

Harnessing BIM for 3D digital management of stratified ownership rights in buildings

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CSDILA
THE CENTRE FOR SPATIAL
DATA INFRASTRUCTURES
& LAND ADMINISTRATION



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Recovery

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Complex Buildings



What are the current challenges of managing ownership rights associated with vertically stratified properties inside high-rises?



Issues of 2D-based representation

- Ineffective management of properties with irregular and interweaving shapes
- Multiple pages of 2D diagrams
- Ineffective representation of properties encompassing parts of several levels
- Inadequate understanding of physical boundaries for non-technical people

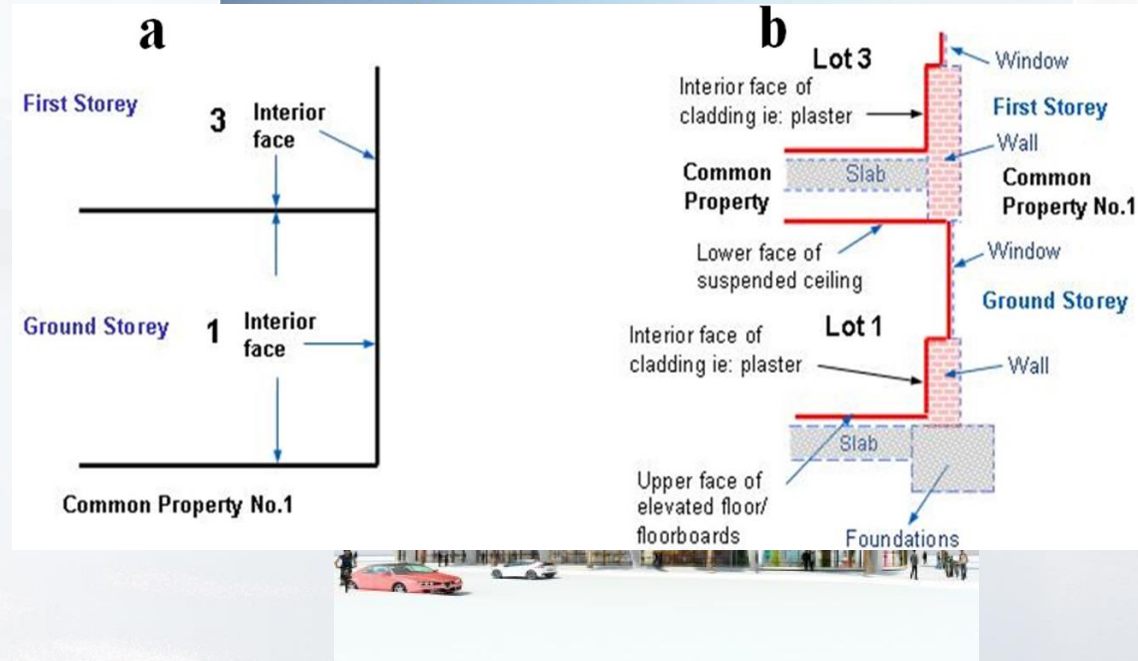


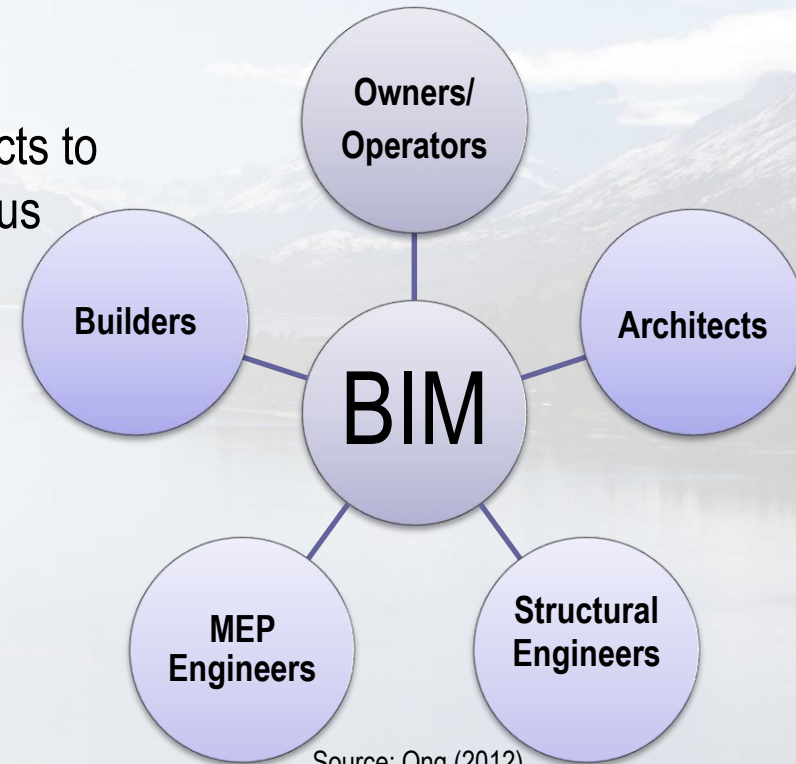
Image sources: Rajabifard et al 2014, Land Victoria 2012



Building Information Modelling

Product: a 3D digital data space containing physical (or spatial) and functional (or semantic) information about elements of a facility

Process: create, manage, derive and share BIM products to facilitate collaboration and communication among various actors involved in the facility lifecycle



Source: Ong (2012)



BIM in Urban Land Administration

- Clemen and Gründig (2006)
 - IFC standard can be enriched with different processed surveying measurements and observations for indoor cadastre purposes.
- El-Mekawy and Östman (2012, 2015)
 - Extension of Unified Building Models (UBM) with four types of boundaries
- Isikdag et al (2014)
 - Connecting legal data models with 3D physical data models such as IFC for property valuation in various countries.
- **Enrichment and use of BIM with 3D ownership data elements used in current building subdivision practices has not yet been investigated**

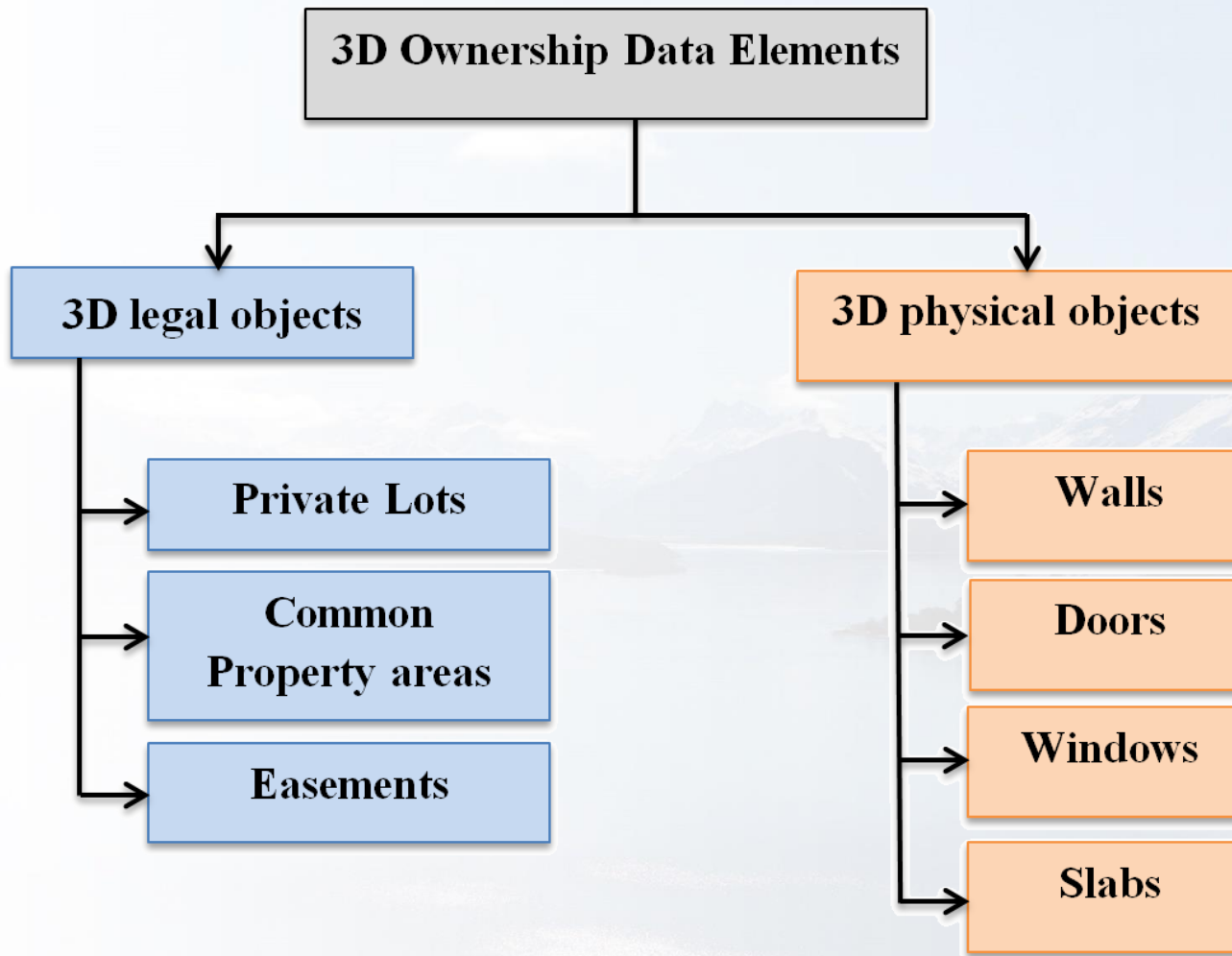


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3D legal objects

- Primary ownership interest
 - Private lots
 - Common properties
- Secondary ownership interest
 - Easements

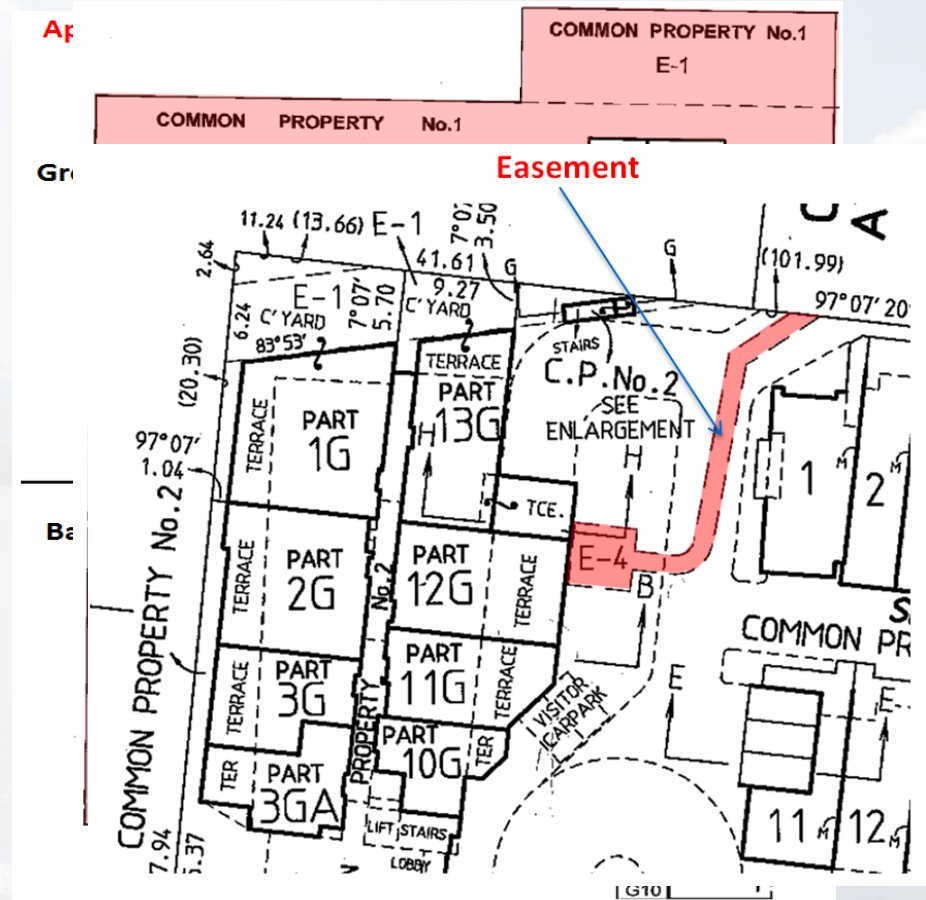




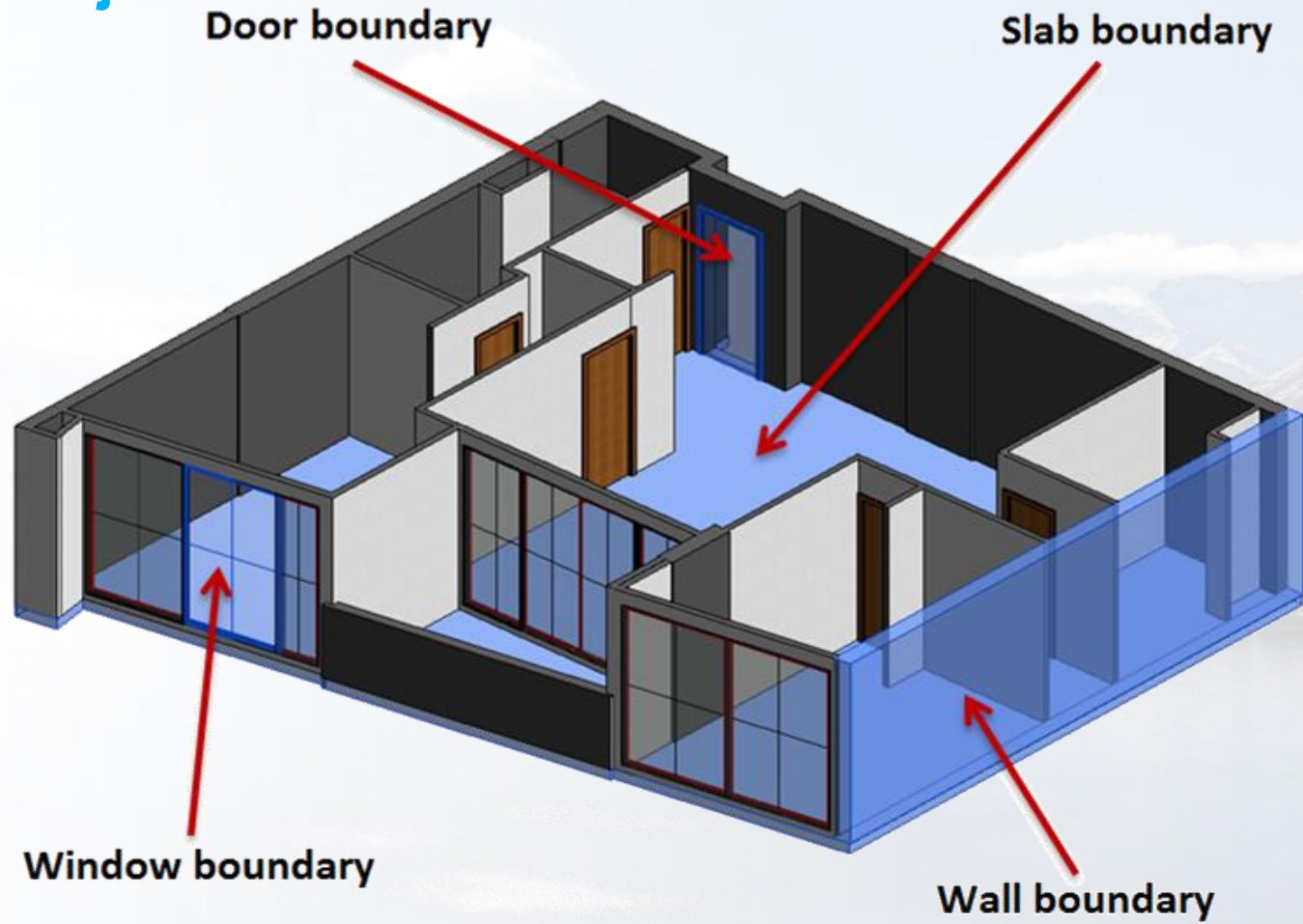
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3D physical objects





Development of a prototype BIM model

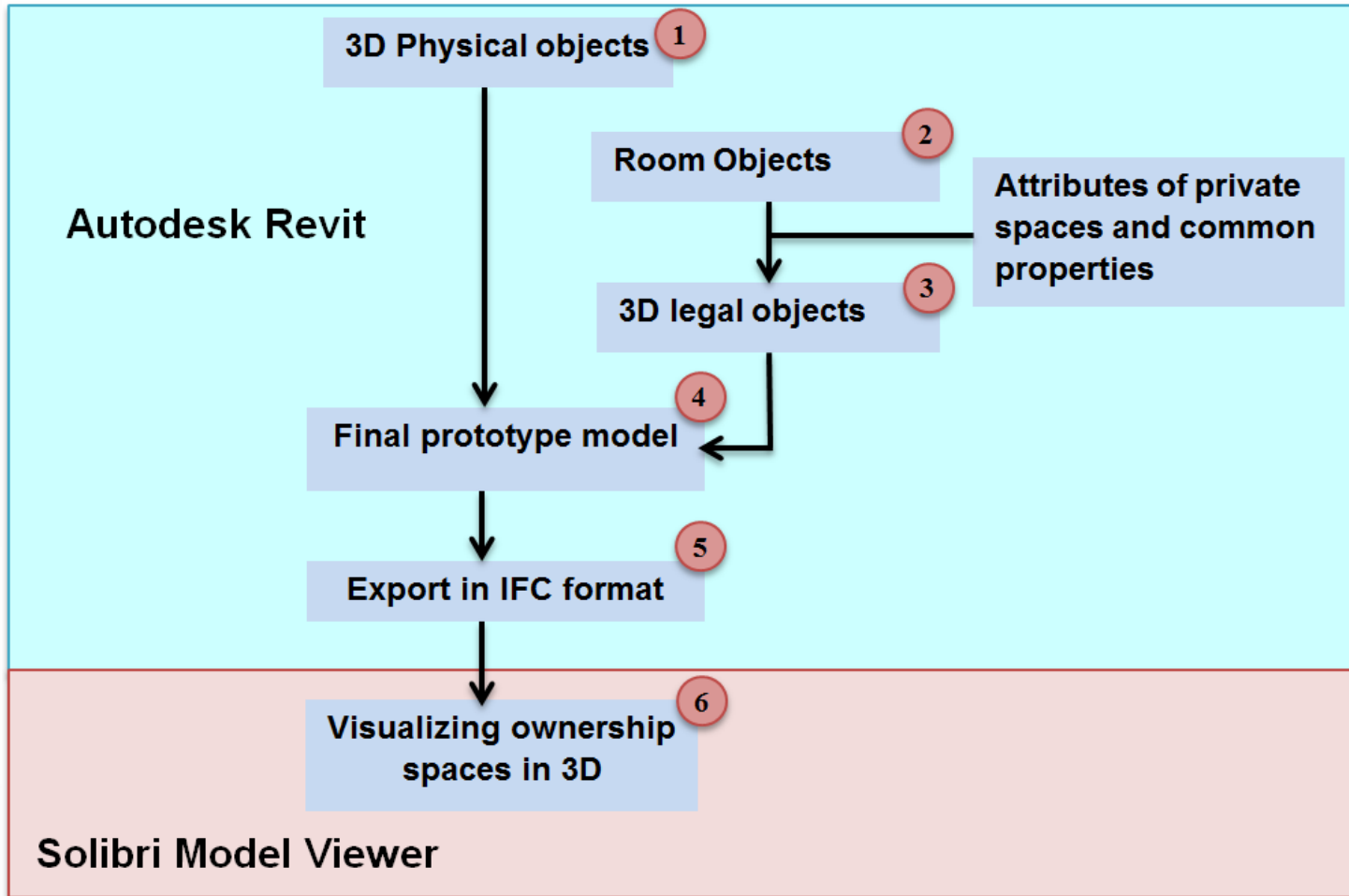




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Physical objects in prototype model

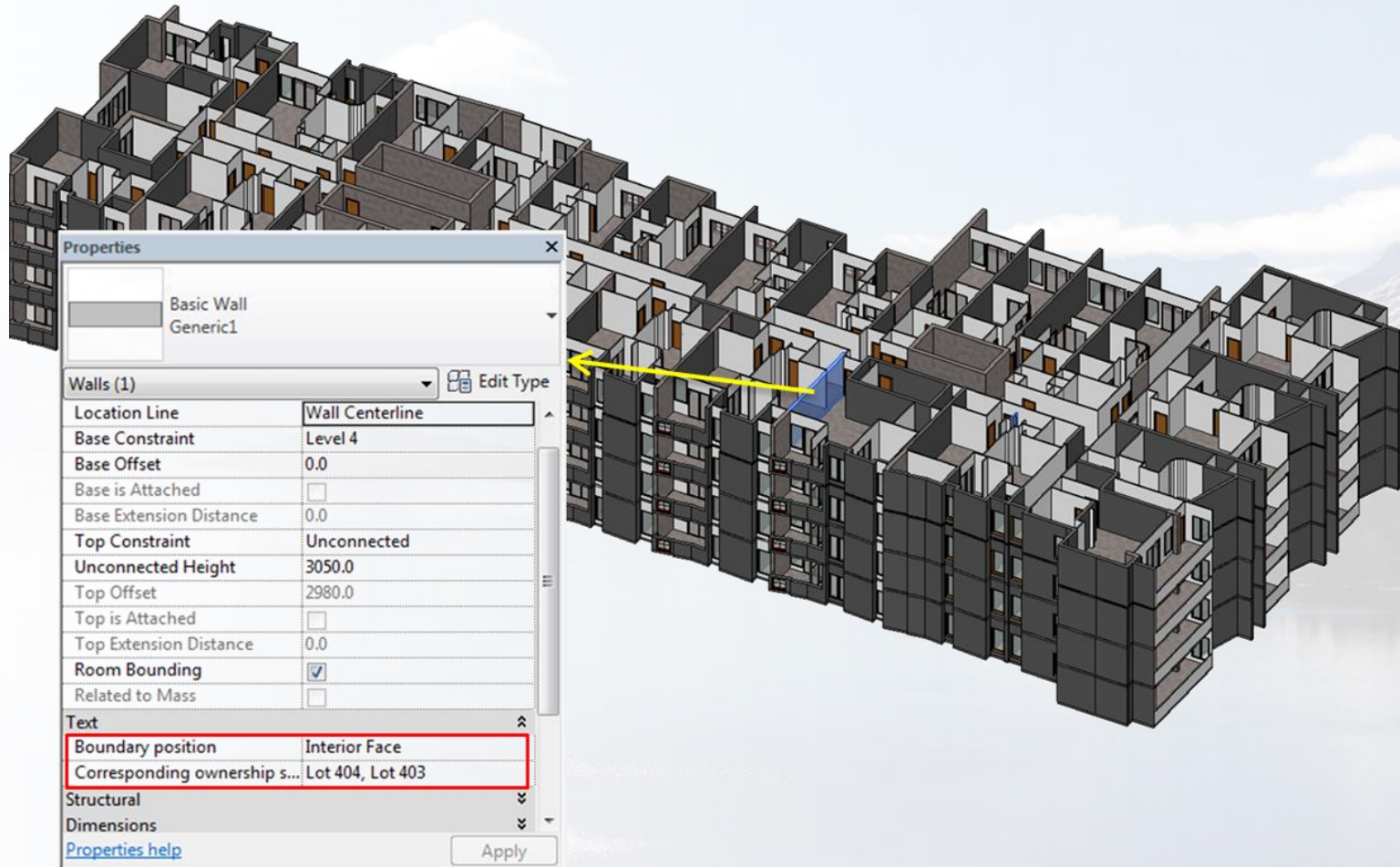




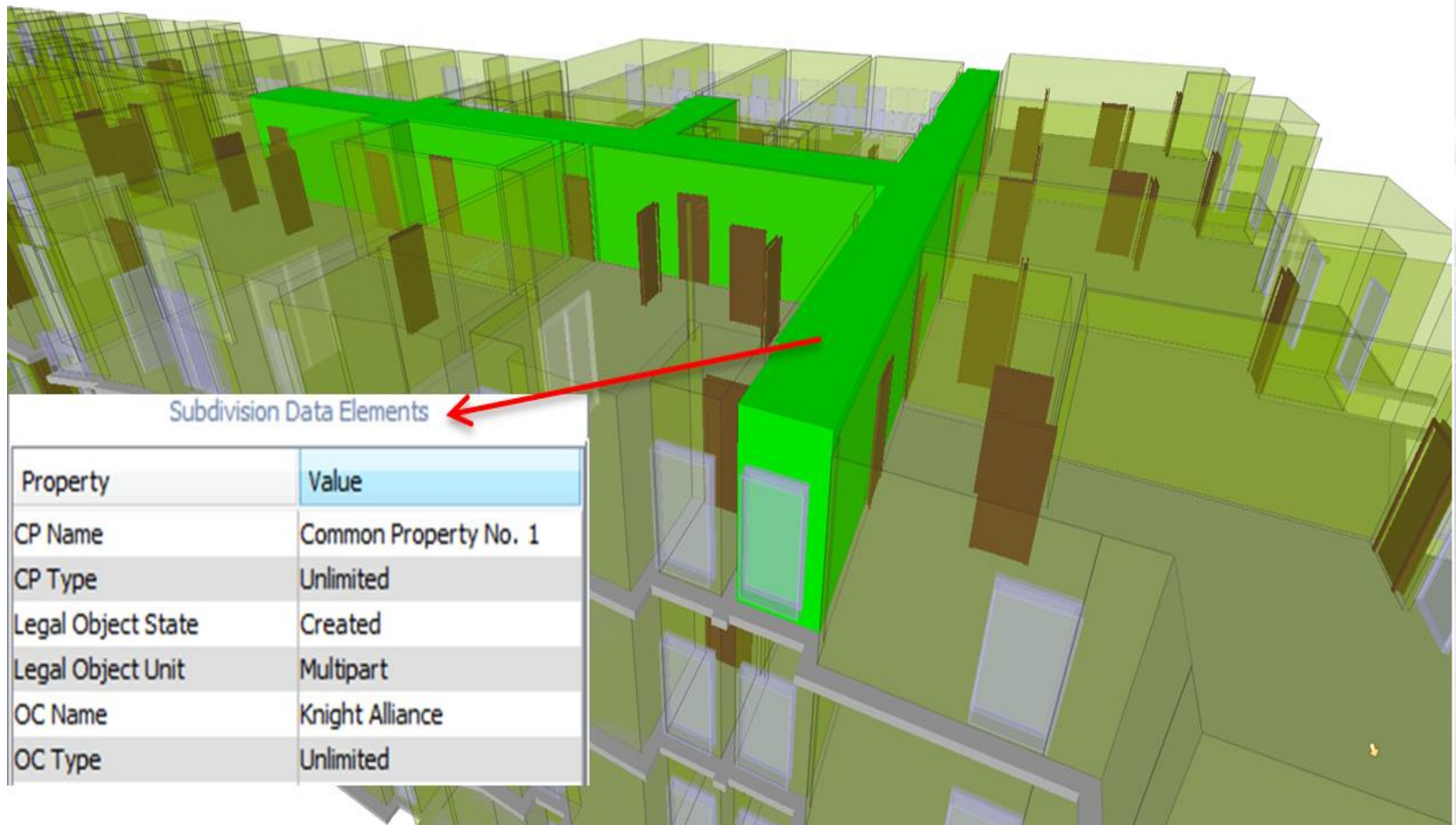
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Legal objects in prototype model



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Benefits of BIM

- Enhancing visualization of boundaries associated with complex and stratified ownership spaces.
- Physical building elements inside the BIM environment can facilitate understanding of physical boundaries and it is easy to specify whether the boundary is interior, median or exterior.
- Computing volume of ownership spaces within BIM environment and utilizing it for valuation and taxation purposes.
- Enriching BIM with information about ownership rights can also support BIM domain in better management of the urban built environment
 - Entitlements and liabilities
- An integrated 3D digital data environment encompassing both legal and physical information. Such a data environment would facilitate collaboration between the land administration industry and the AEC and facilities management industries



Technical issues to implement BIM for LAS

- BIM models usually include abundant physical information, some of which are not necessary in the context of managing ownership spaces. Therefore, the generalization of BIM models is required to remove unessential building elements. This generalization could also result in lowering the data volume of BIM models and increase visualization performance.
- Architects provide the design model which sometimes may not be coincident with the as-built model of the building. The realization of physical boundaries is predicated on the as-built model. Hence, land surveyors will likely need to verify conformance of the design model to the as-built one after construction of the building.



Concluding Key Messages

- Current 2D-based subdivision approaches faces some challenges in managing multi-layered ownership rights in high-rise buildings.
- There is a rich amount of physical information inside BIM models; however, ownership data elements are not recorded in BIM models.
- 3D ownership data elements were identified based on current building subdivision practices and a prototype model was then developed and enriched with the identified ownership data elements
- Enriching BIM models with ownership information would potentially contribute on the performance of these models in better management of facilities throughout the lifecycle of buildings