GEOSPATIAL ENGINEERING

Geographic Information Science

The character and structure of spatial information, its methods of capture, organisation, classification, qualification, analysis, management, display and dissemination, as well as the infrastructure and technologies necessary for the optimal use of this information in an engineering context.

Range Indicators

Competency will be demonstrated in the application of relevant knowledge, understanding and skills set out in the Geographic Information Science 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:

- To have experience and understanding of Geographic Information Systems and their application
- To have hands on experience in the use of GIS software
- To have experience of spatial data capture, methods of acquisition and potential sources of error
- To have knowledge and experience of spatial data formats and representation, and understanding of data quality and management issues
- To have experience of geospatial data referencing systems and projections and their use
- To be able to prepare and structure appropriate spatial data models
- To understand and be able to apply spatial data analytical techniques
- To be able to design and prepare high quality cartographic output
- To have knowledge and understanding of other methods of representing spatial data and the results of its analysis
- To be aware of spatial data infrastructures, standards and metadata
- To be aware of organisations such as the Open Geospatial Consortium (OGC) and industry initiatives such as INSPIRE and the Digital National Framework (DNF)

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 and analysis of Geographic Information with the application of appropriate systems for the capture, storage, analysis and representation of data, at the minimum levels as stated in the competency details and range of elements.

		GES4	Competencies and Range of Elements Geographic Information Science				
		Competency	**Spatial Data**				
Cross Reference	**Reference**	**Optimum Standard**	**Activity Details**	**Date of Assessment**			
				A	**K**	**E**	**B**
	1		Data creation				
		E	• Digitisation				
		K	• Scanning				
	2		Data Processing				
		E	• Data Formats e.g. GML				
		K	• Extract, Transform, Load (ETL)				
	3		Data capture				
		K for all and at E for at least one	• Surveying				
			• GPS				
			• Remote Sensing & Photogrametry				
	4		Data formats/representation				
		E	• Vector				
		E	• Raster				
		E	• Textual				
	5		Data Quality				
		E	• Accuracy, Resolution, Precision				
		K	• Metadata – application & standards				
		A	• Spatial Data Infrastructures				
	6		Data Management				
		K	• Updates				
		K	• Versioning				
		K	• Archiving				
		K	• Digital licences				

		GES4	Competencies and Range of Elements Geographic Information Science				
		Competency	Geospatial Data Referencing				
Cross Reference	Reference	Optimum Standard	Activity Details	Date of Assessment			
				A	K	E	B
	7		Geo-referencing Systems				
		E	• Geographic coordinate systems				
		E	• Plane (rectilinear) coordinate systems				
		A	• Tessellated referencing systems				
		E	• Linear referencing systems				
	8		Geodesy				
		E	• Projections				
		E	• Datums				
		K	• Scale factors				
	9		Transformations / data manipulation				
		K	• Coordinate transformations				
		E	• Interpolation				
		K	• Vector-to-raster & raster-to-vector				
		K	• Raster re-sampling				
	10		Data Considerations				
		K	• Data abstraction				
		K	• Data classification				
		E	• Data selection				
		E	• Data generalisation				

		GES4	Competencies and Range of Elements Geographic Information Science				
		Competency	Data Modelling				
Cross Reference	Reference	Optimum Standard	Activity Details	Date of Assessment			
				A	K	E	B
	11 12 13 14 	E E K K E E E E K A A A K A K	Vector Data Models • Geometric primitives • Spaghetti model • Topological model • Network model • Linear referencing Tessellation Data Models • Grid representation • Raster model • Triangulated Irregular Network (TIN) model Database Management Systems (DBMS) • Co-evolution of DBNS and GIS • Relational DBMS • Object-orientated DBMS • Spatial databases Uncertainty & Error • Problems of scale and zoning • Propagation of error in geospatial modelling • Problems of currency, source, and scale • Relationship of Scale to Accuracy				

		GES4	Competencies and Range of Elements Geographic Information Science				
		Competency	**Spatial analysis & Processing**				
Cross Reference	**Reference**	**Optimum Standard**	**Activity Details**	**Date of Assessment**			
				A	**K**	**E**	**B**
	15 K for all and at E for at least one		Basic Analytical Operations • Buffers • Overlays • Neighbourhoods • Map algebra				
	16 K for all and at E for at least one		Analytical Methods • Surface analysis • Network analysis • Cartographic modelling				
	17 K for all and at E for at least one		Spatial queries & measures • Distance & lengths • Shape • Area • Proximity • Adjacency • Connectivity • Intervisibility				
	18	K	Structured Query language (SQL) & attribute queries				
	19	A	Geostatistics				
	20 E K		Geocoding • Direct (x,y) • Indirect (e.g. post code)				

		GES4	**Competencies and Range of Elements** **Geographic Information Science**				
		Competency	**Cartography & Visualisation**				
Cross Reference	**Reference**	**Optimum Standard**	**Activity Details**	**Date of Assessment**			
				A	**K**	**E**	**B**
	21	K for all and at E for at least one	Cartography • Fundamentals of map design • Scale & generalisation • Colour • Typography • Symbology • Thematic views				
	22	E K A A A	Visual Representations • Map • 3D drape • View shed • Fly thro's • Time series				
	23	A	Web Mapping				

		GES4	Competencies and Range of Elements Geographic Information Science				
		Competency	Technologies, Software & Initiatives				
Cross Reference	Reference	Optimum Standard	Activity Details	Date of Assessment			
				A	K	E	B
	24	E for at least one	Database software • MS Access • SQLServer • Oracle • others				
	25	E for at least one	GIS software • ESRI • MapInfo • CadCorp • others				
	26	A	Open Geospatial Consortium (OGC) Software				
	27	A	Geospatial Initiatives				

		GES4	**Competencies and Range of Elements** **Geographic Information Science**				
		Competency					
Cross Reference	**Reference**	**Optimum Standard**	**Activity Details**	**Date of Assessment**			
				A	**K**	**E**	**B**

		GES4	**Competencies and Range of Elements** **Geographic Information Science**				
		Competency					
Cross Reference	**Reference**	**Optimum Standard**	**Activity Details**	**Date of Assessment**			
				A	**K**	**E**	**B**

		GES4	**Competencies and Range of Elements** **Geographic Information Science**				
		Competency					
Cross Reference	**Reference**	**Optimum Standard**	Activity Details	**Date of Assessment**			
				A	**K**	**E**	**B**

		GES4	**Competencies and Range of Elements** **Geographic Information Science**				
		Competency					
Cross Reference	**Reference**	**Optimum Standard**	Activity Details	**Date of Assessment**			
				A	**K**	**E**	**B**