Ordnance Survey

OS TERRAIN 50

User guide and
technical specification

OS Terrain 50

User guide

Contents

v1.3 – 03/2017

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Preface

This user guide (hereafter referred to as the guide) is designed to provide an overview of OS Terrain 50 (hereafter referred to as the product) and it gives guidelines and advice on how a customer might derive the maximum benefit from the product. It assumes a general knowledge of geographic information. If you find an error or omission in this guide, or otherwise wish to make a comment or suggestion as to how we can improve the guide, please contact us at the address shown below under contact details or complete the product and service performance report form at annexe A and return it to us.

Contact details

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You are advised to copy the supplied data to a back-up medium.

Using this guide

The documentation is supplied in portable document format (PDF) only. Free Adobe® Acrobat Reader® software, which displays the guide, incorporates search and zoom facilities and allows you to navigate within. Hyperlinks are used to navigate between associated parts of the guide and to relevant Internet resources by clicking on the blue hyperlinks and the table of contents.

If you are unfamiliar with any words or terms used and require clarification please refer to the glossary at the end of the document.

Chapter 1 Introduction

Using this guide

This document consists of:

- a user guide which contains basic information you will need to understand, use and manage OS Terrain 50; and
- a technical specification which contains detailed technical information about the data formats.

Annexe A in the user guide contains a product and service performance report form for you to submit any comments on OS Terrain 50. You may also email us at opendata@os.uk

OS Terrain overview

OS Terrain is the name given to Ordnance Survey's new range of height products. These are three-dimensional models of the bare earth surface known as Digital Terrain Models (DTMs). The range will consist of:

- **OS Terrain 5** a mid-resolution DTM, designed to be interoperable with our large-scale data; and
- **OS Terrain 50** a lower-resolution DTM product, designed for landscape visualisation and analysis over large areas. This is available through OS OpenData™.

OS Terrain 50

OS Terrain 50 is published as both grid and contours each in a variety of formats. Both data types are created from the same source data and are supplied as 10 km by 10 km tiles.

- **OS Terrain 50 grid** a grid of heighted points with regular 50 metre post spacing.
- **OS Terrain 50 contours** a contour dataset of 10 metre interval standard contour polylines which includes, mean high and low water boundaries and spot heights.

Applications

OS Terrain 50 provides an ideal base to enable the third dimension for other data within an appropriate geographical information system (GIS). The height data has been created from a source that is also used to update our large-scale data products and it can be used in conjunction with many other Ordnance Survey digital products, for analytical, modelling, planning and visual purposes to enable:

- View-shed modelling.
- Asset/site management.
- Visual aid.
- Signal propagation.
- Environmental analysis.
- High level development.
- Geological analysis.
- Line of sight planning.
- Fly-through sequences.

Features

- Maintained within our integrated 3–5 year flying programme and synchronised with our other product updates.
- Specific modelling of significant features, particularly networks.
- Available in a variety of formats.
- Full coverage of Great Britain.
- Provided free at the point of use as a download through OS OpenData™.

- Designed to work with Ordnance Survey's small-scale data.
- Supplied as both grid and contours with spot heights.
- Annual product updates.
- The foundation for Ordnance Survey's three dimensional strategy.
- Based on the draft INSPIRE elevation specification.
- Available in GML 3.2, using Open Geospatial Consortium (OGC) Simple Features Profile (level 0).

Accuracy

OS Terrain 50 has been compared with GPS points in a range of sample areas to provide a Route Mean Square Error (RMSE) value for the height points in each geographic area; urban and major communication routes, rural and mountain and moorland. OS Terrain 50 grid has been verified to be 4 m RMSE.

Supply format

OS Terrain 50 is available as:

- 50 metre grid in ASCII grid and GML 3.2.1 (Simple Features Profile – level 0).
- 10 metre contours in Esri® shapefile or GML 3.2.1 (Simple Features Profile – level 0).

Ordering data

The data is provided as a full set of Great Britain in tiles and is available as download only. The national dataset is supplied as 10 km by 10 km tiles of data. There are 2,858 tiles in the product arranged into 55 folders representing each 100 km tile grid square.

It is recommended that a download manager is used to extract the data as this additional functionality will be able to automate the process and organise the data folders as desired. There are many commercial and open source download clients available to help manage the data.

This data is designed to be kept up to date by annual full tile resupply. Please visit the OpenData pages to view the update dates.

Coverage and file sizes

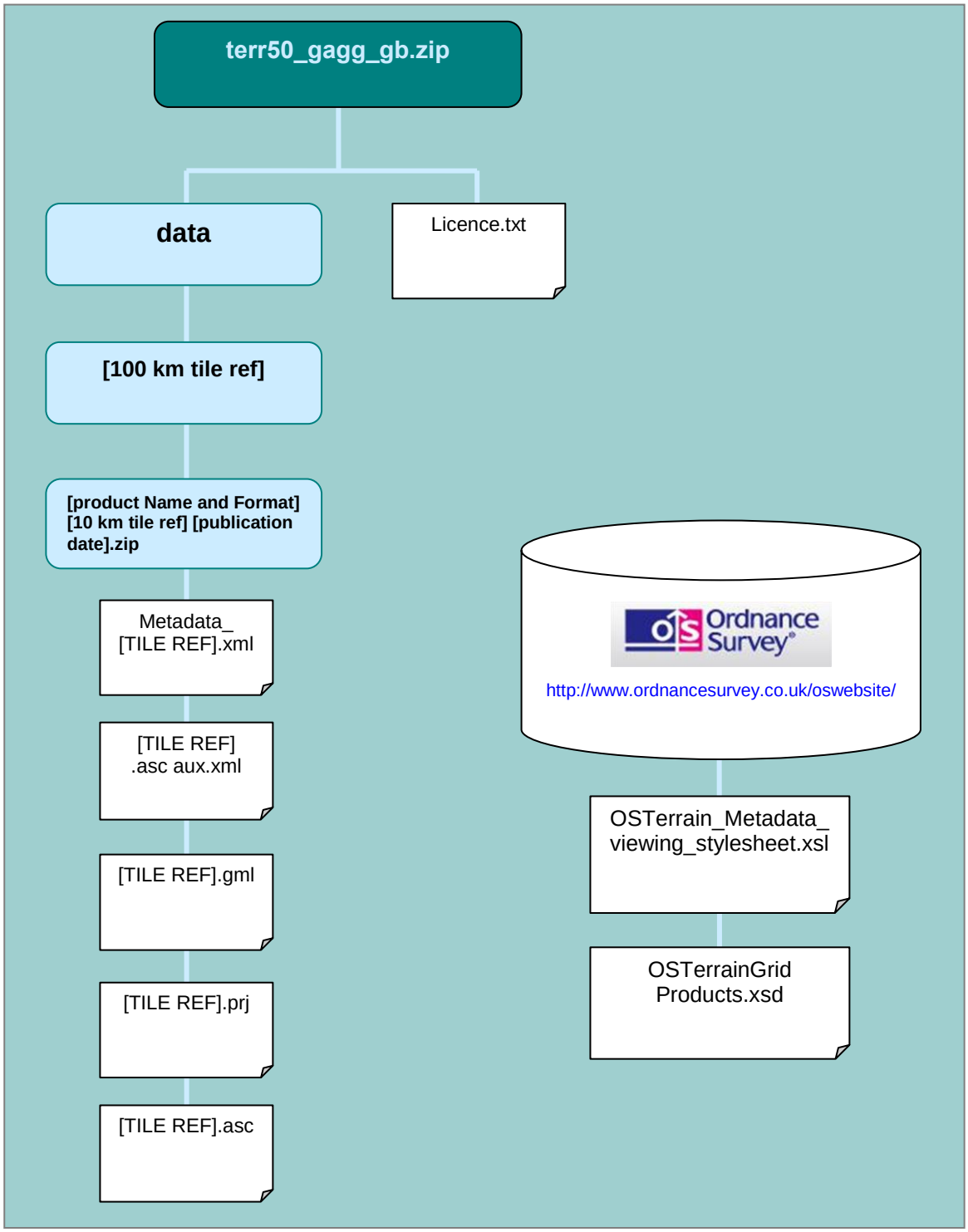
OS Terrain 50 is full national coverage of Great Britain. Terrain 50 is derived from the same source data as our large-scale revision programme.

Data will be compressed using the zip compression method and is not encrypted. Compression rates vary for contour tiles, dependant on the number of features in the geographic location.

A full national supply of OS Terrain grid is 153 Mb compressed.

File structure

When ordered from OS OpenData, the files will be arranged within folders. The following example is for OS Terrain 50 in grid format:



In the diagram above some files are located on the Ordnance Survey website. Please see Data, metadata and additional files for more information.

INSPIRE compliance

OS Terrain 50 is designed to be INSPIRE (Infrastructure for Spatial Data in Europe) ready. Ordnance Survey is a leading member of the UK Location Programme, which is charged with delivering INSPIRE, a directive that applies to all member states and aims to enable more joined-up data across public bodies for environmental applications.

At the time of OS Terrain product development the INSPIRE elevation specification had not been finalised. The data structures of OS Terrain products, and the details of the GML encoding, have been based on the draft INSPIRE specification.

For more information about INSPIRE and UK Location please view the web pages: http://data.gov.uk/location

Computer hardware

This product may be used on a wide range of hardware platforms (provided sufficient memory and storage facilities are available), varying from tablets or computers using GIS or CAD to mainframe computers with specialised translators and applications. Please see Coverage and file sizes for more information. Your system supplier will be able to advise on your requirements.

Computer software

OS Terrain 50 is supplied as inert data in a variety of formats and does not include software for data manipulation.

GML is an open standard format and the data may need to be translated into the appropriate format for use within a GIS application. A wide range of GIS software can read the GML contour data without translation.

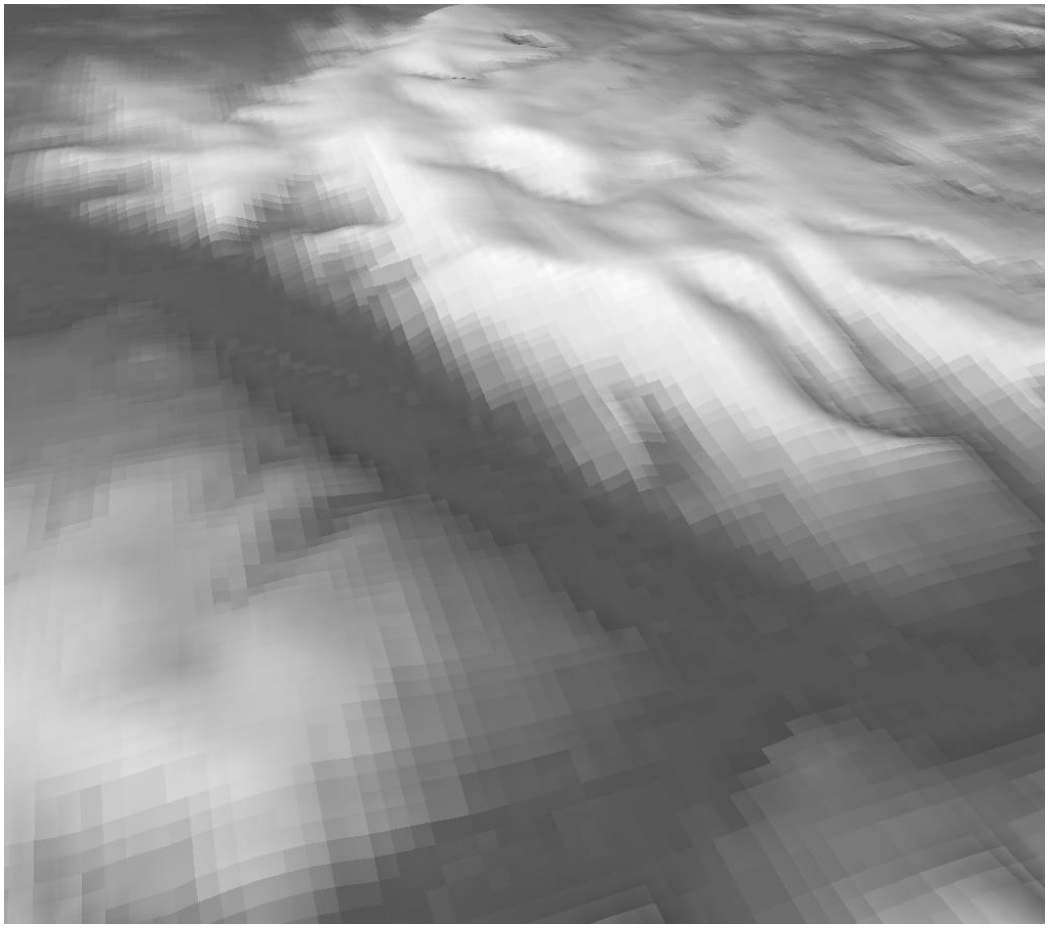
Chapter 2 OS Terrain 50

This chapter describes the structure of the data in grid and contour forms.

Grid

Introduction

The height data is presented as a raster dataset of height values which are calculated at the centre of the pixel. This method of creating the data means there are no overlaps between tiles nor common values along the edge. Coordinate reference systems for DTMs may be used to calculate the DTM origin and coordinates of individual posts.



OS Terrain 50 posts displayed as a heighted, shaded raster in a GIS.

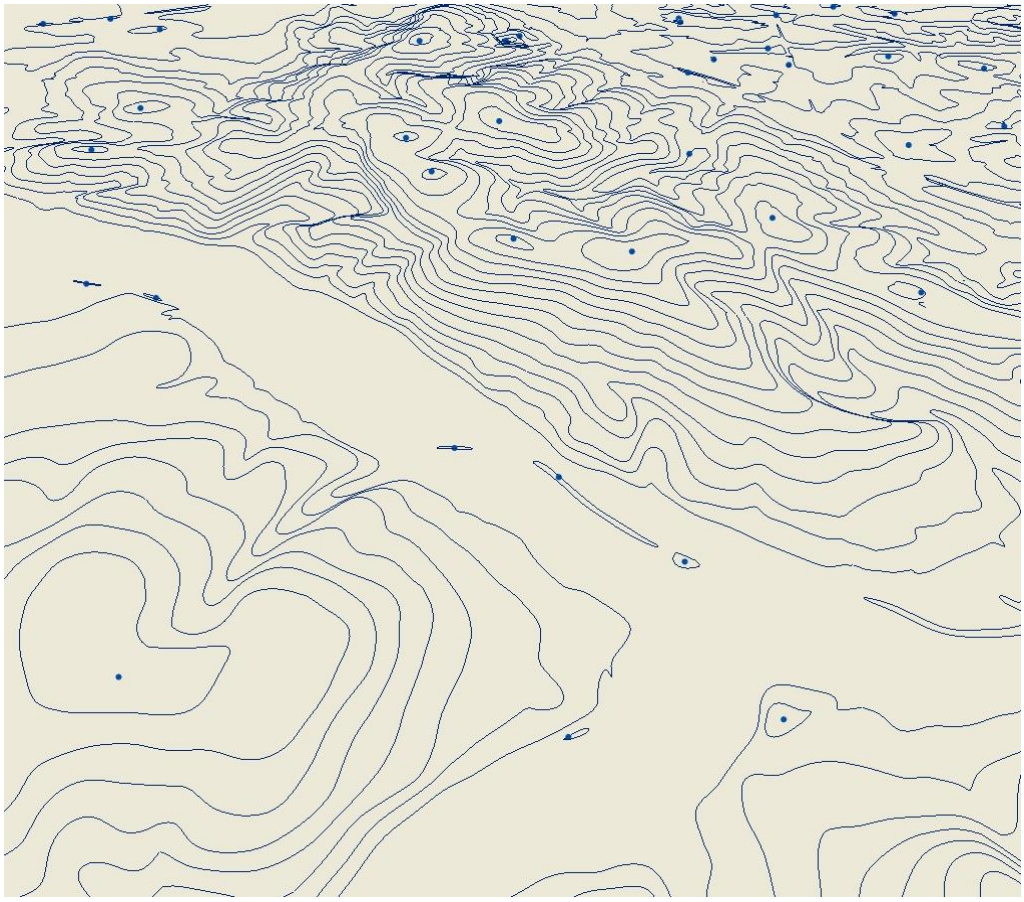
Mean high and low water representation in grid

Due to local tidal conditions, the height of the mean high and low water mark varies continuously around the coast of Britain. The mean high and low water lines have been have been derived from our large scale mapping and assigned constant height values, based on the average for each tile. This average value has been determined from local tide tables. The mean high and low water lines were used as heighted breaklines when creating the grid to ensure the grid product is consistent with the contour product. This means that there may be a small discrete step in the height of tidal water between adjacent tiles. For areas of permanent tidal water, in the grid, the height of the mean low water has been extended out to the tile edge to ensure that the tile is complete. Heights in the foreshore area are interpolated between the mean high and low water heights.

Contours

Introduction

The contours are presented as polyline and spot height features. The contour lines have been divided into tiles for product supply. The contour values can be viewed and analysed in a GIS.



OS Terrain 50 contours and spot heights displayed as a heighted raster in a GIS.

Feature types

The terms used for the feature types are drawn from the INSPIRE elevation specification. The draft INSPIRE elevation specification requires height values to be held in an attribute called ‘propertyValue’, which has been implemented in the new OS Terrain contour GML. In the shapefile format, the GML feature types and attributes have been followed but with the 10-character limit on shapefile fields, ‘propertyValue’ is abbreviated to ‘PROP_VALUE’.

The contours are named ‘master’ and ‘ordinary’, which are equivalent to ‘index’ and ‘standard’ contours in withdrawn Ordnance Survey’s product, Land-Form PROFILE.

Mean high and low water representation in contours

In the contour products, the mean high and mean low water lines have been derived from our large scale mapping and assigned constant height values, based on the average for each tile. This average value has been determined from local tide tables. Inevitably, this means that there is a small discrete step between adjacent tiles. There are no contours supplied between the mean high and low water lines.

The ‘LandWaterBoundary’ feature type has an attribute of ‘waterLevelCategory’, which has four possible sub-values: ‘meanHighWater’ and ‘meanLowWater’ or ‘meanHighWaterSprings’ and ‘meanLowWaterSprings’ for Scotland. This attribution allows their display parameters to be changed to show individual features, as desired.

Spot heights

These have been created using an algorithm that selects the highest source data point within every enclosed contour. As they are from an interpolated surface of the real world they cannot be guaranteed as summits or highest points of the feature but it is intended that, in time, the height source data will be enriched by additional spot height data. The GML data model lists the spot height sub-value, 'spotHeightType', which allows the potential for formSpot, generic, mountainPass or summit to be used in future releases of the product. Currently all spot height features as attributed as 'generic'.

It is possible that there will be some instances of spot heights recording lower height values than the enclosing contour but it is likely that these are the result of genuine depressions.

Chapter 3 Data, metadata, and additional files

The product will be supplied separately for grid or contour as compressed folders for each geographic tile of data. Each compressed folder will consist of data plus a number of additional files. This chapter describes these files and their purpose.

Grid data (ASCII and GML)

<tile name>.asc	Esri ASCII grid data.
<tile name>.gml	OGC file for the ASCII grid to enable the data to be loaded as GML format.
<tile name>.prj	File containing the spatial reference system in a format defined by Esri.
<tile name>.asc.aux.xml	A file which provides parameters to enable default styling in Esri applications. This ensures that the shading is consistent across the data but allows you to apply your own choice of colour ramp.
Metadata_<tile name>.xml	A metadata file for grid data, providing information on the flying date and so on.

Contour data (GML)

<tile name>.gml	GML data file
Metadata_<tile name>.xml	A metadata file for contour data providing information on the flying date and so on.

Contour data (Esri shapefile)

<tile name>_line.shp <tile name>_line.dbf <tile name>_line.shx <tile name>_line.prj	Esri shapefiles for contour and tide line data.
<tile name>_point.shp <tile name>_point.dbf <tile name>_point.shx <tile name>_point.prj	Esri shapefiles for spot height data.
Metadata_<tile name>.xml	A metadata file for contour data providing information on the flying date and so on.

Metadata

The XML metadata for the new terrain products follows the GEMINI metadata standard, which Ordnance Survey has committed to for the UK Location Programme and INSPIRE. Ordnance Survey has provided metadata for national sets of products (https://www.ordnancesurvey.co.uk/xml/products/). OS Terrain 5 and OS Terrain 50 will also have metadata in this form, on a per-tile basis.

The XML metadata contains comments to clarify the meaning of the XML tags used in the file.

Name	Description	Examples
Product identification		
Product name	OS Terrain 50	gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:**collectiveTitle**/gco:CharacterString
Spatial representation	The structure of the data, either grid (DTM) or vector (contours)	gmd:MD_DataIdentification/gmd:spatialRepresentationType/gmd:**MD_SpatialRepresentationTypeCode**
Tile reference	10 km National Grid tile reference	gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:**title**/gco:CharacterString
Topic category	INSPIRE theme: elevation	gmd:MD_DataIdentification/gmd:topicCategory/gmd:**MD_TopicCategoryCode**
Coordinate reference systems	The projected Coordinate Reference System British National Grid and the Vertical Reference System Ordnance Datum Newlyn	gmd:MD_ReferenceSystem/gmd:referenceSystemIdentifier/gmd:RS_Identifier/gmd:code/gmx:Anchor xlink:href="urn:ogc:def:crs:EPSG::27700"/**British National Grid** gmd:MD_ReferenceSystem/gmd:referenceSystemIdentifier/gmd:RS_Identifier/gmd:code/gmx:Anchor xlink:href="urn:ogc:def:crs:EPSG::5701"/**Ordnance Datum Newlyn**
Change history		
Flying date(s)	The date that the area was flown by Ordnance Survey for revision. To accommodate multiple flying dates within the tile, two values will be recorded, earliest flying date then latest flying date present. Both dates can be identical. For Profile content the Date Flown will be recorded as <null>	gmd:MD_DataIdentification/gmd:extent/gmd:EX_Extent/gmd:temporalElement/gmd:EX_TemporalExtent/gmd:extent/gml:TimePeriod /gml:**beginPosition** /gml:**endPosition**
Processing date	The date the tile was created by Ordnance Survey, not the date of the real-world change or survey	gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:date/gmd:CI_Date/gmd:date/gco:**Date**
Version number	An incrementing number to indicate the number of times the tile has been published	gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:**edition**/gco:CharacterString
Reason for change	This provides information about the update of the data and whether it is creation (new) or a revision (modified/verified) which is described in the metadata by using lineage below	gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:date/gmd:CI_Date/gmd:dateType/gmd:**CI_DateTypeCode**
Lineage	Text to describe the current status of the tile, either: 'created from new imagery', 'some parts revised from new imagery', 'new imagery examined and no change'	gmd:DQ_DataQuality/gmd:lineage/gmd:LI_Lineage/gmd:**statement**/gco:CharacterString

Metadata Viewing stylesheet

To make the xml easier to read an XSLT viewing style sheet is provided (OSTerrainMetadataViewingStylesheet.xsl), which converts the XML to HTML for ease of viewing in a web browser. Some browsers and other software will read this automatically if the user is connected to the internet as its address is referenced in the metadata but it can also be located on the Ordnance Survey website http://www.ordnancesurvey.co.uk/xml/stylesheet/OSTerrainMetadataViewingStylesheet.xsl.

Metadata xml file example

This is a section of the xml file in its native format with the location of the style sheet highlighted. It can be read like this when opened in an xml viewer or basic file reader.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="http://www.ordnancesurvey.co.uk/xml/stylesheet/OSTerrainMetadataViewingStylesheet.xsl"?>

<gmd:MD_Metadata xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:gmx="http://www.isotc211.org/2005/gmx" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.isotc211.org/2005/gmx
http://eden.ign.fr/xsd/isotc211/isofull/20090316/gmx/gmx.xsd"><!-- Unique identifier, required
if this record is being used in a metadata management system -->
        <gmd:fileIdentifier>
                <gco:CharacterString>OSTerrain5.NT23NE</gco:CharacterString>
        </gmd:fileIdentifier>
        <gmd:contact gco:nilReason="missing"></gmd:contact>
        <gmd:dateStamp>
                <gco:DateTime>2013-01-08T03:22:25</gco:DateTime>
        </gmd:dateStamp><!-- Projected Coordinate Reference System -->
        <gmd:referenceSystemInfo>
                <gmd:MD_ReferenceSystem>
                        <gmd:referenceSystemIdentifier>
                                <gmd:RS_Identifier>
                                        <gmd:code>
                                                <gmx:Anchor
xlink:href="urn:ogc:def:crs:EPSG::27700">British National Grid</gmx:Anchor>
```

Metadata xml file referencing the XSLT viewing stylesheet example

This is the same section of the metadata file above when viewed directly by clicking on the file, this utilising the style sheet.

OS Terrain Tile Metadata

Product identification:

Product name:	OS Terrain 5
Spatial representation:	grid
Tile reference:	NT23NE
Topic category:	elevation
Coordinate reference systems:	British National Grid

Esri grid styling – asc.aux.xml file

This XML file contains min, max, mean and standard deviation height values for the product, in a format defined by Esri. The same values are supplied for every tile. Providing these height statistics is intended to allow colour ramps to be applied by the user, such that adjacent tiles are styled consistently.

This can be disabled by removing the asc.aux.xml file from each downloaded folder or adjusting the parameters of the minimum and maximum heights in a GIS if desired.

Chapter 4 OS Terrain 50 source data

Introduction

The source DTM for OS Terrain products is captured as a Triangulated Irregular Network (TIN) by editing with mass points and breaklines and/or automated techniques within a photogrammetric environment. The TIN is a superior model for three-dimensional data as it uses triangles which can retain the edges of features more accurately than a grid, for example.

The source data capture is subject to demanding rules defined by the height capture specification. Particular attention is paid to communication routes and features significant to height applications. This section describes some of the key capture requirements from the detailed capture specification which we endeavour to achieve in the source data.

The grid and contour products are both interpolated from this source TIN model. This is because the TIN model is not widely supported by GIS software. As OS Terrain 50 is designed to work with small-scale products the feature modelling will have a more generalised representation in the product.

Coverage

The minimum coverage of the data extends out to the low water mark, defined by Hydrographic Office tables with a height value for each tile. For England and Wales the low water mark is Mean Low Water (MLW) and for Scotland Mean Low Water (Springs) (MLW(S)).

All land wholly within inland water bodies that is represented by topographic area features is captured according to the positional accuracy requirements of the area. The minimum requirement is to capture the outer edge of the feature. The surrounding water will remain flat.

Any other land within inland water bodies captured by automated processes will be removed from the data.

Positional accuracy requirements

The z values of the source TIN data have to meet positional accuracy requirements according to their geographic location. The terrain has been divided into three classifications; urban and major communication routes, rural and mountain and moorland to ensure that modelling reflects customer requirements. The accuracy of the height value above Newlyn Datum must achieve the root mean square error (RMSE) set for each area.

Modelling of features in source data

Representation of the surface

The height of the bare earth surface is recorded as a series of points with three dimensional coordinates.

The X and Y coordinates are Eastings and Northings in OSGB36; the Z coordinate is height in metres relative to the datum for the area. The vast majority of areas will record a height relative to Ordnance Survey Newlyn Datum. For a small number of offshore islands a local datum has been used.

The bare earth surface excludes buildings, supported structures and vegetation. Structures that form an obstruction at ground level – such as dams, breakwaters and groynes (wide enough to affect the positional accuracy requirements), bridge revetments and earthworks – are considered to be part of the bare earth surface. Only permanent terrain features (those expected to remain until the next revision period or longer) are modelled.

Underground and overhead features

Underground and overhead features are, by definition, not the ground surface and are thus not included in a DTM. Underground features are those that are obscured and require excavation to construct. Underground features are not recorded and overhead features are removed from the data.

Terrain smoothness

The DTM will be free of spikes and wells that do not reflect the real world terrain. A surface that is smooth, that is, one that consists of a regular plane (which may be angled) for example, a road carriageway or railway track bed, will also appear smooth in the data.

Edgematching

Most data will present without visible tile edges or discernible height differences between tiles. In places there may be small edges present or a difference in feature modelling between new and older content. There will also be small edges in tidal areas due to local tidal differences

Supported structures

Supported structures include bridges, viaducts, jetties or piers on legs, cranes, elevated buildings, and so on.

Supported structures are removed from the data where the structure departs from the bare earth surface and an air gap exists. All supported structures will be removed from the data

Vegetation

Areas of vegetation, such as hedgerows and trees are removed to ensure the bare earth surface is correctly recorded.

Vertical features

Locations with a vertical change in height, or overhang, have the height of the top of the feature recorded at the correct planimetric location according to the positional accuracy requirements.

The height at the lowest point of the vertical feature is recorded according to positional accuracy requirements of the feature but offset from its real world planimetric position to ensure that there is only one z value present in the same location.

Major communication routes

Major communication routes are major road and rail networks identified in our core database.

The limits of a road carriageway or railway track bed are modelled to ensure that the route reflects its real world shape. Modelling is required for changes in height to meet the positional accuracy requirements, to smooth the surface and to remove extraneous features such as road furniture and bridges. Any associated slopes and embankments along the length of the route are also modelled.

In all other cases the surface must be smooth, flat (not necessarily horizontal) and free from undulations.

Manmade landforms associated with mineral workings and landfill

The outer limits, shape and depth of mineral extraction and landfill sites are captured to meet positional accuracy requirements. Temporary features that do not represent the terrain at the time of capture, for example spoil heaps, are removed from the data

Contained water bodies greater than 0.7ha

In order to respond to the *Flood and Water Management Act 2010* the extent of all flat water bodies that are > 0.7ha in area (that is, greater than 7000 cubic metres capacity) must have their limits captured to ensure that the presence of the water body can be inferred from the data.

The height of the water recorded is that at the lowest height of the surrounding data. The surface of the water will be flat.

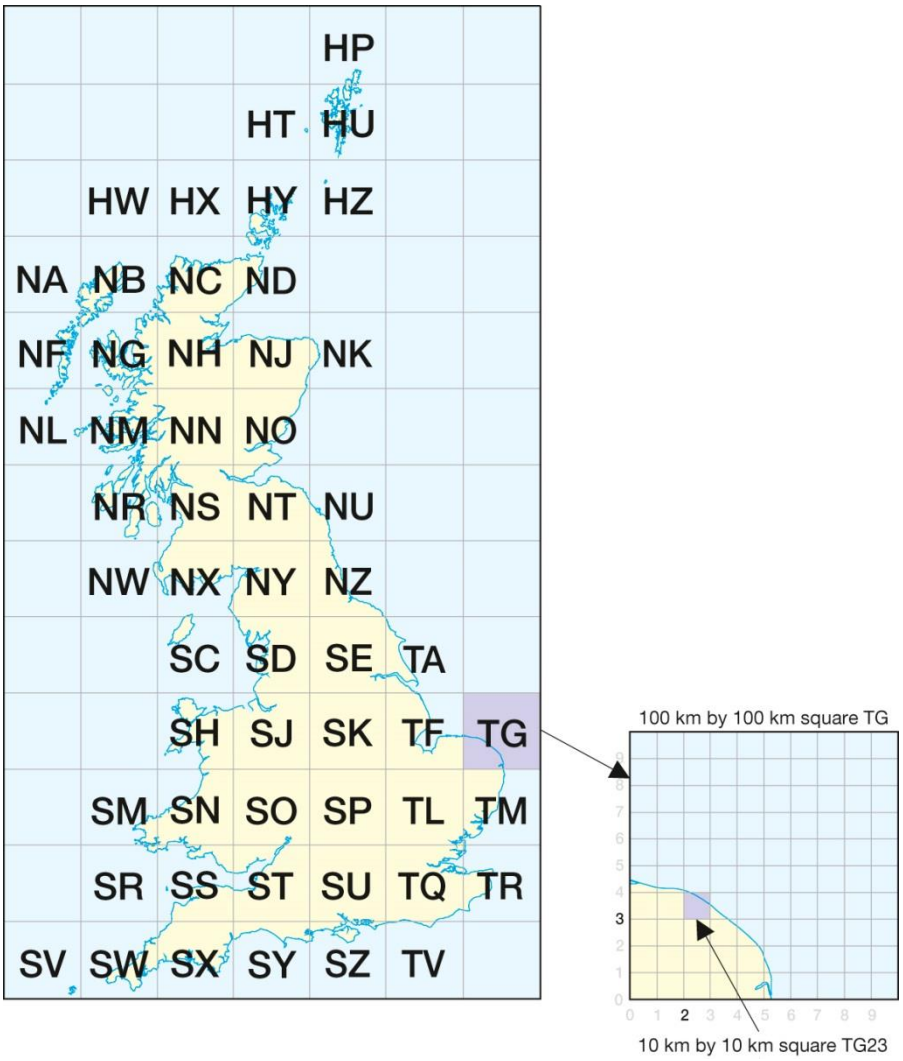
Chapter 5 The National Grid

OS Terrain 50 is supplied as a whole set of Great Britain divided into 10 km by 10 km tiles. These tiles are identified by quoting the National Grid reference of the south-west corner of the area they cover. Ordnance Survey divides Great Britain into squares 100 km by 100 km. Each of these squares has a unique two-letter reference, for example, TG in the diagram below.

To describe a 10 km by 10 km tile, first add a two digit reference to the 100 km by 100 km square reference, with the easting first followed by the northing, for example, TG23. Then identify which quadrant of that grid square is required and add SW, SE, NW or NE to the reference, for example, TG23SW.

For additional information on how to use the National Grid, visit the Ordnance Survey's website at:

http://www.ordnancesurvey.co.uk



Annexe A Product and service performance report form

Ordnance Survey welcomes feedback from its customers about OS Terrain 50.

If you would like to share your thoughts with us, please print a copy of this form and when completed post or fax it to the address below.

Your name: .....

Organisation: .....

Address: .....

.....

.....

Postcode: .....

Phone: .....

Fax: .....

Email: .....

Quotation or order reference: .....

Please record your comments or feedback in the space below. We will acknowledge receipt of your form within three (3) working days and provide you with a full reply or a status report within 21 working days.

If you are posting this form, please send it to:

OS Terrain 50 Product Manager, Ordnance Survey, Adanac Drive, SOUTHAMPTON, SO16 0AS.

If you wish to return it by fax, please dial 023 8005 6159.

Any personal information that you supply with this report form will be used by Ordnance Survey only in the improvement of its products and services. It will not be made available to third parties.

OS Terrain 50

Technical specification

Contents

v1.3 – 03/20177

Introduction

Copyright in this specification

Chapter 1 Technical specification introduction

The purpose of the technical specification is to:

- provide a brief description of the presentation of OS Terrain 50 in its supply formats; and
- provide Licensed System Suppliers with as much detail as necessary to enable OS Terrain 50 files to be easily understood and processed by application software.

OS Terrain 50 is available to download as:

- 50 m grid in ASCII grid and GML 3.2.1 (simple features profile – level 0).
- 10 m contours in GML 3.2.1 (simple features profile – level 0).
- 10 m contours in Esri® shapefile.

Chapter 2 ASCII grid for OS Terrain 50 grid

ASCII grid overview

ASCII grid is a generic, text-based DTM format which was originally developed by Esri and it is sometimes referred to as ArcInfo ASCII grid or ArcGrid ASCII. This data can be read by most standard GIS software without additional translation.

The term data structure refers to the organisation and sequence of the records in the data file and not to the geographical topology of the data.

Data structure

Header section

The data is specified as a raster grid with the height values being calculated at the centre of the pixel. To represent this in ASCII grid format the initial coordinates in the map header originate on the north-west corner of the tile. The data is presented in rows reading from west to east creating a row of 200 values. The next row will begin 25 m from the western edge (pixel-centre) 50 m south of the origin and again progressing at 50 m intervals to the east.

Number of points

ncols 200

nrows 200

xllcorner 290000 (example)

yllcorner 80000 (example)

cellsize 50

Data section

The height values are presented in the standard ASCII grid format as a series of real values. The height values are given to the nearest 0.1 metre.

Chapter 1 GML for OS Terrain 50 grid and contours

This chapter describes how OS Terrain 50 is defined in GML version 3.2.1. An understanding of XML and XML schema is required.

GML overview

The OpenGIS® GML Encoding Standard, the GML is an XML grammar for expressing geographical features. GML serves as a modelling language for geographic systems as well as an open interchange format for geographic transactions on the Internet. As with most XML based grammars, there are two parts to the grammar – the schema that describes the document and the instance document that contains the actual data. A GML document is described using a GML Schema. This allows users and developers to describe generic geographic data sets that contain points, lines and polygons.

http://www.opengeospatial.org/standards/gml/

The GML conforms to GML 3.2.1 Simple Features (level 0) which is a subset of the full GML specification, intended to make it easier for GIS vendors to provide a minimum level of support for GML.

GML schema

XML schemas are used to validate the format and content of the GML. The GML specification provides a set of schemas that define the GML feature constructs and geometric types. These are designed to be used as a basis for building application-specific schemas, which define the data content.

The OS Terrain 50 application schemas, which are referenced by the data, are available at http://www.ordnancesurvey.co.uk/xml/terrainschema/

The user may need to be connected to the internet to access these online schemas while working with OS Terrain 50 in GML unless their software supports local copies of the schema. Depending upon the software that is being used to read the data the user has the following options:

- The software does not use the schema, therefore does not need to be connected to the Internet.
- The software needs the schema, but can reference the schema from a local copy, if it is downloaded in advance.
- The software needs the schema and can only reference it from the online version, therefore needs to be connected to the Internet.

Feature types

The model is ‘feature based’ so that ‘ContourLine’, ‘SpotHeight’ and ‘LandWaterBoundary’ are feature types with specific attributes. Please see GML contours and spot heights for more information.

Coordinate reference system

The coordinate reference system for geometries in the OS Terrain GML, is expressed using an EPSG code embedded in a URN (urn:ogc:def:crs:EPSG::27700). This is a more generic way of expressing the reference system, rather than osgb:BNG (British national Grid), used in previous Ordnance Survey products.

Unique identifiers

GML 3.2 requires features and their geometries to have unique identifiers. For OS Terrain products, the feature identifiers have been structured as follows: os.t50.<tile name>.<sequential number>, where the second part abbreviates the product name. Geometry identifiers in the GML use the same form, but with a .geom suffix.

Therefore, for a given release of the product, every feature and geometry is guaranteed to have a unique identifier. The products will be updated by whole tile refresh and there are no plans to supply feature-based change-only-update. When a tile is updated, the sequential identifiers are re-generated.

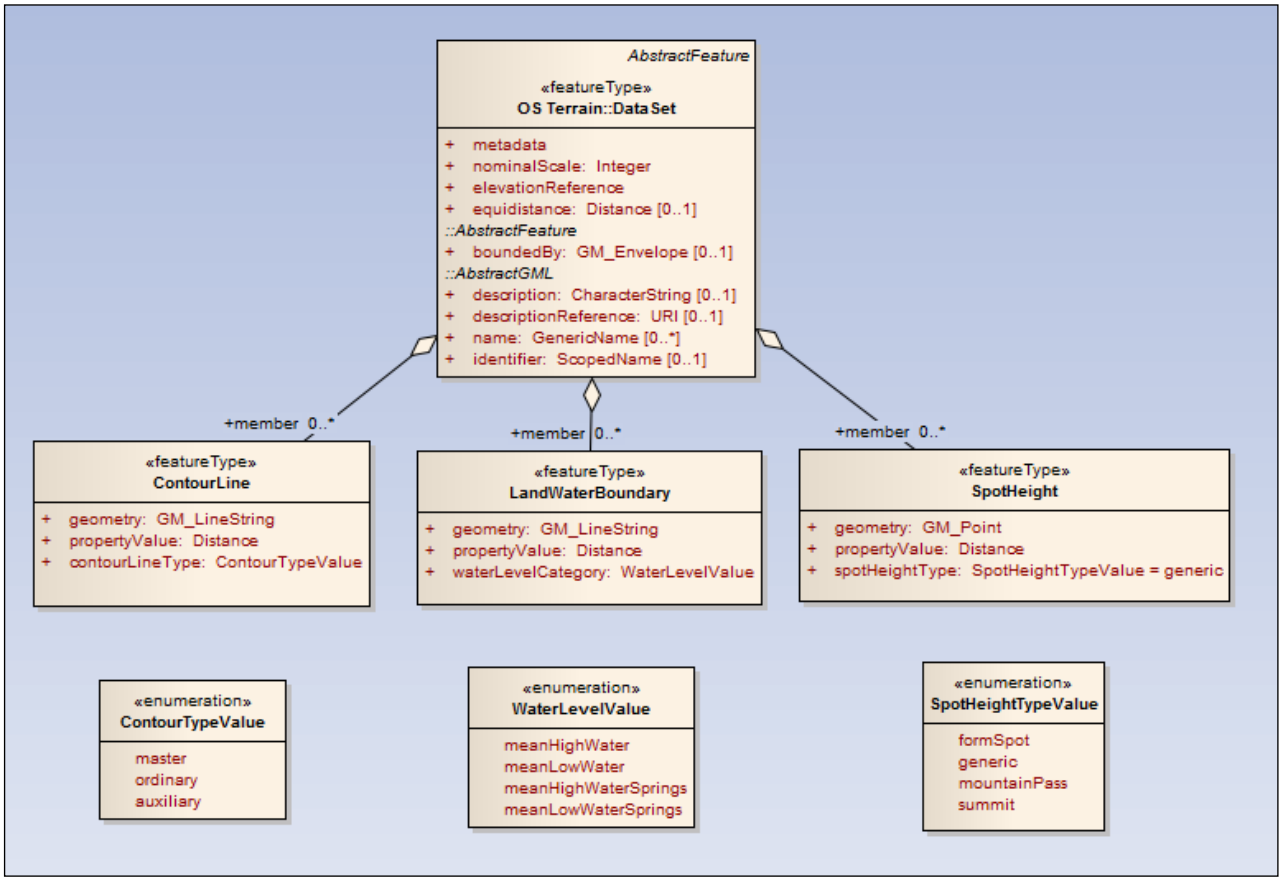
GML grid for OS Terrain 50

Ordnance Survey is committed to open data formats. The grid data is supplied as ASCII with GML, to enable their use in either format. The GML file does not contain any spatial height data as this data has been provided as an 'external data block', that is, the ASCII grid file. The .gml file effectively provides metadata (such as location, grid spacing and the vertical reference system). It also contains spatial reference information in a software independent form.

Currently, common software packages do not support it in this form but the ASCII grid data can be used alone.

GML contours and spot heights for OS Terrain 50

Detailed GML model



Spot heights

These have been created by an automated process to select the highest mass point within every closed contour. If the point is the same height as the contour it will be removed. It is possible that some spot heights could be lower than the surrounding contour due to genuine depressions. The z value is rounded to 0 decimal places.

GML feature types

The feature types within the contours enable their representation as individual features to enable easier interpretation, for example, the contours can be drawn as different colours to highlight the index contours, the high water mark and spot heights over a certain value.

The column names have been reformatted to facilitate compliance with Esri software.

Column name	Type	Description
ContourLine		
+geometry	GM_LineString	The structure of the feature
+propertyValue	Distance	The length of the contour
+contourLineType	String	master ordinary auxiliary
Notes	The ContourLine sub type value names align with INSPIRE draft elevation specification. The terms *master* and *ordinary* represent the more traditionally recognised terms *index* and *standard* (contours) respectively.	
SpotHeight		
+geometry	GM_Point	The structure of the feature
+propertyValue	Distance	The z value (height above Newlyn, or other British height datum) of the feature
+spotHeightType	String	formSpot generic mountainPass summit
Notes	At launch only the sub type value *generic* has been used but the other values provide functionality to enrich the attribution if required in a later product release.	
LandWaterBoundary		
+geometry	GM_LineString	
+propertyValue	Distance	
+waterLevelCategory	String	meanHighWater meanLowWater meanHighWaterSprings meanLowWaterSprings
Notes	Mean high and low waters apply to tidal waters in England and Wales and the Mean high and low water springs apply to those in Scotland.	

Example of the ContourLine feature types

```
<os:member>
        <os:ContourLine gml:id="os.t50.sx98.691">
                <os:geometry>
                        <gml:LineString srsName="urn:ogc:def:crs:EPSG::27700"
gml:id="os.t50.sx98.691.geom">
                                <gml:posList>300000 87424.1 299997 87432.8 299995.9 87445.7
299997.1 87459.6 300000 87473.8</gml:posList>
                        </gml:LineString>
                </os:geometry>
                <os:propertyValue uom="m">40</os:propertyValue>
                <os:contourLineType>ordinary</os:contourLineType>
        </os:ContourLine>
</os:member>
```

Example of the SpotHeight feature types

```
<os:member>
        <os:SpotHeight gml:id="os.t50.sx98.5">
                <os:geometry>
                        <gml:Point srsName="urn:ogc:def:crs:EPSG::27700"
gml:id="os.t50.sx98.5.geom">
                                <gml:pos>298939.2 88163.4</gml:pos>
                        </gml:Point>
                </os:geometry>
                <os:propertyValue uom="m">53</os:propertyValue>
                <os:spotHeightType>generic</os:spotHeightType>
        </os:SpotHeight>
</os:member>
```

Example of the LandWaterBoundary feature types

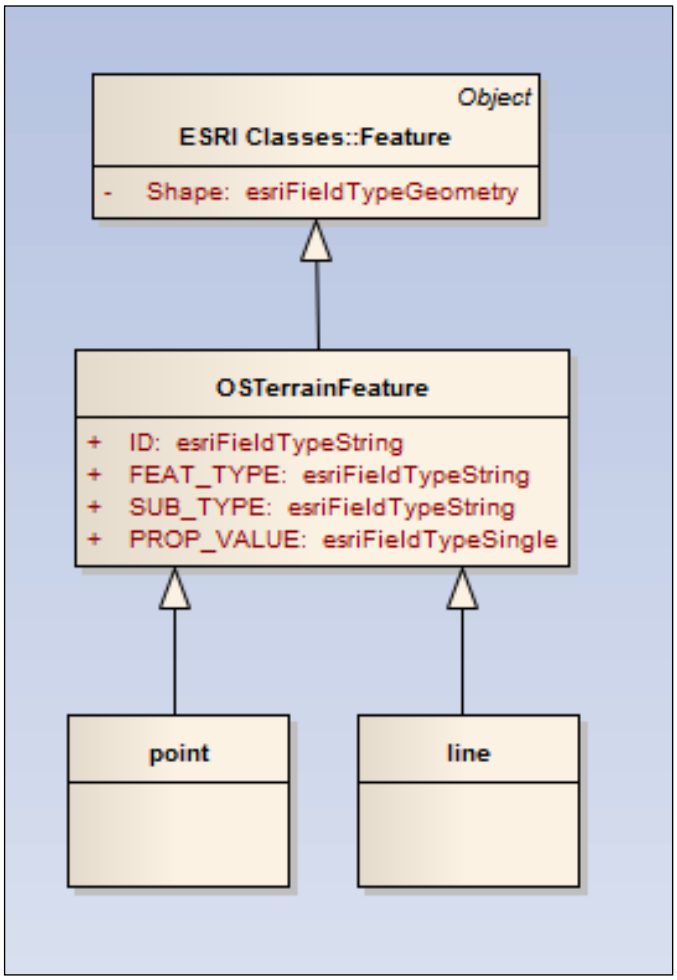
```
<os:member>
        <os:LandWaterBoundary gml:id="os.t50.sx98.138">
                <os:geometry>
                        <gml:LineString srsName="urn:ogc:def:crs:EPSG::27700"
gml:id="os.t50.sx98.138.geom">
                                <gml:posList>298703.2 80000 298695.7 80002.8 298681.6 80002.1
298662.7 80000</gml:posList>
                        </gml:LineString>
                </os:geometry>
                <os:propertyValue uom="m">-0.51</os:propertyValue>
                <os:waterLevelCategory>meanLowWater</os:waterLevelCategory>
        </os:LandWaterBoundary>
</os:member>
```

Chapter 2 Esri shapefile for OS Terrain 50 contours

Esri shapefile overview

The Esri shapefiles consist of eight separate files for the point and line features.

Detailed shapefile model



File name	Description	Examples
Contour line files		
<tile name>_line.shp	Shape format The contour geometry	
<tile name>_line.dbf	Shape attribute format A database file that contains the attributes of each feature	ID FEAT_TYPE SUB_TYPE PROP_VALUE os.t50.sy09.113 ContourLine ordinary 80.00 os.t50.sy09.114 ContourLine ordinary 100.00 os.t50.sy09.115 ContourLine ordinary 70.00
<tile name>_line.shx	Shape index format A positional index of the features to enable searching	
<tile name>_line.prj	Projection format Coordinate reference system information	PROJCS["British_National_Grid",GEOGCS["GCS_OSGB_1936",DATUM…
Spot height files		
<tile name>_point.shp	Shape format The spot height geometry	
<tile name>_point.dbf	Shape attribute format A database file that contains the attributes of each feature	ID FEAT_TYPE SUB_TYPE PROP_VALUE os.t50.sy09.0 SpotHeight generic 30.00 os.t50.sy09.1 SpotHeight generic 66.00 os.t50.sy09.2 SpotHeight generic 41.00
<tile name>_point.shx	Shape index format A positional index of the features to enable searching	
<tile name>_point.prj	Projection format Coordinate reference system information	PROJCS["British_National_Grid",GEOGCS["GCS_OSGB_1936",DATUM…

Annexe A Glossary

For detailed general information about mapping please visit our Support pages online.

absolute accuracy
A measure that indicates how closely the coordinates of a point in Ordnance Survey map data agree with the true National Grid coordinates of the same point on the ground. As the true position can never be known exactly, the statistic is quoted relative to the best known position determined by precise survey methods.

accuracy
The closeness of the results of observations, computations or estimates to the true values or the values accepted as being true. Accuracy relates to the exactness of the result, and is a measure of the exactness of the operation by which the result is obtained.

ASCII
American Standard Code for Information Interchange – a standard binary coding system used to represent characters within a computer.

bit
An acronym for binary digit.

breakline
A line indicating discontinuity in a terrain surface, that is, an abrupt change in gradient.

byte
A unit of computer storage of binary data usually comprising 8 bits, equivalent to a character. Hence megabyte (one million bytes) and gigabyte (one thousand million bytes).

character
A distinctive mark; an inscribed letter; one of a set of writing-symbols.

contour
A line connecting points of equal elevation.

coordinates
Pairs of numbers expressing horizontal distances along orthogonal axes. Alternatively, triplets of numbers measuring horizontal and vertical distances.

copyright
Copyright is a legal property right which enables the creator of an original work to protect it from unauthorised use. Through the *Copyright, Designs and Patents Act 1988*, Crown copyright continues to subsist in all Ordnance Survey products until the end of the period of 50 years from the end of the year in which they were published and, in the case of data, from the end of the year in which it was extracted from the Ordnance Survey database. Crown copyright is vested in The Controller of Her Majesty's Stationery Office, who has delegated powers to the Director General, Ordnance Survey for the administration of copyright in publications and data, including the determination of the rules and terms under which permission for their reproduction is given.

currency
An expression of the up-to-dateness of data.

data
A representation of facts, concepts or instructions in a formalised manner suitable for communication, interpretation or processing.

data capture
The encoding of data. In the context of digital mapping this includes map digitising, direct recording by electronic survey instruments, and the encoding of text and attributes by whatever means.

data format
A specification that defines the order in which data is stored or a description of the way data is held in a file or record.

data model
An abstraction of the real world which incorporates only those properties thought to be relevant to the application or applications at hand. A data model would normally define specific groups of entities and their attributes, and the relationship between these entities. A data model is independent of a computer system and its associated data structures.

data point
A coordinate pair that defines the position of a point feature, or one of a series of coordinate pairs that defines a line feature.

data quality
Attributes of a dataset that define its suitability for a particular purpose, for example, completeness, positional accuracy, currency, logical structure and so on.

data structure
The defined logical arrangement of data as used by a system for data management; a representation of a data model in computer form.

data type
This defines the structure of a data item. This in turn determines the range of values it can take and the range of operations that can be applied to it. Integer, real and character string are examples of data type. Some modern programming languages allow user-defined types.

database
An organised, integrated collection of data stored so as to be capable of use by relevant applications, with the data being accessed by different logical paths. Theoretically, it is application-independent, but in reality it is rarely so.

dataset
An identifiable collection of related data.

digital
Data that is expressed as numbers (digits) in computer-readable form is said to be digital.

digital terrain model (DTM)
Also referred to as a digital elevation model (DEM) this primarily defines the ground surface. This will normally exclude ground surface features such as buildings, woodland and so on.

eastings
See rectangular coordinates.

edgematch
The process of ensuring that data along the adjacent edges of blocks of data matches in both positional and attribute terms.

feature
An item of detail within a digital map that can be represented by either a point, symbol, text or line.

feature identifier
A unique code to identify an individual feature. A specified part of a record containing a unit of data, such as the date of digitising. The unit of data may be a data element or a data item.

field
A specified part of a data file containing a unit of data, such as the date of flying.

format
The specified arrangement of data in a file.

geographical information system (GIS)
A system for capturing, storing, checking, integrating, analysing and displaying data that is spatially referenced to the Earth. This is normally considered to involve a spatially referenced computer database and appropriate applications software.

Global positioning system (GPS)

The Navstar global positioning system (GPS) is a constellation of orbiting satellites that provides navigation data to military and civilian users all over the world. The system is operated and controlled by members of the 50th Space Wing located at Schriever Air Force Base (AFB), Colorado.

GML

GML was developed by the Open GIS Consortium (OGC), a global organisation of developers and users that aims to maximise the benefit of geographic information. GML is a spatially enabled dialect of XML schema.

grid
The planimetric frame of reference, for example, the National Grid or the consistent alignment of data points.

kilobyte (Kb)

A total of 1,024 bytes; a measure of data storage capacity.

line

A series of connected coordinated points forming a simple feature with homogeneous attribution.

mean high water/springs (MHW or MHWS)

Depiction of the encroachment of land by tidal waters at mean highest levels – spring tides in Scotland.

mean low water/springs (MLW or MLWS)

Depiction of limits of tidal waters at mean lowest ebb – spring tides in Scotland.

megabyte (Mb)

A total of 1,048 576 bytes; a measure of data storage capacity.

National Grid

The metric grid on a Transverse Mercator projection used by Ordnance Survey on all post-war mapping to provide an unambiguous spatial reference in Great Britain for any place or entity, whatever the map scale.

Northings

See rectangular coordinates.

Open GIS Consortium (OGC)
This is a global organisation of developers and users that aims to maximise the benefit of geographic information.

origin

The zero point in a system of rectangular Cartesian coordinates.

photogrammetry

The science, art and technology of obtaining reliable measurements and maps from aerial photographs.

point

A zero-dimensional spatial abstraction of an object represented as a coordinate pair.

point feature

A zero-dimensional spatial abstraction of an object with its position defined by a coordinate pair. Points may also be represented by symbols, which may have attributes such as orientation and size.

positional accuracy

The degree to which the coordinates define a point's true position in the world, directly related to the spheroid and/or projection on which the coordinates system is based.

rectangular coordinates

Also known as x-y coordinates and as eastings and northings. These are two-dimensional coordinates that measure the position of any point relative to an arbitrary origin on a plane surface, for example, a map projection, a digitising table or a VDU screen.

Route mean square error (RMSE)

This is the square root of the mean of the squares of the errors between observations, such as GPS points.

Shapefile

This is a data format developed by Esri to describe features such as points, lines and polygons to enable spatial analysis. A shapefile consists of a number of files designed to hold information essential for the transfer of this data between software products which are capable of reading shapefiles.

spot height

A point on the Earth's surface for which the height, above a reference datum, is known and which has been fixed by observation.

transfer format

The format used to transfer data consistently between computer systems. In general usage this can refer not only to the organisation of data but also to the associated information, such as attribute codes, which are required in order to successfully complete the transfer.

Triangulated Irregular Network (TIN)

This is a vector data structure that represents a surface in three dimensions. Masspoints (or z-values) are joined up as irregular triangles to form a surface to provide a more accurate and less dense method of representing a Digital Terrain Model. This is because the edges of features are preserved and masspoints are only depicted where necessary to depict changes in slope.

Extensible Markup Language (XML)

This is a markup language written in a textual data format designed to encode documents and data structures for transfer over the Internet. It was developed by the World Wide Web Consortium (W3C). XML schemas express shared vocabularies and allow machines to carry out rules made by people. They provide a means for defining the structure, content and semantics of XML documents.

Extensible Stylesheet Language Transformations (XSLT)

This is a language for transforming XML documents into objects that can be presented in a format that is more easily read by the user, such as HTML for web pages or plain text.