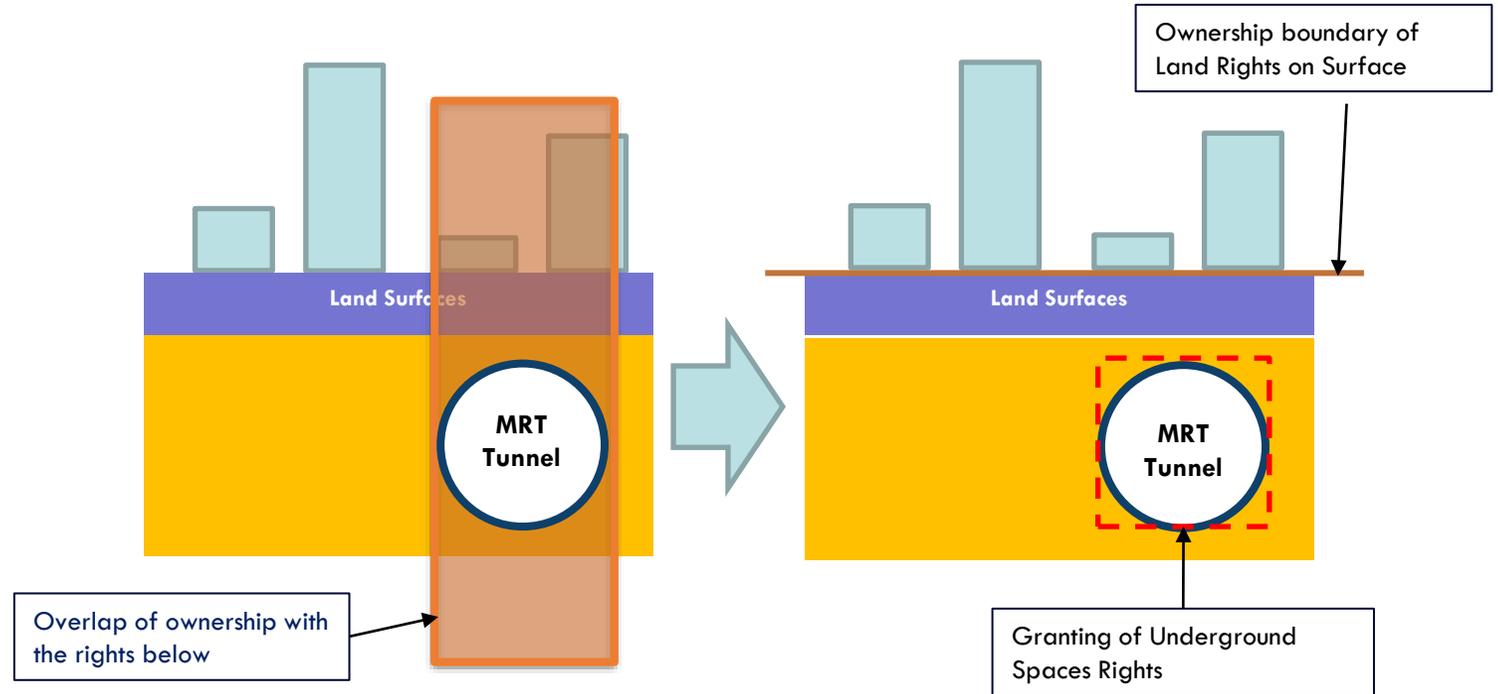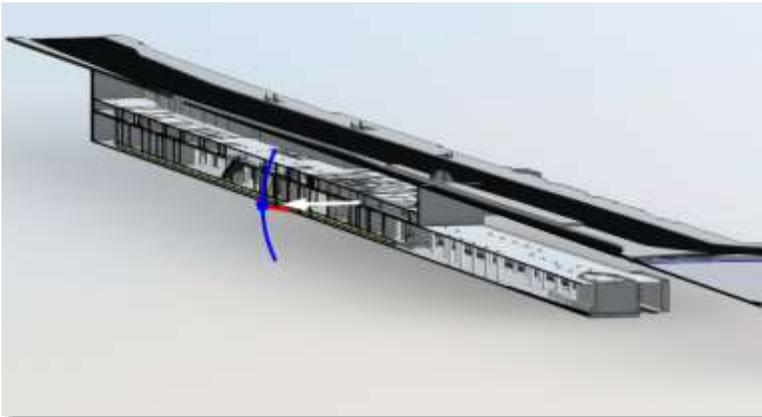**The Human Population Is Increasing**

Vertical Infrastructure Development

The legal aspect of 3D spaces (Above or underground spaces) needs to be concerned (**3D Cadastral**)

Government Regulation No. 18/2021 on Rights to Manage, Land Rights, Strata Title, and Land Registration.

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Utilization of the Upper / Underground Space that Deal With Legal Aspect

3D Visualization on Existing Bhumi WebGIS

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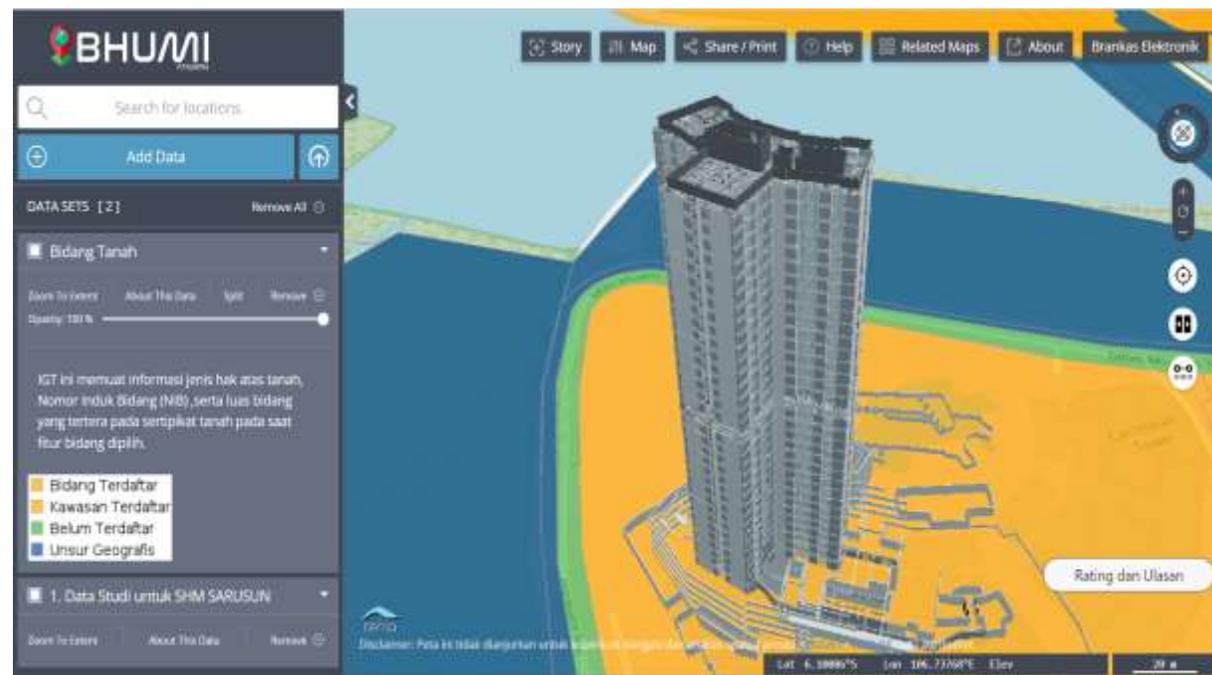
Issues Related to 3D Visualization Based on Previous Research & Existing Bhumi

ISSUES

1. Rendering Large 3D Data

2. Retrieve 3D Legal Spaces Information

3. Base Terrain Integration

4. Occlusion Management
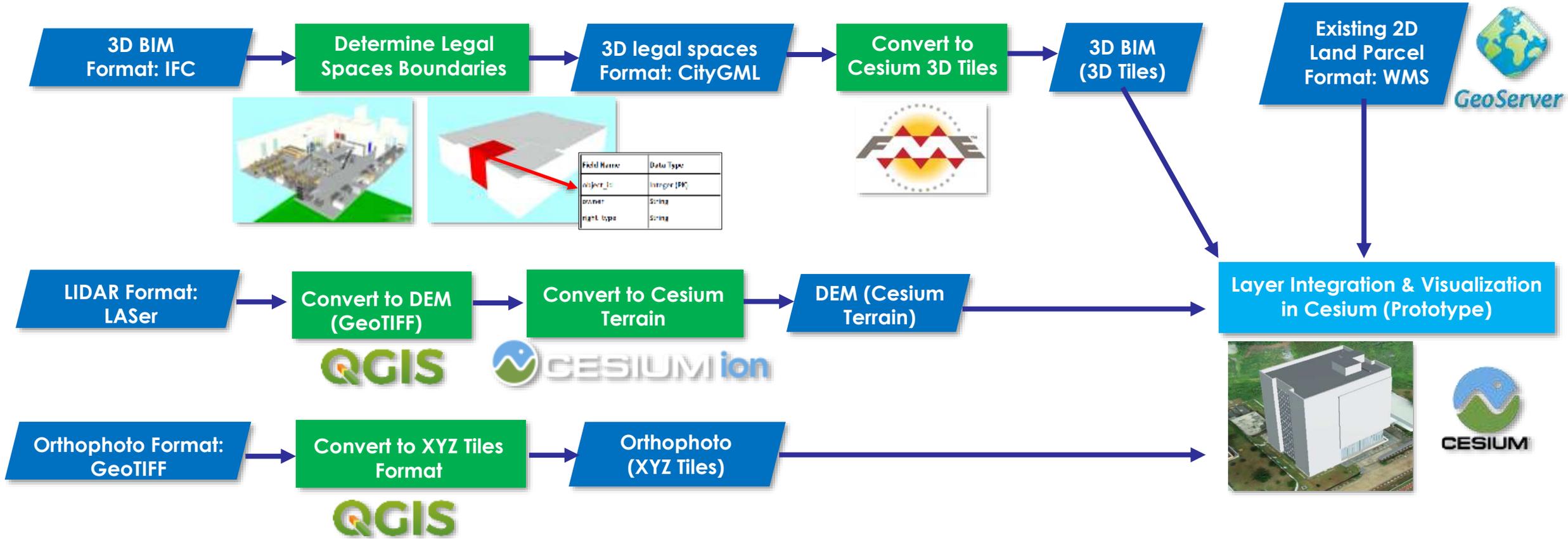
5. Open and Interoperability Formats
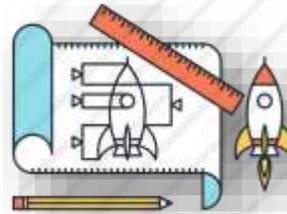
Need to develop a web-based 3D cadastre prototype that handles these issues

PROPOSED REQUIREMENTS

1. The use of Cesium 3D tiles datasets

2. The use of Cesium terrain datasets

3. Layer transparency control

4. Cross-section view

5. Underground view

6. Find and identify legal spaces

7. First-person perspective

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02. PROJECT METHODS

Data Processing and Technology Used to Develop Prototype

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03. RESULTS AND DISCUSSION

Data Visualization in Cesium JS

1 BIM Data in Cesium 3D Tiles

2 Orthophoto Integration in Cesium

Default Cesium Imagery Basemap (Low Resolution)

Orthophotos as Cesium Basemap (High Resolution with Spatial Resolution = 0.1 Meter)

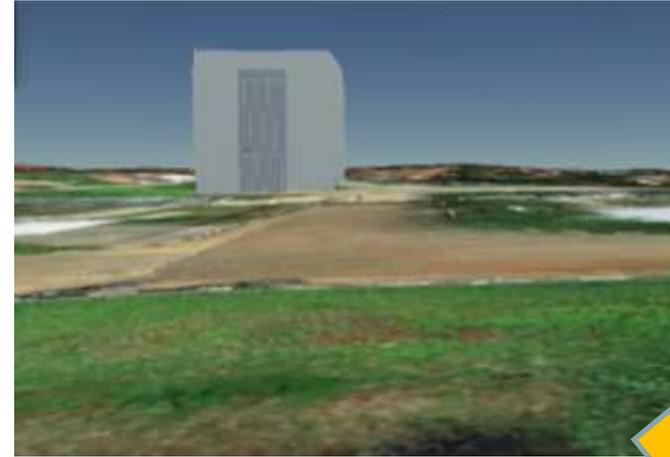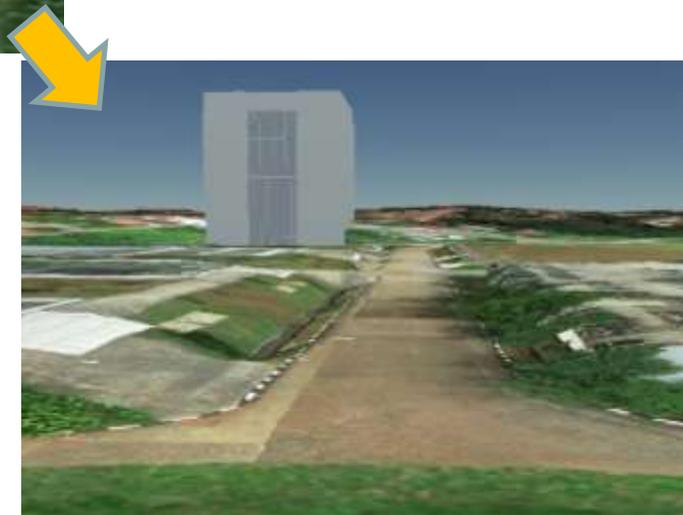## Data Visualization in Cesium JS

3

Default Cesium Terrain (Does not represent the actual topographical conditions)

Lidar DEM as Cesium Terrain

Lidar DEM as Cesium Terrain (More actual representation of topographical conditions)

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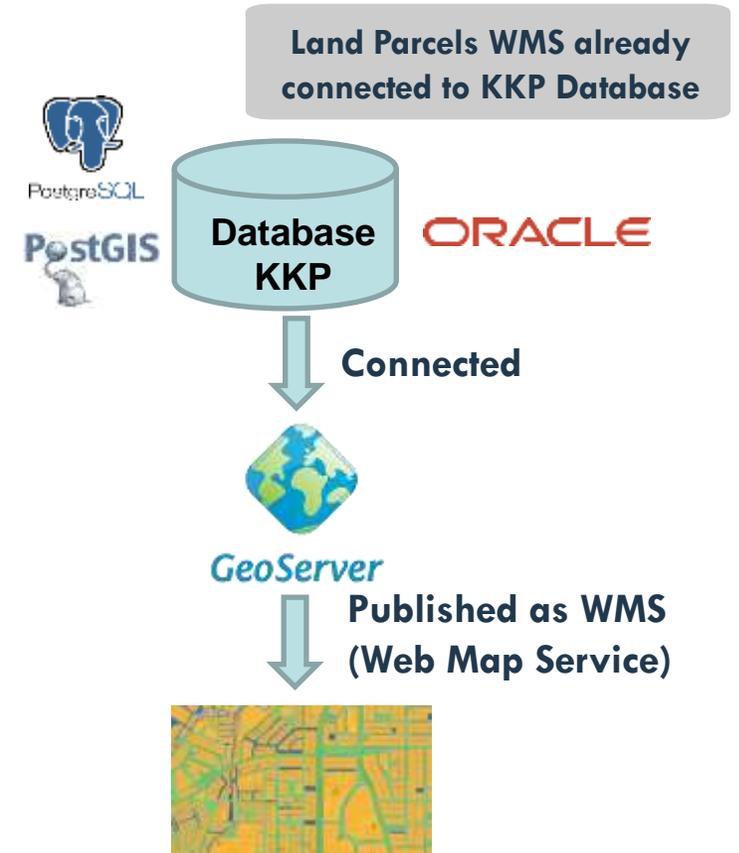
Feature Enhancement Based on Proposed Requirements

1 **Layer Transparency Control**

Legal Spaces blocked by walls

Legal Spaces Underground

- Allowed us to manipulate layer opacity levels
- Helps us to observe important objects that were blocked by other objects or layer shells.
- This function also was implemented on terrain, so that we **could observe** underground objects through the base terrain.

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Feature Enhancement Based on Proposed Requirements

2 **Cross-Section View**

Cross-section view horizontally

Cross-section view vertically
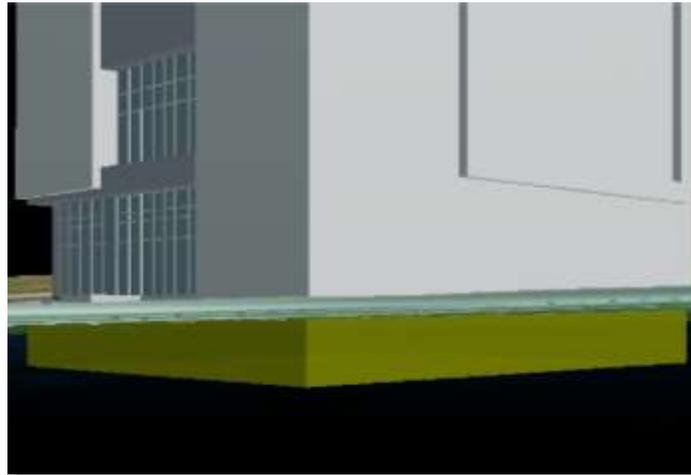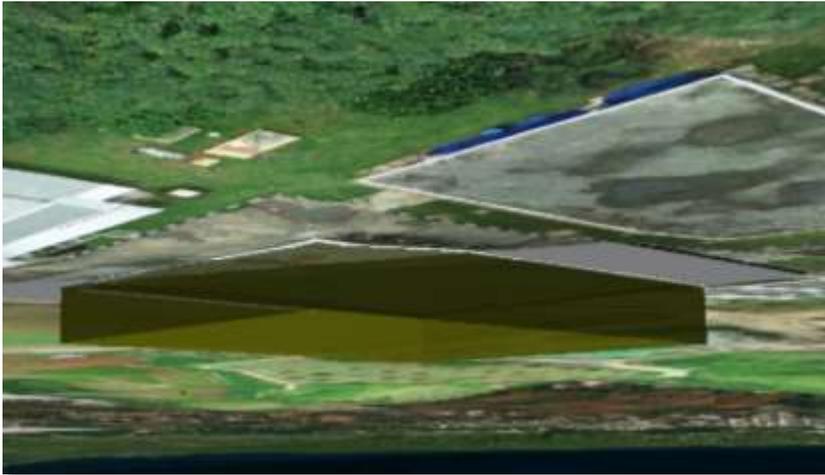
- Allow us to observe 3D objects inside the building by clipping the building parts or elements.
- The clipping plane can be oriented in horizontally or vertically
- Horizontal clipping plane could help us to identify objects based on building level
- Vertical clipping plane is useful to observe 3D objects in all levels inside the building

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Feature Enhancement Based on Proposed Requirements

3 **Underground View**

Legal space object identified in underground view

- Allow us to identify object like legal spaces under base terrain
- Control view could be navigated to underground to observe objects that are plotted below topographic surface
- Alternative solution to observe underground objects instead of terrain transparency.

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Feature Enhancement Based on Proposed Requirements

4 **Find and Identify Legal Spaces**

Legal space found by "object_id" queries

- Allow us to click spatial objects (legal space) and retrieve attribute information related to clicked feature
- However, identifying interest objects by manually navigating and clicking is hard to be practiced. Therefore, finding legal spaces by attribute queries was also implemented
- After providing input value, 3D scene would automatically fly to selected objects.

Feature Enhancement Based on Proposed Requirements

5 **Find and Identify Legal Spaces**

Identifying legal space inside the building in First-Person Mode
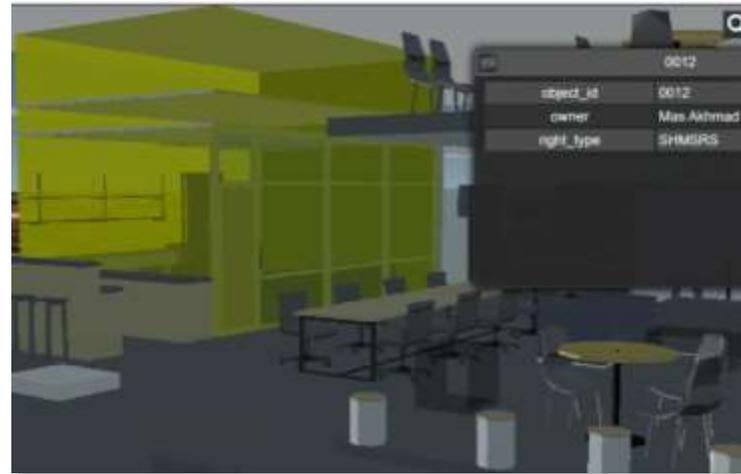
- Allow us to walk freely and look around to observe the topography and building interior.
- Interest objects inside building like legal spaces can be directyly observed.
- This functions also allow users to conduct virtual tours which is a good approach for stakeholders.

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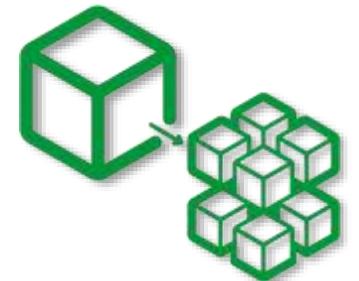for a better living

04. CONCLUSION

- The web-based 3D cadastre prototype has successfully developed and handled several issues related to 3D data visualization such as rendering massive data, terrain integration, and occlusion handling.

- The use of Cesium 3D Tiles dataset is effective in rendering large number 3D data for both physical objects and legal spaces. This format is also interoperable, listed as an OGC standard, and can be directly generated from many BIM formats like IFC, CityGML, and Revit.

- The legal spaces visualized as 3D tiles also effectively remind that semantic capability to store attribute information about legal and ownership in Cesium 3D tiles.

- The Cesium Terrain format has been tested to render terrain from DEM Lidar and produces more realistic 3D environment that represents a real topographical condition.

- The development of this prototype can handle occlusion problem that commonly occurs in 3D data visualization with several functions such as transparency control, cross-section, and first-person functions.

FUTURE DEVELOPMENT

1. **The used of open-source technology.** Software used to generate 3D Tiles like FME and Cesium Terrain like Maptiler is not fully open-source, while the Cesium ION has limited storage (less than 5GB). The possibility of using alternative open-source methods needs to be explored for budget savings.

2. **The 3D cadastre data must be integrated with the KKP database.** The possibility of querying, updating, and manipulating 3D cadastre requires a Database Management System (DBMS), which is then published in fast rendering 3D format (Cesium 3D tiles for current development).

3. **The implementation of microservices architecture.** Each of the Cesium 3D Tiles and Terrain needs to be set up as a service so it can be consumed by many platforms. This will affect the scalability of the web-based 3d cadastre system so that each system can be expanded and updated easily both in data storage or feature improvement.

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THANK YOU

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