FIG WORKING WEEK 2023
28 May - 1 June 2023 Orlando Florida USA
Protecting Our World, Conquering New Frontiers

Guidelines for the Use of GNSS in Land Surveying and Mapping 3rd Ed - an Operational Best Practice Standard (12048)

Dr Chris Pearson
James Kavanagh
Gordon Johnston

BUILDING CAPACITY IN GEODETIC COMPETENCY (TS05G/10567)
Commission: 5
Tuesday, 30 May 14:30–16:00 Taylor, Hilton/Waldorf

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Use of GNSS in Land Surveying and Mapping

RICS Professional Standard 3rd Edition

From Newcastle. For the world.

Authorship

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Geospatial Engineering

RICS®

Aims

- Update and refresh existing 2nd edition guidance notes from 2010
- Condense guidance notes
- Ease navigation of document
- Develop a global, current, relevant and useful guidance notes applicable to varied users

Expert Peer Review & Endorsement

Paul Cruddace, FRICS (Ordnance Survey GB)
Barry Gleeson, FRICS (WSP)
Mark Greaves, MRICS (Ordnance Survey GB)
Richard Groom, FRICS (Consultant)
Dr. William Kelly, (Glasgow University)
Marcin Krzetowski, (Network Rail)
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Dr. James Turner, (HS2)

Plus feedback and comments from many more industry experts

Timeline

Stage 1 2021

- Initial Review of 2nd edition
  - Single part document
  - Multi GNSS
  - PPP
- GEO Business 2021 Questionnaire survey
  - Improve navigation
  - New precision reference tables
  - Reduce coordinate transformation section

Timeline

Stage 2

Spring 2022

- First draft of 3rd edition
  - Industry expert reviews
  - GEO Business 2022 presentation and feedback
  - Snake Projections
  - PPP-RTK
  - Extra experiments not possible

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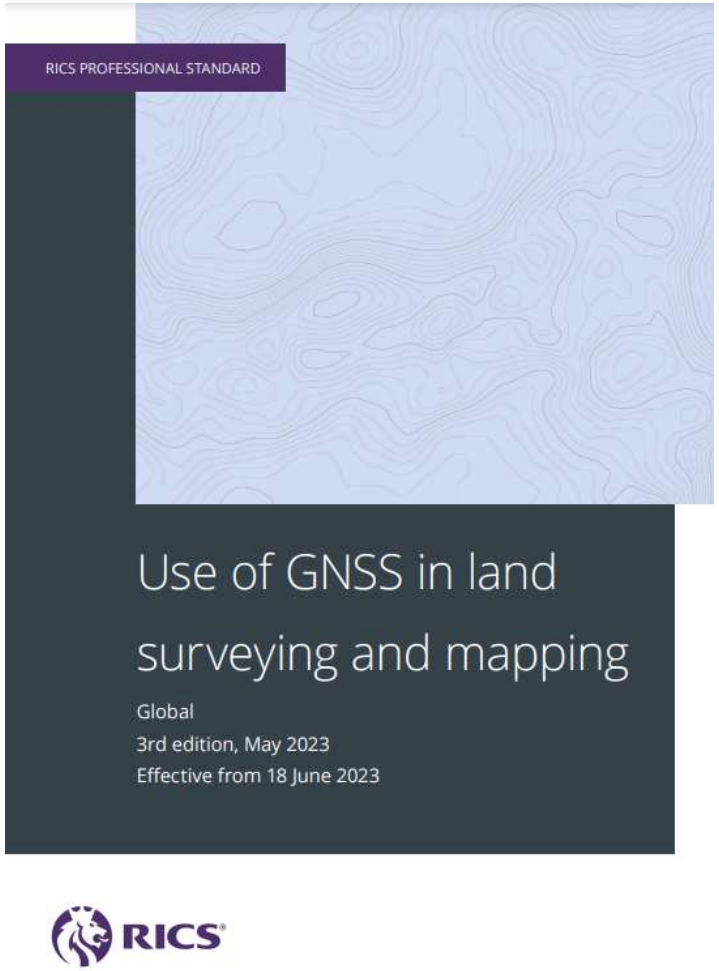
Timeline

Stage 3
Winter 2022

- Second draft of 3rd edition
  - Further national industry expert reviews
  - 4 week open global consultation
- Final version
  - Editorial review

New Guidance Notes



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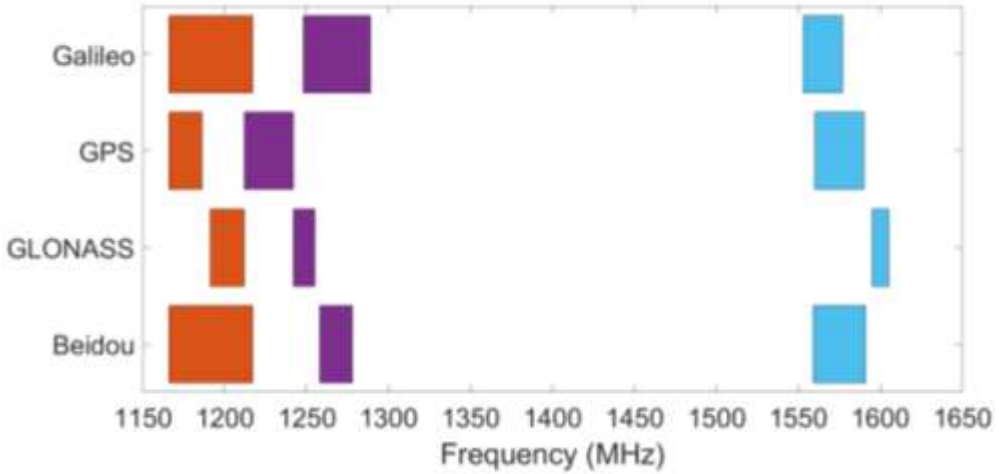
New Guidance Notes

Role of GNSS in surveying

- Different GNSS constellations and frequencies
- Coordinate reference frames (WGS84, ITRS)
- Range of GNSS applications
- Working from the whole to the part
- Survey types
  - Control survey guidelines
  - Detail survey guidelines
  - Low precision positioning guidelines



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New Guidance Notes

Survey Methods

- Static Positioning
  - Static Baseline
  - Rapid Static
  - Static Network RTK
  - Precise Point Positioning (PPP)

- Kinematic Positioning
  - Relative Kinematic
  - PPP-RTK
  - Differential GNSS (DGNSS)

- Impact of Multi GNSS

New Guidance Notes

Technique	Observations	Baseline length	Occupation time	Accuracy
Static baseline	Dual frequency	20 km	>1 h	H 5 – 10 mm V 10 mm
		30 km	>2 h	
		50 km	>4 h	
		100 km	>6 h	
Rapid static	Dual frequency	<10 km	>5 m (5 s or 10s epoch rate)	H 10 - 15 mm V 10 – 20 mm
		<15 km	>15 m (5 s or 10s epoch rate)	H 10 - 20 mm V 20 – 30 mm
Static network RTK	Dual frequency	< 40km	2x >3 min separated by >20 min	H 10 - 15 mm V 15 – 30 mm
PPP	Dual frequency	N/A	24 h	H 10 mm V 10 – 15 mm
			6 h	H 15 mm V 15 – 25 mm
			1 h	H 50 mm V 60 – 100 mm

Table 1: Static positioning – potential accuracies in horizontal (H) and vertical (V). Accuracies are given as one sigma (σ)

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New Guidance Notes

Technique	Observations	Baseline length	Initialisation time	Accuracy
Relative kinematic	Dual frequency	1 km	5 seconds	H 10 – 20 mm
		15 km	1 minute	V 15 - 30 mm
PPP-RTK	Dual frequency	<50 km	5 minute	H 20 – 50 mm
		<250 km	20 minutes	V 30 – 60 mm
DGNSS	Dual frequency float	20 km	1 – 15 minutes	H 0.1 – 0.4 m V 0.2 – 0.8 m
	Phase smoothed code			0.4 – 1 m
	L1 code	100 km	1 minute	H 1 – 5 m V 2 – 7 m

Table 2: Kinematic positioning – Potential accuracies in horizontal (H) and vertical (V). Accuracies are given as one sigma (σ)

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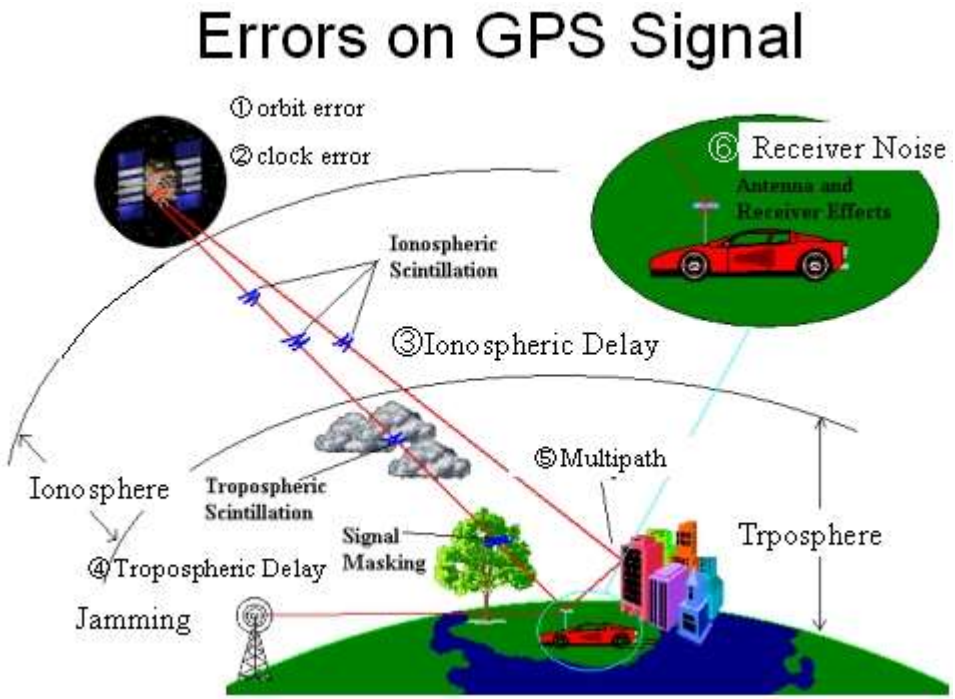
New Guidance Notes

Survey Errors

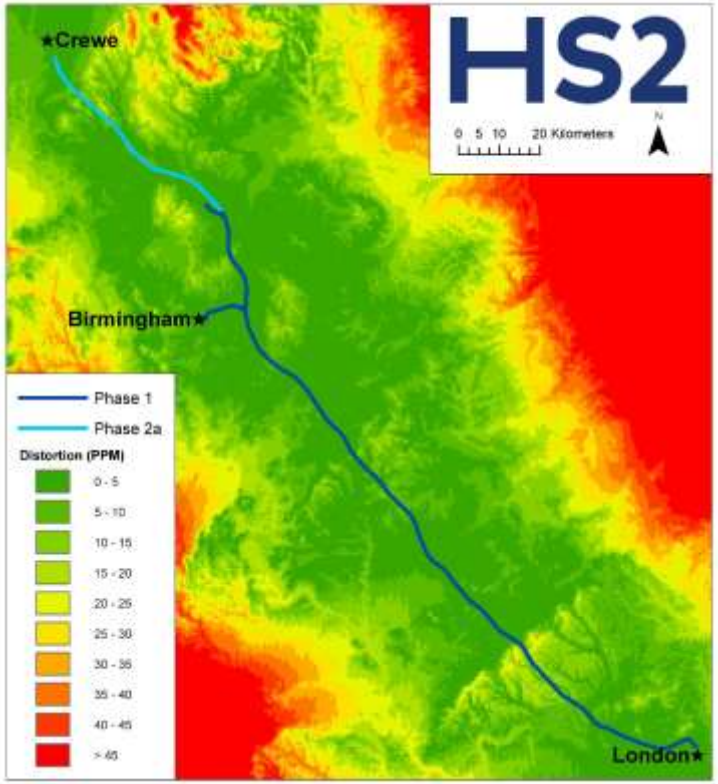
- Satellite orbits and clocks
- Ionosphere refraction
- Tropospheric refraction
- Multipath
- Interference
- Antenna phase centres
- Vegetation cover



New Guidance Notes

Coordinate Reference Systems

- Link to OS guide to coordinate systems in GB
- The geoid
- The ellipsoid
- Datums
- Map Projections
- Projection Coordinates
- Snake Projections
- Height Transformations
- Coordinate Transformations



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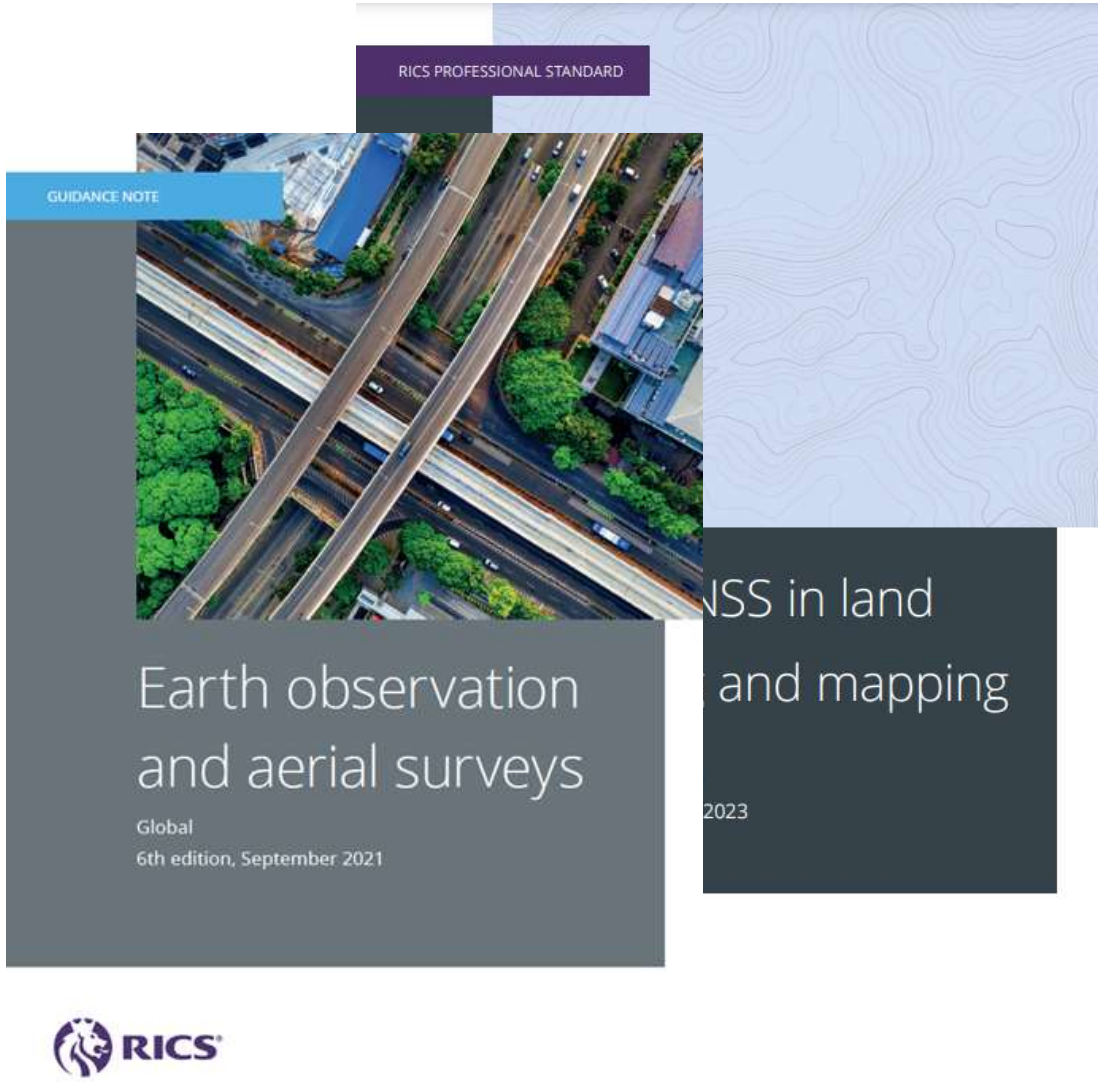
New Guidance Notes

Quality Assurance and Control

- Network Design
- Network Shape
- Linkage to national control
- Quality control of real-time systems
- Recording of field notes
- Office procedures

New Guidance Notes



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Questions

Comments