GEOSPATIAL ENGINEERING COMPETENCIES

Specialist Utilities and Subsurface Mapping Competencies

May 2023 revision

The measurement, definition and portrayal, either digitally or graphically in the form of maps or plans, of the physical features of, and the structures on, the earth's surface. The ability to understand engineering design information and from this provide dimensional control for all stages of construction work.

Notes:

Each of the activities under the competencies must be signed-off to the standard that the applicant has achieved – more details and explanation of the levels (A, K, E and B) are contained in the quick guide to competencies.

Optimum standards of competencies:

These are the optimum levels of achievement that an applicant needs to achieve for the grades of Technical Member or Member.

The optimum standard is given against each activity statement

There is a little flex in the optimum standards, so if an applicant is not able to achieve the optimum standard in a few activities, this can be balanced out by exceeding the optimum standard elsewhere in the competencies.

Experienced applicants may be able to sign off all the competencies in one go, but we would expect trainees and apprentices to do this over the duration of their training period. Competencies may be updated annually, so if you are working on a particular revision you should be aware that you need to be familiar with the latest revision at the time of review and may be questioned on these.

Revisions 2023: This is an extensive update

This document is intended to be used in the United Kingdom, however it can be used in other global areas with adjustments to relevant guidances or standards.

This document has been reviewed and updated by the Utilities and Subsurface Mapping Panel of the Chartered Institution of Civil Engineering Surveyors.

Name of Supervisor	Name of Applicant
Supervisor's signature	Date

GEUS01		Competency	Ability to carry out utility/subsurface mapping surveys				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
A	E	B	Understand relevant specifications and standards relating to utility surveys and mapping e.g. PAS 128:2022 and PAS 256:2017.				
B	E	B	Obtain (either directly or from 3rd party), interpret and understand limitations of Statutory Undertakers records (e.g. PAS 128:2022 Survey Type D), service records and other available historical data and assessment of formal and other informal sources of information.				
C	E	B	Site reconnaissance (e.g. PAS 128:2022 Survey Type C) & methods of identifying services prior to use of geophysical detection methods. Presenting site reconnaissance data clearly and accurately.				
D	K	B	Understand applicable licensing requirements, legislations and how it applies including CDM considerations; HSG47, NRSWA, Traffic Management Act and any other.				

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GEUS01 continued		Competency	Ability to carry out utility/subsurface mapping surveys				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
E	B	B	Effective use of the electromagnetic methods of locating services. *i. Direct connection* *ii. Induction clamp* *iii. Sonde* *iv. Induction* *v. Correct use of frequencies and their purposes* *vi. Passive modes* *a. Power* b. *Radio*				
F	E	B	Effective use of ground penetrating radar (GPR) including post-processing of data. *i. Licensing requirements* *ii. Different GPR technologies and frequencies* *iii. Methods of GPR Survey* *iv. Data collection* *v. Data interpretation* *vi. Data processing* *vii. Use of GPR in PAS 128:2022*				

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GEUS01 continued		Competency	Ability to carry out utility/subsurface mapping surveys				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
G	B	B	Drainage surveys. *i. Understanding of drainage networks and operations* *ii. Drainage recording e.g. STC 25* *iii. Line & level surveys* *iv. Methods of mapping drainage e.g. sonde, gyroscopic mapping, laser scanning.* *v. Presenting drainage on drawings* *Health &Safety when working with drainage assets, including confined spaces*				
H	E	B	Methods of permanent recording of utility locations according to requirements of relevant specifications e.g. PAS 256:2017.				

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GEUS01 continued		Competency	Ability to carry out utility/subsurface mapping surveys				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
I	A	K	Identify where use of alternative detection methods may be suitable or required, and how these techniques are applied. Other methodologies might include: *i. Geophysical methods:* *-Electromagnetic conductivity,* *-Seismic,* *-Electrical resistivity,* *-Microgravity, etc.* *ii. Acoustic pipe detection methods* *iii. Gyroscopic techniques* *iv. Drainage CCTV surveys* v. *See PAS128:2022 / TSA's The Essential Guide to Utility Surveys for additional techniques*				
J	A	K	Geotechnical investigations, including borehole, trial pit and window sampling operations. Appreciation of relationship of geotechnical investigations to PAS 128:2022 & PAS 256:2017.				

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GEUS02		**Competency**	**Use and understanding of surveying instruments**				
				Date of assessment			
	Optimum Standard		**Activity Details**	A	K	E	B
ITEM	**TECHNICAL MEMBER**	**MEMBER**					
A	K	E	Total Stations.				
B	K	E	GNSS - Static – Kinematic.				
C	K	E	Levels: Optical, Electronic, Digital.				
D	K	E	Instrument checking.				
E	K	E	Instrument adjustment within the boundaries and limitations of the equipment in use along with associated checking and procedures.				
F	K	E	Accessories; checking and adjustment.				
G	K	E	Other methods of measuring distance e.g. use of tape, Disto, measuring wheel.				

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GEUS03		Competency	Application of geometric principles				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
A	K	E	Calculating 3-dimensional co-ordinate geometry using manual or computerised methods.				
B	K	E	2D and 3D survey control. Intersections, resections, free station, traverse, network and geometric configurations.				
C	K	E	Adjustment of survey measurements. Redundant observations. Principles of least squares, residuals, standard errors, error ellipses.				
D	K	E	Measurement of heights, use of height datum, datum transformations, geoid / spheroid separations.				
E	K	E	Error propagation.				

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GEUS04		Competency	**Ability to use information and communication technologies (ICT) in surveying**				
				Date of assessment			
	Optimum Standard		**Activity Details**	A	K	E	B
ITEM	**TECHNICAL MEMBER**	**MEMBER**					
A	K	E	Transfer of utility survey and/or subsurface mapping data between instrument and computer.				
B	K	E	Electronic processing of utility survey data and/or subsurface mapping data including but not limited to geometric networks, GPR data, GNSS data.				
C	K	E	Use and manipulation of 3D utility data with digital ground models.				
D	K	E	CAD & GIS - general principles, structure, layering, UCS.				
E	K K	E E	Data Quality 1. Identify and discern data quality and potential sources of errors e.g. capture sources, currency, accuracy 2. Identify and discern the purpose of metadata (why it is important and what should be included)				

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GEUS04 continued		Competency	Ability to use information and communication technologies (ICT) in surveying				
				Date of assessment			
	Optimum Standard		Activity Details	A	K	E	B
ITEM	TECHNICAL MEMBER	MEMBER					
F	K	E	Understand relevant guidances and standards relating to data security e.g. The CICES' Secure Data Management for Utility Surveys, Cyber Essentials, ISO 27001				
G	A	A	Appreciation of how digitalisation and modern techniques such as automation and artificial intelligence (AI) can benefit the surveyor.				

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