

# User Requirements Gathering for a National 3D Mapping Product in the United Kingdom

*Session 4 – EuroSDR/VOLTA SESSION:  
NMCAS I (3D GEOINFORMATION FOR  
NATIONAL AND CADASTRAL MAPPING  
AGENCIES I)  
13<sup>th</sup> 3DGeoInfo Conference, Delft  
University of Technology  
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“With such a large investment in processes and infrastructure, national mapping organisations need to get 3D city modelling almost right the first time.”

*Sargent et al. (2015)*




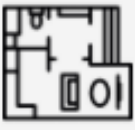





*The Building Blocks of User-Focused 3D City Models*

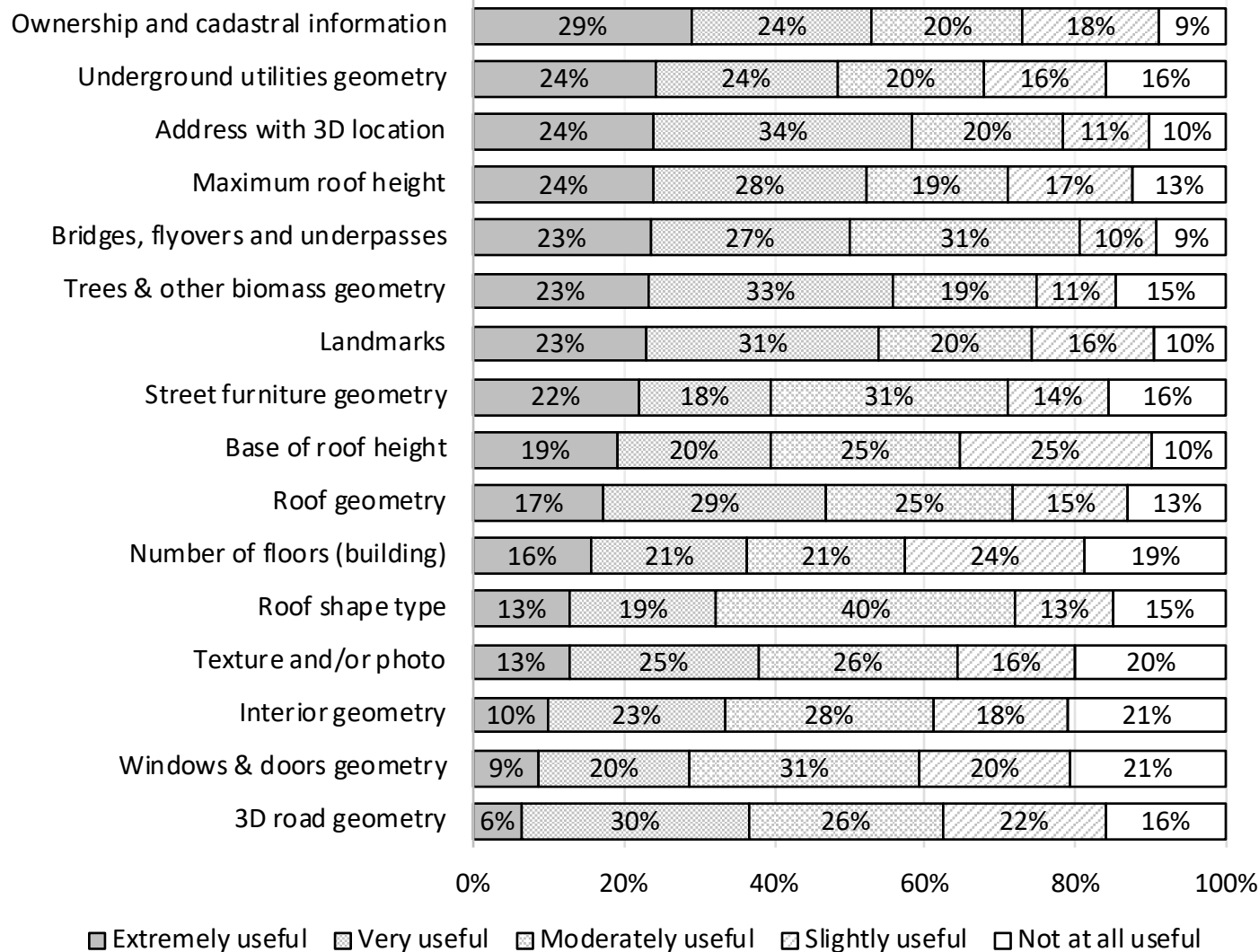
How can we make sure we get things almost right the first time?

- User perception of the 'usefulness'\* of 3D information
- Multiple choice web-based questionnaire (Mar-May 2017)
- 121 completed responses from the UK

\* can be a subjective term!

3. Please rate the usefulness of the following 3D information according to your day-to-day work:

		Extremely useful	Very useful	Moderately useful	Slightly useful	Not at all useful	Not applicable
Roof geometry		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Windows & doors geometry		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Texture and/or photo		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interior geometry		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3D road geometry		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maximum roof height	Max h 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Base of roof height	Base h 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trees & other biomass geometry		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Underground utilities geometry							



### Top 5 (by Extremely useful):

1. Ownership and cadastral info
2. Underground geometry
3. Address (w. 3D)
4. Max roof height
5. Bridges etc.

### Top 5 (by Extremely and Very useful):

1. Address (w. 3D)
2. Trees etc.
3. Landmarks
4. Ownership and cadastral info
5. Max roof height

**Aggregated results.** Stacked bar chart showing the aggregated results

# Simple correlation analysis

3D feature	Correlated featured (>0.5)	Kendall's tau-b
Roof geometry	Base of roof height	0.69
	Roof shape type	0.69
	Maximum roof height	0.62
	Number of floors	0.53
	3D road geometry	0.51
3D road geometry	Bridges, flyovers and underpasses	0.55
	Base of roof height	0.52
	Street furniture geometry	0.52
	Roof geometry	0.51
Trees & other biomass geometry	Maximum roof height	0.57
	Street furniture geometry	0.57
	Bridges, flyovers and underpasses	0.54
Street furniture geometry	3D road geometry	0.52
	Trees & other biomass geometry	0.57
	Bridges, flyovers and underpasses	0.58
Roof shape type (e.g. hipped, mansard, etc)	Roof geometry	0.69
	Maximum roof height	0.52
	Number of floors (building)	0.56
Number of floors (building)	Roof geometry	0.53
	Maximum roof height	0.65
	Roof shape type	0.56
	Address with 3D location	0.50
Ownership and cadastral information	Address with 3D location	0.66
Address with 3D location e.g. identify the floor or height	Number of floors	0.50
	Ownership and cadastral information	0.66
Landmarks e.g. statues, key buildings	-	-

**Correlation analysis.** Excerpt of features correlation with a Kendall's tau-b >0.5

Group name	Features
Basic building information	Roof geometry Roof shape type Base of roof height Maximum roof height Number of floors
Detailed building geometry	Windows and doors geometry Interior geometry
Roads	3D road geometry Bridges, flyovers and underpasses Street furniture geometry Trees & other biomass geometry
Land ownership and addressing	Ownership and cadastral information Address with 3D location
Standalone features	Underground utilities geometry Texture and/or photo Landmarks

**Potential feature groups.** As derived from the Kendall's tau-b correlation

# Exploratory factor analysis

Identifying variables with high intercorrelations, which could measure one underlying factor.

	Group 1	Group 2	Group 3
Underground utilities geometry	0.76		
Street furniture geometry	0.76		
Bridges, flyovers and underpasses	0.67		
Trees & other biomass geometry	0.66		
Ownership and cadastral information	0.57		
Address with 3D location	0.55		
Landmarks e.g. statues, key buildings	0.54		
3D road geometry	0.50		
Windows & doors geometry		0.76	
Interior geometry		0.67	
Texture and/or photo		0.63	
Roof shape type		0.59	0.54
Roof geometry		0.55	0.55
Base of roof height			0.78
Number of floors		0.49	0.64
Maximum roof height	0.41		0.64
Eigenvalues	3.71	2.88	2.77

**Truncated summary table of the EFA.**



# Exploratory factor analysis

Groups	Features
Simple building information (Group 3)	Roof geometry Base of roof height Maximum roof height
Detailed building information (Group 2)	Windows and doors geometry Interior geometry Texture and/or photo Roof shape type Number of floors
Non-building information (Group 1)	Underground utilities geometry Street furniture geometry Bridges, flyovers and underpasses Trees and other biomass geometry Ownership and cadastral information Address with 3D location Landmarks 3D road geometry

**Exploratory factor analysis.** Factor groupings.

# Exploratory factor analysis

Sector	n	Simple building info.	Detailed building info.	Non-building info.	Sum
Solar	1	4.3	4.4	4.8	13.5
Air quality eng.	6	4.5	3.6	4.4	12.5
Subsurface apps.	5	3.7	3.5	4.5	11.7
Cad. & land mgmt.	2	3.8	3.7	4.1	11.6
Acoustic engineering	2	4.0	3.7	3.6	11.3
Env. services	7	4.0	3.2	4.0	11.2
Facilities mgmt..	16	3.5	3.8	3.9	11.2
Urban planning	8	4.0	3.2	3.9	11.1
VR & gaming	6	4.3	3.1	3.5	10.9
Infra. & transport	20	3.3	3.3	4.1	10.7
Other	21	4.0	3.0	3.6	10.6
Academia	19	3.8	3.2	3.4	10.4
Archaeology	15	3.3	3.5	3.3	10.1
Gov. & local council	37	3.3	2.9	3.6	9.8
History & heritage	11	3.0	3.4	3.1	9.5
Emergency services	2	2.3	2.4	2.5	7.2
Oil & gas	5	2.5	1.8	2.9	7.2
Leisure	4	2.0	1.8	3.1	6.9
Insurance	2	1.7	1.7	1.4	4.8

**Exploratory factor analysis.** Median response for UK participants split by factor and sector, sorted by the sum.

## Some conclusions...\*

- Users perceive non-building classes and building attribution to be more useful than additional detail on building geometry.
- There is potential for multiple national 3D mapping products.

\* These conclusions are country and time specific! Specifically, in the UK between March and May 2017)

# Future work

- Repeat with a larger sample, and from non-GI users
- Repeat every 2- 5 years to monitor change in perception.
- Repeat in other nations, to compare and contrast 3D user requirements.

## **“Towards a National 3D Mapping Product for Great Britain”**

<http://bit.ly/kelvin3d>



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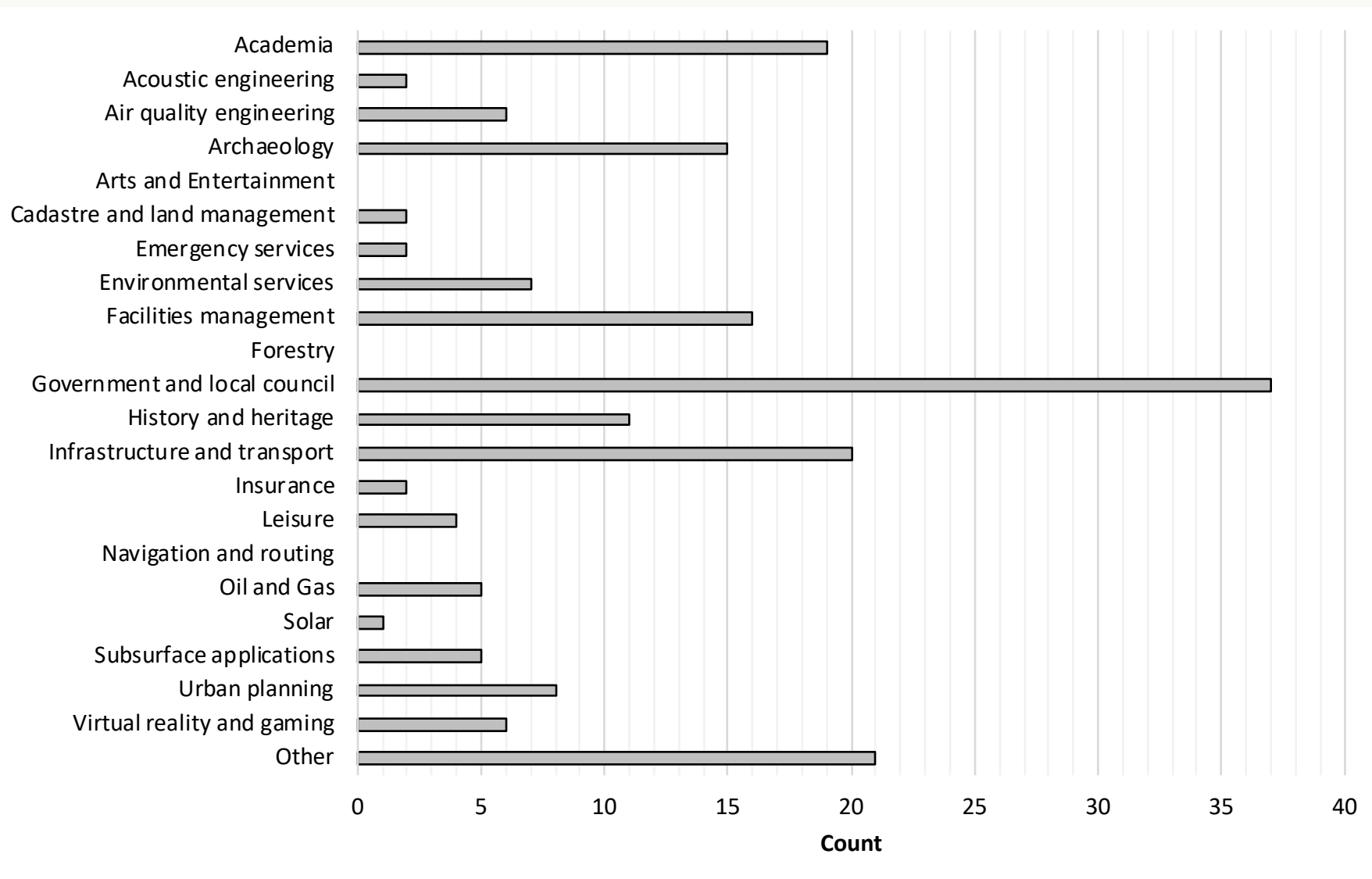
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**UK 3D GIS**   
**Special Interest Group**

Join the conversation: <http://bit.ly/UK3DSIG>



**Sector split.** Which sector would you describe yourself to be in?

## Mode response. Split by sector

Sector	n	Roof geometry	Windows & doors geometry	Texture and/or photo	Interior geometry	3D road geometry	Maximum roof height	Base of roof height	Trees & other biomass geometry	Underground utilities geometry	Street furniture geometry	Roof shape type	Number of floors (building)	Ownership and cadastral information	Address with 3D location	Landmarks	Bridges, flyovers and underpasses
Gov. & local council	37	3	3	3	3	3	3	3	5	4	5	3	4	5	5	3	5
Infrastructure & transport	20	5	3	5	3	5	5	5	5	5	5	4	4	5	5	4	5
Academia	19	3	4	5	3	5	4	4	3	5	3	4	5	4	3	3	5
Facilities management	16	4	3	5	4	3	5	3	5	5	5	3	5	5	5	3	4
Archaeology	15	3	3	4	4	2	4	3	4	5	3	4	4	4	3	3	3
History & heritage	11	3	3	3	4	3	4	2	5	5	3	3	4	4	2	3	3
Urban planning	8	4	3	2	3	3	4	4	4	5	4	4	5	4	5	5	5
Environmental services	7	4	5	1	5	3	5	5	4	5	5	4	5	5	5	5	5
Air quality engineering	6	4	3	5	5	5	5	5	4	5	5	3	5	5	5	5	5
Virtual reality & gaming	6	3	3	5	3	3	5	5	3	5	5	4	5	2	3	5	5
Oil & gas	5	1	2	3	3	2	3	1	3	3	2	1	3	4	5	4	4
Subsurface applications	5	4	4	4	3	4	4	3	4	5	4	4	4	5	5	4	4



## Median response. Split by sector

Sector	n	Roof geometry	Windows & doors geometry	Texture and/or photo	Interior geometry	3D road geometry	Maximum roof height	Base of roof height	Trees & other biomass geometry	Underground utilities geometry	Street furniture geometry	Roof shape type	Number of floors (building)	Ownership and cadastral information	Address with 3D location	Landmarks	Bridges, flyovers and underpasses
Gov. & local council	37	3.0	2.5	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	3.0	3.0	4.0	3.0	4.0	4.0
Infrastructure & transport	20	4.0	3.0	4.0	3.0	5.0	3.0	3.0	4.0	5.0	4.0	3.5	4.0	4.0	4.0	4.0	5.0
Academia	19	3.0	3.0	3.0	3.0	3.0	4.0	3.5	3.0	3.0	3.0	3.0	4.0	4.0	3.0	3.0	4.0
Facilities management	16	3.5	3.0	4.0	4.0	3.0	3.5	3.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0
Archaeology	15	3.0	3.0	3.5	3.0	2.0	3.0	3.0	4.0	4.0	3.0	3.5	4.0	3.0	3.0	4.0	3.0
History & heritage	11	3.0	3.0	4.0	4.0	3.0	3.0	2.0	4.0	4.0	3.0	3.0	3.0	4.0	2.5	4.0	2.0
Urban planning	8	4.0	3.0	2.0	3.0	3.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.5	4.0	4.5
Environmental services	7	4.0	2.5	1.5	2.5	3.0	4.5	3.5	4.0	4.0	4.5	3.5	4.0	4.5	5.0	5.0	4.0
Air quality engineering	6	4.0	3.0	4.0	4.0	4.0	5.0	4.0	4.0	3.5	4.5	3.0	5.0	4.0	5.0	4.0	5.0
Virtual reality & gaming	6	3.0	3.0	3.0	3.0	3.0	5.0	4.0	3.5	3.0	4.0	4.0	4.0	2.5	3.0	4.0	5.0
Oil & gas	5	1.0	1.5	2.0	3.0	2.0	3.0	1.5	3.0	3.0	2.0	1.5	3.0	3.5	2.5	3.5	3.5
Subsurface applications	5	4.0	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.5	4.0	5.0	5.0	4.0	4.0

