

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 401

GIS requirements for engineering site surveys and studies

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1. Scope

This specification defines the minimum standards required by Company, applicable to the Geographic Information System (GIS) data delivery for engineering site survey and studies.

This particularly applies to spatial data provided with the following investigations or studies:

- Site surveys: geophysical engineering survey, debris survey, bathymetric survey, geotechnical survey, metocean survey, and topographical survey.
- Desktop studies: all synthesis or integrated studies dealing with geology, geophysics, geotechnics, meteorology and oceanography, remote sensing, seismicity and natural risks assessment, etc.

This document only provides detailed requirements for the geophysical, the geotechnical, the metocean, the remote sensing and the topographical surveys. These requirements have to be considered as a minimum. Contractor may propose to provide data slightly modified or more detailed, this has to be approved by the Company before the final data delivery. Specific cases where data requirements are not covered in this document need also to be approved by Company.

For the other investigations and studies, Contractor shall provide a detailed proposition or data example to Company for approval before the delivery of the final dataset.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
EPSG Guidance Note 5.12	Coordinate Reference System Definition
ESRI Glossary	http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway
GIS Glossary	http://www.gisdevelopment.net/glossary/
SIMORC website	http://www.gis.com/resources/library/dictionaries.html
ISO 19115	http://www.simorc.org
ISO 19119	Geographic Information MetaData
ISO 19137	Geographic Information Services
	Geographic information - Core profile of the spatial schema

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Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
Not applicable	

3. Deliverables

3.1 Documents provided by Company

The following documents shall be transmitted to Contractor:

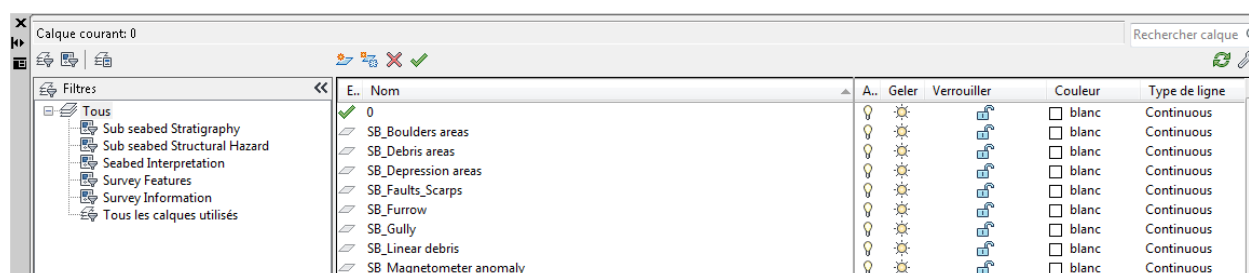
- The official geodesy and its parameters to be applied for the project,
- All the project cultural data,
- Deliverable folder including the empty geodatabase,
- An example of GIS report summary,
- An AutoCad file with layers standardized.

3.2 Documents to be provided by Contractor

3.2.1 Intermediate delivery for validation

Contractor shall provide an intermediate delivery of its cartographic work, using the autoCAD file template provided by Company, with layers name corresponding to layers planned in ArcGIS, in order to ease import into GIS format.

The CAD cartographic representation (line types, colors, hatches, etc...) shall be the same as requested for the final GIS delivery.



Calque courant: 0	E.. Nom	A..	Geler	Verrouiller	Couleur	Type de ligne
	0				blanc	Continuous
	SB_Boulders areas				blanc	Continuous
	SB_Debris areas				blanc	Continuous
	SB_Depression areas				blanc	Continuous
	SB_Faults_Scarps				blanc	Continuous
	SB_Furrow				blanc	Continuous
	SB_Gully				blanc	Continuous
	SB_Linear debris				blanc	Continuous
	SB_Magnetometer anomaly				blanc	Continuous

Figure 1: Example of CAD layers list

3.2.2 GIS summary

Contractor shall fill in the GIS summary Excel file for submission to Company. Any new layer shall be proposed by Contractor and submitted to Company for approval prior building datasets.

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3.2.3 GIS structural report

Contractor shall provide a GIS structural report aiming to:

- Describe all the data identified from the interpretation
- Present the data organization in accordance with this document' specifications.

3.2.4 Final data delivery

Data import into GIS shall only occur once the exchange Excel file is completed and agreed and once the final survey report is validated by Company.

The final data delivery shall consist of the following:

- Rasters and hyperlinks in the directories of the same name.
- All data as Geodatabase (or ESRI shapefiles) formats.
- Project (*.mxd), projection (*.prj), templates (*.mxt), style (*.style), layer (*.lyr), queries and scripts files or any other GIS file.
- Raster data shall be added to the mosaic dataset in the geo-database. A mosaic dataset is a collection of raster datasets (images) stored as a catalog and viewed as a mosaicked image that is dynamic. The properties of the original imagery are maintained, and overlapping imagery can be ordered as required.

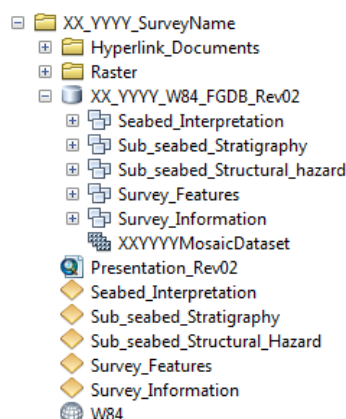


Figure 2 : Typical geophysics survey folder

3.2.4.1 Report delivery

As a separate document, the GIS report shall be delivered in paper and digital copy. A Draft GIS Report shall be provided to the Company for approval.

The report shall at least contain the following information:

3.2.4.1.1 General information

- **Title:** the report shall be entitled:
Name of the recipient - TOTAL affiliate/subsidiary/project
Block reference and location name, Country

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Title of the survey (defined in Contract)

Survey Contractor name

Start/end dates of work offshore and vessel.

- **Certification:** the first page of the report shall show the Contractor's certification, and shall specify:

Name(s) of person(s) responsible(s) for GIS data preparation

Name and signature of QA/QC issuing Authority

Date of issue.

3.2.4.1.2 Project summary

- **Abstract:** giving a brief description of the survey:

Survey dates

Vessel

Site(s) and location(s) surveyed with key co-ordinates and situation plan

Summary of all the project reports.

Project Geodesy

Listing of all the data sets and description.

3.2.4.1.3 Data description

The description of the directories shall be included in the report.

For each data set the following elements shall be described:

- **Content:** meaning of the layer
- Type of **geometry** (raster, vector, point, polyline Z, polyline M, etc.)
- **Attributes:** name, significance, type, values, domains, etc.
- A brief description of the **origin** of the data: excel file, CAD drawing, software export, etc.
- **Method** applied for the data conversion (Example: raster bathymetry from multibeam echo sounder interpolated with kriging method).

3.2.4.1.4 Others

Where applicable: any significant scripts, queries, etc. used for the project.

4. General requirements

4.1 Software compatibility

Contractor's deliverable shall be compliant with Total's GIS software **ArcGis Desktop 10**, from ESRI.

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4.2 Data compatibility

Data shall be stored in folders organized as described section 5.5.

Any geo-referenced data can be imported into GIS. The preferred formats, however, are as follow:

- Raster files: Geotiff, tiff or Jpg (associated with *.Tfw or *.Jwg world file, and spatial index saved). Vector files: a geo-database (GDB).
- Grid data: Digital Terrain Model, ASCII, Microsoft Excel files (etc.) with geodesy description appended.

4.3 Language

The English language shall be used.

4.4 Data QA/QC

It is the responsibility of the Contractor to apply QA/QC procedures for producing the GIS datasets.

Any anomaly or discrepancies between the datasets detected by the Contractor will be brought to the attention of the Company.

In particular, the following items are of primary importance:

- Georeferencing
- Geometry
- Topology
- Content (attributes metadata...).

4.5 Units

International System shall be used.

4.6 Geodesy applicable

All files must be geo-referenced in the official geodetic system specified by Company at the beginning of the project unless otherwise specified by Company.

Every shapefile or feature class created should have its own *.prj file and a spatial index completed. All raster files provided should be given with the spatial index completed. The geodetic description of the data shall be attached to the ASCII file except the UKOOA files.

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5. Data generalities

5.1 Conventional naming of the files

For the layers already available in the geodatabase provided by company, all feature class names and layer names shall remain the same. Names are given in appendix 2 and already applied in gdb.

For any new layer identified, the conventional naming shall be approved by Company.

As a general comment, datasets should have an explicit name, containing the type of the data. Fields names shall be in capital with no space and no hyphen.

However, in the .mxd, it is preferable that layers names are written in any letter for more understanding, quite as in the .dwg.

For example:

Group layer	Layer	Feature Class	CAD/GIS Layer name
Survey information	Survey limits	GP_SI_LIM	SI_Survey limits
Sub seabed structural hazard	Gas anomalies	GP_SS_GSA	SS_Gas anomalies

5.2 Metadata

Any data imported into the GIS shall be traceable, meaning that it should be possible to easily track the source and history of the data. This is achieved by ensuring the inclusion of the relevant metadata.

At least, it is required to fill in metadata covering the following information:

- Data source (Contractor name, project name, creation date, report, conversion type, etc.)
- File ID (name, revision, date, type, etc.)
- Geodesy (geodetic system, transformation parameters, etc.)?

For this aim, nine attributes have been added (Name of the subsidiary Company, Name of the Contractor, Date of the survey, Contractor project reference, Name of the GIS Contractor, Date of the GIS deliver, Number of GIS revision, Name of GIS officer, Geodesy). These attributes have to be completed.

Metadata shall be in accordance with [ISO 19115 - ISO 19119 - ISO 19137](#).

For the specific case of the SIMORC Project (System of Industry Metocean data for the Offshore and Research Communities) needs, metadata shall be as defined in Appendix 1 for the following datasets:

- Meteorological and Oceanographic survey datasets
- Tidal and CTD measures.

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5.3 Symbology

Contractor shall refer to the appendices for the datasets symbology.

The symbol nomenclature should be:

- As simple as possible (use symbols predefined by ESRI or given in *.style file if necessary)
- Stored in all the *.mxd and *.lyr files.

Some AutoCAD symbologies are provided by Company to facilitate the import into GIS. If a datasets symbology is not defined, a new symbology shall be proposed by Contractor and submitted to Company for approval prior building the datasets.

5.4 Associated documents (hyperlinks)

Survey projects may contain some attached documents (image, log, report, Microsoft Excel spreadsheet...) that require to be linked to geographical datasets; this enables users of the GIS project to open and visualize information and files associated with.

The relative file path names shall be given in the hyperlink field of the attribute data. And the layer name has to indicate the hyperlink existence (with “_HYP” at the end of the layer name).

All linked documents have to be stored in a Hyperlink_Documents directory (Figure 2 : Typical geophysics survey folder).

5.5 Organisation

Data shall be organized in a ESRI geodatabase.

The folder directory should be compliant with all the data and associated documents identified.

5.5.1 Geophysical site survey

This section of the document describes the minimum data and fields to be provided. Datasets depend on survey type and interpretation performed (add/removal of data sets can be proposed by Contractor).

Here is below an example of data organized with the minimum information required:

- **Survey information:** survey limits, sampling locations, Conductivity Temperature Density (CTD) or Sound Velocity Profile (SVP) record location, navigation trackplots and shotpoints, etc.
- **Survey features:** bathymetry, backscatter, etc.
- **Seabed interpretation:** seabed geology, slope, side scan sonar mosaic, sonar contacts, debris, scars, pockmarks, depressions, disturbed seabed areas, outcrops, scarps, gullies, faults, etc.
- **Sub-seabed interpretation**
 - Structural hazard: faults, salt domes, buried depressions, etc.
 - Stratigraphy: isopachs, seismic reflectors, etc.

Contractor shall refer to Appendix 2 for the geophysical datasets detailed description.

As an example, the following table could be datasets deliverables on a particular survey.

Group Layer	Layer	Format	Geometry
Survey information	Survey limits	FC, lyr	Polyline
	Coring locations	FC, lyr	Point
	SVP locations	FC, lyr	Point
	CTD locations	FC, lyr	Point
	Reference points	FC, lyr	Point
	Navigation track plots	FC, lyr	Polyline
	Navigation shot points	FC, lyr	Point
	Proposed well location	FC, lyr	Point
Survey features	Bathymetry	FC, lyr	Polyline
		Tiff, lyr	Raster
	Backscatter	Tiff, lyr	Raster
	Hillshade	Tiff, lyr	Raster
	Seabed slopes	Tiff, lyr	Raster
	Side scan sonar	Tiff, lyr	Raster
	Soundings	FC, lyr	Point
Seabed interpretation	Seabed geology	FC, lyr	Polygon
	Sonar contacts	FC, lyr	Point
	Debris areas	FC, lyr	Polygon
	Linear debris	FC, lyr	Polyline
	Boulders areas	FC, lyr	Polygon
	Scars	FC, lyr	Polyline
	Faults, scarps	FC, lyr	Polyline
	Pockmarks	FC, lyr	Polygon
	Depression areas	FC, lyr	Polygon
	Depression axes	FC, lyr	Polyline
	Possible gas leak	FC, lyr	Point
	Slumps	FC, lyr	Polygon
	Observed jackup footprints	FC, lyr	Polygon
	Observed pipelines	FC, lyr	Polyline
	Observed cables	FC, lyr	Polyline
	Observed wrecks	FC, lyr	Point
	Observed wells	FC, lyr	Point
	Mass Transport Deposit	FC, lyr	Polygon
	Mounds	FC, lyr	Polygon
	Ridge	FC, lyr	Polygon
	Magnetometer anomaly	FC, lyr	Point

Group Layer	Layer	Format	Geometry
Sub-seabed interpretation Structural hazard	Buried Faults	FC, lyr	Polyline
	Fracture zone	FC, lyr	Polygon
	Hydrocarbon accumulation	FC, lyr	Polygon
	Gas anomalies	FC, lyr	Polygon
	Buried depressions	FC, lyr	Polygon
	Acoustic mask	FC, lyr	Polygon
	Disturbed sediments	FC, lyr	Polygon
	High amplitude reflector	Tiff, lyr	Raster
	Reflector boundary	FC, lyr	Polygon
	Channel axis	FC, lyr	Polyline
Sub-seabed interpretation Stratigraphy	Isopachs	FC, lyr	Polyline
		Tiff, lyr	Raster
	Isobaths	FC, lyr	Polyline
		Tiff, lyr	Raster
	Isochrons	FC, lyr	Polyline
		Tiff, lyr	Raster
	Isohyps	FC, lyr	Polyline
		Tiff, lyr	Raster

One track plot or shot point layer per equipment type and one raster per seismic reflector shall be done. Common fields can be described and shall be in the following order:

- Automatic attributes (ID, Shape...) are not mentioned in this document
- Minimum particular attributes details are given in Appendix 2. New fields can be added for labelling purposes
- Geometry common attributes can be used for all the data:
 - Points files: Geodetic system, Easting and Northing coordinates, accuracy
 - Polyline files: length (2D / 3D)
 - Polygons files: perimeter, area.
- Common fields regarding the survey performed in order to improve the traceability (Company name, Contractor name, Date of survey, Project reference, Hyperlink to the report, etc.).

In case of a very wide area survey, it could be difficult to provide only one raster for the whole coverage area. Contractor shall try to provide only one bathymetry DTM for the entire survey. If many rasters are provided, a polygon feature class should also be provided, showing the perimeter and the name of the raster as attribute.

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5.5.2 Geotechnical survey

The geotechnical data to be provided shall be arranged in two Microsoft Excel spreadsheets:

- Locations: giving information per borehole, or individual test location basis, e.g. penetration, water depth, soil synopsis, borehole/ testing method (e.g., CPT test, vane test or else) etc.
- Laboratory test results: giving detailed laboratory test results and geotechnical descriptions versus depth, for every borehole.

Attributes detail of both excel files are given in Appendix 3.

Template of the Microsoft Excel spreadsheets can be provided on request by Company to Contractor.

Hyperlink data: the borehole / in-situ test logs shall be provided as a hyperlink attached to the Location table, in PDF format, and by full-profile CPT ASCII data (where available) in Excel format.

Benchmark or reference points used for the survey shall be mentioned in the report and provided in a Microsoft Excel spreadsheet and with a point description sheet file.

5.5.3 Topographic survey

Any of the data used or issued from a topographical survey shall be provided in GIS format even if also requested in CAD format, either from LIDAR or conventional technology. As a minimum, the following layers shall be provided:

- Survey limits: Represents the boundaries of the survey performed
- Geodetic points: Represented in point vector format, this layer shall include existing Ground Control Points used for tie-in and new ones materialized and measured during the survey
- Surveyed points: Points name and elevation value as attributes, in case of conventional surveys
- Digital Terrain Model in raster format: Generated using either the surveyed points here-above mentioned or the ground filtered points from LIDAR point cloud.
- Contours lines in polyline vector format: Contour type (minor or major contour) and elevation value as attributes, issued from the DTM here-above mentioned
- Topographic features (roads, buildings, lakes, etc.) in point, polyline and polygon vector formats

Details level for cartographic work required and symbology to apply shall be agreed with Company prior commencement.

Contractor shall refer to Appendix 4 for the topographical datasets detailed description.

5.5.4 Remote sensing

This section includes satellite images acquisitions, either optical or radar, and aerial acquisitions. As a minimum, the following layers shall be provided:

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- Image limits: Represents the boundaries of the survey performed
- Acquired images: Represented in raster format, this data shall be subject to radiometric corrections, orthorectified and tiled.

Images shall be provided in both GeoTIFF and ECW formats. (associated with *.tfw and spatial index saved)

In case of large area coverage, an ortho-mosaic will be provided and the generated tiles shall not exceed 5000 pixels x 5000 pixels. The tiles shall be joined with no pixel gap but shall also not overlap.

For areas included in the tiles but outside the survey limits, the pixels shall be tagged as "NoData".

Contractor shall refer to Appendix 5 for the topographical datasets detailed description.

A report shall be delivered to the company containing all the images characteristics and processes realized (accuracy, georeferencing, geoprocessing, etc.).

5.5.5 Metocean surveys

Company contributes to the System of Industry Metocean data for the Offshore and Research Communities - **SIMORC** service.

To facilitate insertion into **SIMORC**, Metocean data sets shall undergo a standard quality control and shall be converted to unified file formats (such as NetCDF and ODV ASCII).

The **SIMORC** system consists of an index metadatabase and a database of actual data sets, that together are accessible through the Internet.

A checklist of important metadata is given in Appendix 1.

For purposes of standardization and international exchange it was decided to adopt the **ISO 19115** metadata standard and to prepare the **SIMORC** metadata as a dedicated subset of this standard to make it ISO compliant. For exchange of files the **SIMORC** metadata format is translated into a **SIMORC** XML format, which is fully described in the following documents:

- http://www.simorc.org/content/content.asp?menu=0020014_000000#007
- http://www.simorc.org/documents/simorc/html_page/07-29_SIMORC_XML_metadata_description_V1_01.doc

As an alternative **SIMORC** metadata can also be delivered in a **SIMORC** Excel metadata format, which is also described in http://www.simorc.org/documents/simorc/html_page/07-31_simorc-metadata_excel_exchange_format.xls.

The SeaDataNet Geospatial Feature Types shall be used and is given in Appendix 6.

5.5.6 Other surveys

The delivery of spatial data in GIS format is also required for the following surveys:

- Environmental Baseline Study (EBS).

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5.5.7 Studies

The delivery of spatial data in GIS format is also required for all synthesis or integrated studies dealing with geology, geophysics, geotechnics, meteorology and oceanography, seismicity and natural risks assessment, etc.

In particular, any chart provided in the study shall be delivered in GIS format.

6. Glossary

CAD	Computer Assisted Design
CPT	Cone Penetration Test
CTD	Conductivity Temperature Density
DGPS	Differential Global Positioning System
DTM	Digital Terrain Model
EBS	Environmental Baseline Study
GDB	Geodatabase
GIS	Geographic Information System
QA/QC	Quality Assessment / Quality Control
SHP	Shapefile
SSS	Side Scan Sonar
SVP	Sound Velocity Profile
WD	Water Depth

7. Other references

Following document is applicable: [EPSG Guidance Note 5.12](#), [ESRI Glossary](#), [GIS Glossary](#)

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Appendix 1 **SIMORC** Project required Metadata

Information requested in the report describing the data provided

As data values can't be used without clear information about what was measured, how and when (known as metadata), the collection of this metadata is crucial. The British Oceanographic Data Center (BODC) requests and stores this metadata in a database linked to the data series in order to keep as much information as possible for a long term.

In order to maintain deployment information, each series processed by BODC contains only one deployment and data coming from one instrument. In order to do so, information about the instrument, deployments, position, parameters and time reference and originator processing are essential. As these metadata can be simply reported during the measurement, originators are especially asked to help by providing the following basic list of metadata. In order to understand these requests, their goals are described following each category of metadata.

Owner Details

Contact details of the originator which collected the data

Project Name (if applicable)

Data Type (e.g. current, wave, sea level, met)

Goal: These metadata allow gathering several series from the same project and same originator and to double check the type of data.

Mooring/Instrument Details

Instrument category (e.g. current meter, wave recorder)

Instrument model and Manufacturer

Instrument Serial number

Latitude of mooring (degrees)

Longitude of mooring (degrees)

Site Area and Name of Site

Method of position fix (e.g. GPS)

Water column Depth (m)

Sea Floor Depth Qualifier (e.g. echo sounder, GEBCO)

Instrument depth or height

Operation history:

- Principle of measurement?
- Any instrument modifications?
- Date and Time of Deployment and Recovery of the instrument
- Date and Time of start and end of usable data

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Appendix 1

- Additional notes on deployment
- Additional notes on performance (e.g. high frequency cut-off).

Name of the vessel used if applicable

Cruise information if applicable

Cruise departure date and harbour if applicable

Cruise arrival date and harbour if applicable

Goal: These metadata allow a clear description of the mooring and allow checking and comparing data from the same mooring or location.

Timing Details

Time zone (GMT, UTC)

Type of sampling (e.g. instantaneous, averaged)

Precise time interval between successive data cycles in series (seconds) (optional)

Goal: These metadata allow comparing data series measured at the same time and allow us to estimate the precision of time measurement.

Parameter Details

Parameter definition (description including convention like direction to/from, formulae if possible)

Parameter units

Goal: These metadata allow a clear description of the values measured for the user.

Data Processing Details

Description of calibrations

Description of any data processing done by the originator

List and description of the data folder provided

Originator's Data Format (optional)

Goal: These metadata help data processing and documenting screening observation for the user.