

Integration of multiple data sources for 3D Land Administration through the lifecycle of 3D objects



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Efi Dimopoulou and Javier Morales



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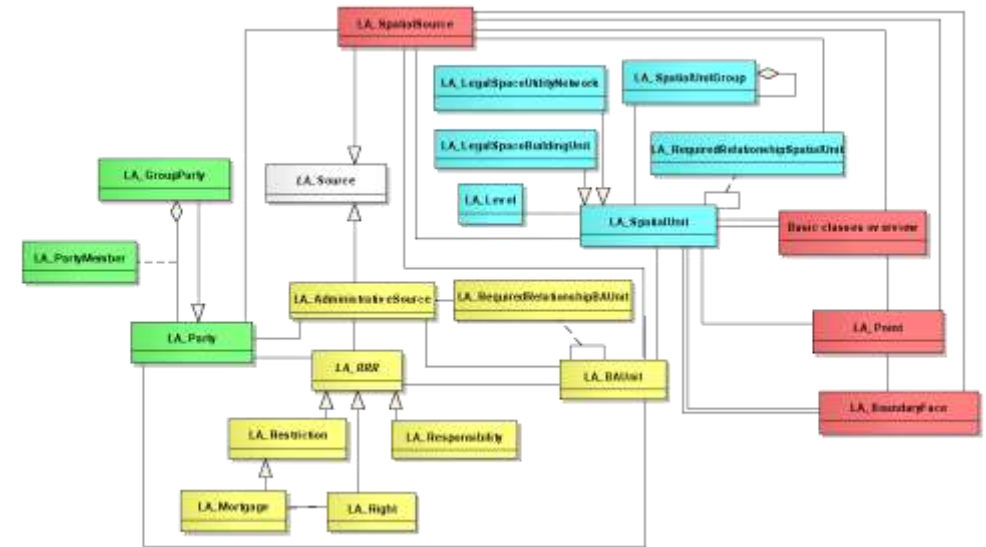


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1. Introduction
2. Multiple data sources for 3D Land Administration
3. Refined Survey Model ISO 19152-2
4. Design Sources in ISO 19152-2
5. Conclusion



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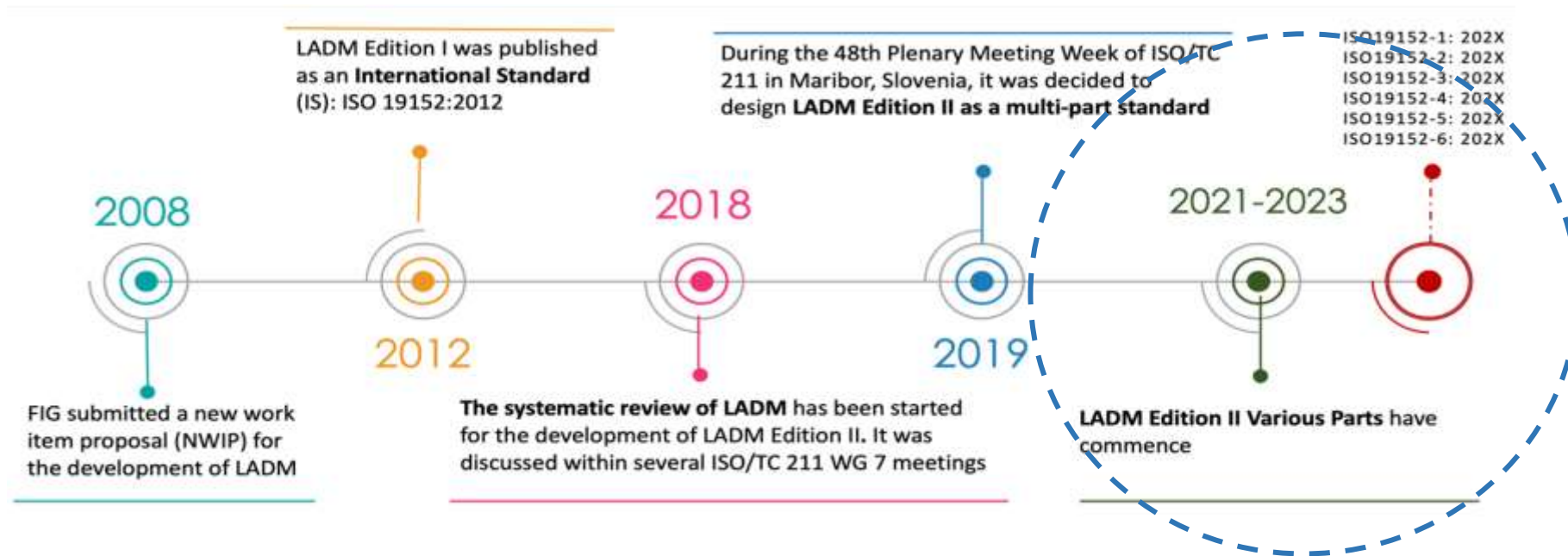
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1. Introduction

Development timeline of the LADM



Revision LADM, refined survey model in part 2

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2. Multiple data sources for 3D Land Administration

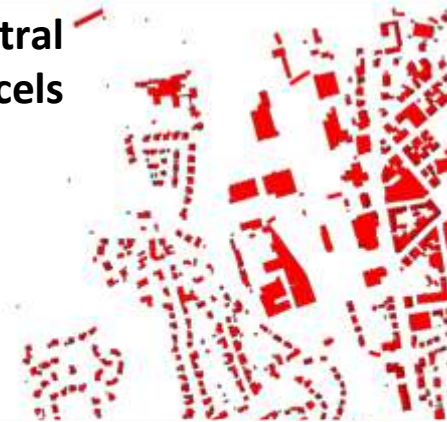
Zoning
Plans



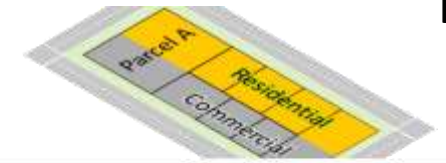
Cadastral surveying



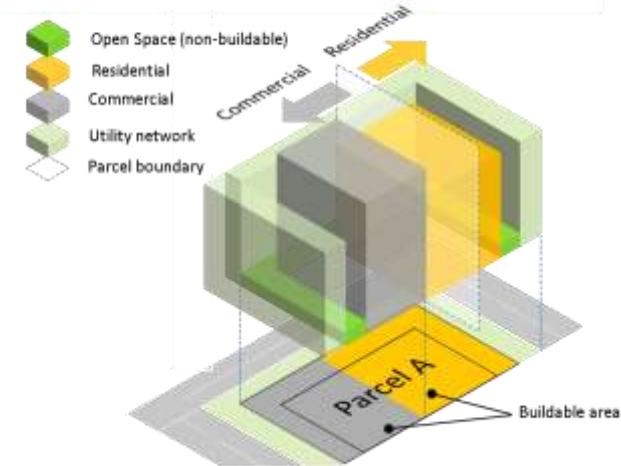
Cadastral parcels



Existing Databases



a. Typical zoning regulation on land parcel boundary



b. Implication of urban plan on a land parcel "A"

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3. Refined Survey Model for ISO 19152-2

1. **LADM Edition I** – Abstract model based on ISO19156:2011 O&M [2012]
2. Integrated Future Data Model for Survey Data and Cadastral Mapping based on the LADM profile for the Netherlands [MSc thesis TUDelft, Soffers P., 2017]
3. **LADM Edition II - Refined Survey Model v.01** [Shnaidman, A., van Oosterom, P.J.M., Lemmen, C.H.J., 2019]
4. Work on LADM – OGC LandInfra synergy on the survey functionality [2020 – 2022]
5. **LADM Edition II - Refined Survey Model v.02**
 1. **v.02a** [Kalogianni, E., Dimopoulou, E., Gruler, H.C, Stubkjær, E., Lemmen, C.H.J., van Oosterom, P.J.M., 2021] ⓘ simple and compact
 2. **v.02b** ⓘ more detailed and complex [work together with E. Verbree, R. Capua & M. Schimtz, 2022]
6. **LADM Edition II - Refined Survey Model v.1** ⓘ **current version submitted in ISO ++ survey-related requirements definition in the context of LADM revision**

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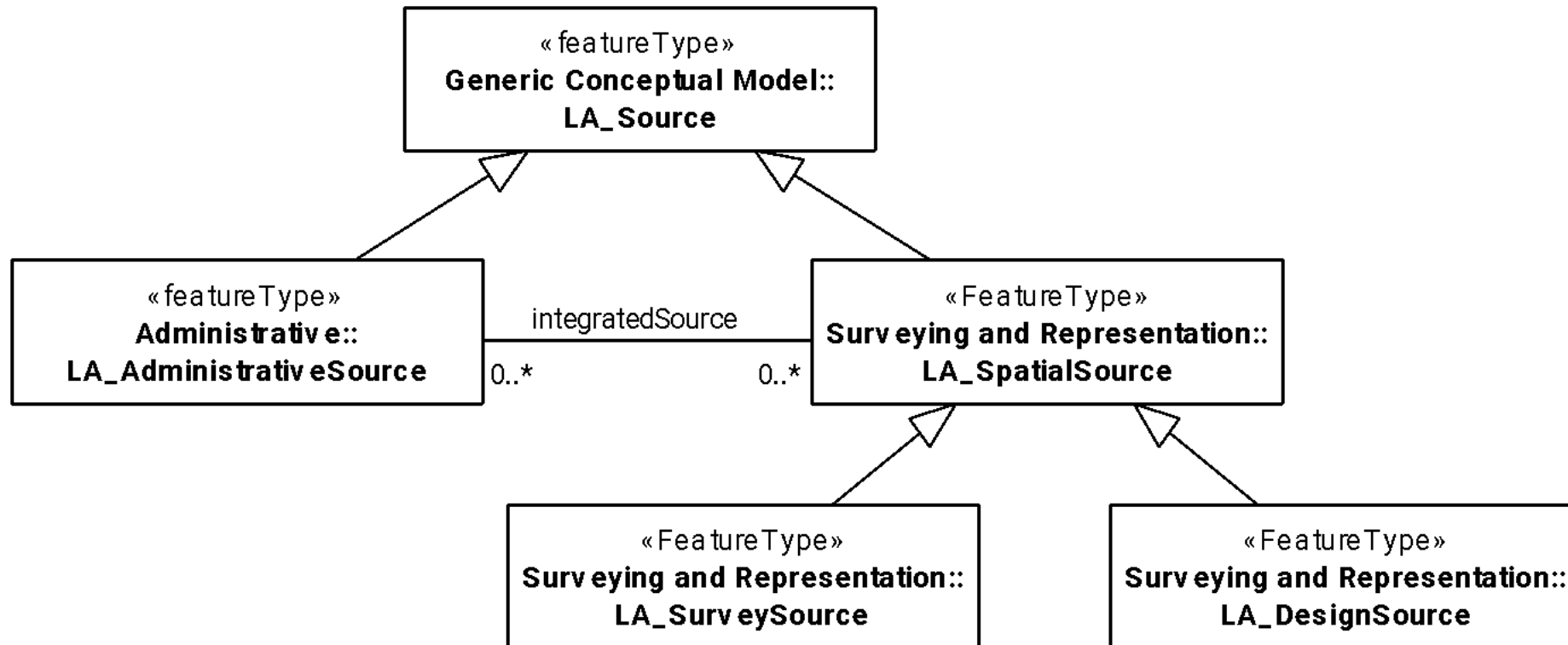


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3. Refined Survey Model ISO 19152-2



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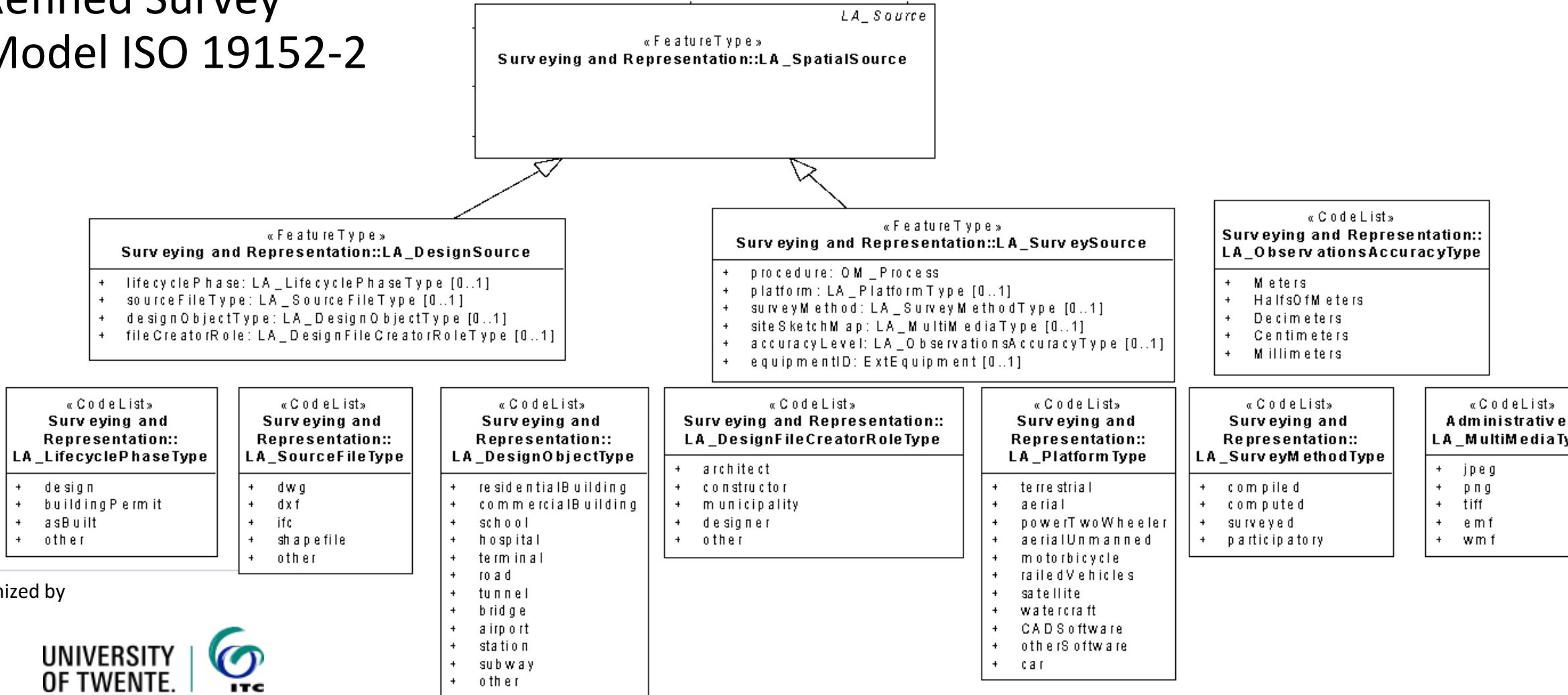


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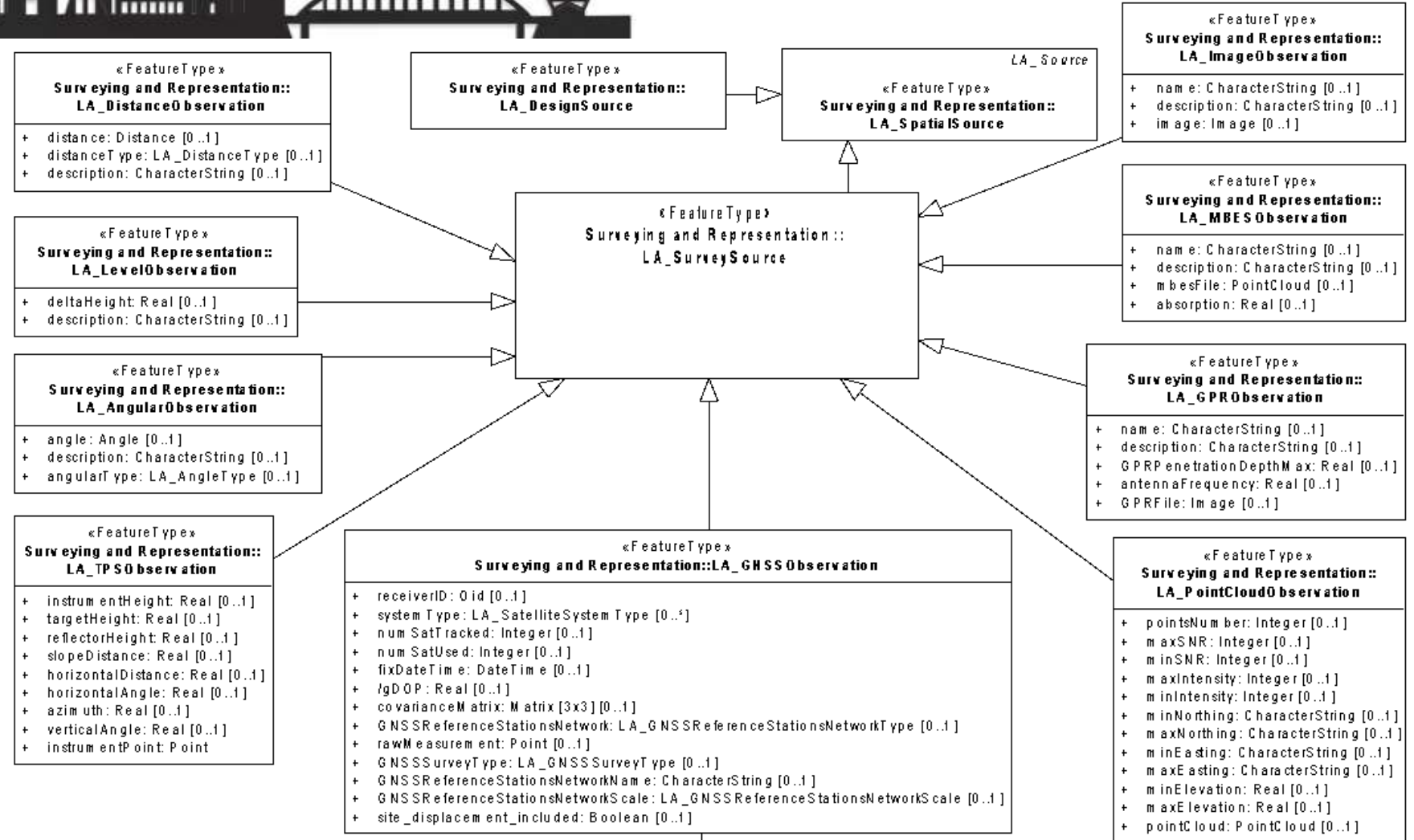
3. Refined Survey Model ISO 19152-2



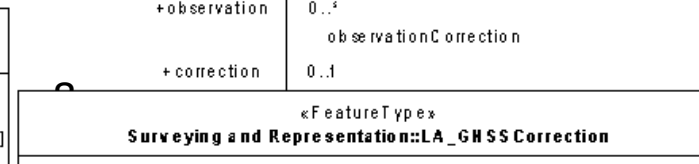
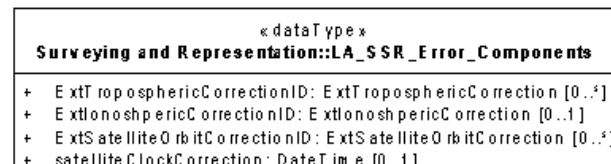
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3. Refined Survey Model ISO19152-2

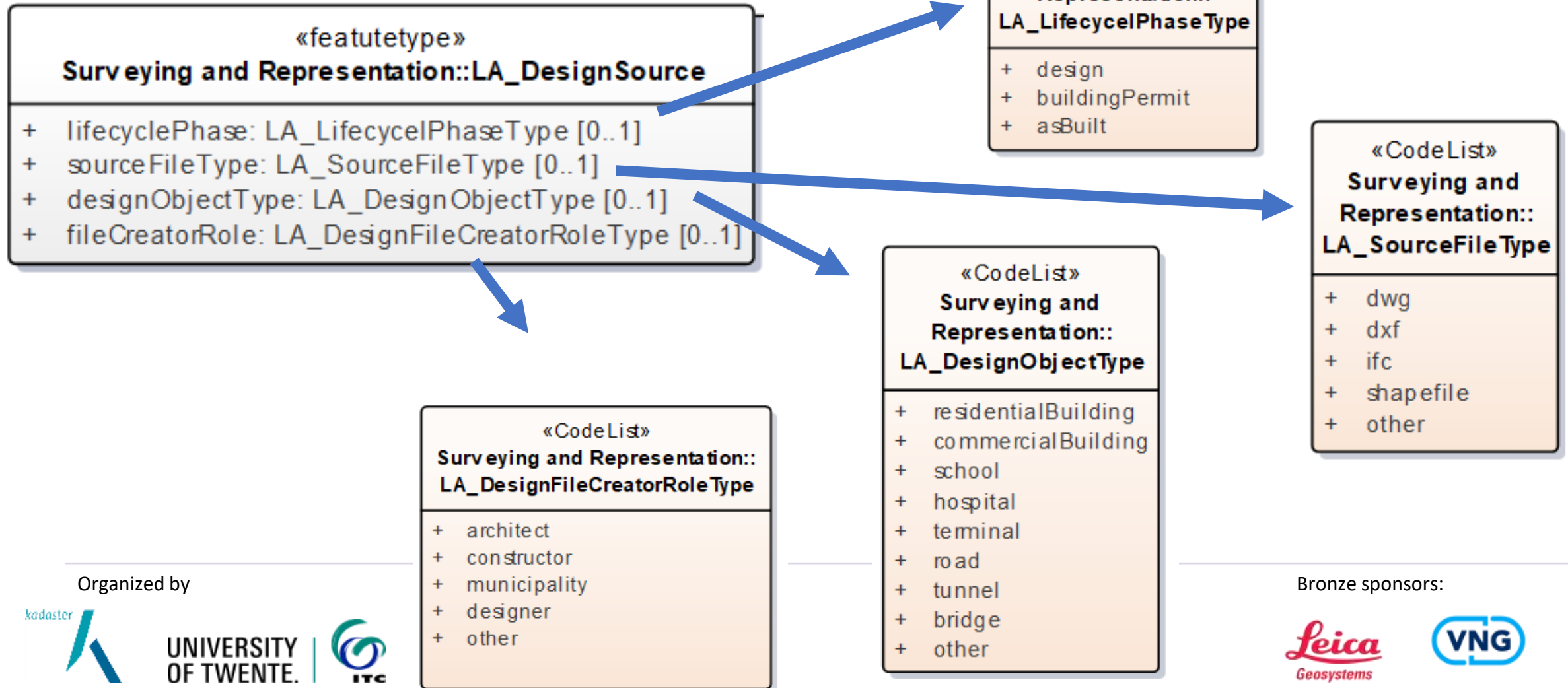


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4. Design Sources



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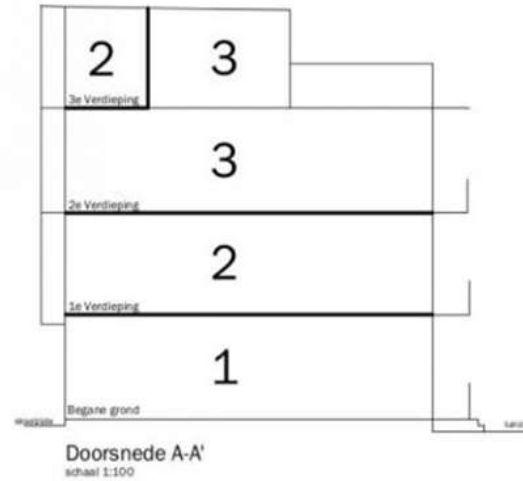
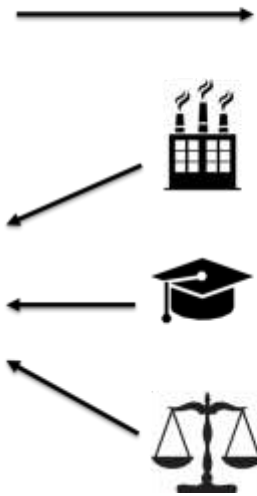
Current practice NL apartment rights

notarial deed:
Internal Arrangements
+ 2D Maps (floor plans)

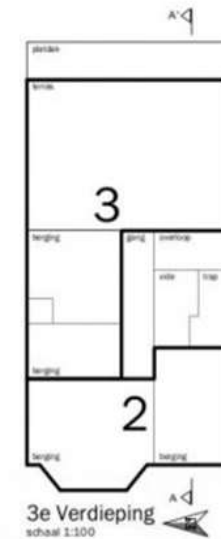
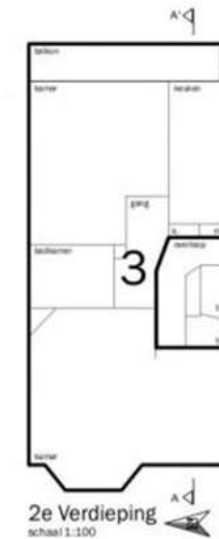
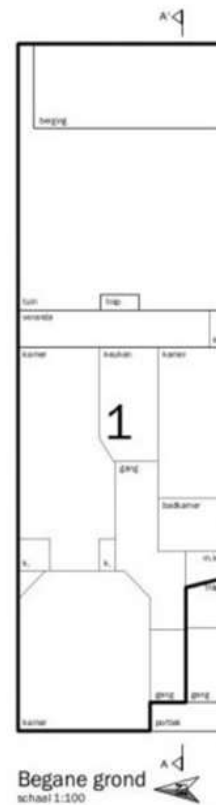
Notarial Deed



IFC BIM



Voorgenomen splitsing in 3 appartementsrechten kadastraal bekend:
GEMEENTE Amsterdam SECTIE X NUMMER ####
Plaatselijk bekend als; XXXXXXXX ###
De datum; De Notaris;



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Gold





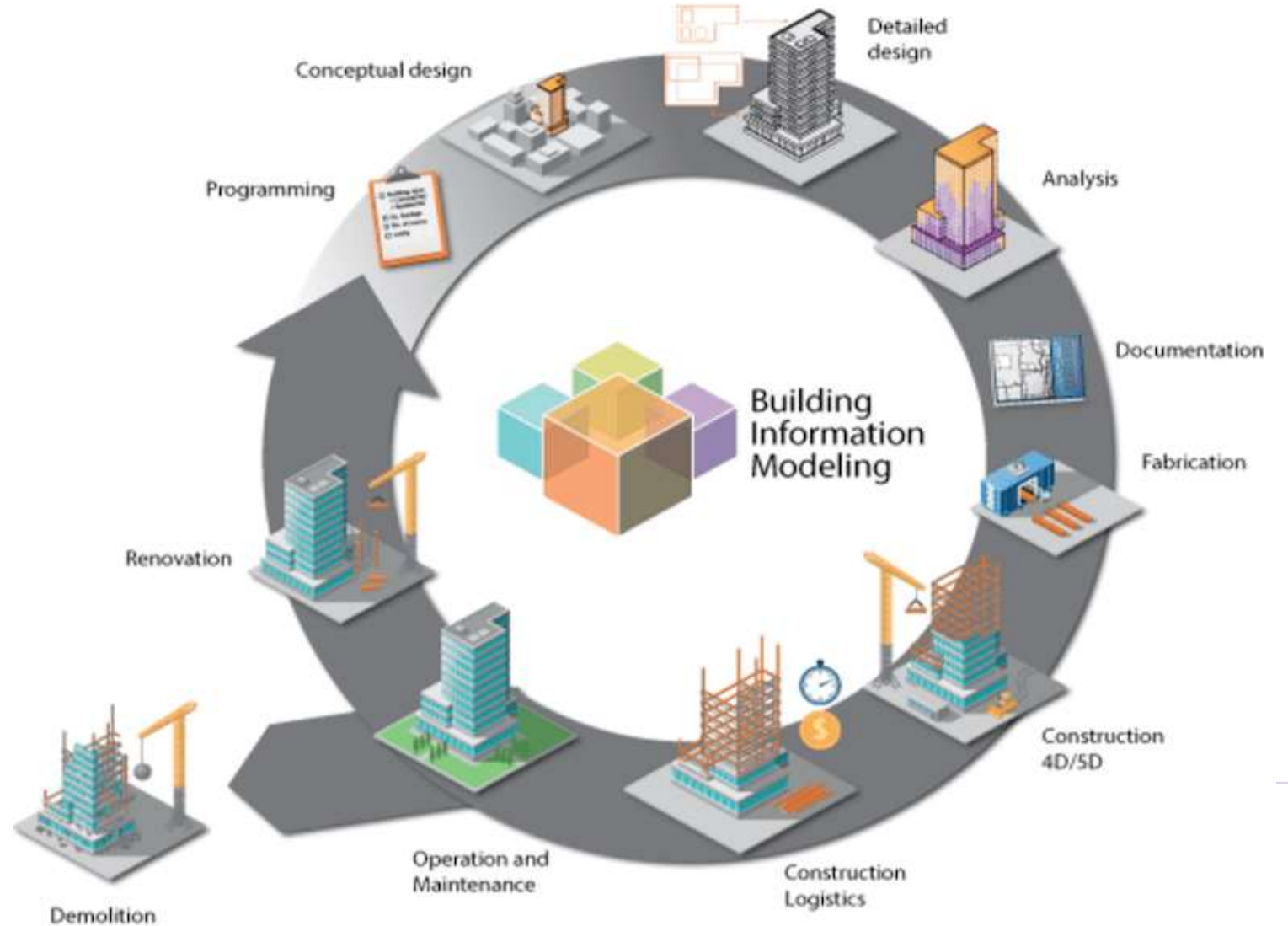
Background – BIM/IFC



Building Information Models
Industry Foundation Class

Future BIM Legal

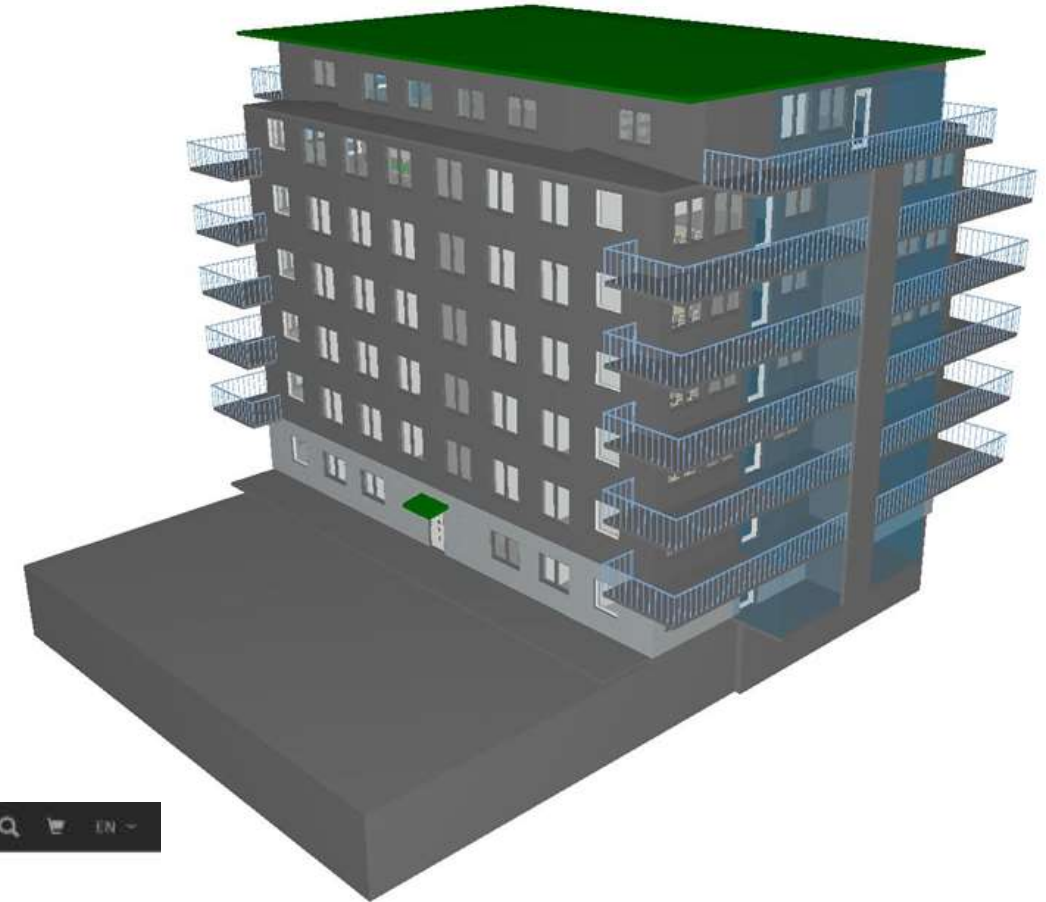
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Design sources for apartments: BIM IFC

- Open data format for BIM
- Most used data model in AEC sector
- NL: BIM mandatory for buildings > €10M
- Rijksvastgoeddienst, BIM Loket
- **No legal space in IFC**
- ISO 16739-1:2018



ICS > 25 > 25.040 > 25.040.40

ISO 16739-1:2018



Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries — Part 1: Data schema

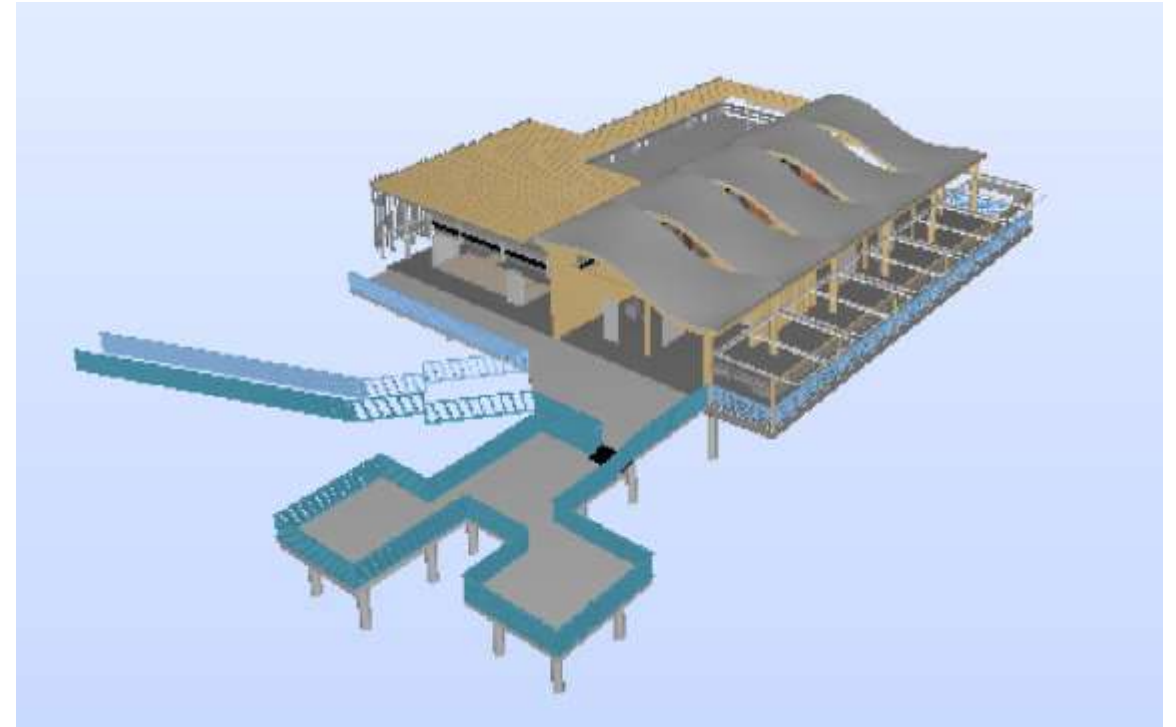
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First attempts BIM Legal

- Workflow  BuildingSMART's Information Delivery Manual (IDM)
- Information BIM/IFC  IfcSpace representing 3D legal space



By MSc GIMA student **Jennifer Oldfield, 2016**

Jennifer Oldfield, Peter van Oosterom, Wilko Quak, Jeroen van der Veen, Jakob Beetz, Can Data from BIMs be Used as Input for a 3D Cadastre?, In: Proceedings of the 5th International Workshop on 3D Cadastres (Peter van Oosterom, Efi Dimopoulou, Elfriede M. Fendel, eds.), Athens 2016

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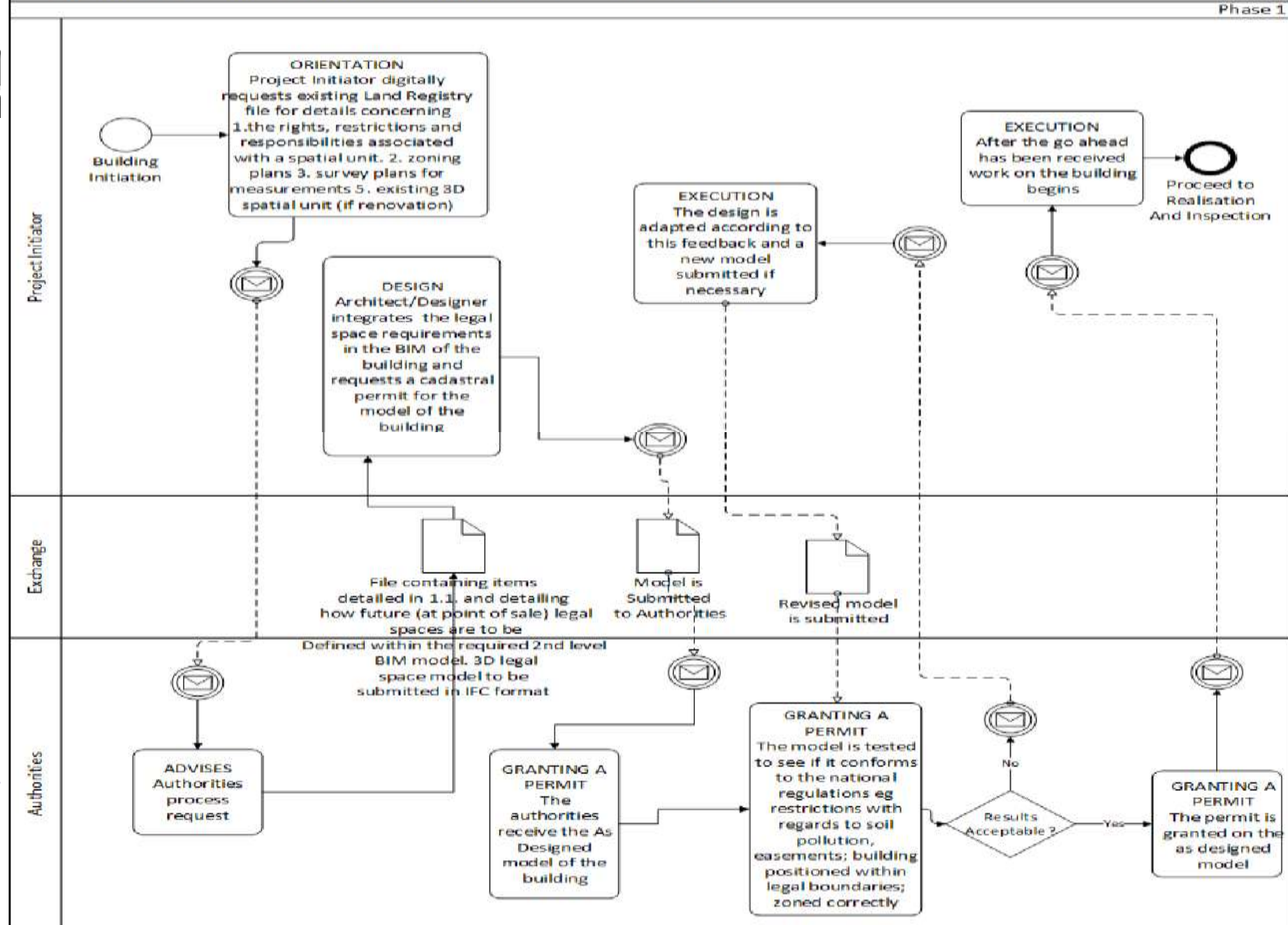


Cadastral Registration by means of a 3D BIM

Orientation-Advising-Designing-Granting a Permit-Execution

Phase 1

Phase 1



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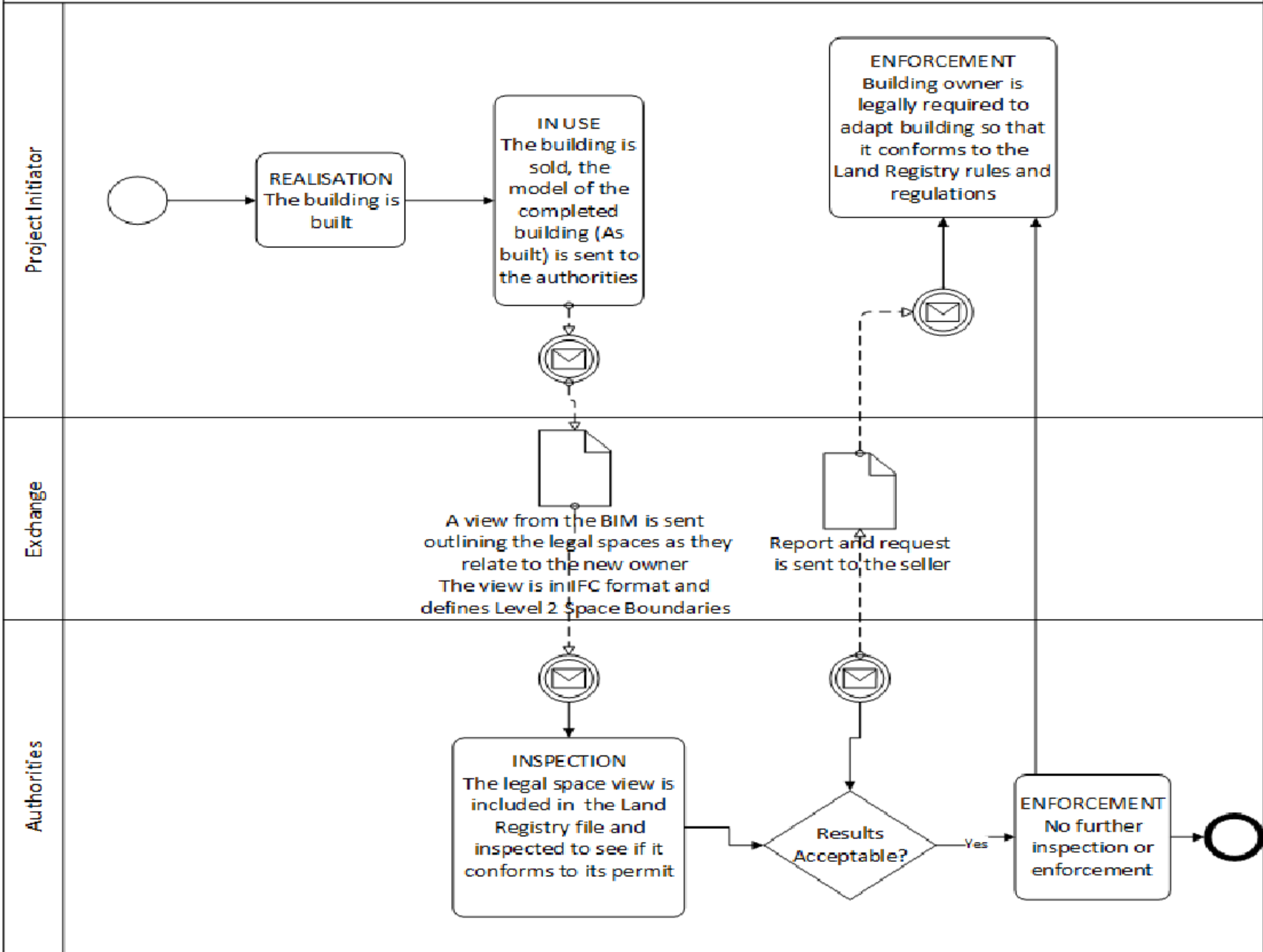


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Phase 2



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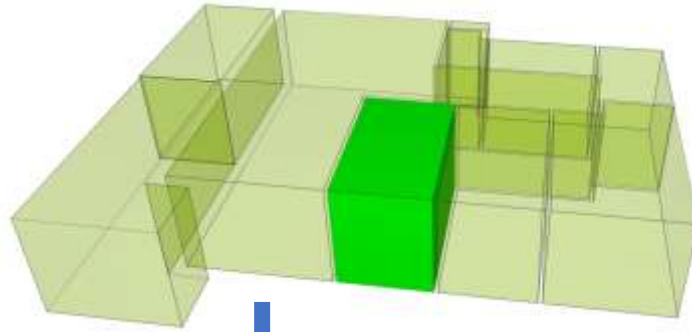
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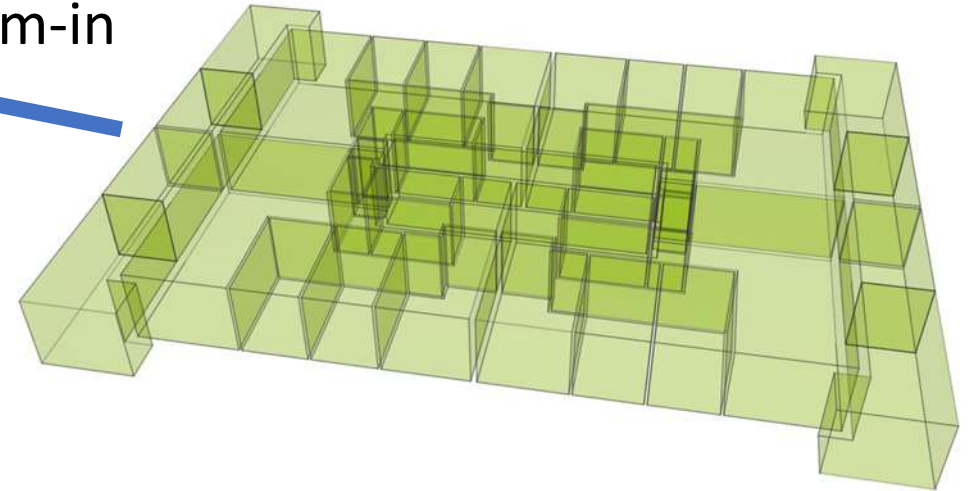


Proposed Solution

- Add User Defined Property Sets for **IfcSpaces**
- IfcSpace one out of 800 IFC entities



Zoom-in



IfcSpaces

UD Property set



INFO					
Space.4.8 : Room[133]					
Identification	Location	Quantities	Profile	Relations	Space Boundaries
Hyperlinks	Pset_AirSideSystemInformation			Pset_CadastralInformation	Pset_Product
Property					Value
complexnumber					8897 A
indexnumber					15
municipality					Delft
parcelnumber					8897
section					A
spacetype					Private

MSc Geomatics thesis
Roeland Meulmeester,
2019



User Defined Property Set

- Based on 2D requirements for map in notorial deed
- Dutch Civil Code
- Official IFC method
- Fits into current practices
 - RVB BIM Norm (Rijksvastgoeddienst, Central Government Real Estate Agency, Mandatory requirements for IFC BIM)
 - BIM Loket IDM



Rijksvastgoeddienst
Ministerie van Binnenlandse Zaken en
Koninkrijksrelaties

RVB BIM Norm

Versie 1.1 (1 februari 2017)

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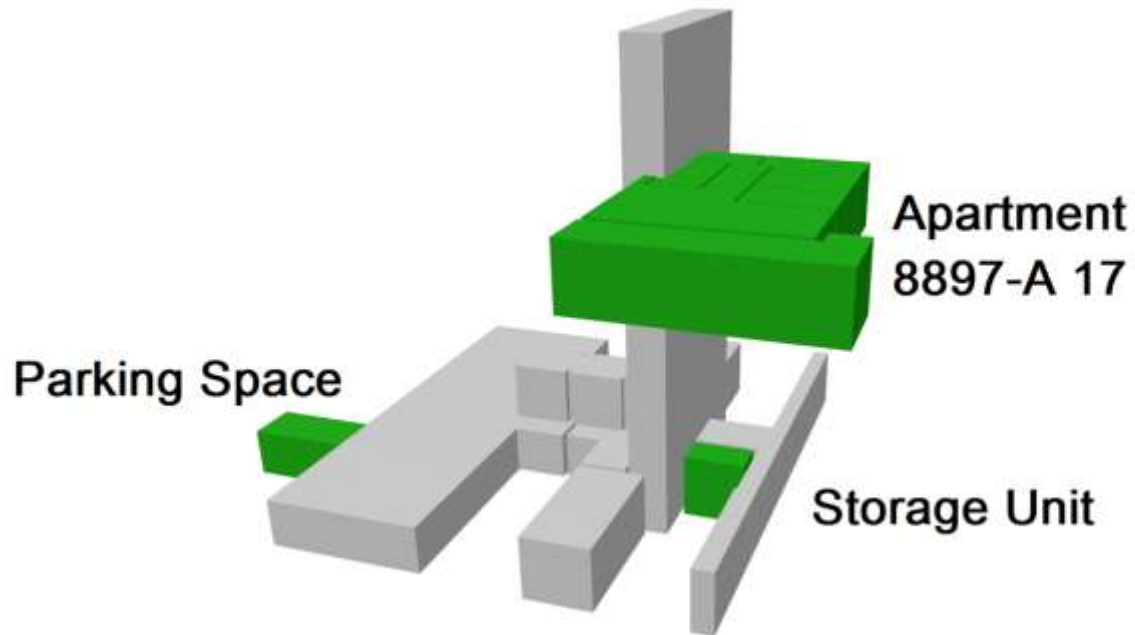
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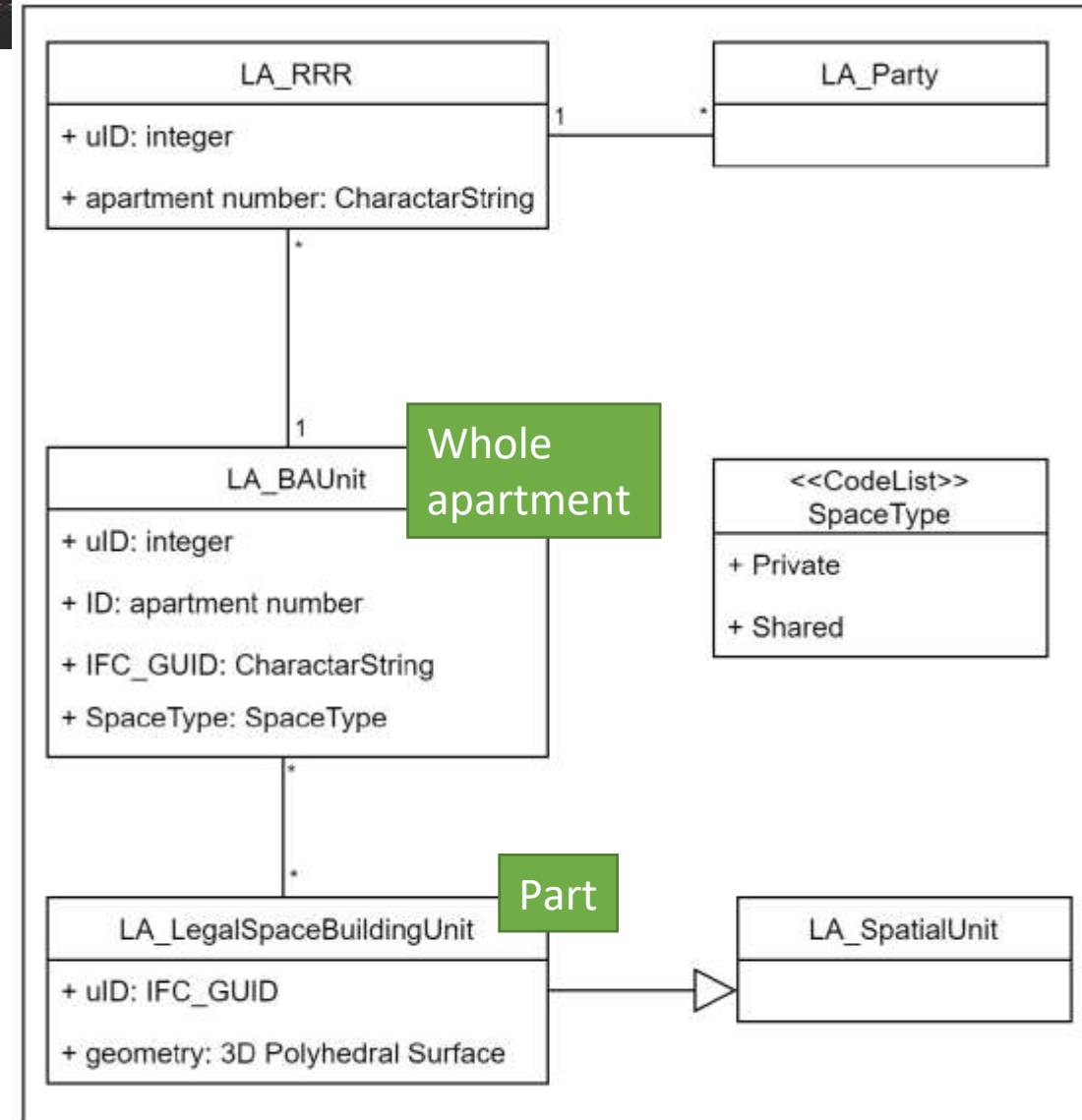


Automatic extraction of Legal Spaces

- Map IFC to LADM
- Can be multipart



<http://pakhuis.tudelft.nl:8080/edu/cesium/apps/bimlegal/>





Validation rules and checking

- Collect real world examples of BIM/IFC models
- Define guidelines for valid BIM/IFC for 3D Land Administration:
 1. Legal Spaces: ifcSpace present
 2. Relation to the LAS: unique identifier per apartment
 3. Geometries: valid polyhedral spaces, closed
 4. Spatial Relations: no overlaps, no gaps
 5. Levels of Georeferencing: LoGeoref 10 (postal address), 20 (WGS84), 30 / 40 (Cartesian CRS), 50 (any CRS specified by EPSG) according to Clemen and Hendrik (2019)
- MSc GIMA thesis of **Marjan Broekhuizen, 2021**

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Name	Supplier	Location
1. Central Park	Municipality of Utrecht	Utrecht
2. Westflank	Municipality of Utrecht	Utrecht
3. Pontsteiger	Menno Mekes	Amsterdam
4. Schependomlaan	Virtual Systems	Nijmegen
5. Central Library	Virtual Systems	Rotterdam



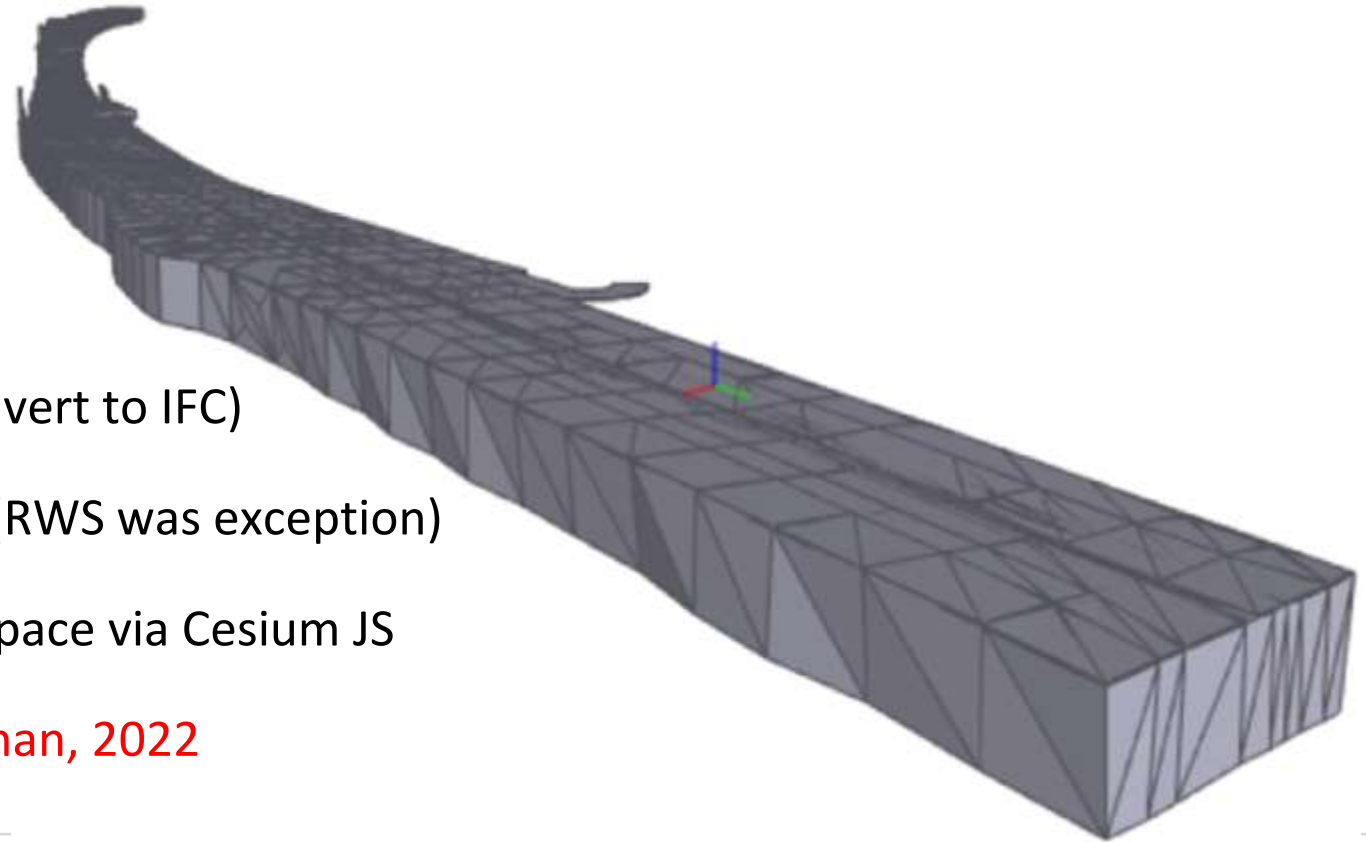
Results of validation

BIM/IFC-model	IFC version	a) Legal Spaces					b) Valid Geometries					c) Overlaps	d) Georeferencing				
		Contains IfcSpace	Unique GlobalId's	LAS propertyset	Groups	Implied relation in name	OGC pass	Passed	Repaired	Failed	Overlaps	LoGeoRef10	LoGeoRef20	LoGeoRef30	LoGeoRef40	LoGeoRef50	
1. Central Park	2x3	No	Yes	No	No	No	100%	97%	3%	>1%	-	False	True	True	False	False	
2. Westflank	2x3	No	Yes	No	No	No	100%	80%	20%	>1%	No	True/False	True	False	False	False	
3. Pontsteiger	2x3	Yes	Yes	No	Yes	Yes	100%	96%	4%	>1%	Yes	True/False	True	False	False	False	
4. Schependomlaan	2x3	Yes	Yes	No	No	Yes	100%	84%	16%	>1%	No	True/False	True	False	False	False	
5. Central Library	2x3	No	Yes	No	No	No	100%	97%	2%	1%	No	True/False	True	False	False	False	



What about underground legal spaces (tunnels, utilities)?

- Several cases, not many IFC
- Most cases in other format (first convert to IFC)
- Heinenoordtunnel was direct in IFC (RWS was exception)
- 3D Web-dissemination of the legal space via Cesium JS
- MSc Geomatics thesis [Rohit Ramlakhan, 2022](#)



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Globe parameters

- Map: Bing Maps Road
- Cesium OSM Buildings
- Translucency enabled
- Alpha 0.5
- Objects
- Heinenoordtunnel
- Parcels
- Fly to

Overview Heinenoordtunnel Parcels



979

Global ID	T7hs9S6KQYmtVkFm2hfgyw
Name	979
Description	
Long name	
Party	Ministry of Infrastructure and Water Management
Rights	Ownership
Restrictions	Listed natural monument
Responsibilities	

1x
Jun 14 2022
07:41:09 UTC

⏪ ⏩



5. Conclusions

- ✓ The proposed refined survey model has currently been submitted in ISO TC 211 at the stage of Committee Draft & it is expected that will be published as ISO standard early 2025.
- ✓ The conceptual refined survey model of the ISO19152-2, has been validated with GISCAD-OV pilots in Germany & Estonia in the context of H2020 GISCAD-OV
- ✓ Using existing Design Sources in the form of BIM/IFC has great potential, but designers (architects) should be aware of the reuse of their design and respect a few simple guidelines
- ✓ Nice demo at <https://bpd2.ogdb.nl/bpd/project/9531/landgoed-hoevesteijn>, also see next presentations
- ✓ Effective (3D) data collaboration, sharing & reuse across the sectors and disciplines in the SDL of (cadastral) objects will enable new ways of data harmonisation and use

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Integration of multiple data sources for 3D Land Administration through the lifecycle of 3D objects

Thank you!



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