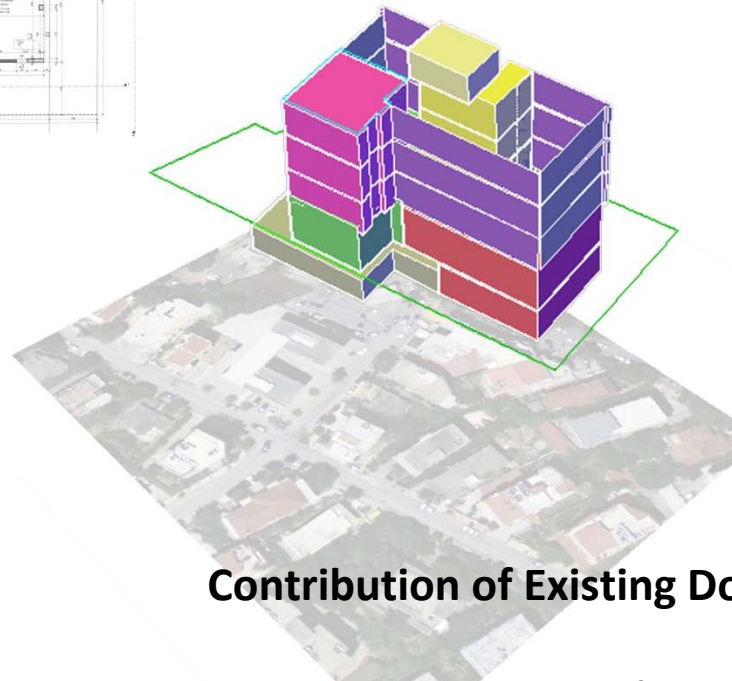
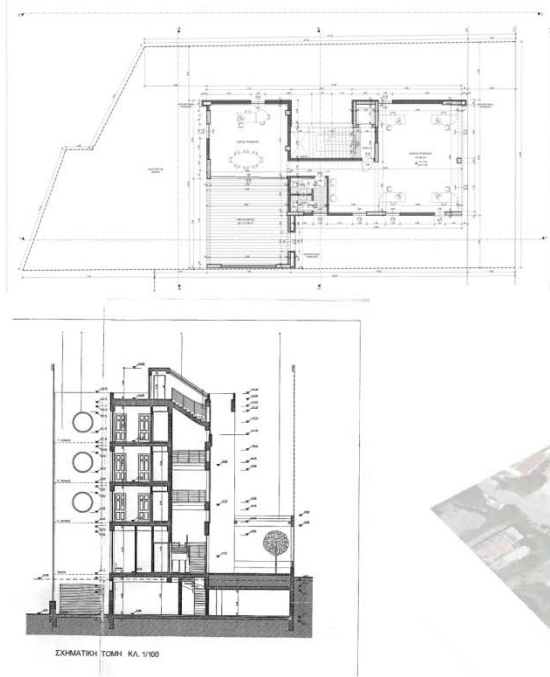


4th International FIG 3D Cadastre Workshop
9-11 November 2014, Dubai, United Arab Emirates



Contribution of Existing Documentation to 3D Cadastre

Dimitrios KITSAKIS and Efi DIMOPOULOU
National Technical University of Athens, Greece

Outline

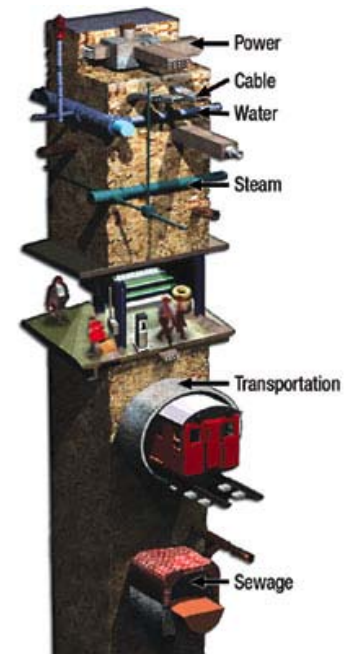
- ❑ Introduction
- ❑ 3D Real Property Features in Existing Databases and Registries
- ❑ 3D Cadastre Modelling and Standardisation
- ❑ Capabilities and Constraints in Generating 3D Cadastral Models from Existing Data
- ❑ Case study : Customary Rights
Apartment Ownership in Urban Area
- ❑ Conclusions

□ Introduction (1/2)

- Vertical accession of real property
- Security, Finance, efficient Land Administration



Legal amendments, introduction of 3D cadastral systems



<http://enr.construction.com>

Requires topological, semantic, **3D data**

- ✓ Simplified 3D data acquisition
- ✓ Various methods
- ✓ Cost/ time effective

□ Introduction (2/2)

3D Cadastre modelling

- Extensive urban areas
- Relation to non-constructed 3D space
- Relation to underground constructions



Current 3D data acquisition methods are still costly, time-consuming and are limited by object type and location

Paper aims

- ✓ Investigate exploitation of data maintained for various purposes in 3D cadastral modelling

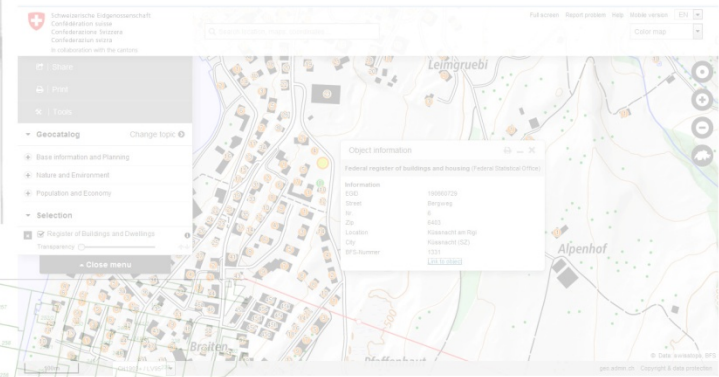
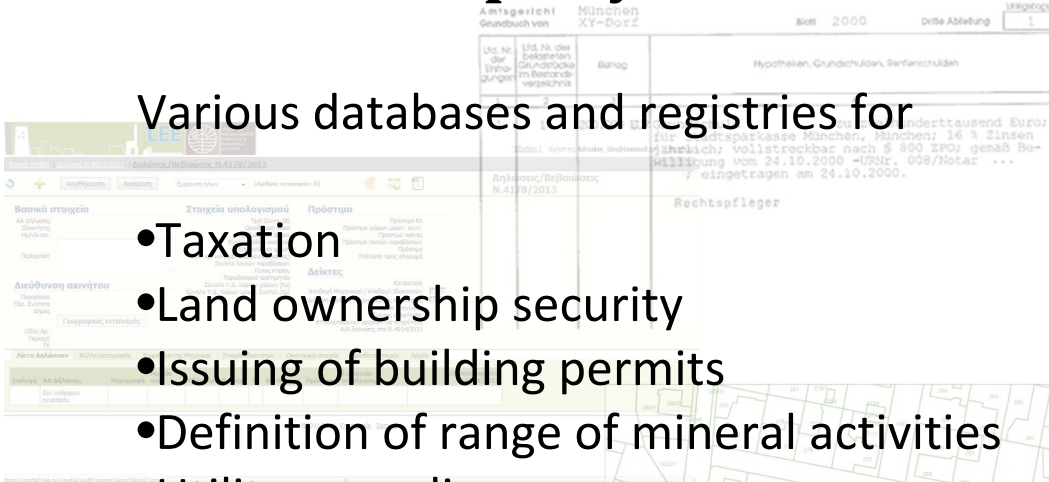


www.neonnotes.org

❑ 3D Real Property Features in Existing Documentation(1/2)

Various databases and registries for

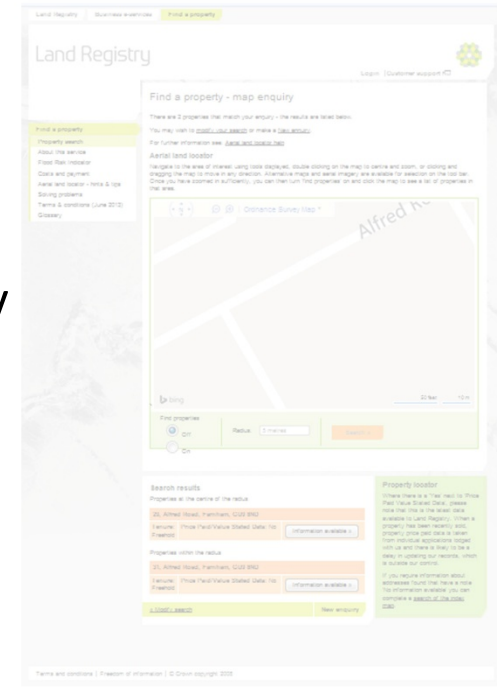
- Taxation
- Land ownership security
- Issuing of building permits
- Definition of range of mineral activities
- Utility recording
- ...



ΠΙΝΑΚΑΣ ΚΑΤΑΡΤΗΣΗΣ ΑΚΙΝΗΤΩΝ

Α/Α	Επωνυμία	Περιγραφή του/των	Κατηγορία	Κατ. Αξίας	Με/ως Αξίας	Αποκαταστάσι Αξία	Βάρος επί του Αξίας	Παρατηρήσεις
11								
12								
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14								
15								
16								
17								
18								
19								

- Including spatial or textual data
- Different data types, semantics, formats, accuracy



□ 3D Real Property Features in Existing Documentation (2/2)

Documentation	Spatial data type	Reference system	Data accuracy
Plans	<ul style="list-style-type: none"> - horizontal dimensions (floor plans), - vertical dimensions (facades, cross sections, - <i>3D coordinates (isometric drawings)</i> 	<ul style="list-style-type: none"> - no reference system - relation to groundmarks 	present the physical objects (buildings) with dimensions
Cadastral maps and databases	<ul style="list-style-type: none"> - land parcel/ building footprint, horizontal coordinates - elevation data (usually stored but not presented in cadastral maps using orthophotos, LIDAR, DTM / DSM models) 	<ul style="list-style-type: none"> - National or local reference systems - relative heights - absolute heights 	Varying accuracy depending on land type (urban, rural), scale and surveying methods (few centimetres to some meters)
Deeds/ titles/ court decisions/ administrative acts	Descriptive data (may refer to drawing or sketch)	Depending on Contract Law requirements	Literal description, except when related to survey plans

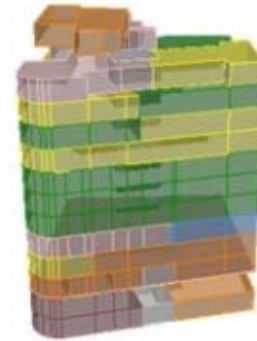
Spatial data characteristics included in existing documentation

□ 3D Cadastre Modelling and Standardisation (1/2)

- Spanish Cadastre

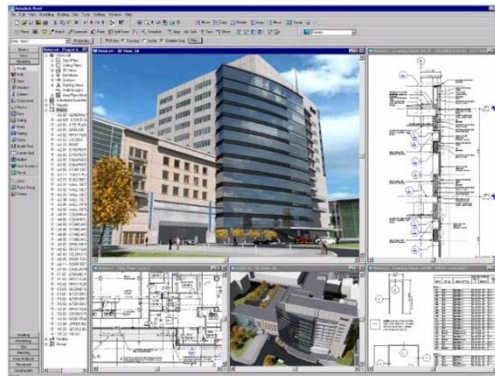


Conejo C. and Velasco, A (2007)



v. Oosterom et al. (2011)

- BIM

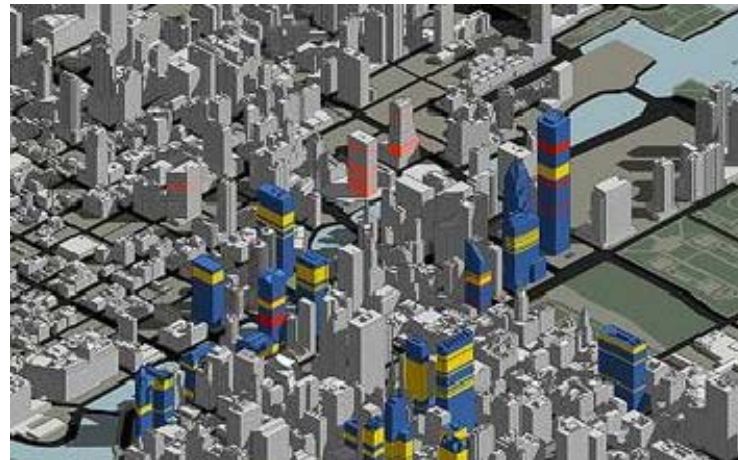


<http://www.uscost.com/5d-bim-education/>

3D Cadastre Modelling and Standardisation

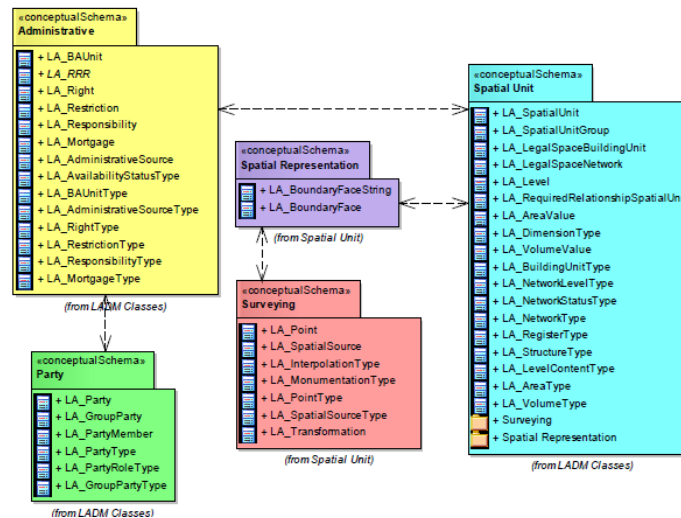
(2/2)

- *CityGML*



<http://blog.lidarnews.com/sig-3d-citygml-and-inspire>

- *LADM*

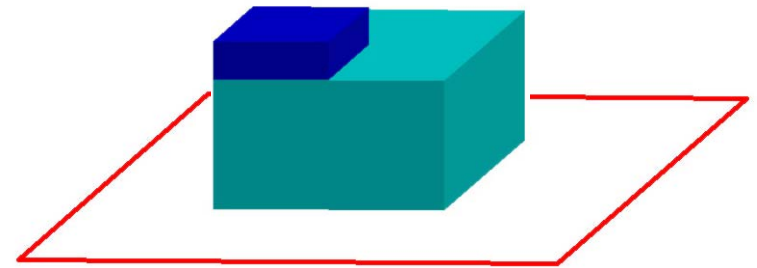


ISO, 2011

❑ Capabilities and Constraints in Generating 3D Cadastral Models from Existing Data (1/2)

Real Property 3D Modelling:

- ✓ parcel boundaries demarcation,
- ✓ demarcation of the object's location,
- ✓ definition of objects' constituent parts
- ✓ elevation or height data concerning real property objects



- Parcel boundaries, objects location, and objects' constituent parts available in cadastral databases
- Elevation/ height data in mapping agencies' databases, Urban Planning Departments
- Isometric plans/ 3d pdf

□ Capabilities and Constraints in Generating 3D Cadastral Models from Existing Data (2/2)

- ✘ Varying accuracy
- ✘ Scanned or paper drawings
- ✘ Reference systems used/ coordinate availability
- ✘ Data accessibility

- ❖ Fusion of different accuracy data
- ❖ Different data formats
- ❖ Insufficient elevation/ height data

- Requires efficient interoperable SDI
- Cannot generate a full 3D Cadastre

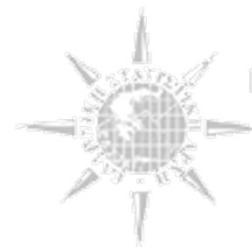
□ Case Study: Greece

(1/8)

➤ Complex legal and organisational framework

- Hellenic Cadastre/ *Mortgage Register Offices/ Cadastre of the Dodecanese*
- Municipal/ Regional Urban Planning Offices
- Utility operators
- Thematic Cadastres (Ministry of Rural Development and Food, Ministry of Environment, Energy and Climate Change, Ministry of Culture and Sports)
- Taxation databases
- Municipal Registers
- Registry of Public Power Corporation
- HMGS
- Hellenic Statistical Authority

ΕΘΝΙΚΟ ΚΤΗΜΑΤΟΛΟΓΙΟ
& ΧΑΡΤΟΓΡΑΦΗΣΗ Α.Ε.



Hellenic Statistical Authority

□ Case Study: Greece

(2/8)

1. Customary rights in Sikinos Island



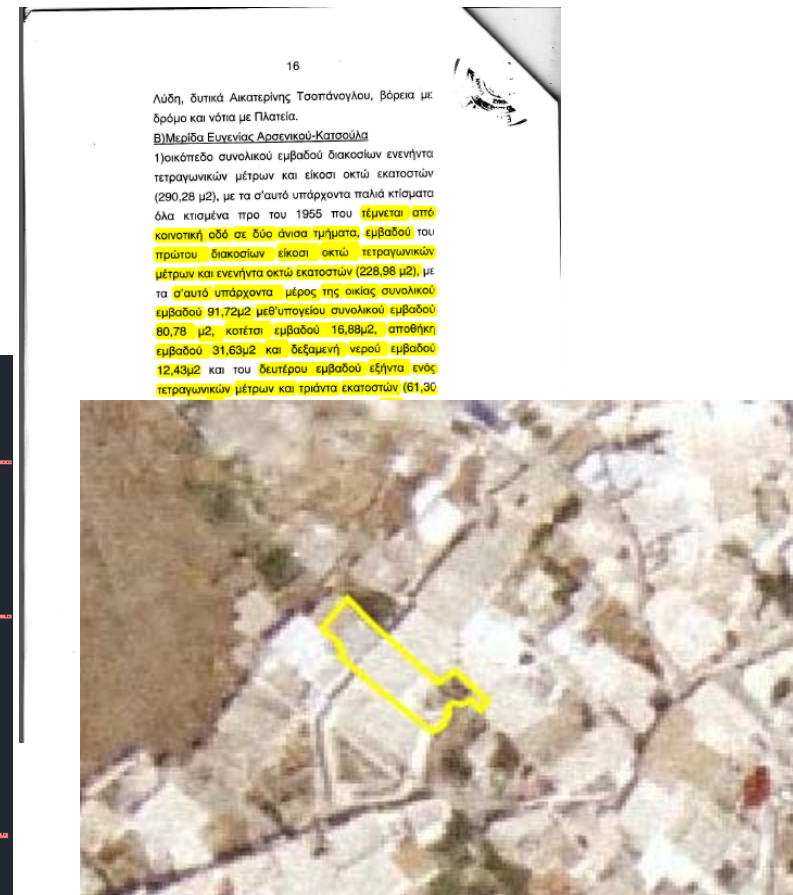
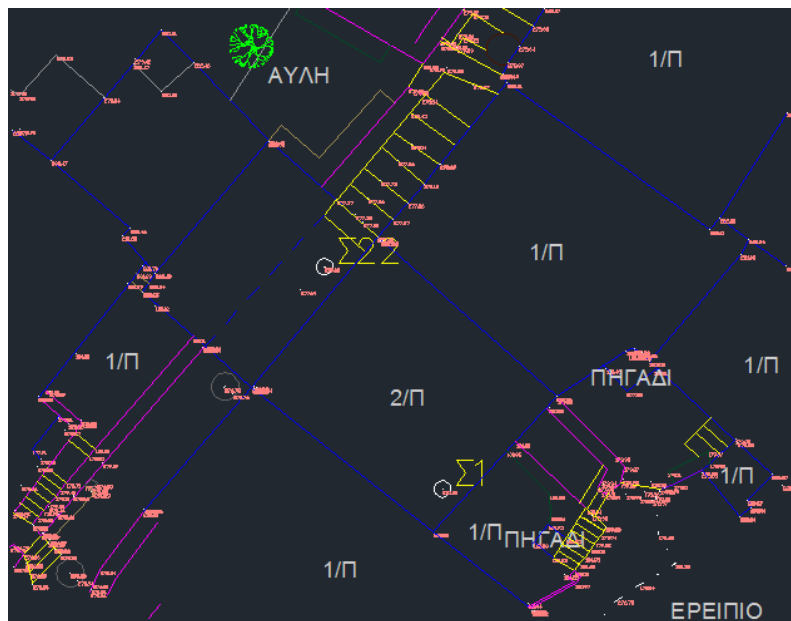
Case Study: Greece

(3/8)

1. Customary rights in Sikinos Island

Available data

- Deed of acceptance of succession
- LSO
- Topographic survey plans



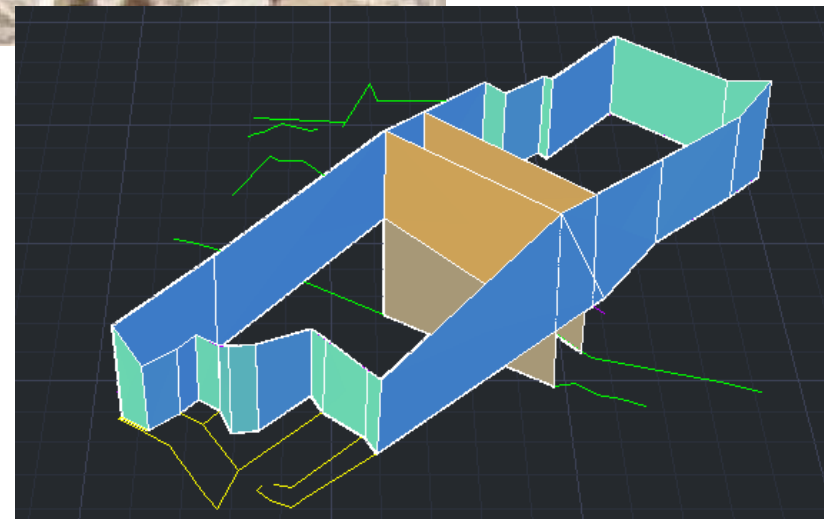
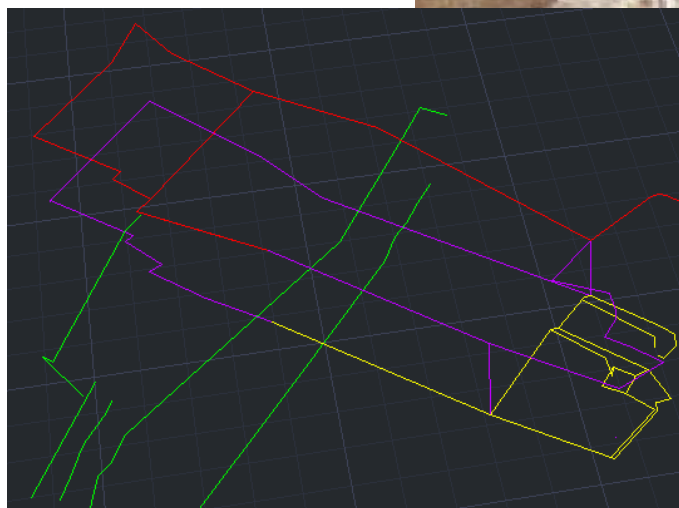
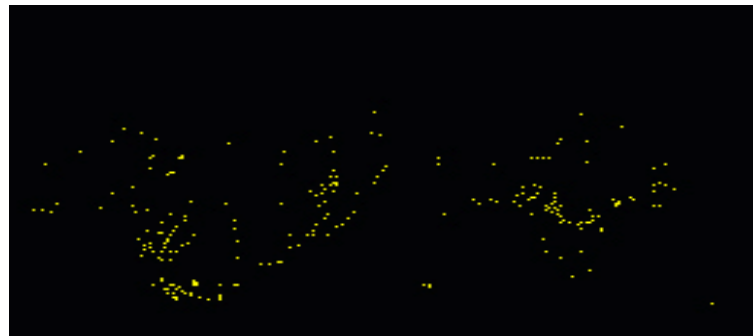
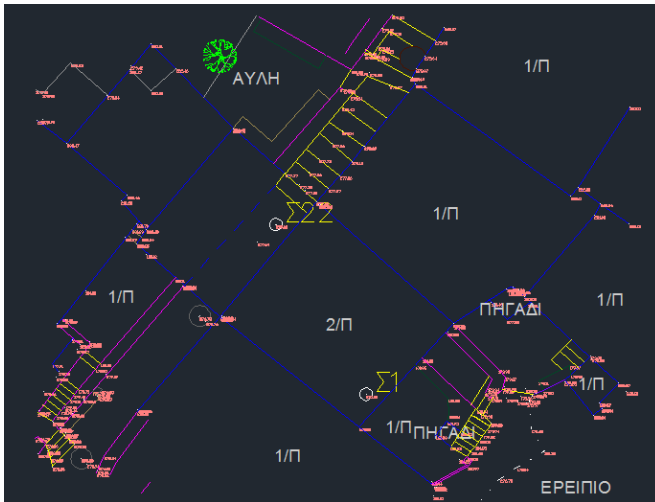
16
Λύση, δυτικά Αικατερίνης Τσοπάνηλου, βόρεια με δρόμο και νότια με Πλατεία.
Β)Μερίδα Ευγενίας Αρσενικού-Κατσούλα
1)οικόπεδο συνολικού εμβαδού διακοσίων ενενήντα τετραγωνικών μέτρων και είκοσι οκτώ εκατοστίων (290,28 μ²), με τα σ'αυτό υπάρχοντα παλιά κτίσματα όλα κτισμένα προ του 1955 που **τέμνεται από κοινοτική οδό σε δύο άνισα τμήματα, εμβαδού του πρώτου διακοσίων είκοσι οκτώ τετραγωνικών μέτρων και ενενήντα οκτώ εκατοστίων (228,98 μ²), με τα σ'αυτό υπάρχοντα μέρος της οικίας, συνολικού εμβαδού 91,72μ² μεθ'υπολοίπου συνολικού εμβαδού 80,78 μ², κατέτα εμβαδού 16,88μ², αποθήκη εμβαδού 31,63μ² και δεξαμενή νερού εμβαδού 12,49μ² και του δεύτερου εμβαδού εξήντα ενός τετραγωνικών μέτρων και τριάντα εκατοστίων (61,90**

Case Study: Greece

(4/8)

1. Customary rights in Sikinos Island

Data processing



Case Study: Greece

(5/8)

2. Apartment units in urban area



ΚΑΕΚ	VP_NUM	BLD_NUM	FLOOR	APP_NUM	BLD_NUM_TITLE	APP_NAME	AREA_DOC	PCNT_COWN
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051470533006	00	01	02	01		B-1	151,65	250
051470533006	00	01	03	01		F-1	151,65	250
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051470533006	00	01	-1	31		Θ-1	12,5	5
051470533006	00	01	-1	32		Θ-2	12,5	5
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□ Case Study: Greece

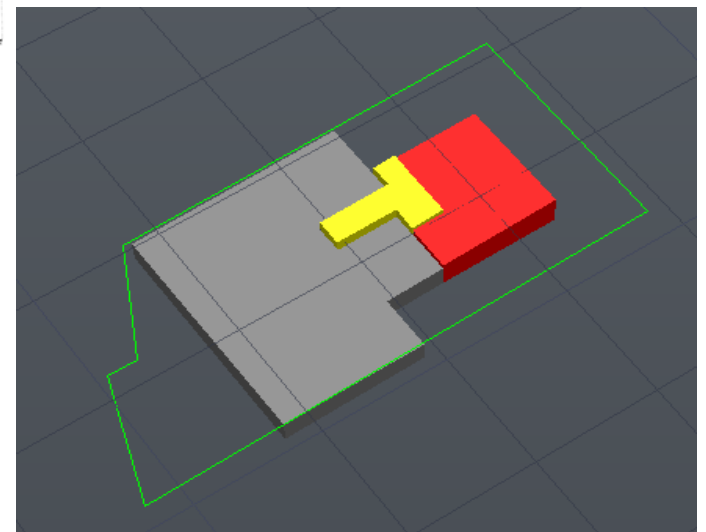
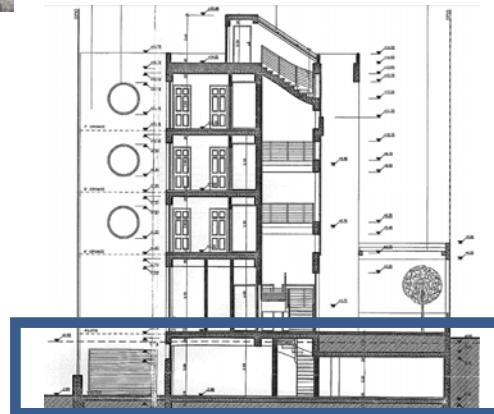
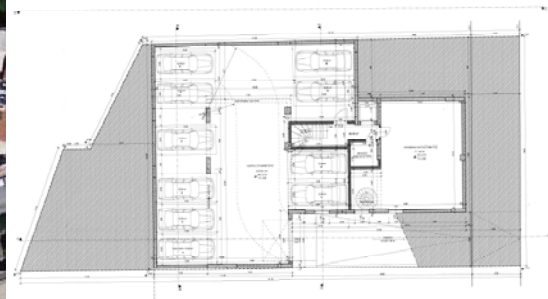
(6/8)

2. Apartment units in urban area

Available data

- VLSO (HC)
- Architecture drawings (Municipal Building Department)

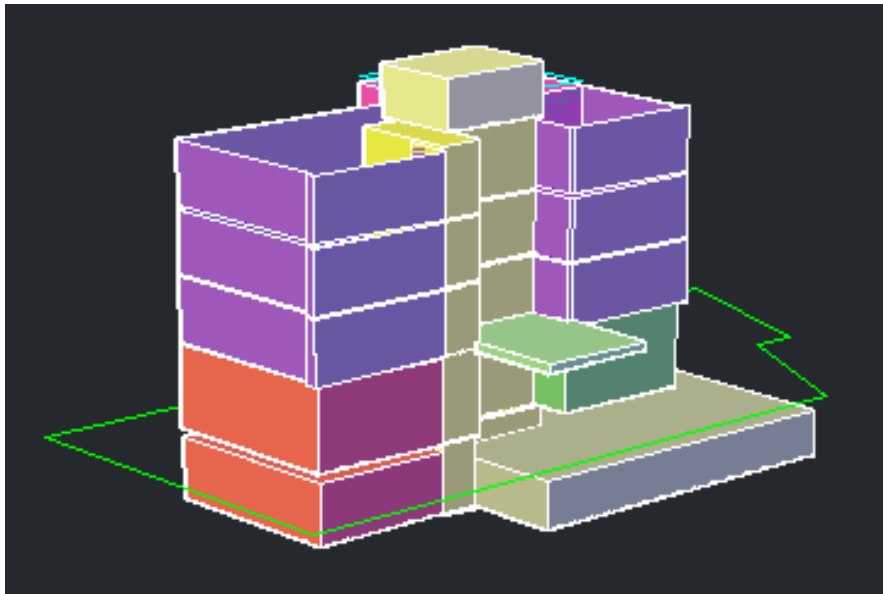
Data processing



□ **Case Study: Greece**

(7/8)

2. Apartment units in urban area



❑ Case Study: Greece

(8/8)

Case study findings

Cannot produce a full 3D cadastre

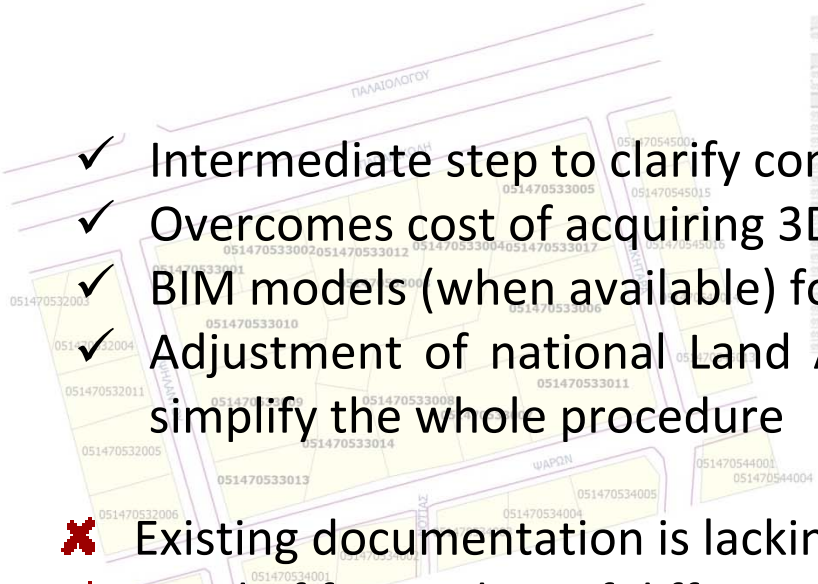
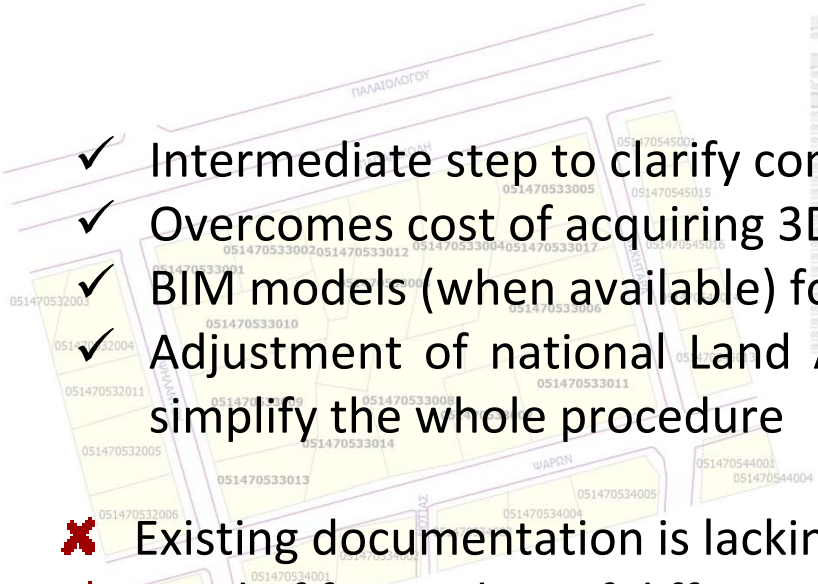
Can update/ extend existing Cadastre to 3rd dimension

Customary rights	Apartment units
Literal descriptions	Can only be applied to buildings
Refer to different legal status	Cannot accommodate variances between real and planned construction
Insufficient height data	Cannot apply to informal constructions
Need of data transform in case of older survey plans	Easier to accommodate survey plans not using national datum

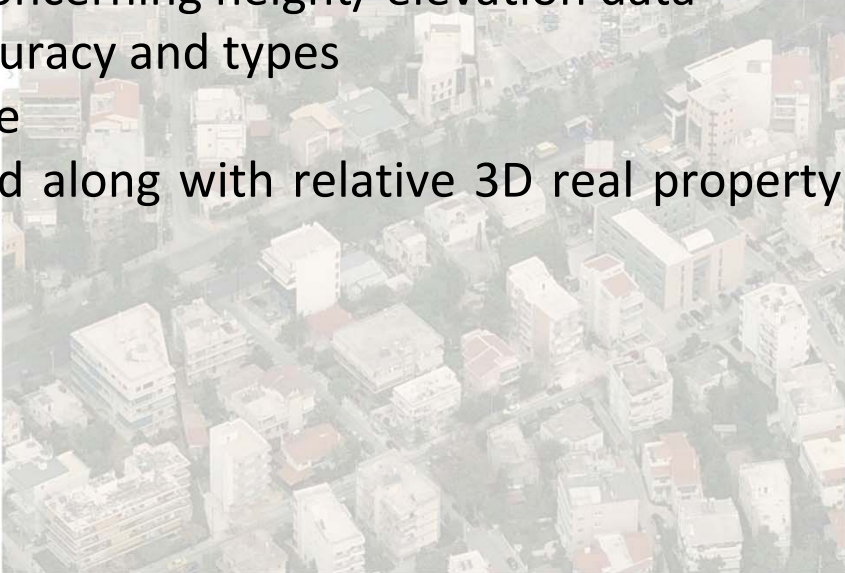
□ Conclusions

(1/2)

- ✓ Intermediate step to clarify complex real property situations
- ✓ Overcomes cost of acquiring 3D data
- ✓ BIM models (when available) for building level modelling
- ✓ Adjustment of national Land Administration Systems to LADM can simplify the whole procedure
- ✗ Existing documentation is lacking concerning height/ elevation data
- ✗ Need of fusing data of different accuracy and types
- ✗ Strong relation to constructed space
- ✗ Semantic data cannot be processed along with relative 3D real property model



KATA	AREA	POLYGOON_ID	ST_NAME	ST_NUMBER_NUM	LOCALITY	LOCATION_ID	TS	COMMENT
051470533006	201.857344	001470533006	NAVOTAPA	2	PERAKI POIANTH		13232	
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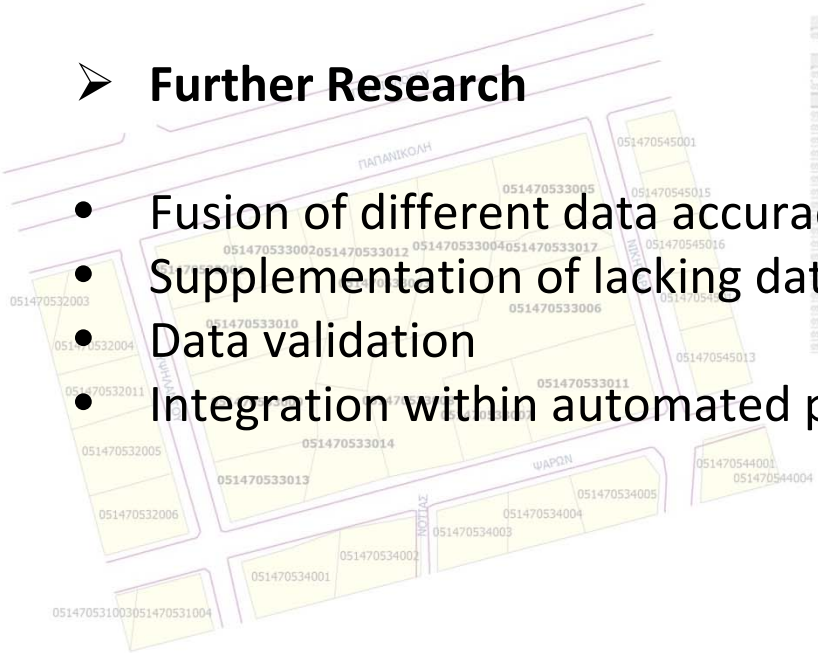


❑ Conclusions

(2/2)

➤ Further Research

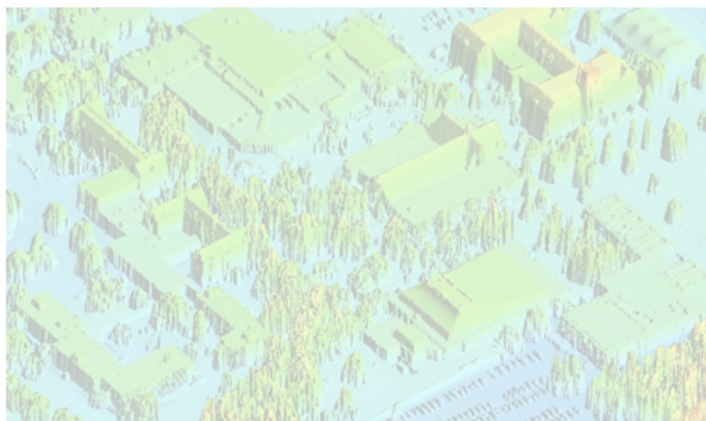
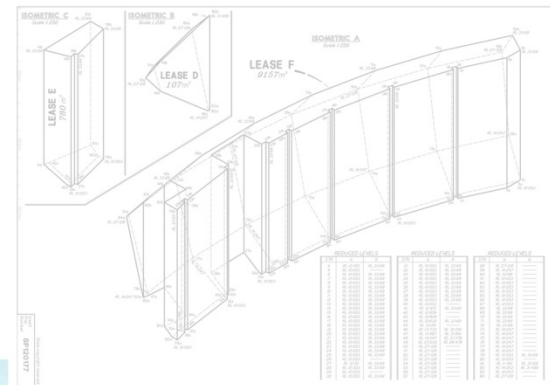
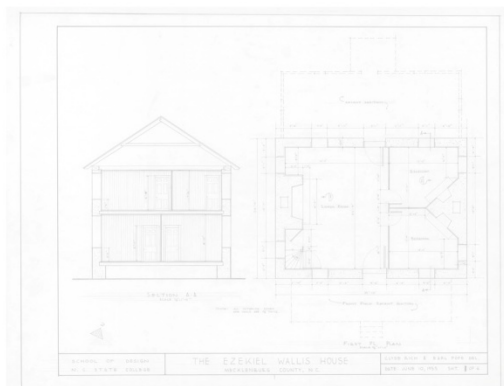
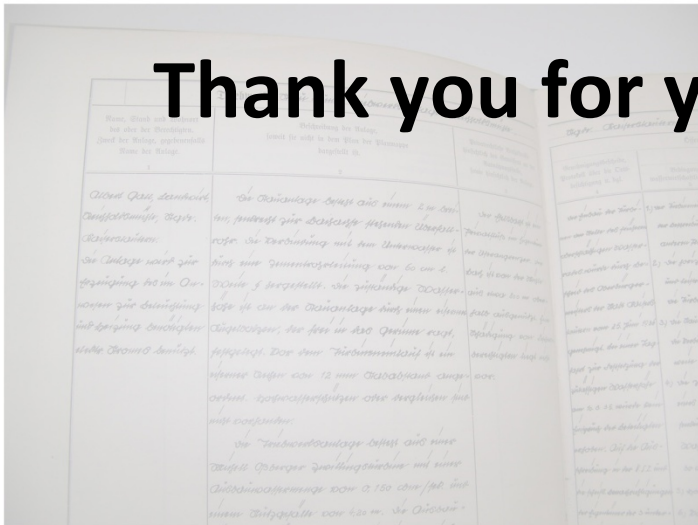
- Fusion of different data accuracy and formats
- Supplementation of lacking data
- Data validation
- Integration within automated process and relative procedural issues



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051470533009	303.327014	0000000014	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533010	302.327014	0000000015	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533011	301.327014	0000000016	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533012	300.327014	0000000017	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533013	299.327014	0000000018	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533014	298.327014	0000000019	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533015	297.327014	0000000020	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533016	296.327014	0000000021	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533017	295.327014	0000000022	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533018	294.327014	0000000023	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533019	293.327014	0000000024	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	
051470533020	292.327014	0000000025	ΠΥΛΑΙΑΝΤΩΝ			PERAKO POGATHI		15292	



Thank you for your attention !



Attribute table - blocks :: 0 / 209 feature(s) selected

POLYID	PERIMETER	HAB_X_MAN	AREA2	AREA_HA	DENS_POB	Densidad d
1	310.30227	40	3085	0.309	129	100-160
2	318.262331	40	3709	0.371	108	100-160
3	321.17129	36	3529	0.353	102	100-160
4	127.112735	12	941	0.094	128	100-160
5	308.86123	40	3304	0.33	121	100-160
6	247.524387	24	2417	0.242	99	80-100
7	206.767266	20	1901	0.199	101	100-160
8	249.358456	28	2488	0.249	112	100-160
9	365.937382	32	8172	0.817	39	30 - 60
10	198.832624	10	1843	0.184	54	30 - 60
11	305.464615	44	4538	0.454	97	80-100
12	136.354175	8	922	0.092	87	80-100
13	316.725515	44	6482	0.648	80	60 - 80
14	362.254147	60	8762	0.876	68	60 - 80
15	257.065587	40	4037	0.404	99	80-100
16	296.878455	56	5709	0.571	98	80-100
17	349.361123	72	6547	0.655	110	100-160
18	365.651765	60	7316	0.732	82	80-100