Measured surveys – at the heart of every good survey is a strong specification (8064)

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Content

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- RICS – brief introduction
- Survey specifications – why, what and how
- BIM and Survey4BIM – the RICS experience
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Client education

That critical first meeting….

- Did you/they really mean that? Just what do they want it for? Fitness for purpose…
- Is the purpose agreed? And output/deliverable? And cost?
- National specifications – highways, utilities, cadastre
- No-body likes surprises!
- Geo-speak

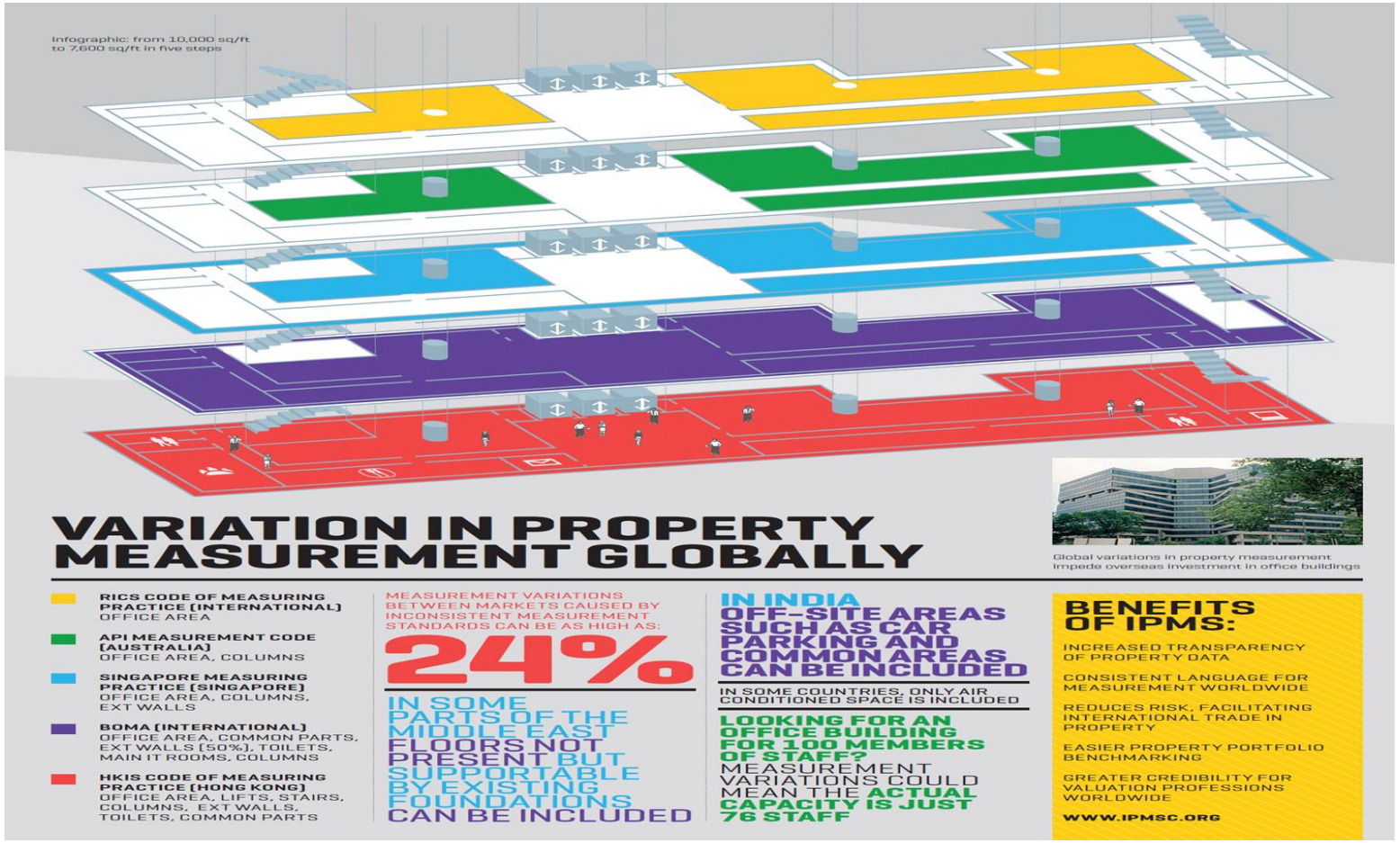
Potential problems, 1 common thread

- Valuation
- Development Land
- Construction – multiple uses (control example)
- BIM and 3D

- Survey Spec

International Standards

International property measurement standards - IPMS



Survey detail accuracy and valuation

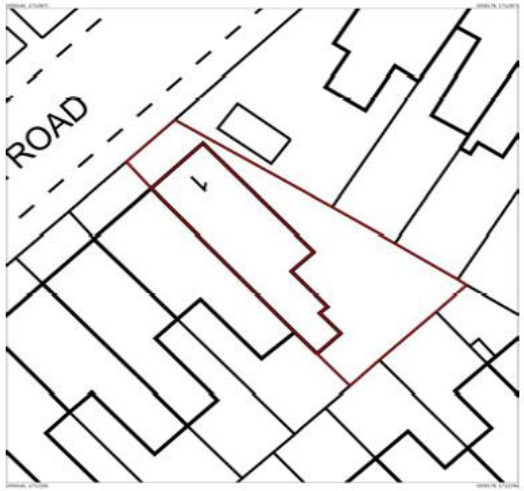
Survey scale	Accuracy (X,Y)	Final valuation accuracy*	Minimum size of feature to be shown to scale without generalisation	Example of survey	Typical use
1:20	+/– 5mm	0.5%	10mm	Engineering surveying and setting out, high accuracy measured building surveying, heritage recording	High accuracy engineering output, structural steel and complex refurbishment, high value commercial property
1:50	+/– 10	1%	20mm	Engineering surveying and setting out, measured building surveys, high accuracy topographic surveys, determined boundaries, area registration	Building surveys, refurbishment and space planning, demolition and structural engineering, commercial area registration
1:100	+/– 25mm	2%	50mm	Measured building surveys, low accuracy setting out, net area surveys, valuation surveys	General arrangement drawings for space planning, estate agency, residential valuation, low accuracy commercial development and valuation
1:200	+/– 50mm	4%	100mm	Low accuracy measured building surveys.	Planning, building footprint or detail design

International Standards

Land

- All buildings, roads and footpaths on land adjoining the site including access arrangements.
- All public rights of way crossing or adjoining the site.
- The position of all trees on the site, and those on adjacent land.
- The extent and the type of any hard surfacing.
- The boundary treatment including walls or fencing where this is proposed.

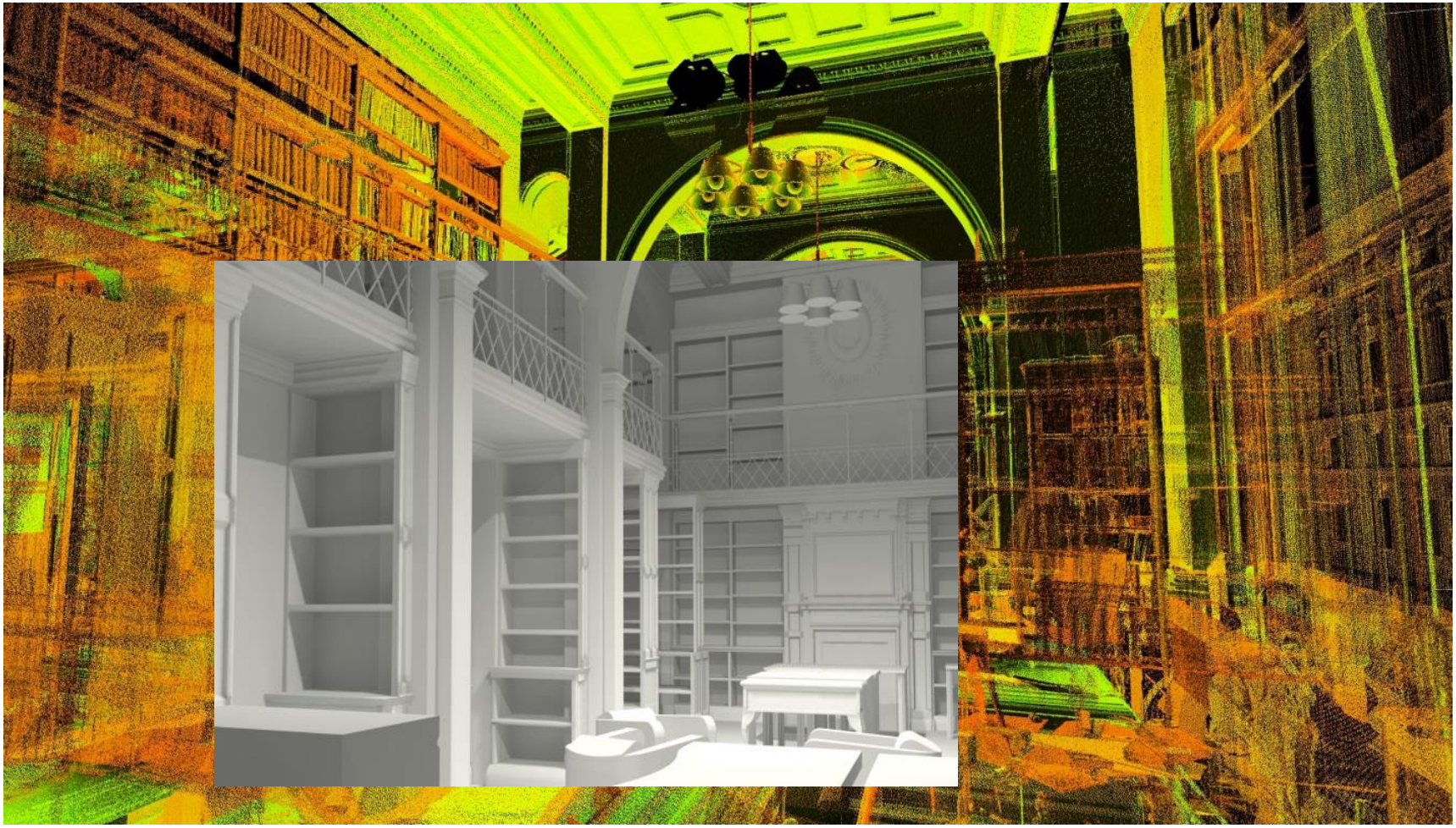
Create and buy a site plan



Scale: 1:200

Scale: 1:500

BIM – the RICS experience



Survey4BIM

Five major geo-issues

- Interoperability
- Accuracy
- Level of detail
- Meta Data
- Generalisation

Survey Specification

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- **Primary focus** – client education
- Placing the relationship and understanding between client and surveyor at the core of any survey project

- **The Legacy** … 2nd ed 1997
- Rapid changes in technology and practice
- Core survey principles remain
- Internationalisation

- **New elements:**
- Survey detail accuracy banding table
- Inclusion of survey feature tables
- Setting-out, deformation, monitoring
- Expanded deliverables

Survey detail accuracy band table

Plan accuracy (X,Y)			Height accuracy (Z)[1]					
Band	1 sigma	2 sigma	Band	Accuracy hard detail	Accuracy soft detail	Example survey types/uses[2]	Approximate legacy plot scale output required to achieve accuracy band[3]	Min size of feature shown true to scale (not symbolised)
A	+/- 2mm	+/- 4mm	A	+/- 2mm	N/A	Monitoring, high accuracy engineering setting out and fabrication surveys	1:5	4mm
B	+/- 4mm	+/- 8mm	B	+/- 4mm	N/A	Monitoring, high accuracy engineering and measured building surveys and setting out	1:10	5mm
C	+/- 5mm	+/- 10mm	C	+/- 5mm	N/A	Engineering surveying and setting out, high accuracy measured building surveying, heritage recording	1:20	10mm
D	+/- 10mm	+/- 20mm	D	+/- 10mm	+/- 25mm	Engineering surveying and setting out, measured building surveys, high accuracy topographic surveys, determined boundaries, area registration	1:50	20mm
E	+/- 25mm	+/- 50mm	E	+/- 10mm	+/- 50mm	Measured building surveys, topographic surveys, low accuracy setting out, net area surveys, valuation surveys, area registration, utility verification (QL-A) PAS 128 (UK)	1:100	50mm
F	+/- 50mm	+/- 100mm	F	+/- 50 mm	+/- 100mm	Low accuracy measured building surveys, topographic surveys, high accuracy utility tracing, gross area surveys	1:200	100mm
G	+/- 100mm	+/- 200mm	G	+/- 50mm	+/- 100mm	Topographic surveys, low accuracy measured building surveys, utility tracing surveys, boundary mapping, high accuracy geotechnical, detection (QL-B1 PAS 128 (UK)	1:500	200mm
H	+/- 250mm	+/- 500mm	H	+/- 125mm	+/- 250mm	Low accuracy topographic surveys, national urban area mapping, geotechnical mapping, tree surveys	1:1000	500mm
I	+/- 500mm	+/- 1000mm	I	+/- 500mm	+/- 1000mm	Low accuracy topographic mapping, national non-urban mapping, general boundary mapping, asset mapping, utility survey – detection QL-B4 PAS 128 (UK)	1:2500	1000mm
J	+/- 1000mm	+/- 2000mm	J	+/- 1000mm	+/- 2000mm	Low accuracy route/corridor planning surveys, large area GIS asset mapping	1:5000	2000mm
X Y	(Custom)[4]		Z	(Custom)	(Custom)	Note: To create a customised band please select the band letter required and add as a prefix to XY or Z (i.e. +/-125mm plan = G-XY)		(Custom)

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Control, coordinate grid and datum

- Move towards
- Control netwo

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Recommended good practice
It is recommended to establish survey control in a hierarchy from primary to secondary to tertiary (first, second or third order) etc. working from the whole to the part (i.e. establish primary or first order control over the full extents of the survey followed by the addition of secondary/second order points etc. to increase density of survey control points for survey detail observation purposes).
The surveyor shall ensure that the required accuracy and suitability of survey control points and traverse/ network observations have been met prior to processing of survey detail observations.
The client and surveyor should consider survey control accuracy requirements for the life cycle of a project including future phases which may require a higher accuracy (i.e. setting out, monitoring).
Maintenance of survey control is also important and is covered in subsection 2.13.

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Measured building surveys

- Level of Detail (LoD) – different accuracy bands for different levels of detail
- Output driven
- Direct links to IPMS & Code of Measuring Practice
- Introduction of BIM as an output
- Extensive feature tables

Underground utility surveys

Quality Level	Scope upon which results are based	Relative accuracy obtained	Relative confidence level in results	Relative cost
D	**Desktop utility records search**	Lowest	Lowest	Lowest
C	**Site reconnaissance**	Medium low	Medium low	Medium low
B	**Detection** with EML and GPR	Medium high	Medium high	Medium high
A	**Verification** using intrusive inspection	Highest	Highest	Highest

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Setting out, deformation and monitoring surveys

- Output driven
- Control reuse issues underlined

Output	Required	Deliverable type	Comments
Site mark out (set out points physically marked on the ground)			
Setting out report (include surveyed			

Monitoring and deforma

- Output driven
- Types of movement
- Features to be monitore
- Frequency

7.3 Survey type

A survey is required to monitor the following types of movement:

Movement type	Required	Comments
Horizontal movement		
Vertical movement		
Verticality		
Tilt movement		
Vibrational movement		
Crack/joint expansion		
Other (specify)		

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Deliverables – the key

- Client requirements
- Format and method of delivery
- CAD deliverables – client or su
- Digital terrain model (TIN) deli
- Point Cloud Deliverables (inc.
- GIS
- Report deliverables
- Imagery, spreadsheet, textual
- Method of delivery
- Receipt
- Background information and re

Deliverable type	Suggested exchange formats
CAD	*.dxf
Digital terrain model (TIN/string)	*.dxf
Digital terrain model (grid)	*.csv
Photography	*.jpeg ; *.TIF, *.ECW
Video imagery	*.mpeg, *.avi
Point cloud	*.LAS; E57
Survey reports	*.pdf, *.docx
GIS	*.dxf, *.GML
Textual data	*.csv, *.txt
BIM	Revit®, AutoCAD, MicroStation and Navisworks

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BIM as a deliverable

- Connected to employers
- BIM execution plan – PA
- BIM checklist
- Basic survey for BIM sp LOD)

8.17.1 Basic survey for BIM specification

Recommended good practice
The below sample specification and the level of detail achievable is directly influenced by the required accuracy detail banding (see subsections 2.3 and 4.1).

BIM output	Required	Accuracy band	Comments
Construction detail			
Modelled to fit specification			
All deviations included (medium/high accuracy)			
Graphical level of detail			
Mass model			
Basic structural model			
Basic architectural model			
Detailed architectural model			
Meta data detail			
Basic			
Detailed			
Digital output and delivery (see also section 9)			
Extra information/ other requirements			

	Complete

Measured Surveys of land, buildings and utilities 3rd ed – best practice guidance

Conclusions

- Remember how important that first meeting with the client is!
- Survey purpose (and future use) drives cost, methodology and output
- Measured Survey specifications and ‘fitness for purpose’ are key to every survey project – understand the ‘purpose’ and ‘output’
- No surprises!
- Don’t blind clients with geo-speak
- Do not undersell your skillsets - liability
- A common language and known industry standards/specifications can get surveyors to the top table
- Most of the developed world is already built – measure it!
- Collaboration is everything

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