

## GEOSPATIAL ENGINEERING COMPETENCIES – Geographic Information Science (GIS)

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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.

GEOSPATIAL ENGINEERING COMPETENCIES – Geographic Information Science (GIS)

	Competency	Spatial Data				
GES4	Optimum Standard	Activity Details	Date of Assessment			
			A	K	E	B
1	E K	Data creation - Digitisation - Scanning				
2	E K	Data Processing - Data Formats e.g. GML - Extract, Transform, Load (ETL)				
3	K for all and at E for at least one	Data capture - Surveying - GPS - Remote sensing & photogrammetry				
4	E E E	Data formats/representation - Vector - Raster - Textual				
5	E K A	Data Quality - Accuracy, resolution, precision - Metadata – application & standards - Spatial data infrastructures				
6	K K K K	Data Management - Updates - Versioning - Archiving - Digital licences				

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

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

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	Competency	Spatial analysis & Processing				
GES4	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) -				

	Competency	Cartography & Visualisation				
GES4	Optimum Standard	Activity Details	Date of Assessment			
			A	K	E	B
21	K for all and at E for at least one	Cartography <ul style="list-style-type: none"> <li>• Fundamentals of map design</li> <li>• Scale &amp; generalisation</li> <li>• Colour</li> <li>• Typography</li> <li>• Symbology</li> <li>• Thematic views</li> </ul>				
22	E K A A A	Visual Representations <ul style="list-style-type: none"> <li>• Map</li> <li>• 3D drape</li> <li>• View shed</li> <li>• Fly throughs</li> <li>• Time series</li> </ul>				
23		Web Mapping				

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	Competency	Technologies, Software & Initiatives				
GES4	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				
	1 <sup>st</sup> Review	Supervisors signature				Date
	(2 <sup>nd</sup> Review)	Supervisors signature				Date
	(3 <sup>rd</sup> Review)	Supervisors signature				Date