OGP

# Guidelines for the use of the OGP P6/11 bin grid GIS data model

*Report No. 483-6g*
*July 2013*

This document is a companion document to the *OGP P6/11 Seismic bin grid data exchange format description* (2012) and the *OGP P6/11 Seismic bin grid data exchange format – user guide* (forthcoming).

International Association of Oil & Gas Producers

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# Contents

# 1. Introduction

This guideline describes the OGP P6/11 GIS data model (P6DM). It is a companion document to the *OGP P6/11 Seismic bin grid data exchange format description* (2012) and the *OGP P6/11 Seismic bin grid data exchange format – user guide* (forthcoming). The objective of the OGP P6/11 GIS data model is to support presentation of the OGP P6/11 seismic bin grid format in an Esri geodatabase.

The OGP P6/11 format is designed for the exchange of seismic bin grid definitions and data from seismic surveys or seismic processing projects but the format may also be used to exchange bin grids definitions and data from other types of survey operations e.g. topographic surveys, hydrographic surveys etc. Files in this format will contain definitions of the coordinate reference systems and bin grids as well as attribute data, such as fold of coverage or water depth referenced to bin nodes. The OGP P6/11 format contains data for a single seismic survey or for a combination of seismic surveys (a seismic project). Therefore this document uses the term seismic projects.

The P6DM stores the information from the OGP P6/11 format in a geodatabase that can be used in ArcGIS to visualise the seismic bin grid data in its geographical context. Note that GIS is not intended to be the master repository for seismic/geophysical data and this data should be managed in a separate database to support different applications.

This user guide explains the data model and provides guidance on its use. The P6DM is available from the OGP Geomatics Mini-site (http://info.ogp.org.uk/geodesy/) and consists of the following material:

1) **Esri Geodatabase template** – A data model template to be used for the storage and exchange of OGP P6/11 seismic bin grid information in GIS including a populated example dataset
2) **Data dictionary** – A spreadsheet which details and describes the different components of the P6DM geodatabase template
3) **ArcGIS style sheet** – Standardised symbology library for the features stored in the geodatabase. In this case this is a sample symbology set as there is no industry standard. This style sheet can be used to create symbolised layer files and standardised maps
4) **Conceptual data model diagram** – Used to help illustrate the architecture of the data model
5) **Basic guidelines** for how this geodatabase can be used (this document)

# 2. Background

The OGP P6/11 seismic bin grid data exchange format defines the following parameters for a 3D seismic survey:

- Coordinate Reference System (CRS) and coordinate transformation parameters between global and local geodetic CRS
- Master bin grid definition/coverage
- Bin grid origin and increments
- Bin grid data attributes
- Scale factor of the bin grid
- Nominal bin width
- Full fold definition/coverage

Since the creation of the original P6 format in 1998, Geographic Information System (GIS) has become a common application used by operators to manage, analyse and map geo-information. GIS enables integration of geo-information of which seismic positioning data is an essential component. The requirement to be able to visualise and use seismic bin grid definitions and data in GIS has become increasingly important for:

- Seismic positioning QC (is a bin grid in the correct geographic location relative to surrounding seismic surveys, wells, permits etc?)
- Improved spatial understanding of seismic coverage
- Linking survey outlines to documents to enable map based search for seismic acquisition and processing reports

With this in mind, OGP has developed a GIS data model for the storage and visualisation of seismic bin grid definitions, that is based on the new OGP P6/11 seismic bin grid exchange format.

The principles behind the P6 data model are:

- Utilise the OGP Seabed Survey Data Model (SSDM) design principles
- A simple data model using only two geodatabase feature classes i.e. bin grid perimeter polygon FC (polygon) and a bin nodes FC (points)
- Feature classes to contain tables to hold the key information carried in the OGP P6/11 format.

# 3. Areas of application

The P6DM can be used wherever OGP P6/11 format seismic bin grid definition and data are created or made available through the seismic bin grid lifecycle:

- Seismic survey planning
- Seismic data acquisition
- Seismic data processing
- Seismic data interpretation
- Seismic data merging and reprocessing
- Seismic data archiving and exchange

These above phases and associated use cases are outlined in the *OGP P6/11 Seismic bin grid data exchange format – user guide* (forthcoming). The P6DM enables a GIS based presentation of the OGP P6/11 format bin grid definition and data.

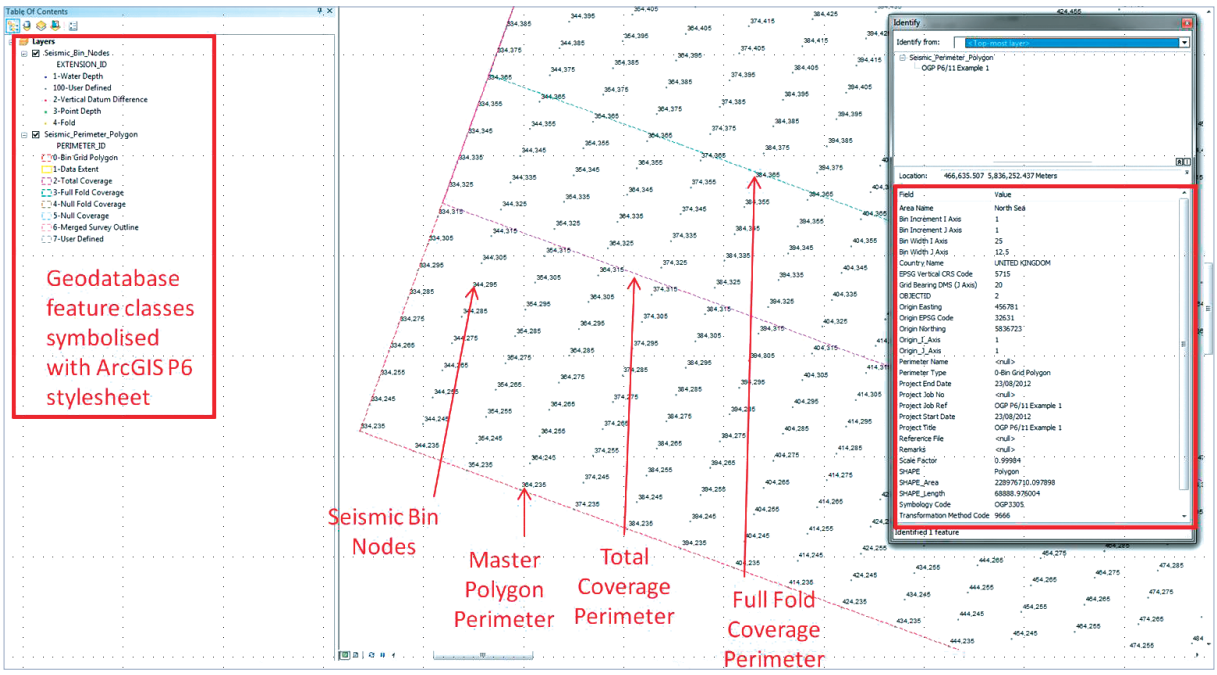



*Figure 1: Example illustrating a populated P6DM based on a P6/11 file General Recommendations*

# 4. General recommendations

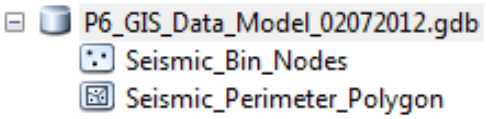
The following are general recommendations for the use of the OGP P6DM:

1) The OGP Geomatics Committee (OGP GC), is the governing body for the OGP P6DM. The OGP GC defines the core data model and maintains a data dictionary (registry) of feature datasets, feature classes, feature subtypes and symbology codes (in line with the OGP P6/11 seismic bin grid data exchange format).
2) The core P6DM must be implemented to constitute a compliant OGP P6DM implementation. However, an operator may choose to extend the data model (feature datasets, feature classes, feature subtypes and feature attributes) to address their company specific requirements.
3) The OGP P6DM template is based on the Esri Geodatabase. Operators may choose to define their own physical implementation of the P6DM on another specific GIS data format as long as it is in compliance with the core P6DM.
4) The OGP P6DM includes a sample set of cartographic symbology in the form of an ArcGIS OGP style sheet. Operators may create their own cartographic symbology as required.

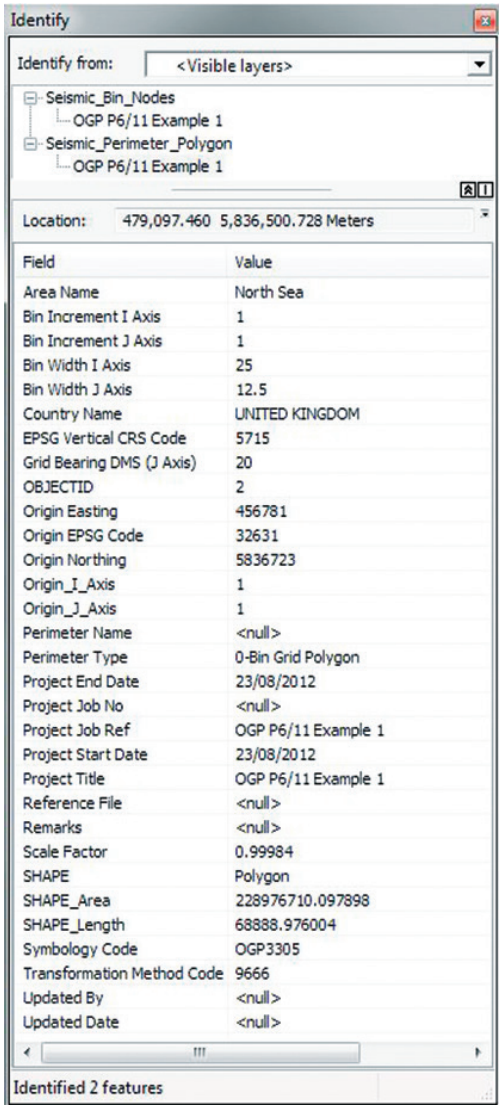
# 5. P6 GIS data model schema and data dictionary

The P6 GIS data model  consists of 2 feature classes:

- A polygon feature class to contain the bin grid outlines (Seismic_Perimeter_Polygon)
- A point feature class to contain the bin grid nodes (Seismic_Bin_Nodes).



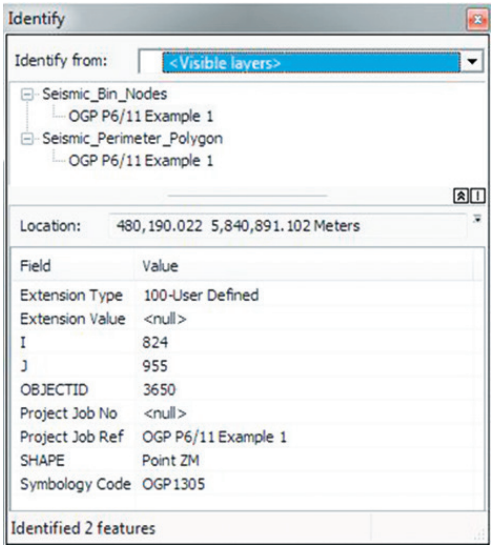

## Seismic_Perimeter_Polygon feature class




This feature class contains the key header information from the P6 format, including the project information, the bin grid definition and the perimeter data for each individual perimeter. Perimeters to be stored as defined by the P6 format can be acquisition outline, full-fold outline, full fold coverage, etc.

The perimeter is stored in the CRS defined by the P6 format. This information is contained within the SHAPE object and will be used by ArcGIS to project the perimeter into the ArcMap view. The Origin EPSG CRS code is stored as a separate attribute together with the other bin grid parameters.

## Seismic_Bin_Nodes feature class




The seismic bin nodes feature class is a point feature class that contains the bin nodes and their attributes. Apart from the I,J values, it can contain attribute data such as water depth, vertical datum difference, fold coverage, or any user defined node attribute data.

Node data will be displayed as points using a marker symbol defined by the symbology_code field. Additional value may be derived by processing node attribute data into a raster data set, as demonstrated in figure 2.

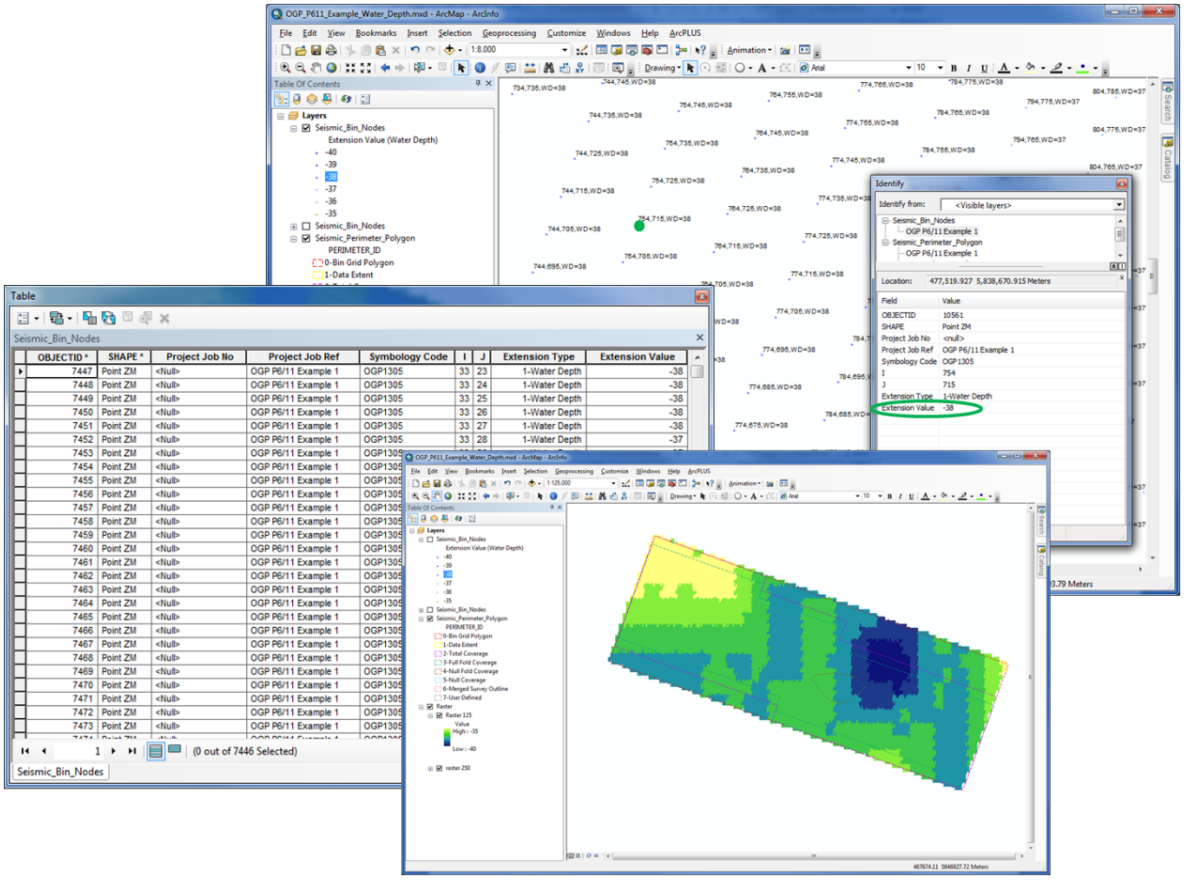



*Figure 2: Bin nodes with water depth values converted to a raster dataset*

The data model schema for the P6DB is outlined in figure 3.

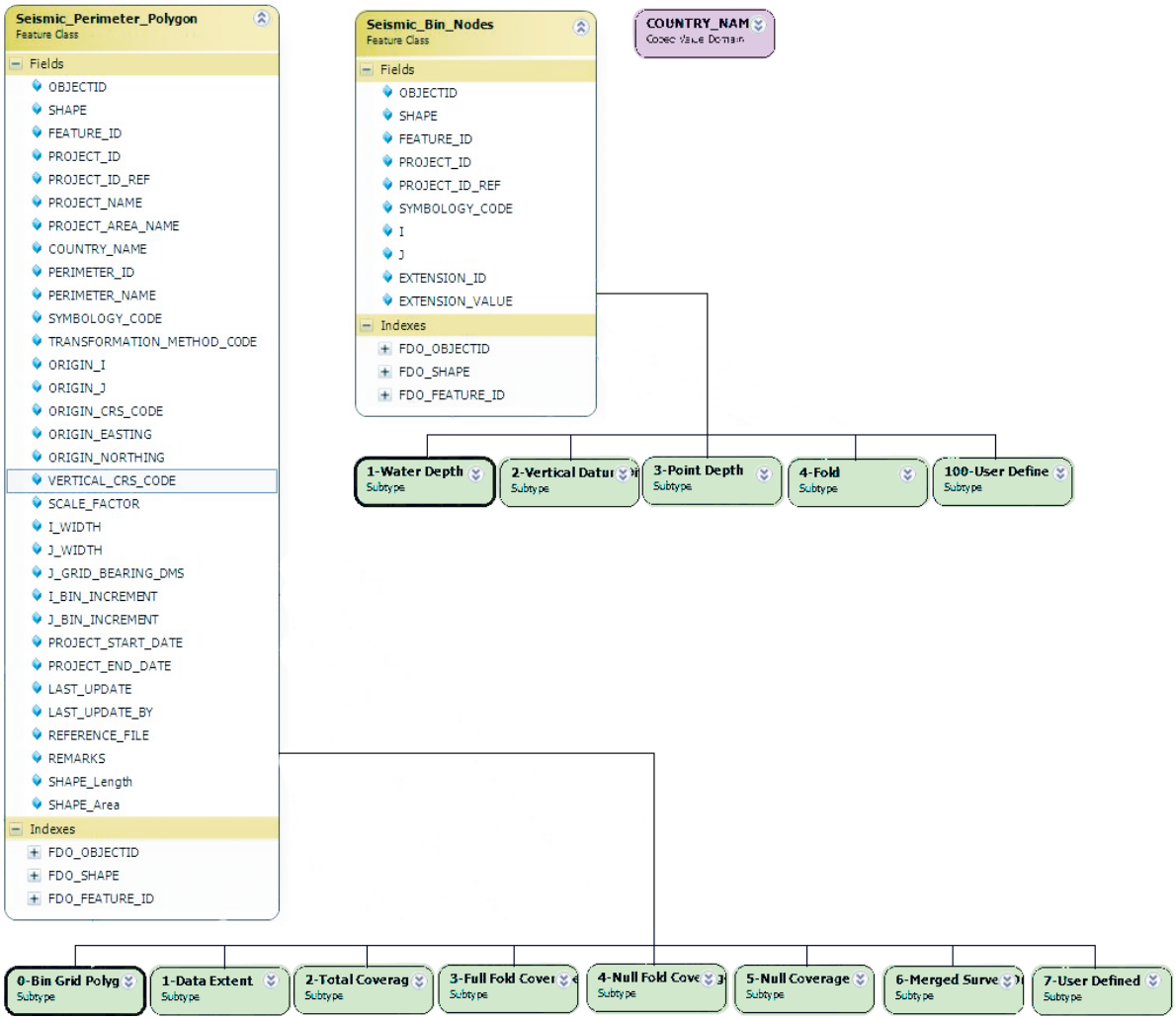



*Figure 3: P6 GIS Geodatabase Data Model Schema*

## Supporting documents

A data dictionary provides the detailed definition of each feature class and a template geodatabase is provided as an Esri personal geodatabase. Both are available from http://info.ogp.org.uk/geodesy.

# 6. The use of the P6DM template

The P6DM template has been defined to support the data contained within the OGP P6/11 file with the objective to support seismic navigation QC and/or better spatial understanding of seismic coverage. It is not an exchange format in itself. Operators may also consider using the P6DM to store bin grid data in a corporate database and linking reference files. This will provide the ability to spatially search seismic bin grids for processing and acquisition reports.

When loading an OGP P6/11 format file to the P6 GIS data model the following data flows are envisaged:

- *Storing the OGP P6/11 file bin grid definition*

A P6 file contains one or more bin grid definitions, each with its own CRSREF. For each bin grid definition a seismic_perimeter_polygon feature needs to be created, with the bin grid extent stored in the SHAPE field and associated bin grid parameters in the attribute fields.

Along with the project details and bin grid definition attributes, the feature class can also store a reference file and comments. It is good practice to store a reference to the P6 file in the reference file field. Alternatively a link to a folder or document management system, containing e.g. the processing and acquisition documentation could be stored. The "reference file" attribute in the Seismic_Perimeter_Polygon can be used to store the link.

- *Storing the OGP P6/11 file perimeters*

The P6 file may contain a range of perimeters. These should all be stored in the Seismic_ Perimeter_Polygon feature class as polygons, with the project details and bin grid definition details stored as attributes. The symbology is based on the perimeter type. Each type has an associated OGP symbol code that refers to a symbol style in the OGP style sheet. Users can change the symbol style as required.

The horizontal CRS used for the perimeter should be the projected CRS taken from the 'CRS 2 number' as defined in the OGP P6/11 header. CRS 1 refers to the bin grid CRS and provides the link to the bin grid definition parameters.

- *Storing the OGP P6/11 file bin nodes*

The P6 file may contain bin nodes for one of the bin grids defined in the header. Bin nodes can optionally have associated attributes. Attribute types can be water depth, fold, depth difference, etc. as defined in the P6 format. Bin node records are to be stored in the Seismic_ Bin_Nodes feature class.

For each bin node the minimum attributes stored are the project reference and inline and crossline values (I,J). In addition attributes can be stored using the extension code and extension value fields. If multiple extension values are stored for the bin nodes then there will be multiple versions of the bin nodes stored in the point feature class using the Extension_ID subtype to segregate them.

Each attribute type (extension) stored for the nodes has an associated OGP symbol code that refers to a symbol style in the OGP style sheet. Users can change the symbol style as required.

The CRS used for the bin node positions should be the projected CRS taken from the 'CRS 2 number' as defined in the P6/11 header. CRS 1 refers to the bin grid CRS and provides the link to the bin grid definition parameters.

- *Data display and analysis*

Once the P6 data is available in the GIS environment it can be used for:

- Seismic navigation QC (does the grid sit in the correct geographic location relative to surrounding seismic surveys, wells, permits etc?)
- Better spatial understanding  of seismic coverage
- Spatial searching of processing and acquisition reports
- Converting between bin reference (I,J) and real-world coordinates (E,N).

The bin grid data can be displayed in its geographical context, together with all other relevant geographical data, such as licences, topography, wells, infrastructure, other seismic surveys, etc. This is an effective way to check that the positioning information is accurate and that the seismic bin grid is located correctly.

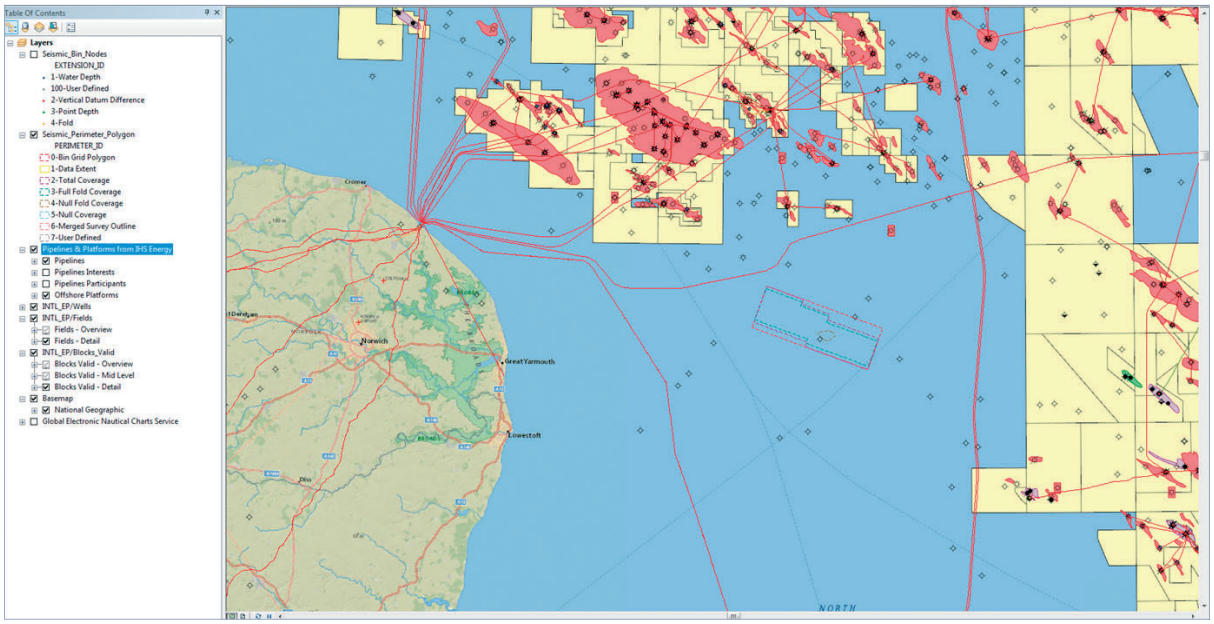



*Figure 4: Example of a seismic bin grid perimeter in its geographical context*

The bin node attribute data, such as water depth, datum difference, fold, or any user defined attribute, can also be converted to raster to provide a continuous surface (e.g. a bathymetry grid), see Figure 2 as an example.

If the reference_file field is populated spatial searches can be made to find related reports on the data. This could be the original OGP P6/11 file or seismic acquisition or processing reports.

Because bin grids can be displayed together, end users can for instance determine:

- Which processing projects make use of the same seismic (acquisition) bin grid
- On which seismic bin grids a project is based
- Which other bin grids overlap with the project area.

Having the seismic bin grid data available in GIS also supports the QC of proposed well locations. The absolute co-ordinates of the bin nodes are stored in the geometry of the feature class and not as attributes in the attribute table as attributes remain static even when a user re-projects the features classes in ArcGIS. This would potentially lead to confusion. The absolute coordinates of a node can be obtained from the geometry when the map display CRS is set to the CRS of the Bin grid origin as specified in the seismic_perimeter_polygon feature class. See the screenshot below.

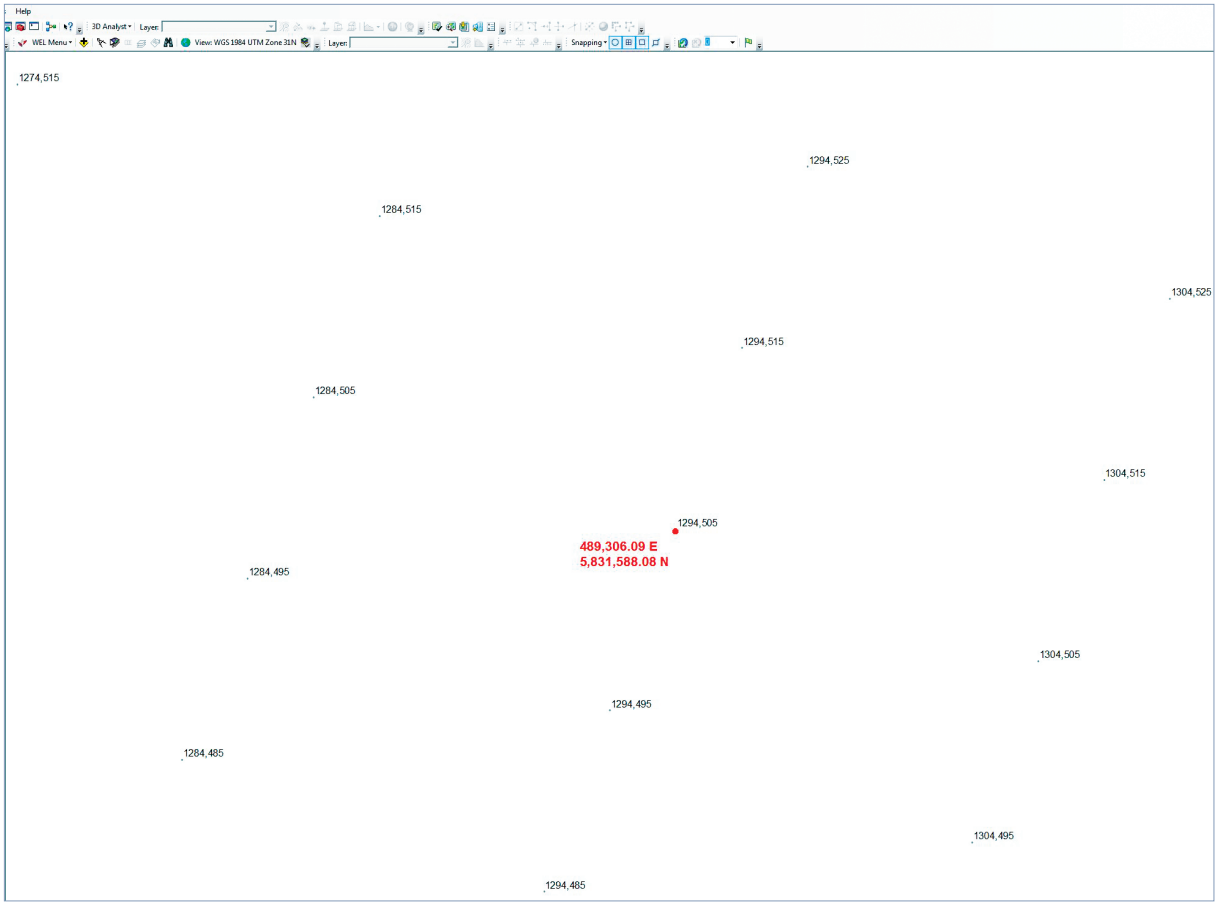



*Figure 5: Screen shot showing I, J and E, N values for a bin node*

- *Export of the data*

If there is no alternative source for the seismic bin grid data of a project, the P6DM can in principle be used to create an OGP P6/11 format export file, with seismic bin grid definition, perimeter data and bin nodes. All data pertaining to a seismic project could be exported into one OGP P6/11 file.

# 7. References

List of reference documents:

OGP (2012), *OGP P6/11 Seismic bin grid data exchange format description*, Report No 483-6, available from www.ogp.org.uk/pubs/483-6.pdf

OGP (forthcoming), *OGP P6/11 Seismic bin grid data exchange format – user guide*, Report No 483-6u

OGP (2013), *OGP P6/11 data dictionary: P6 GIS Data Model Package item 0*, available from http://info.ogp.org.uk/geodesy

OGP (2013), *OGP P6/11 Geodatabase template: P6 GIS Data Model Package item 2*, available from http://info.ogp.org.uk/geodesy

OGP (2011), *OGP Seabed Survey Data Model*, Report No 462-01, available from http://www.ogp.org.uk/pubs/462-01.pdf

OGP (2011), *OGP SSDM – Symbology: Sample ArcGIS style sheet*, available from http://info.ogp.org.uk/geodesy/

# 8. Abbreviations

| | |
|---|---|
| **Esri** | Environment Systems Research Institute, Inc., owner of ArcGIS suite of software products. |
| **CRS** | Co-ordinate Reference System |
| **GIS** | Geographical Information System |
| **P6DM** | P6/11 seismic bin grid GIS data model |
| **SSDM** | OGP seabed survey data model |

For further information and publications,
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