

## **GEOSPATIAL ENGINEERING**

### **Land and Engineering Surveying**

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.

#### Range Indicators

Competency will be demonstrated in the application of relevant knowledge, understanding and skills set out in the Land and Engineering Surveying Competency Requirements. Such knowledge and skills will normally be obtained through a structured education to the requisite level and work experience.

This area of specialism includes the following core skills:

- Comprehensive understanding of 2 & 3 dimensional co-ordinate geometry
- Comprehensive experience of all commonly used classes of instruments/tools that measure angles & distances
- Comprehensive experience of carrying out topographic surveys at various scales
- Comprehensive experience of Engineering Surveying/setting out at all stages of construction
- Understanding of principles of geodesy and the problems of representing curved surfaces with planar coordinates
- Comprehensive experience of the use of ICT for processing/manipulating geospatial information
- Experience of other aspects of measurement.

Communication, basic computing and Health and Safety skills apply to all specialisms and are elsewhere.

#### **Evidence Guide**

Evidence of successful achievement of this competency would be effective and efficient management of the Land and Engineering Surveying process with the application of appropriate systems for monitoring and reporting of data, at the minimum levels as stated in the competency details and range of elements.

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The Ability to carry out TOPOGRAPHIC SURVEYS</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	1	B	Specifications and scope of survey				
	2	B	Understand and use of scale				
	3	B	Site Reconnaissance				
	4	B	Use of appropriate coordinate reference system				
	5	B	Use of appropriate survey control stations and measurements				
	6	B	Height control – different methods of establishing				
	7	B	A variety of methods of capturing topographic survey information. Radial obs, RTK GPS, Tachymetry, Tape/offset etc				
	8	B	Use of appropriate equipment, Total Station, GPS, Tape, reflectorless EDM				
	9	B	Data capture and feature coding. Recording of survey information				
	10	B	Appropriate ongoing checking procedures				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The Ability to carry out TOPOGRAPHIC SURVEYS Continued</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	11	K	Underground services surveys and record investigations.				
	12	B	Data Processing, manual or using ICT				
	13	E	Use and understanding of CAD, layering etc				
	14	B	Presentation of information – digital, hard copy				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The ability to USE AND UNDERSTANDING OF SURVEYING INSTRUMENTS</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	15	B	Total Stations – conventional				
	16	B	Total Stations – reflectorless				
	17	B	Other methods of measuring distance				
	18	B	GPS - Static - RTK				
	19	E	Theodolites				
	20	E	Levels – optical – precise				
	21	B	Levels – optical – automatic				
	22	E	Levels – optical – dumpy				
	23	B	Levels – digital				
	24	B	Levels – rotating laser				
	25	B	Instrument checking				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The ability to USE AND UNDERSTANDING OF SURVEYING INSTRUMENTS continued</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	26	B	Instrument calibration				
	27	B	Instrument adjustment				
	28	B	Accessories checking and adjustment				
	29	A	Laser Scanners				
	30	E	Electronic tapes/handheld measuring devices				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>To be able to undertake ENGINEERING SURVEYING / SETTING OUT and provide reports to clients and third parties</b>				
Cross Reference	Reference	Optimum Standard	Activity Details	Date of Assessment			
				A	K	E	B
	31	B	Understanding requirements, accuracies				
	32	B	Retrieving existing survey information and linking to design drawings				
	33	B	Establishing and surveying appropriate control stations to appropriate accuracy				
	34	B	Use of appropriate equipment, Total Station, GPS, Tape, reflectorless EDM				
	35	B	Data capture, survey records				
	36	B	Methods of marking dimensional information on site				
	37	B	Communication of dimensional information to others. Verbal, Graphical, written presentation of information				
	38	B	Maintenance and verification of dimensional control				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>To have knowledge and understanding of GEODESY</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	39	E	Problems associated with curved surfaces				
	40	K	The Earth – Spheroid, Geoid etc				
	41	K	Projections				
	42	K	National Reference grids				
	43	E	Scale factor				
	44	E	GPS data processing – general				
	45	E	GPS – different reference frameworks, ETRS89, WGS84 or other				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>To have knowledge and understanding of GEOMETRIC PRINCIPLES</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	46	B	3 dimensional co-ordinate geometry. All calculations, manual and using computers				
	47	B	Geometric calculations				
	48	B	2D and 3D Survey control – intersection, resection, free station, traverse, network				
	49	B	Adjustment of survey measurements. Redundant observations, Principles of Least squares, residuals, standard errors, error ellipses				
	50	B	Quality of geometric configurations				
	51	B	Measurement of heights – use of height datums- datum transformations				
	52	B	Planar Co-ordinate transformations				
	53	B	Self-checking survey measurements				



		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The ability to USE ICT IN SURVEYING</b>				
<b>Cross Reference</b>	<b>Reference</b>	<b>Optimum Standard</b>	Activity Details	<b>Date of Assessment</b>			
				<b>A</b>	<b>K</b>	<b>E</b>	<b>B</b>
	54	E	Electronic data capture				
	55	B	Transfer of survey data between instrument and computer				
	56	B	Electronic processing of co-ordinate geometry data including geometric networks.				
	57	E	Use and manipulation of Digital round models				
	58	E	Use of spreadsheets				
	59	E	CAD - general principles, structure, layering				
	60	K	CAD – various formats – Autocad, MOSS, Microstation and others				
	61	E	CAD data transfer – dxf, Genio etc				

		<b>GES1</b>	<b>Competencies and Range of Elements Land and Engineering Surveying</b>				
		Competency	<b>The ability to undertake OTHER ASPECTS OF GEOSPATIAL MEASUREMENT</b>				
Cross Reference	Reference	Optimum Standard	Activity Details	Date of Assessment			
				A	K	E	B
			A candidate should also show significant experience of at least two of the following specialist areas of measurement:				
	62	E	Laser Scanning and processing of scanned data				
	63	E	Measured surveys of buildings				
	64	E	Monitoring of movement				
	65	E	Control and measurement of verticality				
	66	E	Remote Surveying				
	67	E	Photogrammetry				
	68	E	Underground services surveying				
	69	E	Machine Control instrumentation				
	70	E	Hydrography				

