OS MasterMap® Topography Layer

User guide and technical specification

OS MasterMap Topography Layer

User guide

Contents

v1.3 – 07/2007

D05300_27

Preface

This user guide (hereafter referred to as the guide) is designed to provide an overview of OS MasterMap Topography Layer (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 B and return it to us.

Contact details

Our Customer Service Centre will be pleased to deal with your enquiries:

Customer Service Centre
Ordnance Survey
Romsey Road
SOUTHAMPTON
SO16 4GU

General enquiries (calls charged at local rate): 08456 05 05 05

Dedicated Welsh Language HelpLine: 08456 05 05 04

Textphone (deaf and hard of hearing users only please): +44 (0) 23 8079 2906

Email: customerservices@ordnancesurvey.co.uk

or visit the Ordnance Survey website at: www.ordnancesurvey.co.uk.

Use of the product

The terms and conditions upon which the product, including this guide, is made available to you and your organisation are contained in the customer contract made between you and Ordnance Survey. If there is an inconsistency between the terms of your customer contract and this guide, then the terms of your customer contract prevail. If you or your organisation has not signed a valid current customer contract then you are not entitled to use the product.

Purpose and disclaimer

This guide is provided for guidance only and does not constitute any warranty, representation, undertaking, commitment or obligation (express or implied) about the product or its suitability for any particular or intended purpose. Any warranties, representations, undertakings, commitments and obligations given by Ordnance Survey about the product and/or its suitability for any particular or intended purpose are set out in your customer contract. It is your responsibility to ensure that this product is suitable for your intended purpose.

Ordnance Survey does not accept any liability (whether for breach of contract, negligence or otherwise) for any loss or liability you or any third party may suffer in relying on this guide and any guidance, suggestion, advice or explanation provided in it. Any liability that Ordnance Survey has to you in relation to the product, its supply, use, accuracy, data supplied, functionality or any other liability arising out of or in connection with the product is limited as set out in your customer contract.

We may change the information in this guide at any time without notice.

We do not accept responsibility for the content of any third party websites referenced or accessed in or through this guide, any contractual documentation, and/or the Ordnance Survey website.

Copyright in this guide

No part of this guide may be reproduced or transmitted in any form or by any means (including electronically) for commercial exploitation without the prior written consent of Ordnance Survey.

No part of this guide may be copied or incorporated in products, services or publications that you generate for onward sale, or as free promotional or support materials, without the prior written consent of Ordnance Survey.

Data copyright and other intellectual property rights

The Crown (or, where applicable, Ordnance Survey's suppliers) owns the intellectual property rights in Ordnance Survey digital map data.

Full details of the terms and conditions under which Ordnance Survey digital map data may be processed and/or manipulated or copied by a customer – whether or not for use on PCs or workstations or for making hard copies – are available from the Customer Service Centre, please see contact details. You should check the terms and conditions with us before using the data. It is also the responsibility of the holder of the digital map data to ensure that any plotted or printed output contains the required copyright and database acknowledgements in a conspicuous position.

Trademarks

Ordnance Survey, the OS Symbol, OSGB36, OS MasterMap, TOID and OS Net are registered trademarks and Integrated Transport Network is a trademark of Ordnance Survey, the national mapping agency of Great Britain.

Acrobat Reader and Adobe are registered trademarks of Adobe Systems Incorporated. Arial is a registered trademark of The Monotype Corporation. Royal Mail is a registered trademark of Royal Mail Group plc. UNIX is a registered trademark of X/Open Company Ltd. Verdana is a registered trademark of Microsoft Corporation. W3C is a registered trademark of Massachusetts Institute of Technology.

Back-up provision of the product

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 to OS MasterMap products

Introduction

OS MasterMap is a consistent and maintained framework for the referencing of geographic information (GI) in Great Britain. It comprises four separate but complementary layers that provide detailed topographic, cartographic, administrative, address, aerial imagery and road network features positioned on the National Grid.

The key characteristics of the product and why they are of benefit to customers are listed below.

- Individual real-world topographic features represented by points, lines and polygons, each with their own unique reference, called a TOID®.

- A set of addresses, both postal and geographic, each with their own TOID, with a geographic coordinate and cross-referenced to physical features within OS MasterMap and to other address references.

- A structured network representing the road system and routing information related to it that may affect a driver's choice of route, with each feature having its own TOID.

- Seamless orthorectified aerial images of Great Britain taken at a resolution of 25 cm, being both geometrically accurate and colour balanced to create the clearest image possible.

- An online ordering system that allows the customer to order the exact area of interest, with the option for online or media delivery of data.

- Employing a scale of data capture appropriate to the density of features – the higher the number of features within an area, the larger the scale used to survey them – ensuring the detail of individual features can be shown and with coordinates delivered in British National Grid. There are over 460 million[1] individual features within the OS MasterMap product as a whole (all four layers).

- Developed, managed and maintained by Ordnance Survey within one of the world's largest spatial databases.

- The data are delivered as a seamless, geographically contiguous area without artificially dividing features between tiles. This means that the customer receives only the area they order without additional, unwanted data, as may happen with tile-based products.

- Each feature is uniquely referenced and also has attributes that record the feature's life cycle. The feature's life cycle is linked to the life cycle of the real-world object it represents. The life cycle records certain types of changes to the feature that occur over time.

---

[1] *Total as of May 2006*

Figure 1 (below) shows all four OS MasterMap layers together.
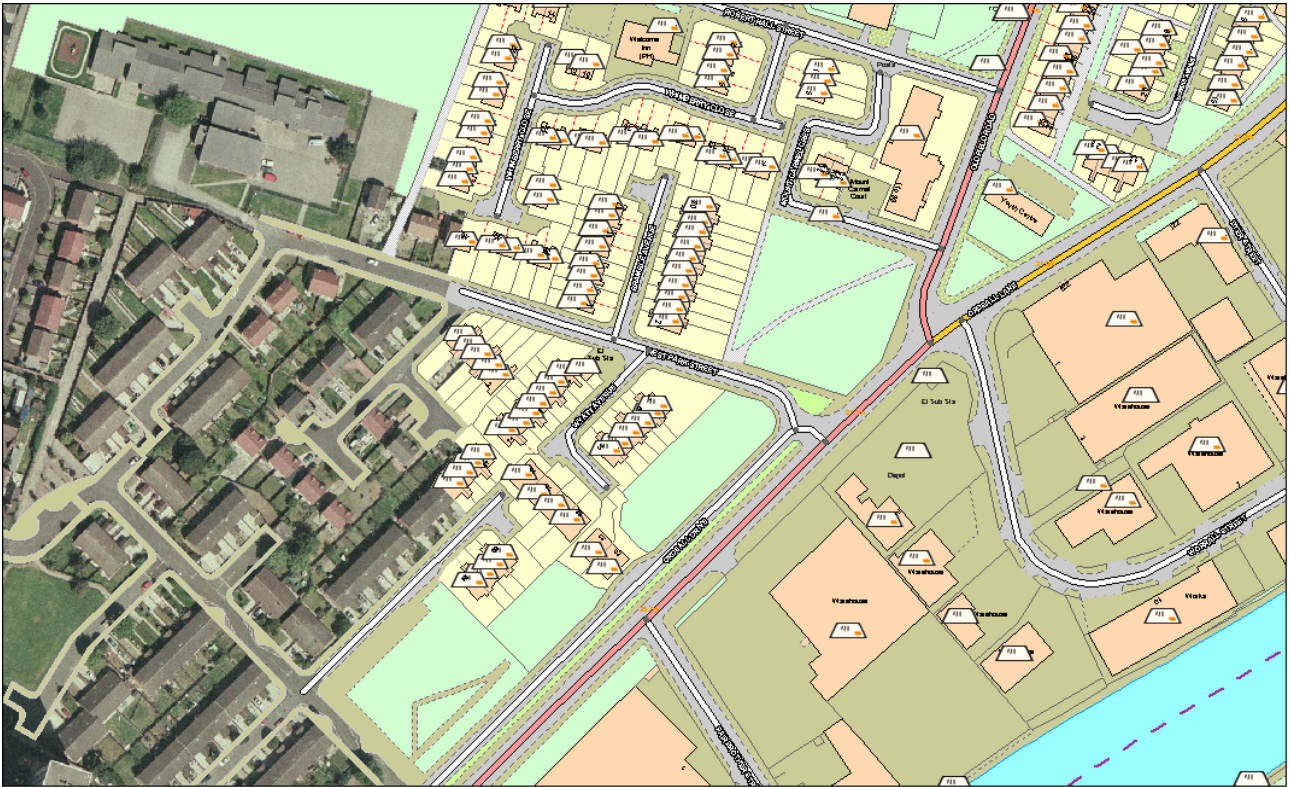
Figure 1: The four OS MasterMap layers.

These characteristics mean that customers may use OS MasterMap in a wide variety of ways, including:

- improving the accuracy of a customer's own derived data;

- improving a customer's data capture processes;

- creating consistency and achieving maintainable standards within geographic data holdings;

- establishing a common reference between a customer's own datasets and data they may wish to share with other organisations;

- improving the visual clarity of data and aiding the visual interpretation of data;

- using the products in an integrated manner to derive additional information;

- identifying and managing change in their area of interest;

- creating historical views of their area of interest; and

- enhancing the queries that can be run on their data and so providing better information for decision making.

There are two general concepts that are relevant to understanding the information contained in the rest of the document. The first concept refers to the data models that are used to represent the real world in a digital environment. The second explains the underlying concept for the OS MasterMap product as a whole and how and why effort is being made to integrate the different layers.

The vector and raster data models

There are two common models for holding GI within a computer environment. These are the vector and raster models. The OS MasterMap Topography, Address and ITN Layers are vector data. The Imagery Layer is raster data. The vector model holds features as a series of geometric shapes based on coordinates within a file or database (see figure 2). Within OS MasterMap Topography Layer features are captured as a series of coordinates, with each coordinate indicating a vertex or node in the geometry of the feature. Surveyors work in millimetres so there is a tolerance for each point; if it is within a certain distance of another point it is deemed to be the same coordinate so that it is possible to create a polygon. The relationships between features are implied rather than explicit. Each feature is stored independently of any other feature, therefore there is no information contained on a line, for example, to record what lines it joins to or what polygons to which it is adjacent.
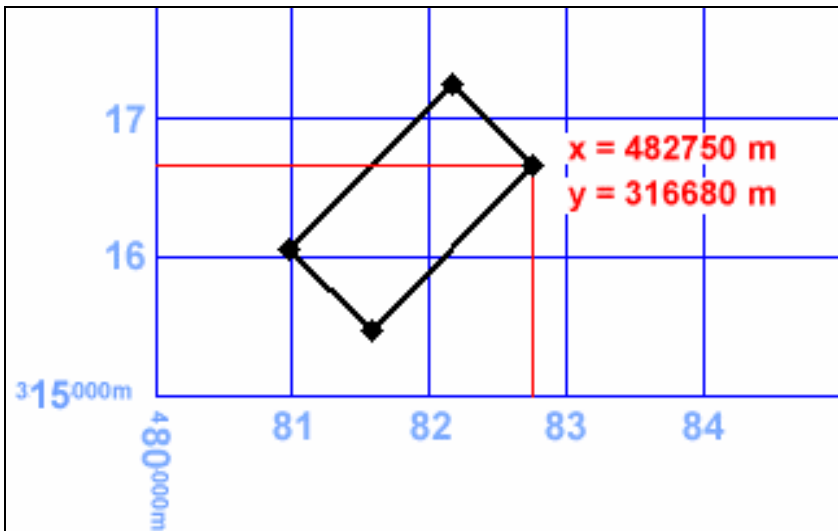
Figure 2: Vector data is stored as coordinates

The raster model encodes the features as pixels within a geographically referenced image. The representation of the feature is made by the colour of the pixel (see figure 3).

Figure 3: Raster data is stored in a grid made up of pixels

These models result in datasets that are very different in terms of how the data can be used. The main difference is that with vector models multiple attributes can be stored alongside the coordinates that supply the geometry. In raster models, usually only one piece of information can be stored, apart from the colour, against the pixel. Typical examples include a height measurement or a value representing a type of land cover.

OS MasterMap Topography, Address and ITN Layers have much in common with each other in terms of their structure and how they can be used and much of the information within this general guide can be applied to all vector layers. The Imagery Layer has been geographically referenced to align with the other layers to the greatest extent possible, as shown in figure 1.

The Digital National Framework (DNF)

The OS MasterMap products are different from other Ordnance Survey products. OS MasterMap has been designed to facilitate the adoption of a larger geographic concept called Digital National Framework (DNF).

DNF is a model for an industry-standard way of integrating and sharing business and GI from multiple sources.

GI increasingly needs to underpin mainstream information services, yet it has proved difficult for it to move from a niche or specialised data type. Ordnance Survey has recognised that GI needs to move from simple and relatively unintelligent maps and pictures to computer records that mainstream information technologies can recognise and handle logically, reliably and in increasingly automated processes.

The idea behind DNF is to enable better integration of all kinds of information with location as the common denominator. Within the confines of information technology the best way of achieving this is to link multiple information sources to a definitive location by having a common reference for each geographic feature by giving them all unique identifiers. Within OS MasterMap Layers there is a set of unique references for geographic features (TOIDs) that are managed and maintained to a consistent, published standard. Each referenced feature may be viewed as a building block for any GI a customer wishes.

Ultimately, this has the potential to evolve into a network of information, which, while distributed, when brought together can be used with assurance. Business information can then be shared with the knowledge that all users can have confidence that they are referring to the same location and entity in the real world. This can be critical in many applications. The adoption of the DNF principle by businesses using GI can lead to the following benefits:

- using effective techniques for a 'create once, use many times' model that reduces the amount of data duplication and the cost of gathering data;
- delivering data integrity for underpinning critical business decisions by following a definitive maintained reference;
- lowering the costs of handling multi-source data; and
- flexible data holdings that can underpin a wide range of applications without the need for recapturing data.

For more information on DNF, including those organisations taking part in the initiative, case studies of implementations using OS MasterMap and events, please see the DNF website.

System requirements

OS MasterMap data is designed for use as a digital map within geographical information systems (GIS) and database systems.

For details of Ordnance Survey's Licensed Partners who can incorporate OS MasterMap in their systems please see the systems/software page on the Ordnance Survey website.

Ordnance Survey does not recommend either suppliers or software products, as the most appropriate system will depend on many factors, such as the amount of data being taken, resources available within the organisation, and the existing and planned information technology infrastructure or last but by no means least, the applications OS MasterMap is to be used for.

However, as a minimum, the following elements will be required in any system:

- a means of reading the data in its native format, or by translating into a file format, or for storage in a database;
- a means of storing and distributing the data, perhaps in a database or through a web-based service; and
- a way of visualising and querying the data, typically a GIS.

Ordnance Survey has produced a list of questions to ask system suppliers that may help customers in choosing their system. There is also more information on handling OS MasterMap in chapter 6 on the supply of OS MasterMap.

Currently, national cover is available for the Topography, Address and ITN Layers. The format for most of the data is Geography Mark-up Language (GML). Address Layer 2 is available in GML and in Comma Separated Values (CSV) formats. The data is supplied in the zipped format, indicated by the suffix 'GZ' at the end of the file name. Table 1 below gives the approximate data volumes in the zipped GZ format for national cover. Due to the way different systems may store the unzipped data, it is not possible to provide file sizes for national cover in the unzipped format.

Table 1: OS MasterMap data volumes

Layer	Size
Topography	32 Gb
Address Layer 1 and 2	2 Gb (GML) 1.4 Gb (CSV)
ITN	440 Mb

National cover for the Imagery Layer is due to be available in 2006. The current estimated sizes for the images only are:

- 11 300 Gb for TIFF
- 360 Gb for Mr SID or ECW
- 660 Gb for JPEG

Additional space should be allowed for metadata and registration files.

The minimum system requirements to use the OS MasterMap online service are detailed on the Ordnance Survey website.

For further information on the technical implications of implementing OS MasterMap please see Information sheet 3 – Technical implications from the implementing OS MasterMap series of documents from the Ordnance Survey website.

Gaelic or Welsh names are also supported. A character set is available.

The data model

OS MasterMap vector products have a hierarchical structure. The highest level of the structure is the layer. Within each layer can be a series of themes. Within each theme there will be features deemed to belong to that theme. A feature can belong to more than one theme. This model is extensible at all levels. New layers can be added to OS MasterMap. New themes can be added to layers. New features can be added to themes. Each feature will have one or more versions of itself that demonstrate change to that feature over time. New versions of features replace existing features. Features that no longer exist can be deleted. The rest of this chapter discusses the main features of the first level of the model, the layer, and introduces the concepts of themes, features and attributes.

Layers

OS MasterMap is currently supplied in four layers. Each layer can be used independently of the others, although they are designed to integrate and complement each other.

Topography Layer

The Topography Layer was the first layer to be produced, in November 2001. The features within this layer are mainly features that appear in the landscape, such as buildings, land, water and roads (figure 4). It also includes administrative boundaries. These are not physically present in the landscape but are often important in relation to the physical features that are present in the real world. It is the most detailed layer, containing over 425 million features as of May 2006.
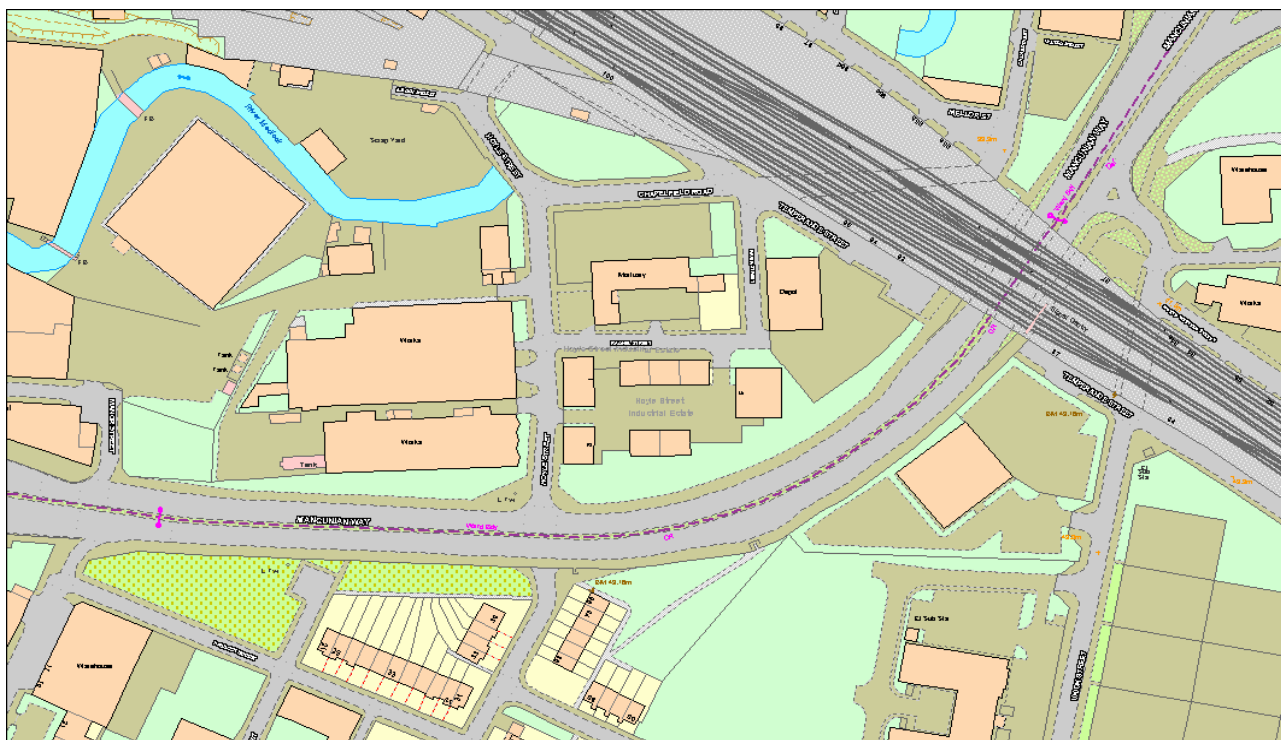
Figure 4: OS MasterMap Topography Layer

Address Layers

OS MasterMap Address Layers contain approximately 28 million geographic features in Great Britain (which is England, Scotland and Wales, but not the Isle of Man, the Channel Islands or Northern Island). Addresses are available in two sets. The first Address Layer contains postal addresses with a unique identifier, references to the underlying OS MasterMap Topography Layer feature, and information on how and when the address may have changed. In Address Layer 2 each feature is provided with a unique identifier, a series of cross-reference identifiers to relevant features in other datasets, one or more postal addresses, a coordinate position on the British National Grid, one or more classifications and information on how and when that feature has changed. Figure 5 shows the addresses symbolised as letters and displayed in geographic relationship to each other.
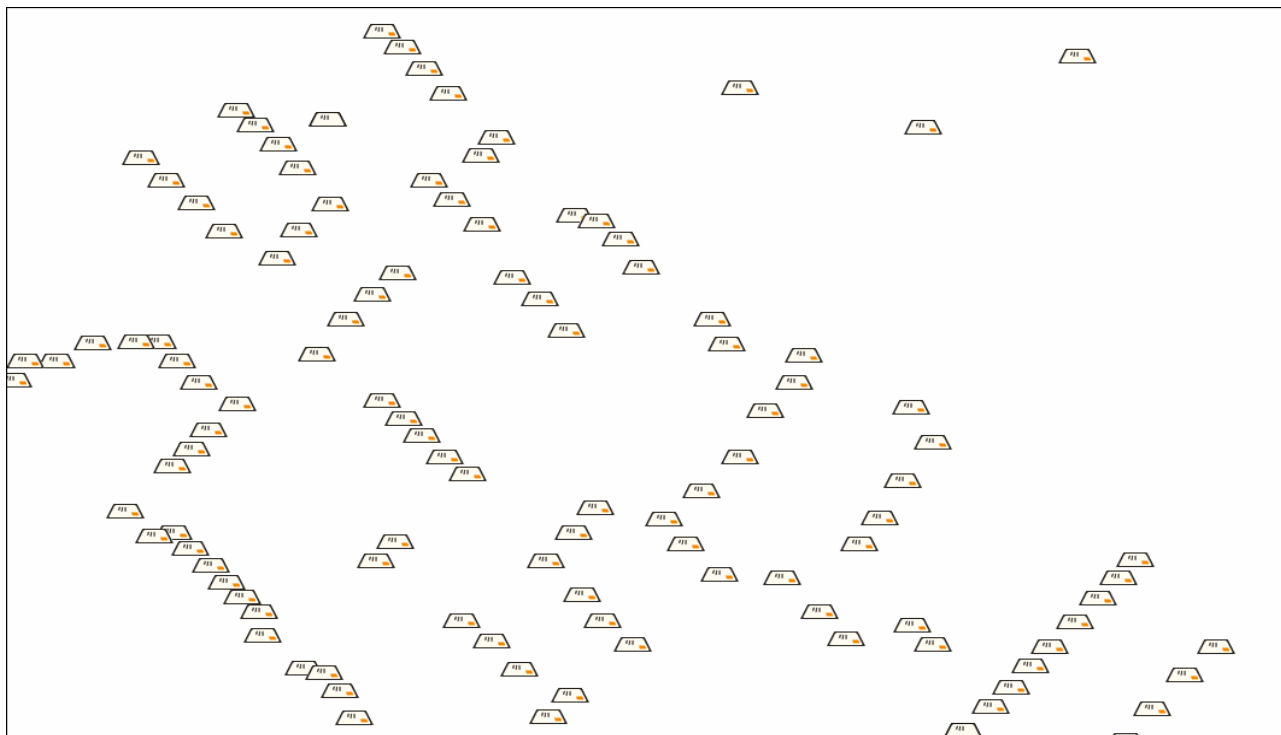
Figure 5: OS MasterMap Address Layers

Integrated Transport Network (ITN) Layer

OS MasterMap includes an ITN Layer that currently contains the Roads Network and Road Routing Information (information that may affect a driver's choice of route) for Great Britain. The road network is in geometric sympathy with the underlying topographic features and includes cross references between network components and the features in the Topography Layer that they intersect. The Road Routing Information is only useable in conjunction with the roads network data, so can only be ordered together with the Roads Network theme. The Roads Network theme can be ordered on its own. The ITN Layer contains approximately 13 million road features and 1.5 million items of Road Routing Information. Figure 6 shows a selection of the road network. Each colour represents a different classification of road.
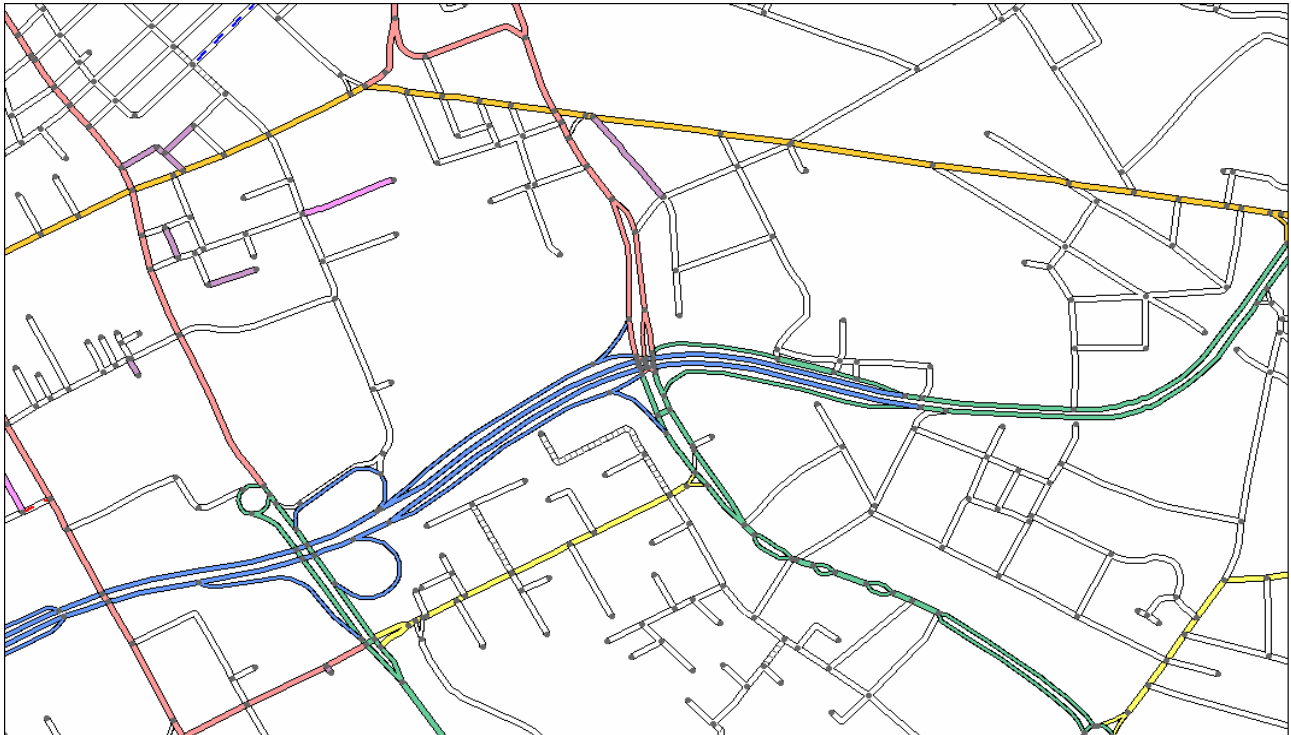
Figure 6: OS MasterMap ITN Layer

Imagery Layer

The Imagery Layer comprises aerial images. An example of the Imagery Layer is shown in figure 7. The images have been orthorectified so that the features in the other layers align well with their counterparts in the image. The aerial images bring context to the features that exist within the vector layers. It also allows interpretation of other features that are not held as features in the vector datasets. The images have also been captured under specific weather and time conditions to minimise obscuration by shadows and cloud. Each image is also colour balanced with its adjacent images to minimise differences in the colours of the physical environment. These differences occur largely as a result of flying at different times during the year.

Figure 7: OS MasterMap Imagery Layer

Themes

A theme is a set of features that have been grouped together for the convenience of customers and to provide a high-level means of dividing the data on the layer coherently or logically. A feature can be a member of any number of themes. All features belong to at least one theme.

A theme is created by applying rules based on the attributes of features. A theme rule can depend on the value in more than one feature attribute. A feature is a member of every theme for which it passes the theme rules.

Themes are not part of the classification system of OS MasterMap features. A new theme can be created for the convenience of users without in any way affecting either the existing themes or the classification of OS MasterMap features.

Features

In this user guide the term real-world object is used to describe a geographic entity that can be captured and represented in the data. A real-world object is represented by a feature in OS MasterMap data. A complete list of the real-world objects and their feature representations is given in the OS MasterMap Real-world Object Catalogue.

Each feature has one of three geometrical structures – a point, a line or a polygon. A line feature will have a start and end node that reflects the start and end of the real-world object it represents. Where the start and end node is coincident, the feature created is structured as a polygon. Lines and polygons represent both the location and the geometry of the real-world object. Points do not necessarily represent the exact geometry of the real-world object, just the centroid of its location. Text features are used to provide additional information and context about real-world objects represented by point, line or polygon features. They are represented as a point, which indicates the location where the text should be displayed.

Polygon features, with the exception of a few special cases called structuring layers, sit adjacent to each other like pieces of a jigsaw puzzle, rather than on top of each other. In figure 8 below it can be seen that a building, if 'removed', leaves its footprint in the land feature; the land feature does not exist below the building.
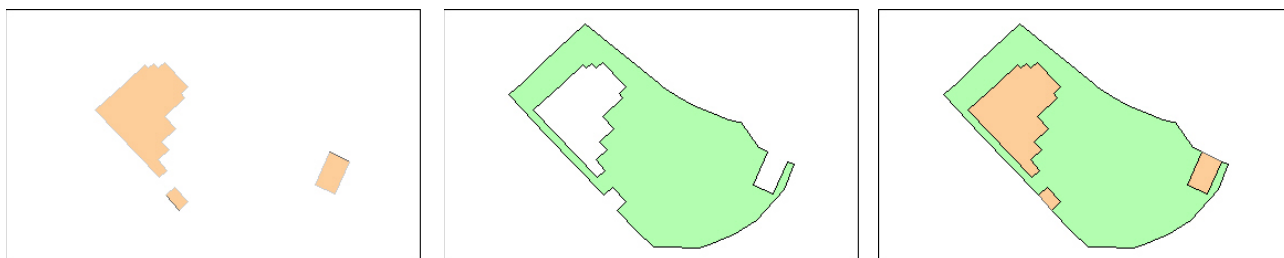
Figure 8: OS MasterMap polygons

Structuring layers are types of polygon features that may overlap other polygon features. Examples of structuring layers include landforms such as the top and bottom of slopes and pylons.

It should be noted that OS MasterMap Imagery Layer is not part of the feature model as it does not contain individual features, but provides a seamless source of orthorectified aerial photography that can be visually related to the other layers in OS MasterMap.

Attributes

Each feature comes with an extensive set of attributes that provide information about the feature, for example, its identity, its relationship to other features, geometry, and the kind of real-world object it purports to represent. Each type of feature has a different set of attributes.

There are two types of attribute information. Some attributes provide data about the real-world object the feature represents, such as its area or its nature. Other attributes provide additional information about the feature, such as its life cycle and quality. Three of the most important pieces of additional information for the vector layers – the TOID, version and version date – are discussed in more detail in chapter 3.

OS MasterMap provides attribution that can be searched for and queried within a GIS. Attribution makes it possible to select, for example, parcels of land that have coniferous tree cover.

This chapter has outlined the main features of the OS MasterMap product and the data models that underpin the layers. It has explained the role OS MasterMap Topography Layer plays both within the OS MasterMap family and within the wider vision Ordnance Survey has of providing a framework for customers to create and derive additional value from their GI. The following chapter looks at OS MasterMap Topography Layer in more detail.

Chapter 2   Introduction to OS MasterMap Topography Layer

The OS MasterMap Topography Layer contains features that represent objects in the physical environment such as buildings, fields, fences and letter boxes, as well as intangible objects such as county boundaries or the line of mean high water. There are over 450 million features in the current product. It is available for all of Great Britain (England, Scotland and Wales). Figure 9 below shows an extract of OS MasterMap Topography Layer. Geographic features are modelled in such a way as to make it easy to identify buildings, roads, water and land at a glance. The data has been collected by Ordnance Survey and is based on the National Grid.

The basic unit of OS MasterMap Topography Layer data is a point, line or polygon feature that represents a real-world feature. A feature may also have text that goes with it or a symbol. Both are considered a feature within OS MasterMap. Each feature comes with a set of attribution that provides information, either about the real-world object it represents or metadata that helps track changes to the feature. The structure of OS MasterMap, combined with its rich attribution, gives scope to undertake quite complex geographic analyses and to enhance customers' data-capture processes. Attribution provides the opportunity to use the data as far more than a map. Using the product within a GIS, attribution can be used to analyse, sort, query and visualise the data in many different ways.

Each feature in OS MasterMap Topography Layer has a unique reference called a TOID. The vast majority of database systems used within organisations rely on the use of unique referencing for the efficient management of the data stored within them. Each feature also has a version number and a version date as well as the TOID. As the real-world feature that it represents changes during its life, so the feature within OS MasterMap will also change in terms of its shape or its attribution. Whilst it remains the same feature – essentially occupying the same space and having the same function – the TOID will not change, but the version number will increment and the version date will change. This allows an instance of a feature to be identified in both space and time.

Figure 9: Extract of OS MasterMap Topography Layer showing all themes

The product is divided into nine themes that group, at a high level, the features into logical groups of objects that indicate the scope and contents of the data contained within the product. They are:

- Administrative boundaries

- Buildings

- Heritage and antiquities

- Land

- Rail

- Roads, tracks and paths

- Structures

- Terrain and height

- Water

OS MasterMap Topography Layer introduces many new concepts designed to take advantage of the latest technologies in spatial data management and modelling the real world in computer systems. The combination of structure and attribution means that OS MasterMap Topography Layer is adapted to being stored in tabular or database form and can be more readily manipulated and searched by spatial querying tools, such as a GIS or a spatial database. It is supplied in GML, an open format, rather than an Ordnance Survey-specific one.

An online ordering system has been developed for customers to place and manage their orders. The data can be delivered electronically or on digital media.

When ordering OS MasterMap Topography Layer there are no artificial divisions in the data caused by a tile-based unit of supply. OS MasterMap Topography Layer is supplied as a seamless dataset.

In the following chapters of this user guide these new concepts are explained in more detail. The reasons behind the concepts, where appropriate, are given along with indications of the benefits they may bring and the possible considerations for a customer's use of the product. Firstly, the purpose for introducing this type of product and some typical applications for the product are outlined in the rest of this chapter.

Purpose

OS MasterMap Topography Layer has been developed in response to the need for a national topographic dataset that offers customers a more sophisticated type of data that represented the world in a more realistic way and was more aligned to the increasing use and functionality of GIS and spatial database technology within organisations.

Its primary purpose is to provide the most detailed topographic data available of the physical environment of Great Britain. It is regularly updated by ground and aerial survey to published schedules and capture standards. In addition, OS MasterMap Topography Layer may also provide a solution to the needs outlined below.

Many customers use geographic products as a basis to derive their own data, which can be time consuming and inefficient where features in the data are amalgamations of more than one real-world feature or even parts of real-world features. Where the feature represents a real-world feature that has an 'area', such as a building or a parcel of land, the feature is represented in the data as a polygon. This is the first large-scale product from Ordnance Survey to adopt a polygonised structure for such features. This should provide opportunities for customers to derive their data with greater efficiency and ease as features can be selected either singularly or customers can group features together by selecting more than one feature. The way and the extent of a customer's ability to take advantage of the polygonised structure will depend, to a certain extent, on the systems in use, but most GIS have the necessary 'data capture' tools.

OS MasterMap Topography Layer provides new and improved attribution relating to the real-world object the feature represents. This means certain types of analysis can be performed without the customer having to add their own attribution to the data first. The improved attribution also means the customer can apply their own criteria to refine the data into sets of features that meet their own specific requirements. An example of this would be finding buildings of a certain size using the calculated area provided as one of the attributes.

It is important for many applications of GI to be able to identify where change has taken place. Customers may need to learn how the landscape has altered and to reflect those changes in the customer's own data. Ordnance Survey updates OS MasterMap Topography Layer on a regular basis and these changes are passed on to the customers through a service called change-only update (COU). This supplies just those features that have changed since a customer either first ordered OS MasterMap Topography Layer or last took an update. This should normally result in much less data needing to be processed every time a customer updates their holding, although that is dependent on how frequently it is taken. Furthermore, OS MasterMap Topography Layer is the first product from Ordnance Survey to introduce the concept of feature life cycles and unique referencing. This makes it possible to relate change in the real world to features in the digital environment, and to identify and manage that change so that customers can, if they wish, keep their own data up to date and the consequences of change can be assessed. It may even be possible, depending on the systems used, for customers to roll back their holdings of OS MasterMap Topography Layer to a specific point in time. Ordnance Survey, it should be noted, does not supply previous versions of any feature.

One of the most common uses for GI is to produce maps that are coloured to highlight a particular value or property that a real-world feature may have. These are often called thematic maps. An example is given below in figure 10. The figure was created by grouping the calculated area value attribute of each unit on an industrial park into one of five categories. Each category is 'themed' with its own colour. The ranges and colours are shown in the legend. Most computer systems offer the ability for features to be assigned a colour or style based on the value of an attribute; OS MasterMap Topography Layer has both the structure and attribution to make it relatively quick to produce such maps. The result is data that is easier to customise, easier to interpret and more eye-catching.

Figure 10: Thematic mapping with OS MasterMap Topography Layer

One of the barriers to customers making greater use of both their own data and data they may wish to share with other Ordnance Survey customers is being able to link the datasets together. To be able to link or 'associate' datasets together normally requires each dataset to have a common reference – one piece of information that is in all datasets. OS MasterMap Topography Layer can help to create links between customers' own datasets and OS MasterMap features by using the TOID as a common reference. In this way OS MasterMap Topography Layer provides a foundation dataset for a Digital National Framework that aims to help users of spatial data to derive more value by associating datasets together. Using a common reference can also provide such benefits to an organisation as removing ambiguity over a feature's identity and allowing the faster retrieval of data when querying or analysing the data.

Applications

OS MasterMap Topography Layer is used extensively by businesses and organisations that need to relate their activities and/or their assets to the physical environment.

One of the most common uses for the product is by organisations that have their own GI and wish to examine it in relation to the real world around them. An example would be utility companies that have assets both at surface and below surface level. They frequently need to visit these assets either for repair, maintenance or to add new assets. By viewing their infrastructure against the features in OS MasterMap Topography Layer it helps their crews locate the assets, know what the area is like before they leave their depot and allows them to provide a better customer service by identifying those nearby premises that need to be contacted about the works.

Taking this a stage further, many organisations need to derive their own GI from OS MasterMap Topography Layer. They use the individual features that Ordnance Survey provides to form the building blocks for their own sets of GI. Many local- and central-government organisations use it this way. A local authority, for example, may use it to maintain a register of land and buildings in their ownership. Once they have the physical feature or group of features they are interested in, they can attach their own attribution to that already provided with the product. When this kind of data association takes place it can lead to efficiencies in storing and using data. It can also enable data to be shared more easily between and within organisations.

As more and more GI is created it is possible to analyse the spread and distribution of features or activities and learn from their relationship to other physical features. For instance, a police force might plot the locations of certain types of street crimes, and by analysing the pattern and the timing of the incidents against the local topography, they may be able to target their resources more efficiently.

OS MasterMap Topography Layer can also be used as part of a predictive or modelling tool. For example, OS MasterMap Topography Layer is also used by organisations looking for areas where specific physical conditions exist. A retailer, for example, may use OS MasterMap Topography Layer to help it find a site for a new store by using the attribution to find land parcels of a certain size and distance from a settlement or main road. Emergency planners may use OS MasterMap Topography Layer to assist in planning and preparing for emergencies by identifying the areas most likely to be affected or for modelling the sequence of events in any given type of emergency so that their own resources and command centres are unlikely to be cut off or taken out of action by the emergency itself.

As OS MasterMap Topography Layer is easy to customise in terms of how it looks, it is often used as a way of communicating GI in reports and presentations. GI can be conveyed more clearly in a map than by text or tables, making it easier to get points across to many different types of audience, whether they are key decision makers, people inside the organisation or members of the public.

It should be noted that the ability of an organisation to develop any or all of the applications listed above will depend in part on the systems they use. Most GIS are capable of performing to a greater or lesser degree, the applications listed above. Table 2 below gives examples of other applications that frequently use OS MasterMap Topography Layer.

Table 2

Land management and property development	Environmental monitoring
Site planning	Tourism and promotional material
Citizen services	Risk assessment
Location-based services on mobile devices	Customer service centres

This chapter has provided a detailed introduction to OS MasterMap Topography Layer, including its main features, the reasons behind its development and some of the many applications in which it may be used. The next chapter looks at the concept of the feature life cycles. Understanding life cycles is key to managing the features within a computer system.

Chapter 3   Feature life cycles and tracking change

The features within OS MasterMap vector layers are viewed as having a life cycle. The life cycle of each feature is matched, where practically possible, to that of the real-world object it represents. For example, a new building will become a new object in the Ordnance Survey main holding of the data and will be treated as the same feature – even if it undergoes change – until the building is demolished. By adopting this approach Ordnance Survey is emulating real-world behaviour within a digital model and therefore creating a more realistic version of the real world in a computer.

Life-cycle rules

Feature life cycles are established and maintained in accordance with a set of published rules. Essentially, these rules indicate when an OS MasterMap feature will be retained and when it will be replaced, for different types of feature and different change scenarios. These rules are not only there to guide surveyors (from Ordnance Survey) collecting and attributing the features but also to provide customers with a consistent definition of how real-world change is handled by Ordnance Survey.

However, not all changes to the real-world object will be reflected in changes to the feature. For example, the addition of a new porch to a house would usually be considered too minor a change for Ordnance Survey data capture.

Different customers with different applications think of feature life cycles in different ways. For some, any change to the geometry or classification of a feature means that the feature is no longer the same feature for their application. For others, the requirement is for persistence of features – so a feature continues to exist through extensive modification. Customers may wish to consider and create their own definitions of change for comparison with Ordnance Survey definitions. Understanding change is important to understanding the OS MasterMap product and to deriving the optimum value from it.

Life cycle rules adopt the approach of allowing features to persist through changes so far as is reasonable. There is inevitably some degree of subjectivity involved in judging that a real-world object has changed so much it can no longer be considered the same object, and therefore the OS MasterMap feature(s) representing it should be deleted and replaced. The specific rules are detailed later in this chapter. First, though, it is important to understand how the attribution records a feature's life cycle.

Unique feature references (TOIDs)

Firstly, every OS MasterMap feature has a unique reference known as a TOID. The TOID is a number with a prefix of 'osgb'. They are never reassigned to a different feature. The TOID is allocated sequentially when a feature is created by Ordnance Survey. The TOID does not contain any intelligence about the feature. One of the key principles of unique referencing is that **the TOID will stay the same throughout the life of a feature**. This gives the feature continuity within its life cycle and makes managing change in a holding of the product easier.

TOIDs are also used to identify one OS MasterMap feature from another. This can reduce the ambiguity when sharing data. A typical example of this is shown in figure 11. An organisation could have the property on the corner as 32b Morris Road in one set of records and as The Vicarage, Handel Road in another. If the TOID of the building (osgb0001000013217664) was recorded as well, the records could be matched up and the ambiguity removed.
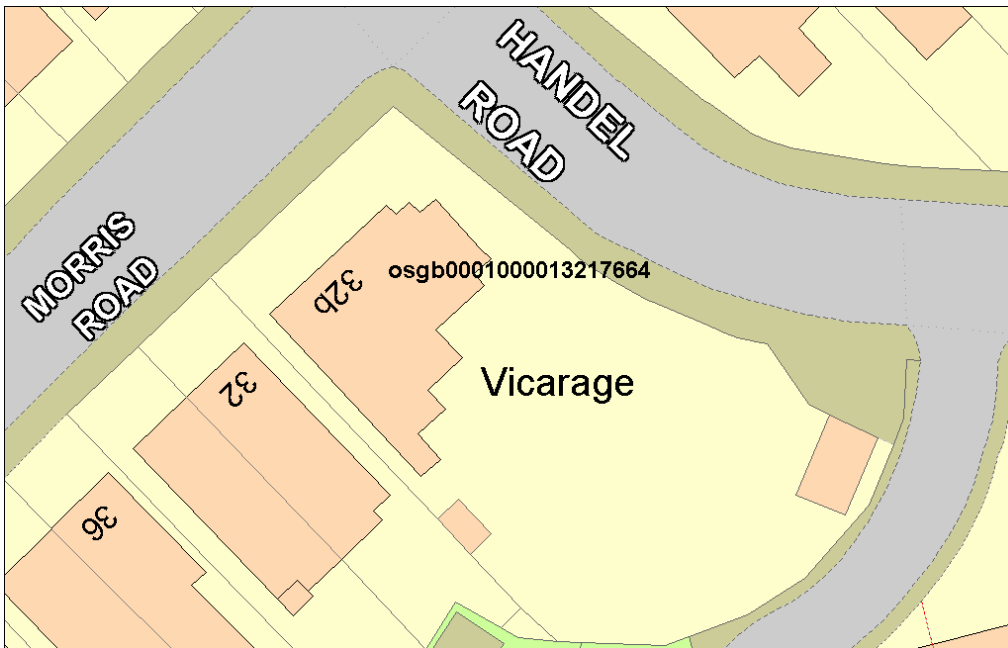
Figure 11: Using the TOID to resolve ambiguity in customer records

Customers could consider grouping sets of features together into more complex features – representing schools, factories or individual properties comprising a house, its garage and garden – by storing a list of the TOIDs.

TOIDs enable explicit, maintained references between features in different layers. OS MasterMap ITN line and point features reference the OS MasterMap Topography polygon features within which they are located. This allows the user to navigate between the network and polygonised view of the same road network. OS MasterMap Address features reference the OS MasterMap ITN network features they are addressed from and the OS MasterMap Topography polygon feature they are located within. This allows the user to navigate to premises from the road network or between the point and polygonised view of premises, respectively.

Feature version numbers

Although a feature might remain essentially the same in terms of its nature throughout its life, it is likely to experience changes in terms of the information that Ordnance Survey collects and supplies in its attributes. Each feature also has a version number that is incremented each time there is change of any kind to the feature via one of its attributes. The change can be due either to real-world change or to processes not connected with real-world change, such as error correction or geometric cleaning and structuring of the data. What constitutes a change leading to a version and what constitutes a change that is deemed to be the end of that feature's life cycle is discussed below.

The previous version is referred to as the **superseded** version, and the new version as the **superseding** version. It should be noted that in a small minority of cases, a new version of a feature can be created without any change apparent to the customer. This is due to change to internal attributes that the OS MasterMap database uses during the maintenance process but which are not included in product data.

Feature version date

The date on which the new version is created is recorded in the feature version date attribute. The date is important for tracking and identifying when change has taken place. Using the TOID, the version number and the version date, it is possible to track a feature's changes over time. It is worth noting that the date the version changed for Ordnance Survey will probably be different from the date on which the feature is loaded into the customer's file or database holding. Many translators will provide an additional column within the holding to record the load date. It is important for the customer to identify these dates in their holdings and to understand the difference between them if they want to be able to track changes.

One of the key differences between OS MasterMap features and other products is that, with the correct data storage model, a data holding can be rolled back and forward to a given point in time. It must be emphasised though that this is the customer's responsibility since only the current version is available in the product; none of the previous versions are included.

Life-cycle rules

The following sections set out the rules that define the life cycles of features in OS MasterMap Topography Layer. By understanding how change is defined and recorded within the product customers can start to identify what kind of change has a bearing on their applications and develop their own management regimes.

Polygon feature life-cycle rules

The flowchart below in figure 12 shows the process followed whenever a real-world object represented as an OS MasterMap polygon feature appears, changes or is removed from the physical environment. The rules are described in more detail in the following sections, especially the guidelines used to answer the question in the centre of the flowchart.
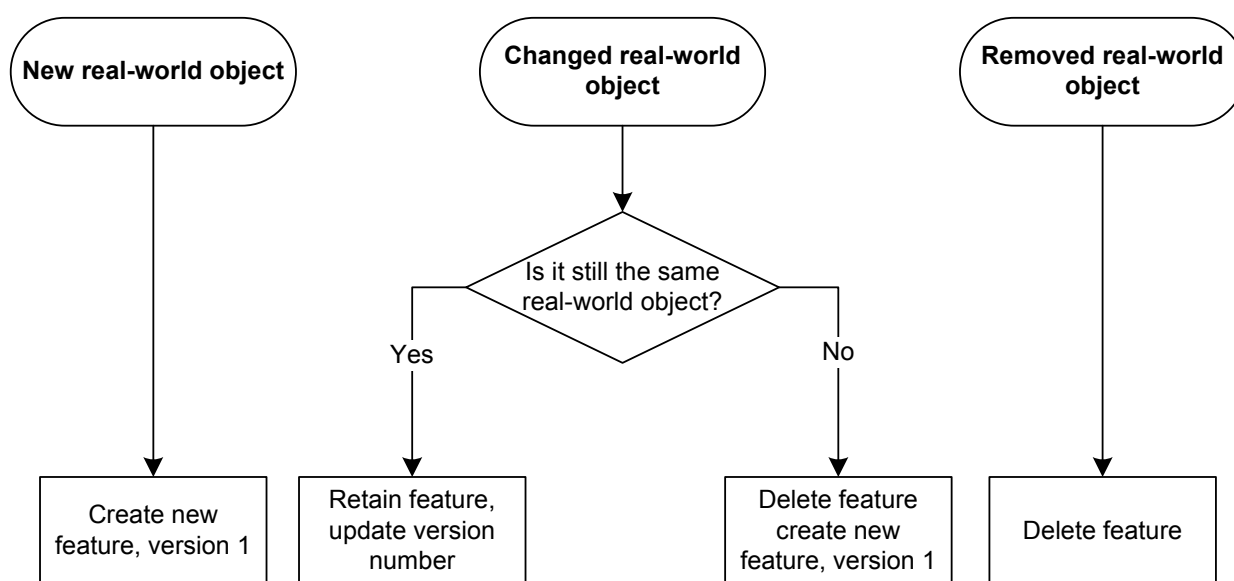
Figure 12: Feature creation in OS MasterMap

Creation of polygon features due to real-world change

When a new real-world object with an area – such as a pond, a building or a land parcel – comes into being, a new polygon feature is created in the data, with a new TOID and version number. Customers with local holdings of OS MasterMap data will be informed of new features in their holding via COU.

Deletion of polygon features due to real-world change

When a real-world object represented as a polygon feature no longer exists in the real world, the polygon feature is deleted from the database. A record is kept in the database to indicate that a feature with this TOID used to exist and when it was deleted. Customers with local holdings of OS MasterMap data are informed of the deletion in their next COU.

Modification of polygon features due to real-world change

When a real-world object represented as a polygon feature changes, but is considered to be still the same real-world object, the corresponding modified feature is retained in the database. The version number is incremented and the date on which the new version became current is stored.

If, however, the real-world object has undergone change such that it is not considered to be the same object as before, the polygon feature representing it is deleted and one or more new features created. Alterations due to positional accuracy improvement (PAI) or any other error correction of Ordnance Survey data that is not related to real-world change are treated as detailed in modification of line features due to error correction, later in this chapter.

Changes to geometry of polygon features

When a real-world polygon object expands or contracts due to alteration to its boundaries, yet is considered to be the same real-world object, the corresponding feature is retained with an unchanged TOID. For instance, the polygon feature representing the back garden of a residential property is retained, even if it is greatly reduced or increased in size through alterations done to the house. This is because its identity as the representation of the garden of a particular property means it can be considered the same feature despite extensive changes to its geometry.

If it is not clear whether the real-world object after modification is the same object or a new one, the following considerations are used as a guideline:

- Is there topographic information to suggest the function of the resultant real-world object is the same as that of the original?
- Is the resultant real-world object more than half the size and less than twice the size of the original?
- Does the majority of the extent of the resultant real-world object lie within the bounds of the original?
- Is the resultant real-world object the obvious logical successor to the original?

If the continuation of the feature cannot be justified on one or more of these grounds, the feature is deleted and replaced with a new feature.

Examples

- A private house is extended. The building and garden features are retained.
- A field changes shape and reduces in size due to the realignment of one of its boundary fences alongside a road. The field feature and the adjacent road features are retained.

Splitting of polygon features

When a real-world polygon object is split into two or more separate real-world objects, one of the features may be clearly recognisable as the original real-world object. If this is the case, then the feature is retained.

If it is not clear whether one of the resultant features represents the same real-world object as the original feature then the following considerations are used as a guideline:

- Is the function of one of the resultant real-world objects the same as the original?
- Is one of the resultant real-world objects the obvious logical successor to the original?
- Does one of the resultant real-world objects occupy more than half the area of the original?

If the continuation of the feature cannot be justified on one or more of these grounds, the original feature is deleted and replaced with new features.

Examples

- A new housing development is completed within an agricultural field. Part of the field remains and continues to be used for agriculture. The feature representing the remainder of the field is recognisable as the original and has the same function, therefore it is retained. New polygon features are created to represent the new development.
- An agricultural field is subdivided into three approximately equal parts that continue to be in similar usage. Using the guidelines above, none of the fields can be considered the obvious successor to the same as the original field: all have an area less than half of the original; therefore three new features are created.
- A house is built within a field. A new feature is created to represent the house. The feature representing the field is retained.
- A house is divided equally in two by an externally surveyable division. No other changes take place. The original feature is deleted and new features created. This is because neither of the resultant houses is the obvious successor to the original.
- A large agricultural building is split into two by the addition of an externally surveyable division enclosing approximately 25% of the original area. The original feature is retained to represent the larger part, and a new feature is created to represent the smaller part.
- Most of the large garden of a residential property is sold off for development. The garden feature is retained to represent the much reduced garden.

Joining of polygon features

When two or more real-world polygon objects are merged by the removal of physical boundaries, it may be that one of the original real-world objects is clearly recognisable as subsuming the other(s). If that is the case the feature representing the dominant real-world object is retained and the other feature(s) deleted.

If one of the original real-world objects is not clearly dominant, the following considerations are used as a guideline to determine whether a feature is retained.

- Is the function of the resultant real-world object the same as one of the originals?

- Can one of the original real-world objects be considered the obvious predecessor to the resultant real-world object?

- Is the area of the resultant real-world object less than twice that of one of the original real-world objects?

If the continuation of the feature cannot be justified on one or more of these grounds, all the original features are deleted and replaced with new features.

Examples

- Two fields, one of which is larger than the other, are merged into one, such that the resultant real-world object is recognisable as the larger field subsuming the smaller field. The feature representing the larger field is retained. The smaller field feature is deleted.

- Three fields, which are broadly similar in size, are merged into one, such that none of the original fields are recognisable as the obvious predecessor of the resultant field. The original features are deleted and a new feature is created to represent the field.

- A small pond within a field is filled in. The feature representing the pond is deleted and the field feature is retained.

- Two semi-detached cottages of equal size are combined into one dwelling, with no alteration to the external geometry of the building. Both of the original features are deleted and a new feature is created.

- A large greenhouse lies within a parcel of land only marginally larger than itself. The greenhouse is demolished. The feature representing the greenhouse is deleted, and the feature representing the land parcel is deleted as it has increased significantly and can no longer be considered as the same object.

Change of polygon feature classification

When a real-world object represented by an polygon feature changes such that the nature of the feature changes, then the feature is retained, unless changes to its geometry indicate deletion of the feature under the guidelines above.

Alterations due to PAI or any other error correction not linked to real-world change are treated as detailed in modification of line features due to error correction, later in this chapter.

Examples

- An area of agricultural land is wholly planted with trees; there are no changes to its bounding features. The descriptive group of the feature changes but its geometry is unchanged. The feature is retained.

- An area of woodland is felled and the area now consists of rough grass and scrub. The feature is retained.

- A barn is converted into a private dwelling. There is no change to the nature of the building (it is still a building) and the feature is retained.

Modification of polygon features due to error correction

When a polygon feature is changed solely to correct errors either in geometry or other attributes, then the feature is retained. If the feature has been moved to correct an error and simultaneously modified for real-world change; for example, when natural movement of a physical feature occurs, such as a river bank or foreshore, then the feature modification rules above are followed.

Examples

- A line feature representing an old fence is found to have an error in its position and is corrected. The line feature and the polygon features bounded by it are retained. The version numbers of the features involved are incremented.

- The feature representing an area of road has been assigned an incorrect descriptive group. The feature is reclassified and retained. The feature version number is incremented.

- An area of non-coniferous trees has been incorrectly assigned the descriptive term coniferous trees by photogrammetric revision techniques. The feature is reclassified and retained. The feature version number is incremented.

- A building foundation captured as a feature with descriptive group of 'unclassified' is completed, and the feature is reclassified to descriptive group of 'building'. The feature is retained. The feature version number is incremented.

- A feature is no longer included within Ordnance Survey's capture specification. The feature is not retained.

Line feature life-cycle rules

Line features in OS MasterMap are not as persistent in the same way as polygon and point features. This is because line features are maintained by what are called topological structuring rules. These are explained in more detail in the technical specification. In short, this means that if a line feature is intersected by another line, it is broken at the intersection. This means that a single linear real-world object is often represented by several line features – no real world object should ever be made up with a partial line feature. There is no concept in OS MasterMap of a line feature that is made up of multiple line geometry elements. An illustration of this rule is shown in figure 13. A fence cuts a field into two real-world objects. A new fence is built at right angles to the original to further divide one half of the field. Although the old fence has not changed at all, it will be split into two separate line features.
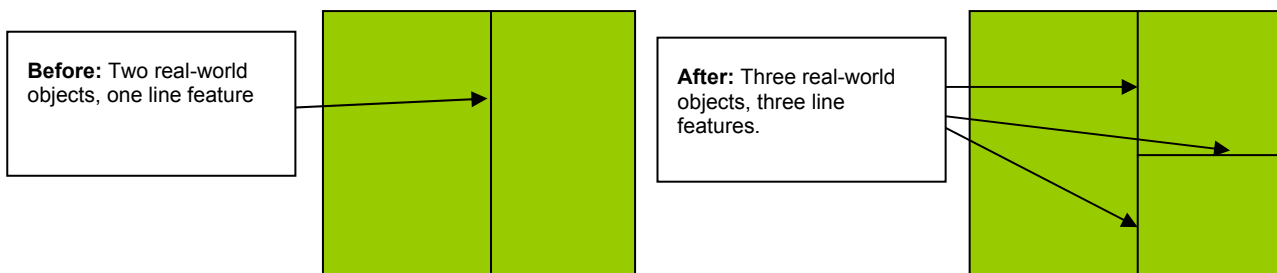
Figure 13: Line life-cycle rules

As there is no recorded relationship between OS MasterMap line features and particular, discrete real-world objects, any change to a line feature may result in deletion or significant modification of that feature and creation of new line features. This change is not necessarily caused by real-world change to the linear object represented by the feature. In the example above the original line feature is retained as one of the resultant line features; the other line feature is new. The user cannot predict which of the resultant line features will bear the original TOID. The major exception to this is that when the reason for change is a correction of error rather than real-world change, then features are retained whenever possible.

The more rapidly changing life cycle means that associating user data with OS MasterMap line features by TOID references needs to be considered very carefully as there will be greater overheads in terms of managing change. In most cases it will be more practical to associate with points and polygons, rather than lines.

Inferred links

Inferred links are a particular type of line feature that does not actually exist in the real world. It is a line that Ordnance Survey has introduced into the data to make some types of polygons into more manageable units. There are two main uses. The first type of inferred links is network closing links. They are frequently found where roads meet at junctions. If the roads were not split in this way, the road theme would contain many very large polygons that would not be particularly useful in terms of being able to derive data from them or for customers to attach meaningful attribution to them. Roads with comparatively few junctions, such as motorways, are also split where another feature crosses them, such as a road bridge or foot bridge.

The other type is a polygon closing link. These are used to make more manageable, or logical, polygons. One example would be the creation of a link to separate an 'open plan' garden around a pair of semi-detached houses into two distinct entities, reflecting that there are two properties there in the real world. It must be stressed that these polygon closing links do not constitute the legal boundary of any property, any more than a physical line feature does. These links are clearly identified in the 'descriptive group' attribution and if a customer wishes to not show these features it would be possible with most GIS to not display them by filtering out any line features with this value. The descriptive group attribute is discussed in further detail in the next chapter. Figure 14 shows both types of inferred link; the links highlighted in black are network closing links and the lines highlighted in red are polygon closing links.

Figure 14: Inferred links

Creation of line features

When a new linear real-world object comes into being, a new line feature is created to represent it.

Deletion of line features

When a real-world object is no longer present in the real world, the corresponding line feature is deleted from the Ordnance Survey's main holding. A record is kept in the database to indicate that a feature with this TOID used to exist. Customers with local holdings of OS MasterMap data are informed of the deletion in their next COU.

Modification of line features due to real-world change

As noted above, a line feature may be modified due to changes to the real-world object, or due to changes in adjacent real-world objects. The original feature may be retained if a portion of its geometry remains, and one or more new features may be created to reflect the change. If the classification attributes of a line change, then it will usually be retained and the version number incremented. Occasionally, a line feature may be replaced with a seemingly identical line feature, which is considered a new feature. An example of this would be where a line is created to represent a newly erected fence placed along the alignment of an existing line boundary between a garden and the pavement.

Modification of line features due to error correction

When a line feature is changed solely to correct a surveying or cartographic error, the feature is retained, unless the resulting topological changes with adjacent features make this inappropriate.

General point feature life-cycle rules

The life cycles of point features are simpler than those of lines or polygons, since they cannot change in size or split into multiple features.

Creation of point features

When a new real-world object comes into being, a new point feature is created to represent it. If, however, the object is a replacement for a previous real-world object in the same position, the original feature is retained. An example would be if an existing postbox was replaced by another postbox in the same location.

Deletion of point features

When a real-world object is no longer present in the real world, the point feature is removed from Ordnance Survey's holding. Ordnance Survey keeps a record to indicate that the feature with this TOID used to exist and notifies the customer at the next date of COU supply.

Modification of point features due to real-world change

By the nature of the real-world objects represented as point features in OS MasterMap data, it is unlikely that one will be modified without changing its identity. Therefore, any modification to a point feature as a result of real-world change will result in the deletion of the original feature and creation of a new feature, unless there is a clear reason to identify the resultant real-world object with the original. This applies to both geometric change and change of descriptive group or descriptive term.

Modification of point features due to error correction

When a point feature is found to be incorrectly attributed due to an error, or is moved due to the correction of a positional accuracy error, the original feature is retained, appropriately modified.

This chapter has explained in some detail the life cycles of features so that customers can understand how the data is managed by Ordnance Survey. The next chapter focuses on the content of themes.

Chapter 4   OS MasterMap Topography Layer themes

This chapter describes in more detail the content of each theme. This will aid customers' understanding of what features they can find in the data and the most likely theme or themes that the feature will be found in. OS MasterMap Topography Layer comprises nine themes. To recap, these are:

- Administrative boundaries
- Buildings
- Heritage and antiquities
- Land
- Rail
- Roads, tracks and paths
- Structures
- Terrain and height
- Water

The main features of each theme are described below. It is important to understand how features are assigned to themes so that the attribution is logically assigned. As stated earlier in chapter 3, there are rules that govern what theme or themes are assigned to a feature. These are discussed later in this chapter.

Wherever possible, real-world objects are represented in their true surveyed position. For the sake of clarity of display or plotting, real-world objects may be generalised, for example, small juts in house fronts may not be shown. The normal methods of generalisation that can be applied to features are:

- emphasis;
- selection for inclusion;
- simplification; and
- omission.

Real-world objects may also be aggregated in OS MasterMap. For example, a small group of trees may be recorded as a single feature.

Administrative boundaries

These are defined as showing the limits of responsibility and representation for electoral and administrative purposes. Boundary alignments are shown within the administrative boundaries theme. As well as the boundaries relationship to real-world objects, its mereing and boundary descriptions, where needed for clarification, are also supplied.

The following types of boundary are shown within the administrative boundary theme.

Parliamentary boundaries

- European electoral region;
- county constituency;
- borough constituency (England and Wales);
- burgh constituency (Scotland);
- assembly electoral region and assembly constituency (Wales); and
- parliamentary electoral region and parliamentary constituency (Scotland).

Local government boundaries

In England:

- county;
- City and County of London, district, London borough, unitary authority and metropolitan district;
- civil parish and the Inner and Middle Temples;
- electoral division; and
- ward.

In Wales:

- unitary authority;
- community; and
- electoral division.

In Scotland:

- unitary authority; and
- ward.

Physical features shown in the administrative boundaries theme:

- boundary posts;
- boundary stones; and
- boundary markers.

Non-physical features shown in the administrative boundaries theme:

- alignments of boundaries; and
- textual descriptions of:
    - boundaries;
    - boundary mereings; and
    - boundary posts and stones.

Application of precedence

Where two or more boundaries are coincidental a single alignment is shown by the most important boundary in the following order:

In England and Wales:

- county, City and County of London, unitary authority, district, London borough and metropolitan district, civil parish, community, Inner and Middle Temples;
- European electoral regions, county/borough constituencies;
- Welsh Assembly electoral region; and
- electoral division and/or ward.

In Scotland:

- unitary authority;
- European electoral regions, county/burgh constituencies;
- Scottish parliamentary electoral region; and
- Ward.

A textual description is used for clarification. If the alignment of an administrative boundary coincides with any other feature (other than another boundary), then both will be shown in their respective themes. More information on administrative boundary alignments can be found in annexe A.

Buildings

Buildings are defined as roofed constructions, usually with walls and being permanent. This includes permanent roofed constructions that exceed 8.0 m^2 in area (12.0 m^2 in private gardens). Exceptions are made to this area rule for smaller buildings that, due to their detached position, form relatively important topographic features. They are shown at minimum size stated above. With a few exceptions, for example, by describing government offices or hypermarkets, no distinction is currently made between residential, private, public, commercial or industrial buildings.

Physical features shown in the buildings theme:

- roofed buildings (of sufficient size or importance to be shown);
- mobile or park homes that are permanent, residential and have a postal address;
- archways and covered passageways where the alignment can be determined from outside the building;
- horticultural glasshouses over 50 m^2; and
- covered tanks.

Features such as cooling towers, uncovered tanks, bridges and monuments are shown within the structures theme.

The specification for the capture of glasshouses has recently been clarified. Only glasshouses over 50 m^2 that serve a horticultural purpose will continue to be captured as glass structures. Other glass structures, such as office buildings and conservatories, exist within OS MasterMap and will be recorded as buildings. There are some non-physical features shown in the buildings theme, represented as the following text features:

- house numbers;
- descriptive building names; and
- distinctive building names.

Heritage and antiquities

For Ordnance Survey purposes, antiquities are defined as existing artificial features of a date not later than AD 1714 (the date of the accession of George I), together with very important sites of battlefields and natural features connected with important historic events. Exceptionally, features and sites of a date later than AD 1714 may be treated as antiquities if they are of national importance.

The investigation, recording and surveying of archaeology is the responsibility of English Heritage and Royal Commissions on Ancient and Historical Monuments (RCAHMs) for Scotland and Wales. Antiquity find sites are not shown in OS MasterMap. Ordnance Survey has no responsibility for defining the authenticity of distinctive or descriptive names of antiquities.

Physical features shown in the heritage and antiquities theme:

Due to the variety of real-world objects in this theme an exhaustive list is not provided, but they do include:

- standing stones;
- earthworks;
- hill figures;
- ruined buildings;
- tombs; and
- stone circles.

Some non-physical features are shown in the heritage and antiquity theme. These include:

- textual descriptions for the real-world objects; and
- battle sites as either text or symbol.

There are some constraints on what can be shown imposed by survey principles. Many earthworks are of low relief and do not meet Ordnance Survey criterion. To depict the feature clearly it may be necessary to exaggerate antiquity detail. In mountain and moorland areas some antiquity features may be generalised without losing the essential characteristics of the depiction.

Land

The land theme is defined as those man-made and natural features that delimit and describe the surface cover, other than routes of communication and buildings. This includes both natural and man-made slopes and cliffs. All general features are also placed in the land theme.

Landform features, such as slopes and cliffs, behave slightly differently from other features in that where they are represented as line features they can cross other line features without being broken at intersections, and when they are polygon features can overlap other polygon features, instead of sitting adjacent to them.

The land theme encompasses those areas that do not form part of another theme. For example, a grass verge next to a road would appear in the roads, tracks and paths theme, whereas a grass area within a park would be in the land theme.

The limits of geographic features such as hills and valleys are not recorded, although the distinctive names of these geographic features are shown.

Physical features shown in the land theme include:

- parks, playing fields, football pitches, golf courses and so on;
- slopes and cliffs;
- car parks;
- gardens;
- woodlands; and
- other areas of vegetation, including scrub, heath, rough grass and marshland.

In Figure 15 below, two different types of tree cover have been identified on the edges of a settlement. Each type has been labelled using the attribution within OS MasterMap.
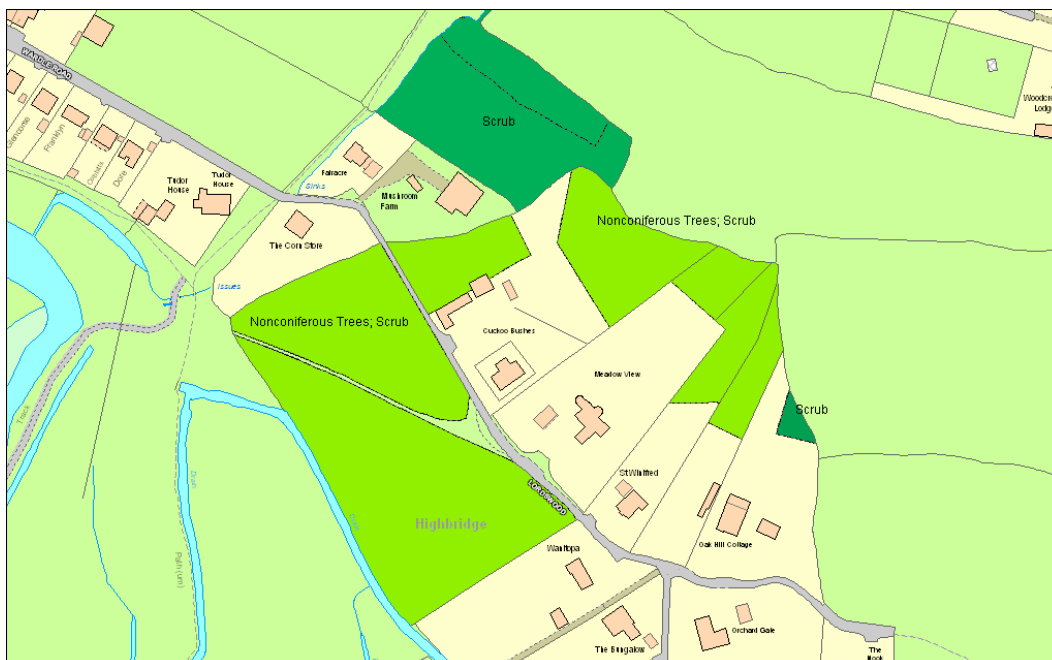
Figure 15: Vegetation in the land theme

The theme contains text features that describe these physical features.

Rail

These are defined as features related to travel by railway or tramway. Currently, railway tunnels are in the structure theme. The Topography Layer of OS MasterMap contains information relating to permanent railways that form communication between two points, for example, from railway station to railway station or from an industrial building to a private quarry.

Standard gauge railways are shown to scale by a pair of rails, separated by the correct distance of 1.435 m. Railways narrower than 1.435 m are deemed to be narrow gauge and are shown by a single line representing the central alignment. Tramways, metros and light rapid transit systems are treated as railways.

Underground portions of the Metropolitan and District lines in London that are close to surface level are shown. Where a deep-level tube railway comes to the surface and continues as a normal railway it is shown as a standard gauge railway. In other cities only the sections of underground railways that are open to the sky are currently shown.

The physical features shown in the rail theme include:

- level crossings;
- lighting towers;
- loading gauges;
- turntables;
- mile or kilometre posts and stones;
- sand drags;
- signal posts, bridges and gantries;
- switches and slips;
- retarders;
- bridges and viaducts;
- mail pick-ups;
- rails;
- permanent way; and
- station buildings and platforms.

Some physical features are not shown in the rail theme. These include:

- telephones associated with level crossings;
- conductor rails and overhead wires for electrified trains;
- detail beneath the roofs of railway stations;
- water troughs; and
- repetitive features such as signal lights within marshalling yards.

Some non-physical features are shown in the rail theme. These are text descriptions of railway and associated railway features.

Roads, tracks and paths

Roads

For Ordnance Survey purposes, a road is defined as a metalled way for vehicles. Roads that form part of the public network and driveways to private properties that are over 100 metres in length are included with the Topography Layer.

Tracks

A track, for Ordnance Survey purposes, is defined as an unmetalled way that is clearly marked, permanent and used by vehicles. Tracks are only recorded in private gardens if they are 100 metres or more in length. They need not be 'all weather'. All tracks are described as Track, or Tk if required to be abbreviated. Distinctively named tracks have their name recorded, for example, HICKS LANE (Track).

Paths

For Ordnance Survey purposes, a path is defined as any established way other than a road or track. They can be considered as either 'made' or 'unmade'.

Made paths

Made paths are those whose surface is paved or metalled. Only major paths are shown in parks, public gardens, cemeteries and so on. Made paths are described by the annotation Path, except in built-up areas, where the description will not normally be recorded or if the path has a distinctive name, such as Simmons Walk.

Unmade paths

Unmade paths are those that are neither paved nor metalled. An unmade path is included in the Topography Layer when its entire length is evident on the ground and it starts at a road, track or path and finishes at a similar feature or a specific place of interest. Unmade paths are described by the annotation Path (um) in urban and rural areas.

The physical features shown in the roads, tracks and path theme are listed below:

- Kerb lines or the limits of metalling representing:
  - carriageway limits, including any hard shoulder or shallow drainage gullies forming the side of the road on dual carriageways or motorways;
  - kerbed roundabouts;
  - traffic islands in roads, except when very small (traffic islands must be 8 m² or more);
  - traffic calming measures forming a physical obstruction, including pinch points;
  - dedicated cycle lanes;
  - fords;
  - car parks;
  - edges or centre alignments of tracks and paths; and
  - the treads of steps.
- Road furniture:
  - mile posts;
  - guide posts (traditional finger posts only);
  - kerb barriers;
  - gates across roads;
  - posts preventing vehicular access;
  - weighbridges; and
  - cattle grids.
- Road-bounding features:
  - hedges, walls, fences and banks; and
  - crash barriers (where they form the sole bounding feature of a carriageway).

Non-physical features shown in this theme are descriptive and distinctive text and inferred links.

There are two situations where constraints on how the features are depicted are imposed by survey tolerances:

- Where the central alignment of an unmade path is less than 1 m (urban areas) or 2 m (rural and moorland) from an adjacent building, fence, hedge or wall, the central alignment is shown at that minimum distance away from the feature.

- Where one edge of a track is parallel and close to the bank of a water feature, the track edge nearest to the river is omitted.

It is important to note that rights of way are not identified in the Topography Layer. The representation of a road, track or path is no evidence of a right of way:

Structures

These are defined as features that are man made constructions but do not qualify as buildings. These may or may not obstruct passage at ground level. The Topography Layer contains information relating to all permanent structures that are large enough to be included. Figure 16 below gives some examples, highlighted in black, of structures.
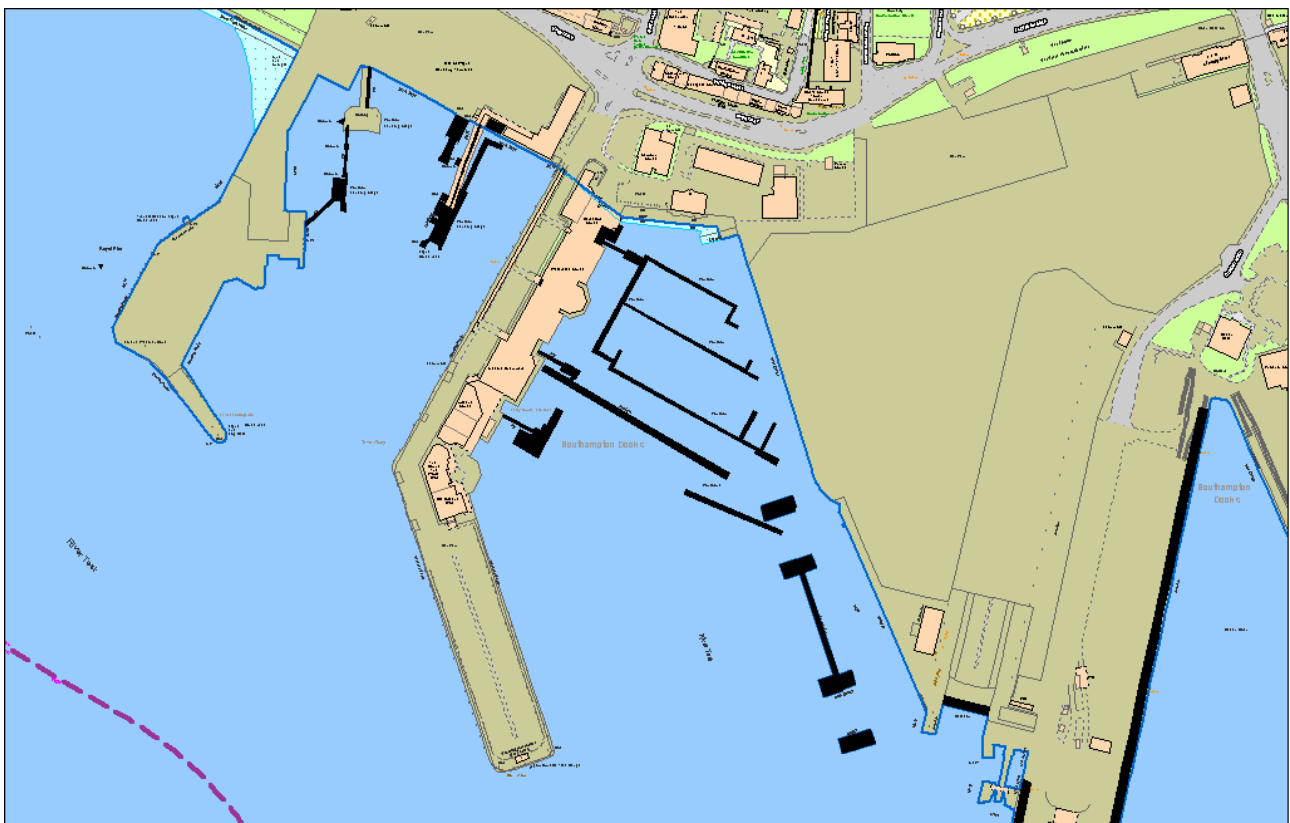
Figure 16: Examples of real-world objects in the structure theme

The physical features in the structure theme include:

- stand-alone monuments;
- fountains;
- covered reservoirs;
- pylons;
- weirs and sluices;
- gas holders;
- double walls;

- pontoons;
- uncovered tanks;
- conveyors;
- cooling towers;
- upper levels of communication; and
- bridges, viaducts, aqueducts and piers.

Non-physical features include text.

Terrain and height

These are features that define ground level. OS MasterMap Topography Layer does not contain height contours. The following point features of known height are included.

Triangulation stations

These are physical marks that represent one point in the national triangulation scheme. The best known form is the triangulation pillar, often found on hill or mountain tops. Other forms include triangulation points placed on church towers and flag poles. The coordinates of a triangulation station in the data are not usually the very accurate coordinates for the control point. The accurate coordinates of the control point can be obtained from Ordnance Survey (see below). All triangulation stations are shown, except for buried and surface blocks.

Spot height

These are non-physical points, the altitude of which (relative to Ordnance Datum) has been determined by levelling. All current spot heights are shown by a point feature or symbol. The altitude to one decimal place of a metre is shown by a textual description. Ordnance Survey has a dedicated website at www.gps.gov.uk where the latest information on triangulation and control points can be found.

Bench marks are represented in the Topography Layer as a symbol to mark their position. The values for these bench marks are available from www.bench-marks.org.uk. It should be noted that this website is not maintained by Ordnance Survey and the bench mark information is historic, and Ordnance Survey cannot guarantee its accuracy.

Water

Water features are defined as features that contain, delimit or relate to real-world objects containing water. The physical water features shown in OS MasterMap Topography Layer include:

- mean high water (springs) and mean low water (springs), except where passing beneath a permanent structure such as a jetty;

- swimming pools, ponds, lakes and lochs;

- moats, bridges and footbridges;

- reservoirs, rivers, canals and streams;

- drains and ditches;

- foreshore features;

- floating objects (they are only shown when they are fixed and attached to permanent detail);

- shake holes and swallow holes (in mountain and moorland areas, limits of numerous shake holes are shown and the area described as area of shake holes);

- sluices (except those found in sewage works) and culverts;

- stepping stones;

- taps (which take the form of drinking fountains or that form the communal water supply) drinking fountains and water troughs (public);

- tidal gauges;

- waterfalls (only if formed by natural features) and weirs;

- bollards, capstans and mooring posts;

- breakwaters and groynes;

- perches, pilot beacons and navigational beacons; and

- pumps, wells, spouts, springs and fountains.

Taps, water troughs and drinking fountains are no longer captured under current specification.

Figure 17 shows a sample of real-world objects in the water theme, including a pond, a river, flow arrows, sluices and drains.

Figure 17: Examples of features within the water theme

The non-physical features shown in the water theme are:

- the highest point in a river to which normal tides flow is described as normal tidal limit (NTL). The point is shown and annotated by text;

- low water level (LWL) is the point to which mean tides (or mean spring tides in Scotland) flow at low water. The point is shown and annotated by text;

- the text descriptions of all water features; and

- flow arrows, which are symbols used to indicate the direction of flow of non-tidal moving water.

As water is a dynamic element within the landscape, certain survey principles and constraints are imposed on the representation of water within OS MasterMap Topography Layer.

Rivers, streams and drains are shown at their true scale width. A single line is used where their width is less than:

- 1.0 m urban areas; and

- 2.0 m rural, and mountain and moorland areas.

OS MasterMap Topography Layer does not contain polygons of the open sea. Where inland water bodies meet the sea the following principles are applied:

- Ordnance Survey shows high and low water marks of a mean average tide, that is an average tide halfway between spring and neap tides in England and Wales, and of average spring tides in Scotland.

- In tidal rivers the point to which mean tides (or spring tides in Scotland) flow at high or low water is included.

Lakes and ponds are surveyed at normal winter level; reservoirs are shown at top water level, that is spill-over level. All water features are described. Continuous topographical water features that extend into private gardens are shown. Where a river flows under another object, typically a bridge, the part of the river beneath the object is not supplied. This is why there are gaps in rivers when the theme is viewed on its own. This is shown in figures 18 and 19 below.
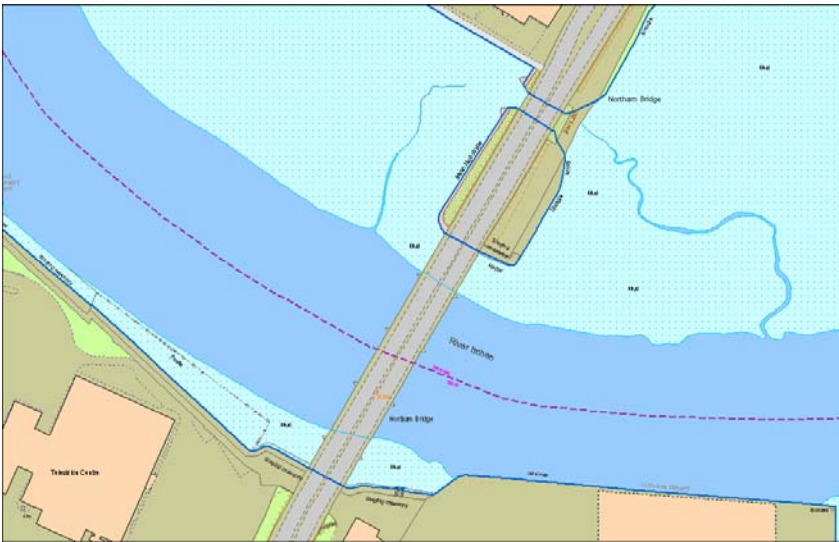
Figure 18: The depiction of water and bridges (all themes)
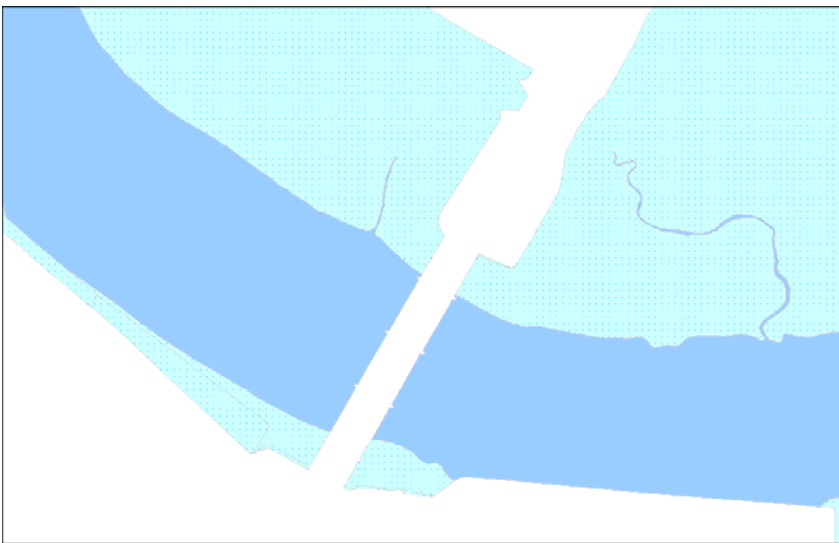
Figure 19: The depiction of water and bridges (water theme only)

Theme rules

There are a number of rules that govern what theme or themes are assigned to a feature. These rules give the data consistency so that the same kind of real-world objects is assigned to the same themes as far as possible.

Attributes are discussed in detail in the next chapter, but there is one attribute – called the descriptive group attribute – that has a major bearing on the theme rules. The value in the descriptive group is the key determinant of which theme(s) the feature is assigned. Table 3 below relates the value of descriptive group (of which there are 21) to the theme. If the feature has the value listed in the first column it will be assigned into the theme listed in the third column.

Table 3

Value of descriptive group attribute	Description of value	Theme	Examples
Building	Features representing buildings (not including glasshouses)	Buildings	Houses, barns factories
Buildings or structure	Text features describing or naming buildings and structures	Building	Houses, barns factories
Built environment	Geographic areas and extents of man-made environments, terrain and communication links	Land	Residential land, car parks, agricultural land, slopes, cliffs and quarries
General feature	General topographic features and minor detail	Land	Residential land, car parks, agricultural land, slopes, cliffs and quarries
General surface	Features representing, describing or limiting areas of land not covered by buildings or structures	Land	Residential land, car parks, agricultural land, slopes, cliffs and quarries
Glasshouse	Features representing glasshouses	Building	Glasshouse
Height control	Features with height information	Terrain and height	Bench marks
Historic interest	Features of heritage value	Heritage and antiquities	Text indicating the site of a historic event or an actual physical historical structure such as Hadrian's Wall
Inland water	Features representing, describing or limiting areas of water that are not tidal	Water	Streams, lakes, rivers and canals
Landform	Features representing, describing or limiting areas of landform, for example, slopes or cliffs	Land	Residential land, car parks, agricultural land, slopes, cliffs and quarries
Natural environment	Features representing geographic areas and extents of natural environments and terrain	Land	Residential land, car parks, agricultural land, slopes, cliffs and quarries
Network or polygon closing geometry	Features used to close polygons	Land and road, tracks and paths	Road junctions, gardens
Path	Features representing and limiting the extent of pathways	Roads, tracks and paths	Road section, roundabouts, central reservations, cycle paths
Political or administrative	Features representing political or electoral boundaries	Administrative Boundary	Euro, county, district, ward and civil parish boundaries, boundary stones and boundary mereing symbols
Rail	Features representing, describing or limiting the extents of railways	Rail	Rail alignments, permanent way and railway land
Road or track	Features representing, describing or limiting the extents of roadways and tracks	Roads, tracks and paths	Road section, roundabouts, central reservations

Value of descriptive group attribute	Description of value	Theme	Examples
Roadside	Features representing, describing or limiting the extents of roadside detail	Road, tracks and paths	Road section, roundabouts, central reservations, cycle paths
Structure	Features representing, describing or limiting structures other than buildings or glasshouses	Structure	Chimneys, pylons, masts, bridges, gantries and tunnels
Terrain and height	Features giving information about the altitude at a location or changes of level of the ground surface	Terrain and height	Spot height
Tidal water	Features representing, describing or limiting areas of water that are tidal	Water	Tide lines
Unclassified	Topographic features that have not been given a description yet	Land	

There are some additional rules for assigning lines to themes. Lines serve two purposes in OS MasterMap Topography Layer. There are lines that are coincident with the boundaries of polygon features. These are the most common type of line of the two. Some lines, however, do not form boundaries to other features. These are called non-bounding line features.

In addition to being a member of each theme for which it passes the theme rule, a line feature that is part of the boundary of one or more polygon features is also a member of the themes of those polygon features. For instance, any line feature that bounds a polygon feature that is a member of the roads, tracks and paths theme is also a member of the roads, tracks and paths theme, in addition to any other themes to which it belongs. Figure 20 below gives examples of the application of theme rules.
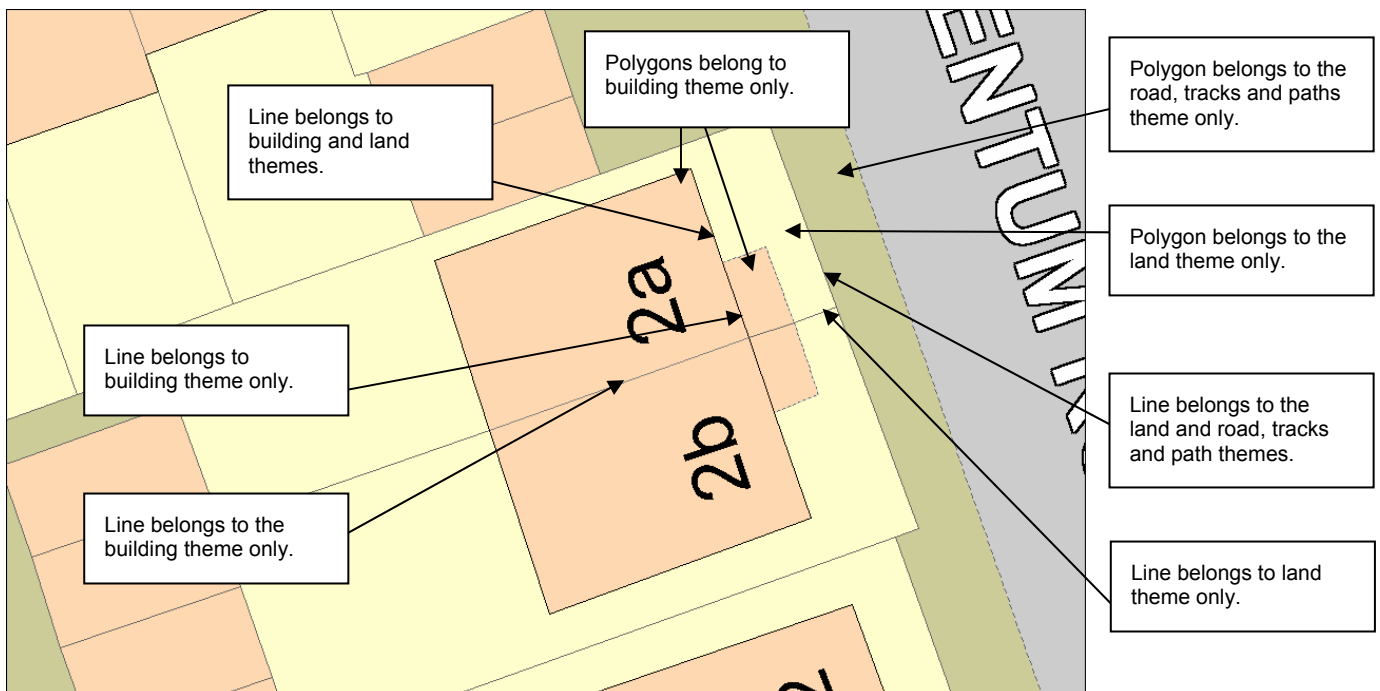
Figure 20: Application of theme rules

This chapter has discussed the themes of OS MasterMap Topography Layer and outlined the contents of each theme. It explained how Ordnance Survey allocates a feature to one or more themes. This helps the customer to understand which theme a feature is likely to be found in and also why some features may appear in a theme that may not seem logical on first appearance. The next chapter discusses the types of geometry used to represent features and the attributes that come with each feature type.

Chapter 5   OS MasterMap Topography Layer feature types and attribution

Each OS MasterMap Topography Layer feature is represented as either a point, line or a polygon. These four types are further divided into six feature types to give a further refinement to reflect the different types of geographic or non-geographic function the line, point polygon or text represents.

Point features

There are three types of point feature:

- **Topographic point** features that represent topographic detail and spot heights.
- **Cartographic symbol** point features that store information about the location and type of symbology used when rendering OS MasterMap graphically.
- **Cartographic text** point features that define the content and placement of text when rendering OS MasterMap graphically.

Line features

There are two types of line feature:

- **Topographic line** features representing topographic information and inferred topographic area boundaries such as polygon closing links.
- **Boundary line** features representing the boundaries of administrative areas.

Polygon features

There is one polygon feature type:

- **Topographic area** features representing topographic information.

The value of assigning features to data types

Assigning each feature to data feature type creates a logical way for GIS to handle the data and reflects how GIS typically like to handle geometric data by having separate tables for each geometric type. There can be six separate, smaller tables rather than one large table.

As there are different types of geometry and different types of features, having different data types allows each type to have its own particular set of attribution. It would not make any sense, for example, to have an attribution of a calculated area value for a line or point feature as these by their very nature do not have areas to measure. By having this particular structure, Ordnance Survey can provide more meaningful and more detailed attribution.

Attribution

Each feature comes with a set of attribution. Attribution provides additional information about the feature. This information could relate to the real-world object the feature represents or it could relate to the properties of the feature itself. For example, the theme the feature belongs to is an attribute, as is the TOID. The descriptive group is a property of the real-world object; the TOID is a property assigned to the feature. This chapter explains each attribute provided with OS MasterMap Topography Layer features and its purpose or value to the customer. The ranges of values that are associated with the attribute are listed in the technical specification.

Each feature type has a different combination of attributes. Some are optional and some may occur multiple times on the same feature. Table 4 shows the attribution available with each feature type. Many attributes are common to all features but some are specific to a particular type.

Table 4: Attribution by feature type

Attribute	Topographic area	Topographic line	Boundary line	Topographic point	Cartographic symbol	Cartographic text
Accuracy of height above ground level		✓		✓		
Accuracy of height above datum		✓		✓		
Accuracy of position		✓	✓	✓		
Anchor point						✓
Anchor position						✓
Broken	✓	✓				
Calculated area value	✓					
Change date	✓	✓	✓	✓	✓	✓
Descriptive group	✓	✓	✓	✓	✓	✓
Descriptive term	✓	✓	✓	✓	✓	✓
Feature code	✓	✓	✓	✓	✓	✓
Font						✓
Height						✓
Height above datum		✓		✓		
Height above ground level		✓		✓		
Make	✓	✓		✓		✓
Non-bounding line		✓				
Orientation					✓	✓
Physical level	✓	✓	✓	✓	✓	✓
Physical presence	✓	✓	✓	✓	✓	✓
Point				✓	✓	
Polygon	✓					
Polyline		✓	✓			
Reason for change	✓	✓	✓	✓	✓	✓
Reference to feature					✓	
Theme	✓	✓	✓	✓	✓	✓
TOID	✓	✓	✓	✓	✓	✓
Text string						✓
Version	✓	✓	✓	✓	✓	✓
Version date	✓	✓	✓	✓	✓	✓

The next section describes the attributes that are common to all features. Attributes are grouped into those associated to the referencing and change management of the feature, and those that are descriptive, that is that detail properties of the real-world object the feature represents.

Common attribution

Feature referencing attributes

Theme

A theme to which the feature belongs. This will be one or more of the themes described in chapter 4.

TOID

The unique identifier comprising a number and the four-letter prefix 'osgb'. It is recommended that the TOID be treated as a character rather than a number as some TOIDs have zeros at the beginning; the TOID should always be retained/stored in its entirety.

Life-cycle metadata

Version

The version number of the topography feature.

Version date

The date this version of the feature became the current version. This is the date on which the feature was changed in the database, and is **not the date when the real-world object it represents changed**.

Reason for change

The reason why a new version (or new feature) has been created or changed. There can be more than one reason per version.

Change date

The date of the above reason for change. This will not necessarily be the same as the version date. It is likely to be earlier as it records when the change was observed by survey in the real world.

Reason for change and change date are collectively known as the change history attributes, as they give the reasons that have led to this particular version of a feature coming into existence. All change history for a feature is supplied in GML.

Feature description attributes

There are four attributes common to all features that make up the descriptive attributes. These are descriptive group, descriptive term, physical level and physical presence.

Descriptive group

This is the primary classification attribute of a feature. It assigns a feature to one or more of 21 groups, most of which are categories of real-world topographic objects such as path, building or natural environment. Others are categories of supportive or administrative features such as network or polygon closing geometry and political or administrative boundaries.

Descriptive term

This attribute, if present, gives further classification information about the feature. A feature may have multiple descriptive term attributes, but this is little used at present. Most features have zero or one descriptive term attributes. A situation where multiple descriptive term attributes are used is where polygon features have a descriptive group with the value of 'natural environment'. These features can have one or more descriptive term attributes specifying the natural land cover types present in the area.

The descriptive group and term attributes are frequently used in applying styling and in querying. It makes the data more flexible and customisable in terms of customers being able to manipulate just the features they are interested in for any particular application.

Physical level

The physical level attribute states whether the feature is underground, obscured below normal level, at normal level or overhead.

Physical presence

The physical presence attribute indicates the real-world presence of the object represented by the feature. For example, a value of obstructing indicates that the feature prevents pedestrian access, whereas a value of edge/limit means that the feature represents a change of surface type and does not generally impede access.

Feature code

Topography Layer features have a numerical feature code (a five-digit integer) assigned to each feature. This feature code is wholly determined by the feature type, the descriptive group(s) and the descriptive term(s). The feature code can also be used to help style the data as it contains information about the geometric feature type – whether it is a point, line or polygon.

The feature code itself is an arbitrarily assigned number, and is therefore not informative without the look-up table that gives the feature type and attribute values corresponding to each feature code. The table can be found in the technical specification.

Other attributes

These attributes are not common to all feature types. Please refer to the table above to see which features have which set of attributes.

Make

Make is also a feature description attribute but only for topographic point, line and polygon features. It indicates whether the feature is 'man-made' or natural, if this is known. This attribute may be useful, for example, in applications where the porosity of land cover is important, such as in calculating surface run-off from rainfall.

Calculated area value

This is the calculated area of a polygon feature in square metres. Calculating the area of a feature or group of features is a common action within GIS. By providing this as part of the attribution, the product should save customers the time it would take them to calculate the areas themselves.

Broken

Polygons may get temporarily 'broken' due to the editing process. How this happens and the implications for a customer's holding of the product are discussed in full on the Ordnance Survey website. This attribute records a value of either true or false. True indicates that it is broken.

Height above datum

The simple attribute contains the height of the feature above the Ordnance Datum Newlyn vertical datum, in metres. The complex attribute contains the simple attribute of the same name with some additional accuracy information. This information is only provided for spot heights.

Accuracy of height above datum

The accuracy of a height above datum in metres.

Accuracy of height above ground level

The accuracy of a height above ground level in metres.

Non-bounding line flag

Some lines do not form boundaries of polygon features. This attribute records this status by having either true or false as its value. If the value is true then the line does not bound any polygon feature. An example is given below in figure 21. The lines highlighted in red are all 'non-bounding' lines as they do not form part of a polygon's boundary. Such lines often, though not always, have one free end. They have been identified in the attribution so that customers can turn off the bounding lines if they so wish when they display the data.
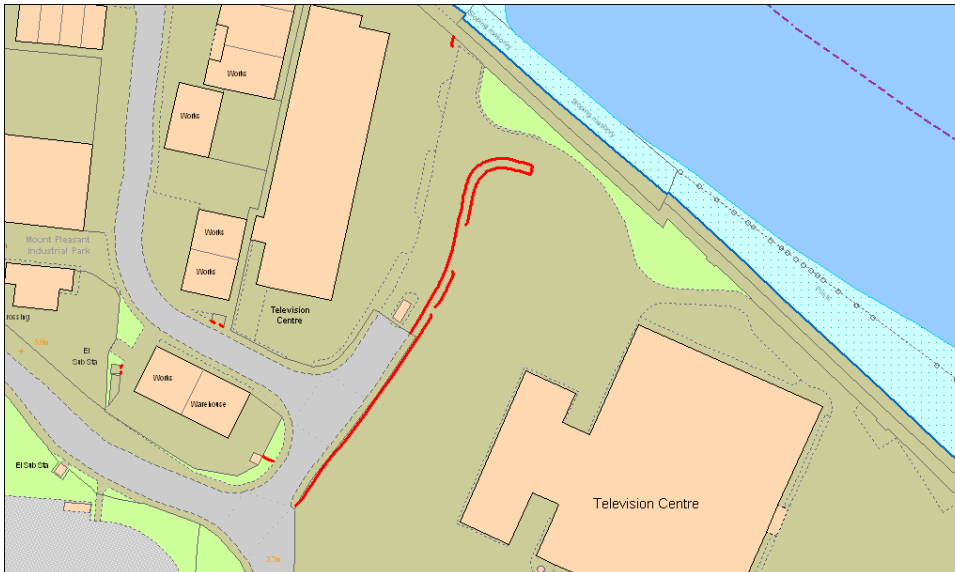
Figure 21: Example of a non-bounding line (shown in red)

Reference to feature

A reference by TOID to a related feature. In cartographic symbol features it is used to point from a water culvert symbol feature to the topographic feature to which it refers.

Accuracy of position

The accuracy of a horizontal position in metres.

Anchor point

A piece of text is bound to a coordinate position. This position is called the anchor point and is measured in metres in the British National Grid spatial reference system.

Font, orientation, height and anchor position are collectively known as the **text rendering** attributes. They are required to graphically display a text string in harmony with the underlying map detail.

Font

The font that is to be used to display the text string. More information is available in the technical specification.

Orientation

The orientation of text or symbol features for cartographic placement. This is measured in tenths of a degree anticlockwise from due east (0–3599).

Height

The height of cartographic text. The height is expressed as the distance on the ground covered by the text, in metres.

Anchor position

A number between 0 and 8 that specifies which part of the text is bound to the anchor point. Further explanation is given in the technical specification.

Text string

Cartographic text that can be rendered using the four text rendering attributes explained above.

Geometric attributes

Point

A pair of easting and northing coordinates in metres, defining a horizontal location in the British National Grid spatial reference system.

Polygon

A polygon is a single closed region defined by a set of lines that represent the boundaries.

Polyline

A polyline is an ordered set of points forming a line feature.

This chapter has explained how OS MasterMap Topography Layer features belong to one of six feature types and shown how each feature type has its own set of attribution. The attribution of OS MasterMap Topography Layer provides information about both the feature's real world counterpart and metadata about the feature itself. The next chapter describes the key features of the supply of OS MasterMap Topography Layer.

Chapter 6   OS MasterMap supply

An online service to supply OS MasterMap has been created. All OS MasterMap Topography Layer orders are supplied from a master copy held in a database by Ordnance Survey. The information the customer submits through the online service to define the area and supply options form the criteria for a database query. This query is run on the database to extract the data the customer requires. The main features of the supply system are outlined in this section. The OS MasterMap Topography Layer themes cannot be purchased separately. Customers may opt to have a theme excluded from the supply.

Online ordering

OS MasterMap incorporates a web-based ordering system that allows the customer to order initial data supply and update, obtain price estimates and view details of their holdings on demand.

GML format and schemas

OS MasterMap Topography Layer is available in GML format version 2.1.2. GML was developed by the Open GIS Consortium (OGC), a global organisation of developers and users that aims to maximise the benefit of GI. GML is a spatially enabled dialect of XML schema.

According to 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. Following a schema ensures a level of standardisation. Standardisation encourages compatibility between different sources of data.

GML can therefore be considered as a worldwide standard language for the production and distribution of geographic data and this is why Ordnance Survey chose it as the format for OS MasterMap Topography Layer. More information on the standards and the bodies governing the standard can be found on the following links;

- Open GIS Consortium (OGC)
- World Wide Web Consortium (W3C) XML schema specification

Information specific to OS MasterMap can be found using the following links:

- Schema repository
- Schema changes

It is important to understand the schemas when developing a translator or loader for OS MasterMap. Full details of the schema and the GML can be found in the technical specification. The majority of users, that access the data after it has been either translated or loaded into their GIS, need not be concerned with the details of the schema.

To speed up the online supply of data and enable areas to be supplied as complete files on CD or DVD, the data will be compressed using the gzip compression method. Most translators accept the zipped files directly, so customers do not have to unzip the files prior to processing.

Seamless

OS MasterMap features in the vector layer are a seamless representation of Great Britain. Prior to the introduction of OS MasterMap both paper and, to a certain extent, digital maps derived at large-scale tend to be divided into tiles. This results in the artificial splitting of features across one or more tiles. OS MasterMap is delivered without dividing features up – as a seamless entity. As there is no map tile or similar data unit, the basic units of OS MasterMap data are features. Therefore customers are advised to manage OS MasterMap data at the feature level, using the TOID to reference and store information on features.

Initial and COU supply

Initial supply refers to the first order of OS MasterMap that a customer takes. An initial supply contains all features for all layers selected for the complete area covered by the order. Updates, which contain the latest changes to the features, are not automatically sent out at regular intervals. A customer decides when to place an order for updates. A COU only contains new features, new versions of features and information about departed features. Any feature within the area covered by the order that has not undergone any of the change will not be supplied.

The advantages of supplying COU rather than a complete resupply is that, if taken regularly, the amount of data that has to be loaded is much smaller. Users may request updates of the latest changes in their area of interest at any time using the online service. It is also possible to set up a scheduled for supply.

It is possible to assign a regular date for receipt of COU. These will then be sent automatically on the required media or placed on the file transfer protocol (FTP) server for collection. A customer can specify the area of interest to be updated by defining a data selection polygon around the features required. This can be done by selecting predefined areas and by importing tile lists or vector polygons, although some restrictions apply. Customers are advised to contact the Customer Service Centre for further information on importing vector polygons.

Currently, change comes through on a minimum six-week cycle. Both initial supply and updates are available on CD, DVD and via a FTP server, although the FTP server is limited to an order volume of 400 Mb. For initial supply it is recommended that customers select CD or DVD (single side, 4.6 Gb) due to the larger volumes of data involved.

This data is designed to be kept up to date via an online COU. Files containing initial supply and COU update supply should never be translated together in the same session, nor should more than one COU supply be translated at a time.

For those customers taking other Layers along with the OS MasterMap Topography Layer, it is important from the point of synchronising these links that supply of all layers is taken at the same time.

Updating data holdings

The OS MasterMap database is live and undergoes continuous revision. Period licence customers have unlimited access to COU and can order updates or resupplies at any time. When a customer orders COU, a 'change-since' date is specified, and all features that have changed since 00.00 hours on the date specified are supplied. This will normally be the date the data was last extracted from the Ordnance Survey main holding, but could be a previous date. The last extraction date can be found on the label of the CD/DVD containing the data (Order no date) or in two 'read me' files accompanying the data (Extraction date). More information on ordering COU is available from Ordnance Survey's website.

To be able to resolve changes to the data holding, the system used to translate or load the data must check the TOID and version of every feature in the update against the current data holding, to determine whether it should be loaded, and if so, what existing feature(s) it replaces. This makes it possible to request and load COU with a date preceding the last data supply date without damaging the data holding. This process can be used to correct a data holding if inconsistencies have occurred due to partially loaded or non-sequential COU, by ordering a single COU with a change-since date that precedes the problem updates.

More information on ordering COU is available from Ordnance Survey's website.

Managed Great Britain (GB) sets

For those customers with full Great Britain coverage contracts of OS MasterMap there is a Managed GB Set service. The Managed GB Set is available for all vector layers of OS MasterMap.

The Managed GB Sets service is a means of processing identical orders faster, thus improving delivery times, with benefits for GB customers and partners. Subscribers to this service will automatically receive their updates (full supply or COUs) on CD or DVD, either quarterly or every six weeks.

With this option customers and Ordnance Survey Licensed Partners that take Great Britain coverage can benefit from:

- data arriving faster and in a more predictable and timely manner;

- seeing the same version of features as other organisations; and

- easier data management as the data is automatically generated and sent out. It is comparable to setting up a scheduled update except that Ordnance Survey determines when the data is made available.

Further information on the Managed GB sets service, including the release dates, are available on the Ordnance Survey website.

Supply options

There are a number of options available to customers when ordering data that provide additional metadata or aid data management.

Chunk files

To make the management of large areas easier, data is split into chunks, each of which covers a nominal square area or part of such a square or a nominated file size. Two types of chunks are available: geographic and non-geographic chunks. Chunk boundaries are imposed purely for the purpose of dividing large supply areas into pieces of a manageable size in a geographically meaningful way. Both full supply and updates (whether COU or full resupply) are chunked.

Geographic chunking option

As OS MasterMap data is seamless, GML files containing large areas could be very large. In order to provide files of a manageable size, data supplies are divided into chunks of a user-specified size, each of which is supplied in a separate GML file. Figure 22 below illustrates how geographic chunks work.
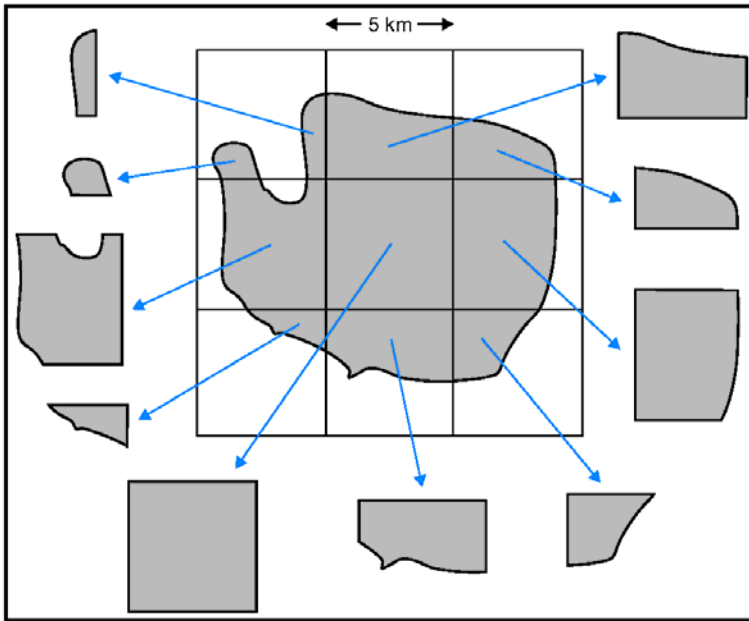
Figure 22: Chunking

1 The customer submits an area or area of interest and specifies a size for the chunks – 2 km by 2 km, 5 km by 5 km or 10 km by 10 km.

2 The online ordering system creates a grid covering the entire area based on the specified size.

3 Each square within the grid forms a chunk file.

4 Each feature that intersects that square goes into the chunk file.

5 National cover of OS MasterMap Topography Layer is supplied in 5 km by 5 km chunks.

In the case shown in figure 22, ten chunks are created. The central chunk is a complete grid square; the others are partly bounded by the data selection polygon. The upper-left square shows the effect when the data selection polygon crosses a grid square twice – two or more separate chunks are created.

System suppliers are able to advise the best chunk rates for their systems.

A consequence of this is that some features are supplied in more than one chunk. Systems reading OS MasterMap data must identify and provide the option to remove these duplicated features.

Empty chunks are not supplied; that is, if a chunk contains no information relating to a customer's selected themes then it would be an empty file, so it is not supplied.

Chunks cannot be treated as persistent data management units; as it is a floating grid, the origin of the chunking grid may differ between orders, particularly if the contract area changes or if they order a different chunk size.

Supply of OS MasterMap Topography Layer features in chunk files

The packaging of a seamless dataset into chunks means that where a feature lies across, or touches a boundary of a chunk or chunks, it is supplied in all of the chunks. This is because the individual feature is the smallest unit within OS MasterMap Topography Layer – it cannot be physically split into two or more parts.

When a polygon falls across a chunk edge but its bounding line or lines lie outside it may not be included in that chunk. It will be included in the adjacent chunk, unless the polygon is at the edge of the contract area, in which case the line will not be supplied at all.

When a polygon changes so that it no longer falls in the same chunk, for instance, when a Topography Layer feature used to lie partly inside a chunk and instead is now reduced in size so it is wholly within an adjacent chunk, it is reported as a departed feature in one chunk and as a modified feature (new version) in the adjacent chunk. This is shown in figure 23 below. For more on departed features see the section below.
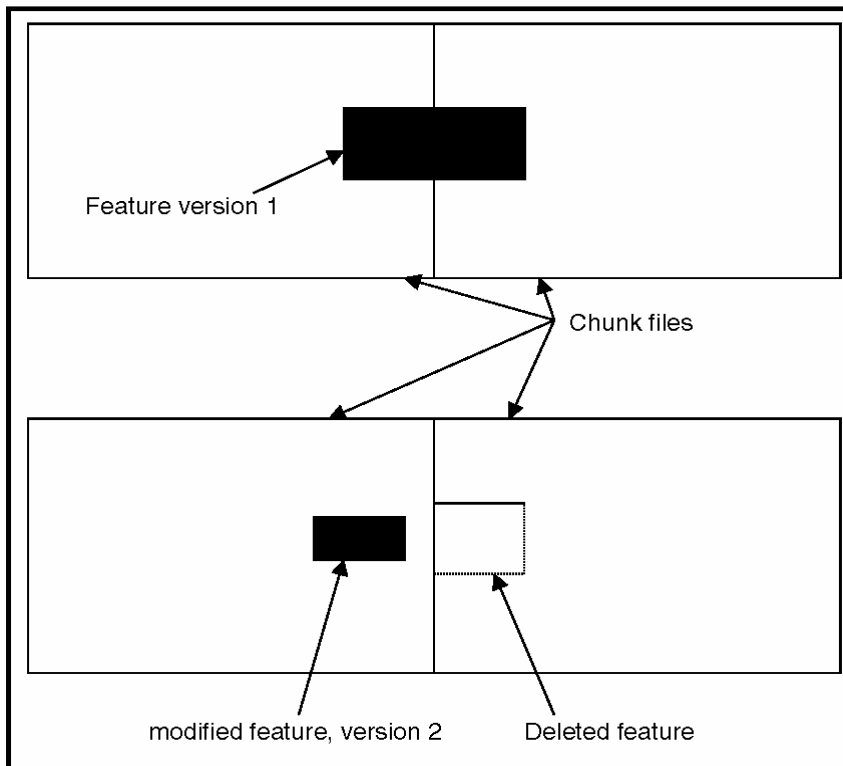
Figure 23: Feature types and chunk boundaries

It is possible for OS MasterMap features with point geometry to be included in multiple adjacent chunk files. This is because the query used to populate a chunk file includes all features that touch its boundary, and this boundary is shared with adjacent chunks. Therefore OS MasterMap loading software must be able to identify and remove point features across multiple files in the same way as for features represented by lines and polygon geometries.

Non-geographic chunking option

This supply format delivers OS MasterMap vector layer data for the Topography Layer polygon format, ITN Layer and Address Layer 1 and 2 (non-geographic chunks are not available for the Imagery Layer) in files that have a fixed nominal file size, as opposed to a given geographic area. The customer selects the compressed file size from options of 10 Mb, 30 Mb or 50 Mb via the online service.

Each feature appears in only one chunk file. It is possible for features from various geographic locations to appear in one file, and for adjacent features to appear in different files. Non-geographic chunk files are designed for use as a set to load spatial databases, but can be used in a file format as long as all chunks are translated or imported into the system at the same time. It is not possible to tell in which file a particular feature will be found before reading the files. With non-geographic chunks there are no duplicate features lying across chunk edges, which speeds up the translation process.

The features shown in red in figure 24 can end up in the same non-geographic chunk even though not adjacent to each other.
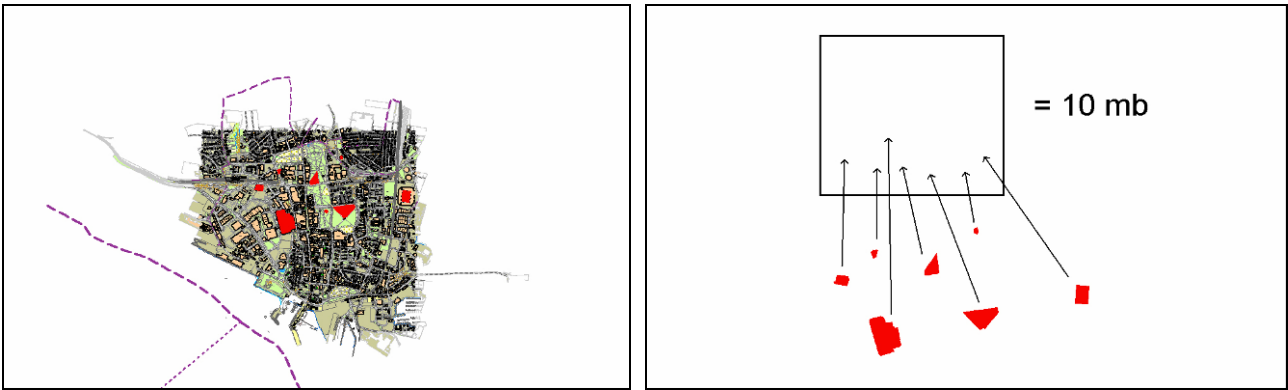
Figure 24: Non-geographic chunking

Feature validation dataset (FVDS)

The FVDS is a new set of files that can optionally be supplied with either a full supply or a COU OS MasterMap order. The FVDS can be ordered with the Topography, Address and ITN Layers and must be supplied together with an OS MasterMap data order; it cannot be produced on its own. FVDS allows a customer to validate that the data holding contains the correct set of features after loading the data with which it was supplied. It reports on all the data it expects to find in the holding after the application of the supply, **not just what is contained in the supply**. It is intended to be used for periodic checks on data holdings maintained by a COU regime. It is not intended that customers order it with every supply as processing it will slow down the translating process. It can also be used to check that an initial supply of OS MasterMap data has been correctly loaded. FVDS can be used with both geographic and non-geographic chunk file options. FVDS is itself divided into files on a non-geographic basis, using a 10 Mb nominal file size.

The FVDS is a comma-separated value (.csv) text file format that gives the TOID, version number and version date of every feature that should exist in the current data holding, based on the polygon extent, themes, polygon format and extraction date of the current order. Each .csv file is compressed to a .gz file using the same compression algorithm as for OS MasterMap GML files.

GML summary file

An order summary file in GML format will be supplied with all OS MasterMap vector data orders, containing the order information specified by the customer. This information includes:

- the order number;
- query extent polygon(s) of the order;
- the order type: 'Full supply' or 'COU';
- for COU orders, the change-since date;
- themes requested;
- chunk type: 'Non-geographic' or 'Geographic'; and
- chunk size: in Mb for non-geographic chunks, in km² for geographic chunks.

Departed features

As mentioned in the section on life cycles, when a feature reaches the end of its life it is removed from the Ordnance Survey's main holding. When a feature is removed its status is reported to the customer that is taking COU as a **departed** feature. When a customer orders a COU, a list of departed features is provided so that the loading software can add and subtract the features to the customer's holding accordingly.

Departed features are supplied in COU data with respect to a given date. Features that have left the area or themes of the data supply since midnight on this date are included as departed features. This information is supplied to inform user systems that all versions of this feature are no longer current. Some departed features are present in COU for features that have not been previously supplied; this is for a number of reasons, including the creation and removal of features in the specified time period and the limited information stored in the OS MasterMap main holding about previous versions of features. Departed feature information is not given when a particular version of a feature is replaced by a new version with an incremented version number. The existence of the new version in the data supply set indicates that any feature with the same TOID but a lower version number is no longer a current feature.

The list provides the TOID of the departed features along with the following attributes, which assist the software to manage the change within the customer's holding. It is important to note that the actual geometry of the feature is **not** supplied.

Departed feature bounding rectangle

Each departed feature states a bounding rectangle within which the feature lies. This rectangle is not necessarily the minimum rectangle of the last version of the feature. Instead, it is a bounding rectangle of all versions of the feature that have existed within the chunk area (for geographic-chunked orders) or order extent (for non-geographic-chunked orders) since the extraction date of the last supply of data and of all versions of the feature with bounding rectangles within the area/extent. This ensures that customers who hold a superseded version of the feature will find this version within the rectangle, even if the feature has subsequently changed shape or location.

Departed feature theme(s)

Each departed feature states the theme or themes it has been a member of since the extraction date of the customer last supply of the data. Added themes may or may not be included. Again, this is to ensure that customers who hold a superseded version of the feature will be able to locate it in theme-based or layer-based data holdings.

Reason for departure

Departed features report whether they are (a) **deleted** – the feature no longer exists within OS MasterMap – (b) **vacated** – indicates that the feature is no longer within the chunk/order, but still exists in OS MasterMap and therefore could reappear in the chunk/holding in the future. A deleted feature also has a date of deletion, but a date is not applied to a vacated feature. 'Deleted' is the default value, which can be assumed unless 'vacated' is stated.

If a feature has left one geographic chunk but continues to exist in an adjacent chunk, it will continue to be reported as a departed feature in the former chunk. The reason for departure is 'vacated', and the latter chunk will contain a later version of the feature. If the feature has vacated a chunk and subsequently been deleted, the reason for departure is 'deleted'. In other words, each chunk file reports COU with respect to the boundary of that chunk, and without knowledge of the other chunks in the customer's order. This is required because the concept of geographic chunks is that they can be used alone or in customer-defined blocks, if required. The same TOID can appear as both a departed feature in one chunk file and as a modified feature in an adjacent chunk.

In non-geographic chunks there is logically only one set of departed features in the data order. There is no concept of a feature having 'departed from a chunk' since the chunk does not have a geographic boundary. However, vacated features will still exist in data supplied in non-geographic chunks due to features moving outside the data holding boundary, or (unusually) changing theme to a theme that the customer has not taken.

To ensure that departed features are dealt with properly within a holding it is important to load all the COU files all in one go or session.

If a customer processes COU chunk files one at a time, deleting all departed features from the data holding, it is possible that the software might be deleting some features that should still exist, because they are departed from one chunk and modified in another. This problem can be avoided by the loading software making two passes through the set of COU files, the first pass resolving departed features from all chunk files and the second pass applying new or modified features from all chunk files.

File names

Each OS MasterMap chunk file supplied, except Imagery and non-geographic chunks, has the following format:

nnnnnn-llnnnn-nnlnnnn,

for example, 123456-SU1212-2i3. This example is broken down as follows:

'123456' is the order number,

'SU1212' is the 1-km square in which the south-west corner of the chunk falls,

'2' is the chunk size, in this case 2 km by 2 km (this will be set to 5 for 5 km by 5 km or 10 for 10 km by 10 km),

The '**i**' is a flag indicating that the data selection polygon does not completely fill the chunk square; that is the chunk is 'incomplete'. If it does, this will be shown as a '**c**'. If an area selection contains no data then an empty chunk file is supplied. The fact that it is empty will be shown by the letter '**e**' in the filename.

The '3' is a counter to provide a unique file name in the case of multiple chunk files within one chunking grid square. This can have a value between 1 and 9999. Figure 25 below shows what happens in the instance of a selection polygon that falls within a chunk square twice.
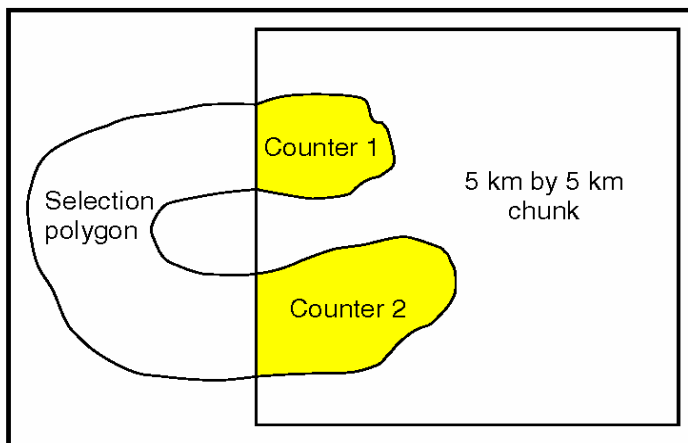
Figure 25: Explaining counters in file names

Two files are supplied, each one distinguished by a counter number – 1 and 2.

Other file names

A non-geographic chunk will have the following file name format: nnnnnn-nnnnnn-nn.gz, for example, 123456-000012-10.gz, where the final two numbers indicate the nominated file size in megabytes. Compressed FVDS files are named as follows: nnnnnn-llnnnnnn-nn.gz For example, 1232456-FV000012-30.gz, where the two letters FV indicates that it is a FVDS file. A GML summary file has a name in the form nnnnnn-summary.gml

This chapter has described how OS MasterMap Topography Layer is supplied, including descriptions of the new online ordering system and data format, the system of chunking required to handle seamless data, the way change is supplied (including the issue of departed features) and how to understand the file names. It has also offered guidance on how to update a customer's data holdings. The next chapter expands on the issues surrounding change management that derives from applying updates and expands on the principles of data association.

Chapter 7   Change management and data association

This chapter provides an introduction to two aspects of deriving additional value from OS MasterMap Topography Layer. The first is utilising the referencing and change-tracking attributes to identify and manage the impact of change on a customer's data. It discusses the process of applying change and the implications for archiving data. The second is associating customer data and OS MasterMap Topography Layer through the use of the TOID as a common reference. This creates the potential to share data between departments and organisations. It explains what data association is and it gives examples of how data association can bring benefits to organisations. As both these subjects have quite complex issues surrounding them in terms of the systems needed to support them, they are discussed in finer detail in a number of topic-specific documents that are available from the following links.

These are:

- DNF website
- Implementing OS MasterMap technical information sheet 1

Change management

The feature-reference and change-tracking attributes provide the opportunity for customers to put in place a change-management regime. The system that the customer uses to translate and load OS MasterMap Topography Layer should use the TOID and version information to update the local holding when a COU is taken.

The software needs to handle three types of situation – features that have been departed, features that are new and features that have changed. The software should resolve departed features first.

Departed features

- In the COU there is a list of features that have been departed since the last time the customer took data. There are some additional considerations with departed features that are covered in more detail in chapter 6 on supply, but in essence the software would find all the TOIDs and versions on the departed features list in the COU in the main holding and remove those features.
- In the case of superseded and departed features, these could be removed totally from the customer's holding but it may suit the requirements of the customer better to archive them for future reference.

New features

- With a new feature the software compares each TOID in the COU against the TOIDs in the existing holding. If the TOID exists in the COU but not in the main holdings it is a new feature and the software should insert it in to the holding.

Changed features

- If the TOID exists the software needs to compare the version number in the existing holding against the version number in the COU. The version number in the COU should be higher than the existing holding. In this case the software needs to take out the existing version of the feature and replace it with the version in the COU. If, on the other hand, the COU version is lower the COU version should be ignored.

Archiving the OS MasterMap data holding

As OS MasterMap features progress through their life cycles it is possible to develop snapshots of the features by holding superseded versions in a local data archive. By holding and maintaining a local data archive, customers will be able to interrogate previous views of the world straight from their local data holding.

It will be important to consider carefully how to archive OS MasterMap features and what requirements the applications and users will have to access the older information. Archiving may be done by simply writing older versions of the data off to hard media or a more sophisticated system of keeping historical data live on the system may be adopted. It is important for customers to recognise their unique requirements (be they user, statutory or regulatory requirements) as archiving can become a significant overhead in terms of storage.

Before designing or implementing an archive of OS MasterMap Topography Layer it is advisable for a customer to discuss requirements with their system supplier.

Associating data to OS MasterMap features

As stated in the first two chapters, one of the key reasons behind providing this level of reference attribution is to provide a mechanism for customers to link their data to Ordnance Survey data and share data with other organisations. Data association can be a complex undertaking as the extent to which an organisation can implement it depends on many factors, including the systems they have in place, the number of different sets of data within the organisation and the manner in which they have created that data in the first place. This chapter concentrates on the key concepts of data association and serves as an introduction to the subject from the OS MasterMap Topography Layer point of view. For a fuller discussion of data association please see the OS MasterMap Implementation guide 1 and the DNF website referred to above. Firstly, a relatively simple example of how data association might work.

In figure 26 below there is a car park owned and operated by the local authority. Within the local authority there are a number of different datasets that contain information about that car park. The finance department hold information on the number of spaces it has, the opening times and the parking rates. The maintenance department has details on when it was last resurfaced, how much it cost and who undertook it. The tourism department have it on a list of car parks that it makes available to visitors. Each department has a different way of referencing the car park and none of them hold the same piece of information as any other department. It is not easy to match the data to the real-world object as no single piece of information clearly and uniquely identifies the physical location of the car park. If the TOID is introduced as a unique reference and the data is stored within a GIS and/or spatial data base system, the data can be queried using the TOID as the search criteria. Each department would be able to find all the available information on the car park in any record that had the same TOID as an attribute.
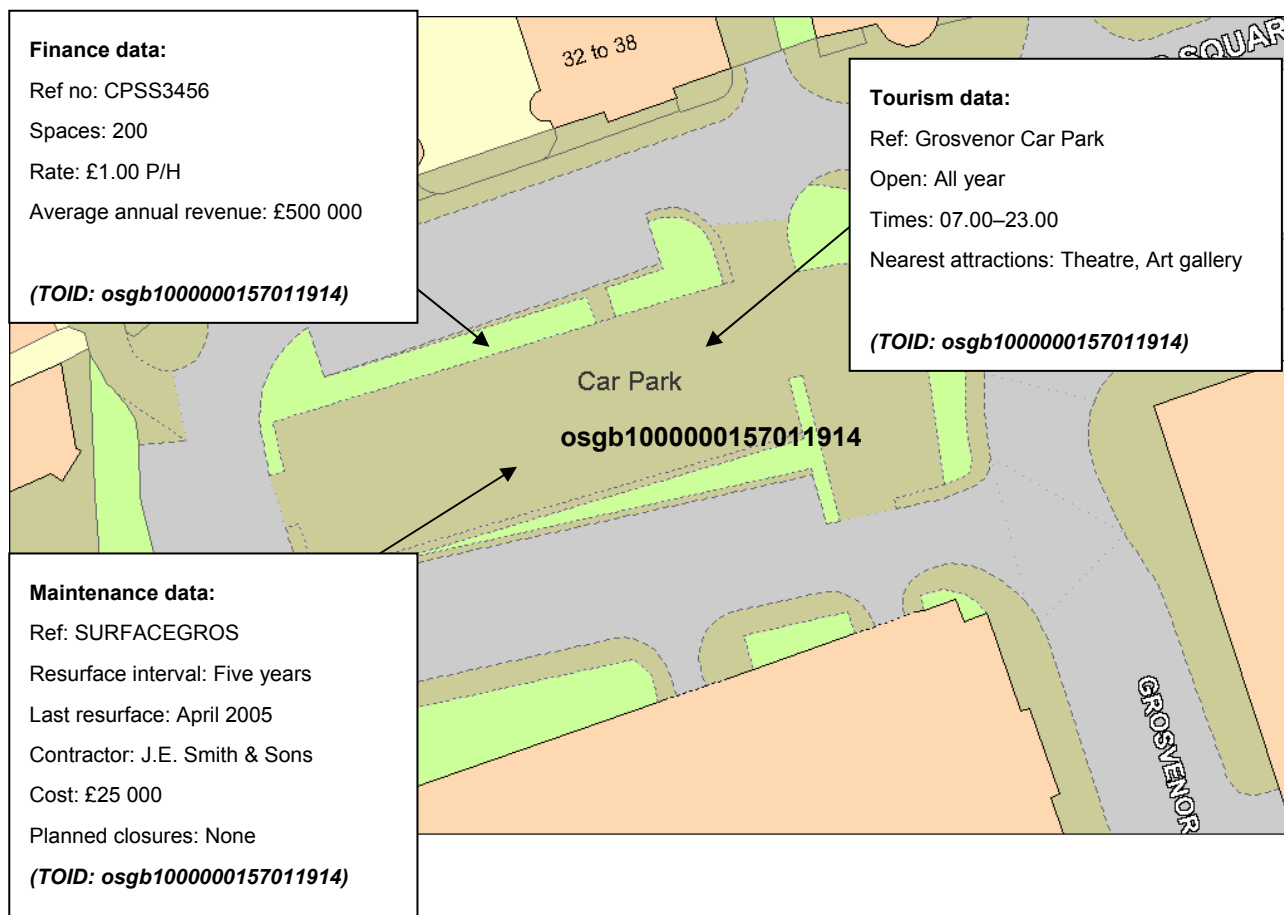
Figure 26: Data association

Organising the data in this manner offers the following advantages.

This is a more efficient way of storing and accessing data as it requires only one attribute to be known, and, given the correct database structure, may only require the TOID to be stored once. It also means that any update to the information by one department will be immediately accessed by all other departments. In the above example, for instance, if the parking rates were raised by finance, the tourism department would be able to give out the correct rate to visitors as soon as this increase was implemented. This reduces the likelihood of out-of-date information being passed on to customers. It also reduces the temptation to duplicate data across departments, enabling data to be stored once but reused many times.

To be able to associate datasets together, a customer needs to understand what the relationship is between the datasets; relationships can be categorised as spatial or a-spatial.

An example of a spatial relationship is when the customer uses the individual features to construct, or derive, their own geometry data. An example would be a Planning Department wishing to record the exact extent of the area submitted in a planning application.

An example of an a-spatial relationship is where the geometry is either always going to be the same as a single feature or, at the opposite end of the spectrum, the geometry is unimportant to the application within which the features are used. An example would be recording buildings that have received improvement grants for energy efficiency. It does not matter what shape the house is, just that it has received monies for some improvements. It should be noted that relationships are mainly created polygon to polygon. It is possible that users may wish to associate point and line data to OS MasterMap polygons as well. Tabular or text-based data, which has no geometry currently, can also be associated by introducing the relevant TOID as one of the attributes.

In addition to the documents mentioned at the beginning of this chapter on data association, further assistance on change management and data association is available from Ordnance Survey's Pre and Post Sales Support team, which can be contacted via the numbers given in the preface to this document.

This chapter has provided an introduction to managing change and utilising the unique reference to gain more value from the data by associating datasets together. Both these subjects are covered in more depth in the documents referred to in this chapter, and customers are encouraged to explore these issues more fully through these resources and to talk to system suppliers about how they might adopt some or all of these practices. The next chapter looks at how more value can be derived from OS MasterMap Topography Layer by using the attribution to apply different styles.

Chapter 8   Style guide

Ordnance Survey have produced a style guide for OS MasterMap. This is a distinct set of colours, fill styles and symbols. The styling has been worked out by using a combination of three of the descriptive attributes: descriptive group, descriptive term and make. A full description of the styling is available in the technical specification.

Providing a style guide has allowed many software providers to develop their own styling, based and adapted from the guide, which can be applied when the data is initially translated so that the data can be displayed immediately with a coherent style. Within most GIS, however there are tools that enable customers to choose to make the data appear in any preferred manner. A customer can apply their own colours, styles and symbols based on the same three attributes. Alternatively, they can use any of the attributes, either in isolation or in tandem, if their systems permit, to render the data to their own specification. Attaining a coherent style depends on choosing the attributes carefully. There is little point in using the TOID, for example, as each feature would need its own colour. If the TOID version number was used, a customer could get some idea of how much change there goes on in one area compared with another. In figure 27 below the darker the red the higher the version number and the greater the amount of surveyed change.
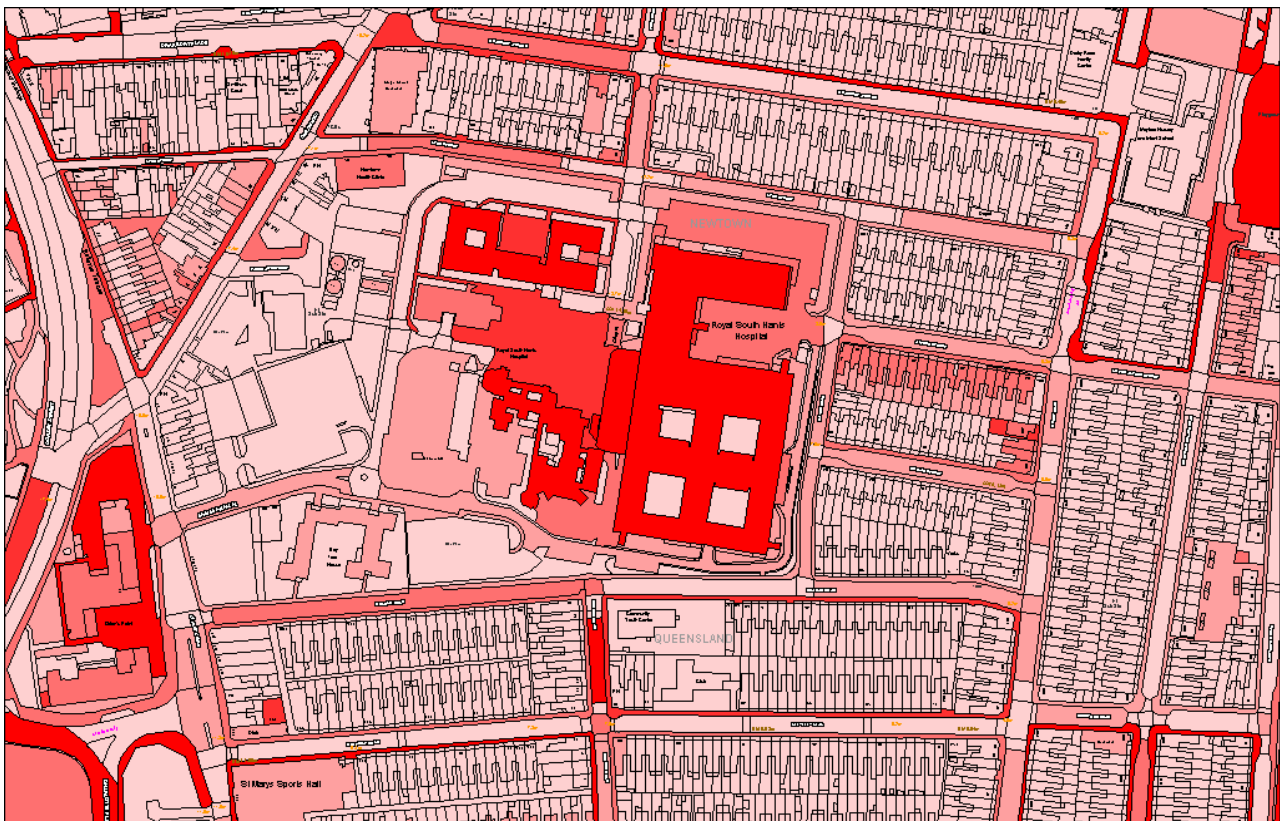
Figure 27: Using attribution to visualise amount of change

This displays the areas where the greatest amount of change is occurring in the landscape. Having so many attributes allows this to be done without any additional work to the data itself. If a customer's own attributes are added to OS MasterMap Topography Layer, these can also be used as the basis for the styling.

Having such flexibility to customise the data presents an opportunity to derive additional value from OS MasterMap Topography Layer. For example, where there is a necessity to have a clear display of what features look like from a real-world point of view, then styling schemes based on the style guide work well. If there is a requirement to view a customer's own data alongside OS MasterMap Topography Layer, the customer could consider toning down or removing colour from the features so that their own data makes more of a contrast, and therefore has the bigger visual impact. In the example shown in figure 28 below, a customer has derived a set of grassed areas, coloured and hatched in green, which is displayed over OS MasterMap Topography Layer with just the buildings highlighted in grey to give some additional definition to the data and to help viewers of the data orientate themselves within the landscape.
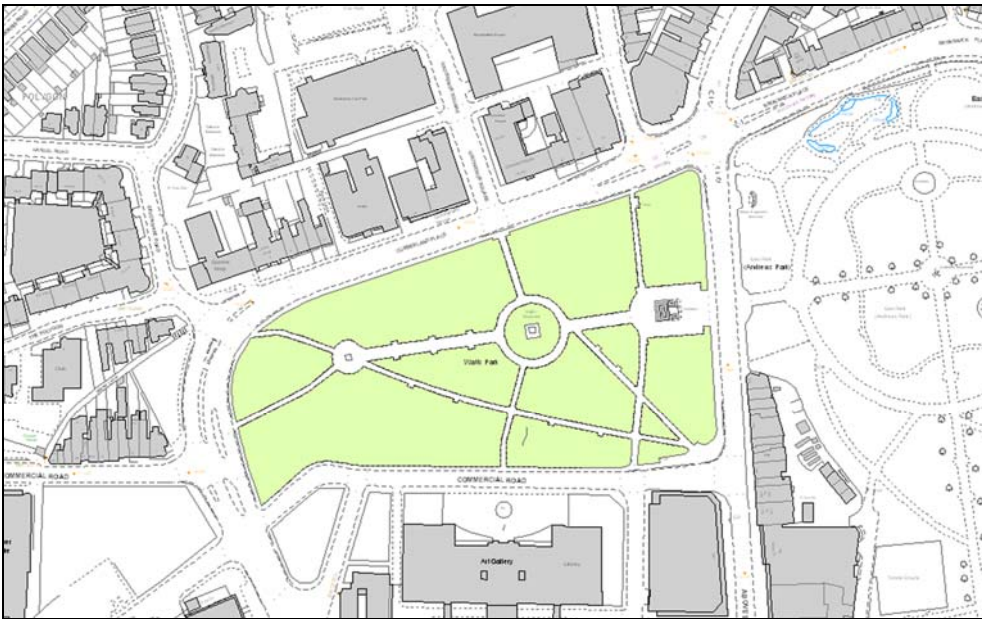
Figure 28: Styling options with OS MasterMap Topography Layer

The customer's own data is what catches the eye first and is the focus of attention. Some systems will allow different views of the data so that one type of styling can be seen by one set of viewers and a different style entirely by others, to suit their individual requirements.

OS MasterMap Topography Layer may also be styled just by the line or point features, to replicate the engineering style of drawing commonly used in computer-aided design (CAD) systems. Further information on using OS MasterMap Topography Layer in CAD systems is available from the Ordnance Survey website. The data can even be rendered in black and white to save on printer ink if the printed map is going through various drafts before a final full colour version in produced, or for use in presentations and documents that are only going to be printed in black and white.

This chapter has discussed how, by adapting the flexibility of OS MasterMap Topography Layer in terms of how it can be displayed, a customer can visualise the attributes in thematic maps and derive information from the map in a visual way, customise the maps to best reflect the different applications to which it is put and produce clear, high-quality maps for use in document, presentation or just as hard copy for when it is not possible to access the data through a screen.

Chapter 9   Data measures

Ordnance Survey measures the data in its products in one or more of the ways set out in table 5 below.

Table 5: Definitions of data measures

Data measure	Definition	Sub-measure	Definition
Completeness	Presence and absence of features against the specified data content*	Omission	Features representing objects that conform to the specified data content but are not present in the data
		Commission	Features representing objects that do not conform to the specified data content but are present in the data
Logical consistency	Degree of adherence to logical rules of data structure, attribution and relationships	Conceptual consistency	How closely the data follows the conceptual rules (or model)
		Domain consistency	How closely the data values in the dataset match the range of values in the dataset specification
		Format consistency	The physical structure (syntax): how closely the data stored and delivered fits the database schema and agreed supply formats
		Topological consistency	The explicit topological references between features (connectivity) – according to specification
Positional accuracy	Accuracy of the position of features	Absolute accuracy	How closely the coordinates of a point in the dataset agree with the coordinates of the same point on the ground (in the British National Grid reference system)
		Relative accuracy	Positional consistency of a data point or feature in relation to other local data points or features within the same or another reference dataset
		Geometric fidelity	The 'trueness' of features to the shapes and alignments of the objects they represent*
Temporal accuracy	Accuracy of temporal attributes and temporal relationships of features	Temporal consistency	How well ordered events are recorded in the dataset (life cycles)
		Temporal validity (currency)	Validity of data with respect to time: the amount of real-world change that has been incorporated in the dataset that is scheduled for capture under current specifications
Thematic accuracy (attribute accuracy)	Classification of features and their attributes	Classification correctness	How accurately the attributes within the dataset record the information about objects*

*When testing the data according to the dataset specification against the 'real world' or reference dataset.

Currently available measures for OS MasterMap Topography Layer can be found on the product page of the Ordnance Survey website.

Annexe A   Administrative boundary alignments

Administrative boundaries may or may not have a predefined relationship with the topographic features in their locality. This relationship is known as a *boundary mereing*. This relationship is recorded within OS MasterMap as a textual description. A list of the most common abbreviations is given below.

Object or mereing	Abbreviation	Object or mereing	Abbreviation
Baulk, bank, base, basin, bridge, broad	B	Mean high water	MHW
Cam, canal, causeway, centre of, channel, cliff, conduit, cop, course of, covered, culvert, cut	C	Mean high water springs (Scotland only)	MHWS
Dam, ditch, dock, double, down, drain	D	Mean low water	MLW
Double ditch or drain	DD	Mean low water springs (Scotland only)	MLWS
Double fence	DF	Metres	m
Defaced	Def	Old	O
Edge of, eyot	E	Passage, path, plate, pond, post	P
Face of, fence, fleet, foot, freeboard	F	Race, railway, ride, river, road, root of	R
Feet	ft	Root of hedge	RH
Harbour, hedge	H	Scar, sewer, side of, slope, sluice, stone, stream	S
Inches	Ins	Top of	T
Kerb	K	Track	Tk
Lade, lake, lead, loch, lockspit, lynchet	L	Undefined	Und
Marsh, mere, moat	M	Wall, weir	W

The following are examples of combined abbreviations:

Object or mereing	Abbreviation
Centre of bank, basin, baulk, broad and so on	CB
Centre of railway, river, road and so on	CR
Centre of old course of stream	COCS
1.22 metres root of hedge	1.22 m RH

NOTE: Special rules apply to boundary mereings and only the more common ones are listed.

Where the mereing relationship of any boundary alignment changes or where a boundary changes from one side of a real-world object to another, the point of change is shown by a boundary half-mereing change symbol, usually in opposing pairs. The location of the boundary half-mereing symbol is coincident with the boundary alignment and not the feature to which it is mered.

Annexe B   Product and service performance report form

Ordnance Survey welcomes feedback from its customers about OS MasterMap Topography Layer.

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 MasterMap Topography Layer Product Manager, Ordnance Survey, Romsey Road, SOUTHAMPTON, SO16 4GU.

If you wish to return it by fax, please dial 023 8079 2615.

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 MasterMap Topography Layer

Technical specification

Contents

v1.3 – 07/2007

Introduction

Purpose of this specification and disclaimer

This is the technical specification (hereafter referred to as the specification) applicable to the OS MasterMap Topography Layer (hereafter referred to as the product), which is referred to in the Framework Direct Licence, Specific Use Framework Partner Licence or your other customer contract for the product.

We may change the information in this specification at any time, giving you the notice period specified in the customer contract made between you and Ordnance Survey.

We do not accept responsibility for the content of any third party websites referenced or accessed in or through this specification, any other contractual documentation, and/or the Ordnance Survey website.

Copyright in this specification

This specification (including for the avoidance of doubt any mapping images reproduced herein) is © Crown copyright 2007. All rights reserved.

Any part of this specification may be copied for use internally in your organisation or business so that you can use OS MasterMap for the purpose for which it is licensed to your organisation or business (but not otherwise).

No part of this specification may be reproduced or transmitted in any form or by any means (including electronically) for commercial exploitation without the prior written consent of Ordnance Survey.

No part of this specification may be copied or incorporated in products, services or publications that you generate for onward sale, or as free promotional or support materials, without the prior written consent of Ordnance Survey.

Chapter 1   Key concepts

This section outlines the three core concepts underlying the OS MasterMap vision as it relates to the provision of topographic features. These are:

- a feature model with identifiable persistent features;
- feature life cycles defined to best match actual change; and
- integrated OS MasterMap layers.

Feature model

From Ordnance Survey's view, the world is full of features that have identity, location and other additional attribution. It is this sense of *feature* that is central to the development of OS MasterMap, as a database of features that are a useful reference base for users.
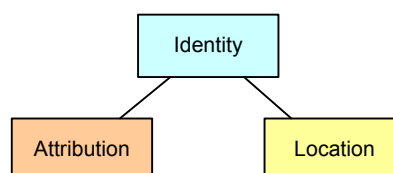
Feature life cycles

Changes to real-world features conforming to the specification are reflected in changes to the data. The OS MasterMap capture specifications define what real-world change constitutes a change to an existing feature in the data and what change causes a new feature to be created. The rules behind these decisions are discussed further in the descriptions of change-only update (COU) and life-cycle rules. The main purpose behind the handling of feature life cycles in the data is to provide users with a consistent representation of changes in the real world based on a capture specification. Due to the periodic way in which data is captured and updated, other surveyable changes may have occurred to the real-world feature between survey dates, and these intermediary changes will not be recorded in the data.

Integration of the OS MasterMap layers

A main premise of OS MasterMap is that layers can be integrated with each other. Layers are integrated by the sharing of common coordinate systems and context. With the exception of the Imagery Layer, the TOID feature identifier attribute provides a unique feature level link for referencing between related features in different OS MasterMap layers and user's features. For example, in OS MasterMap Address Layer 2 data there is an explicit link between the addressable feature and the OS MasterMap Topography Layer feature that it falls within. Similarly, the OS MasterMap ITN road links are attributed with the TOID of the Topography Layer feature they fall within.

Chapter 2   Data specification overview

Structure

This data specification works within the existing structure of OS MasterMap as represented in the UML class diagram below:

```
                    ┌─────────────────────┐
                    │        Layer        │
                    ├─────────────────────┤
                    │for example, Topography│
                    ├─────────────────────┤
                    │                     │
                    └─────────────────────┘
                              │ 1
                              │ 1..*
                    ┌─────────────────────┐
                    │        Theme        │
                    ├─────────────────────┤
                    │for example, Building│
                    ├─────────────────────┤
                    │                     │
                    └─────────────────────┘
                              │ 1..*
                              │ 1..*
                    ┌─────────────────────┐
                    │       Feature       │ 1
                    ├─────────────────────┤
                    │for example, topographicArea│
                    ├─────────────────────┤
                    │                     │
                    └─────────────────────┘
            1..*                        1..*
   ┌──────────────────┐        ┌──────────────────────┐
   │    Attribute     │ 1..* 1 │       Complex        │
   ├──────────────────┤        ├──────────────────────┤
   │for example, TOID │        │for example, changeHistory│
   ├──────────────────┤        ├──────────────────────┤
   │                  │        │                      │
   └──────────────────┘        └──────────────────────┘
```
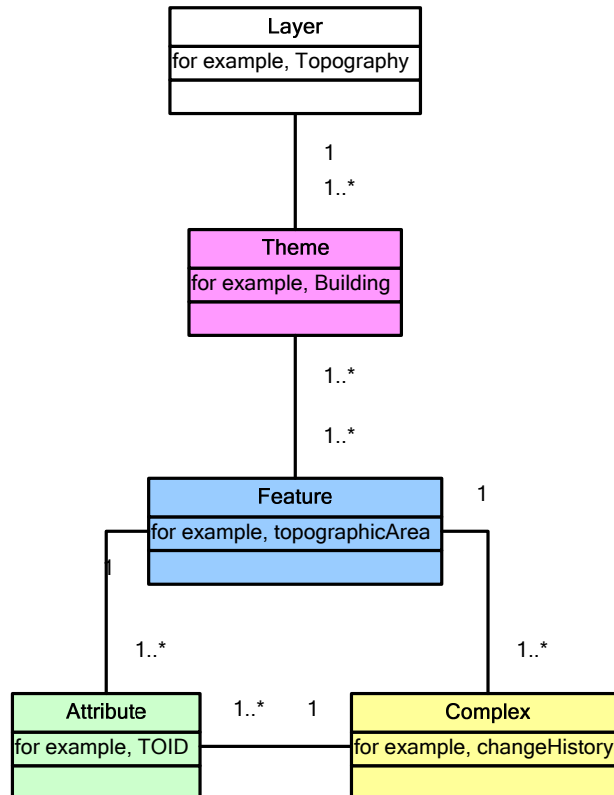
Layers

A layer is a set of related OS MasterMap themes that can be used together for end-user applications. A layer may consist of one or more themes.

Themes

Within the Topography Layer features belong to one or more themes. A theme is a logical collection of features that have been grouped according to their classification or relationship with other features. The primary purpose of themes is to enable easier selection and use of features by the user. Themes do not form part of the classification of a feature and do not affect the feature life-cycle rules. Topography Layer is composed of nine themes, which are detailed in chapter 3 Theme definitions

Features

Features are digital representations of real-world concepts. The life cycle of a feature, its creation, modification and deletion are managed to most appropriately reflect the life cycle of the abstracted real-world concept they depict.

Attributes

An attribute is any item of information packaged in an OS MasterMap feature. The TOID and the geometry of the feature are both attributes of the feature.

Chapter 3   Theme definitions

This chapter describe the themes that are included in Topography Layer data and gives example of real-world objects that are represented within these.

Definitions

Administrative boundaries

Description: The limits of responsibility and representation defined for electoral and administrative purposes.

Theme rule: descriptiveGroup = 'Political Or Administrative'.

Examples: Euro, county, district, ward and civil parish boundaries. Boundary stones, boundary mereing symbols and relevant cartographic text.

Buildings

Description: Roofed constructions, usually walled. This includes permanent roofed constructions that exceed 8.0 m^2 in area (12.0 m^2 in private gardens). Exceptions are made for smaller buildings in such a detached position that they form relatively important topographic features. Storage tanks may be classified as buildings.

Theme rule: descriptiveGroup = 'Building', 'Glasshouse' or 'Buildings Or Structure'.

Examples: Covered and roofed structures, and relevant cartographic text

Heritage and antiquities

Description: Features and cartography that depict sites or constructions of historic interest. This theme is currently very limited in content.

Theme rule: descriptiveGroup = 'Historic Interest'.

Examples: Text 'Site of', 'Hadrian's Wall' and explicit sites of features.

Water

Description: Features that contain, delimit or relate to real-world objects containing water.

Theme rule: descriptiveGroup = 'Tidal Water' or 'Inland Water'.

Examples: Areas of inland water, edge of water features, related cartographic text and flow direction.

Land

Description: Man-made and natural features that delimit and describe the surface cover other than communication routes and buildings. This also includes all features relating to man-made and natural slope and cliff. All general features are also placed in the land theme.

Features with a descriptive group of landform are not topologically structured with the other features in the theme. This means that landform line features cross other line features without being broken at intersections, and landform area features overlap other area features.

Theme rule: descriptiveGroup = 'General Surface', 'General Feature', 'Landform', 'Built Environment', 'Natural Environment' or 'Unclassified'.

Examples: Residential land, slopes, cliffs and types of land cover.

Rail

Description: Features related to travel by railway or tramway. Currently, railway tunnels are not classified as railway and so will be present in the structures theme.

Theme rule: descriptiveGroup = 'Rail'

Examples: Rail alignments, permanent way and railway land.

Roads, tracks and paths

Description: Features related to transport by vehicles, cycles or pedestrians. This includes features that are road, made paths or text classified as road, track or path related. All tracks and unmade paths are not currently classified as such and so will be available in the land theme. Road tunnels are not classified as related to roads and so will be present in the structures theme.

> **Roads –** Metalled communication routes usable by ordinary vehicles, that is not those especially adapted for cross-country travel. Typical examples of metalling include tarmac, concrete, gravel, cinder and must constitute a specific and systematic improvement to allow the passage of vehicles for features to be described as a road.

> **Tracks –** Non-metalled communications routes, including those utilised by agricultural and other especially adapted vehicles. Exposure of underlying subsurface materials through erosion by vehicular traffic and the intermittent application of metalling to features that are predominantly tracks do not constitute a feature that should be described as a road.

> **Paths –** Metalled or non-metalled communication routes for use by cyclists or pedestrians. Unmade paths are those without metalling and are only captured when they are continuous between identifiable points.

Theme rule: descriptiveGroup = 'Roadside', 'Road Or Track' or Path'.

Examples: Road section and verges.

Structures

Description: Man-made constructions that are not buildings. These may or may not obstruct passage at ground level.

Theme rule: descriptiveGroup = 'Structure'.

Examples: Pylons and general structures.

Terrain and height

Description: This includes terrain-related features, some of which have associated heights, that is spot heights.

Theme rule: Features that have the optional property HeightAboveDatum; or descriptiveGroup = 'Terrain And Height' or 'Height Control'.

Examples: Spot heights, tide lines and bench marks.

Chapter 4   Feature attribution

In OS MasterMap Topography Layer features are classified using feature type and feature description attributes. This section describes the feature types and shows their permitted attribution.

Feature type

The Topographic Layer contains not only physically apparent real-world objects but also topographic concepts such as inferred area feature boundaries. There are six types of feature used to represent geospatial information in the Topography Layer; they are:

TopographicArea	Features representing topographic objects that have a polygon-based geometry.
TopographicLine	Features representing topographic objects and concepts that have a line-based geometry.
BoundaryLine	Features representing the boundaries of administrative areas that have a line-based geometry.
TopographicPoint	Features representing topographic objects and other concepts that have a point-based geometry.
CartographicSymbol	Features providing information on symbols used when rendering OS MasterMap graphically.
CartographicText	Features that define the content and placement of text when rendering OS MasterMap graphically.

In addition, if change only update (COU)* supply has been provided the data may contain information about the movement and deletion of features. These are represented by the following feature type:

DepartedFeature	Features that indicate that a feature in a previous supply may no longer be relevant, for example, it may have been deleted or moved. This is used in COU data supply only.

* A description of COU data supply is provided in the OS MasterMap Topography Layer user guide.

Feature type attributes

This section defines the attributes associated with each OS MasterMap Topography Layer feature type and shows the expected occurrence in the data of the attributes for each feature type. This is shown in UML notation, that is if they are optional (0) and if they can be single (1) or multiple (*), with 'or' being represented by double dots (..).

NOTE: In some instances the XML schema definitions may differ from those shown. In particular a featureCode attribute is mandatory on all Topographic feature types but to harmonise the definition of core attributes with other layers it is defined as optional within the XML schema.

TopographicArea

Attribute	Occurrence
TOID	1
featureCode	1
version	1
versionDate	1
theme	1..*
calculatedAreaValue	1
changeHistory	1..*
descriptiveGroup	1..*
descriptiveTerm	0..*
make	0..1
physicalLevel	1
physicalPresence	0..1
polygon	1

TopographicLine

Attribute	Occurrence
TOID	1
featureCode	1
version	1
versionDate	1
theme	1..*
accuracyOfPosition	1
changeHistory	1..*
descriptiveGroup	1..*
descriptiveTerm	0..*
nonBoundingLine	0..1
heightAboveDatum	0..1
heightAboveGroundLevel	0..1
make	0..1
physicalLevel	1
physicalPresence	0..1
polyline	1

BoundaryLine

Attribute	Occurrence
TOID	1
featureCode	1
version	1
versionDate	1
theme	1..*
accuracyOfPosition	1
changeHistory	1..*
descriptiveGroup	1
descriptiveTerm	0..*
physicalLevel	1
physicalPresence	1
polyline	1

NOTE: There is only ever one descriptiveGroup with the value of 'Political Or Administrative' on a BoundaryLine feature. This is defined as multiple in the schema because the definition is shared by all feature types.

TopographicPoint

Attribute	Occurrence
TOID	1
featureCode	0..1
version	1
versionDate	1
theme	1..*
accuracyOfPosition	1
changeHistory	1..*
descriptiveGroup	1..*
descriptiveTerm	0..*
heightAboveDatum	0..1
heightAboveGroundLevel	0..1
make	0..1
physicalLevel	1
physicalPresence	0..1
point	1

CartographicSymbol

Attribute	Occurrence
TOID	1
featureCode	0..1
version	1
versionDate	1
theme	1..*
changeHistory	1..*
descriptiveGroup	1..*
descriptiveTerm	0..*
orientation	1
physicalLevel	1
physicalPresence	0..1
point	1
referenceToFeature	1

NOTE: referenceToFeature is only used for culverts and in that case it is singular and mandatory.

CartographicText

Attribute	Occurrence
TOID	1
featureCode	0..1
version	1
versionDate	1
theme	1..*
anchorPoint	1
changeHistory	1..*
descriptiveGroup	0..*
descriptiveTerm	0..*
make	0..1
physicalLevel	1
physicalPresence	0..1
textRendering	1
textString	1

DepartedFeature

Attribute	Occurrence
TOID	1
boundedBy	1
theme	1..*
reasonForDeparture	1
deletionDate	0..1

NOTE: DepartedFeatures *are only supplied in COU data. Please refer to the* COU section *for further details.*

Chapter 5   Attribute definitions

Attribute data types

Each attribute has one of the following data types. Each item of information in a complex attribute has one of the following data types.

Type	Description
Boolean	Value of 'true' or 'false'.
Date	Specifies a day within the Gregorian calendar in the format YYYY-MM-DD.
Integer	Any positive or negative whole number or zero.
MultiLine	A set of Polyline geometries. See chapter 7, Geometry and topology for details.
Point	A pair of easting and northing coordinates in metres, defining a horizontal location in the British National Grid spatial reference system. See chapter 7, Geometry and topology for details.
Polygon	A closed area defined by one outer boundary and zero or more inner boundaries. Each boundary is a closed ring of coordinate pairs, interpolated as for a polyline. See chapter 7, Geometry and topology for details.
Polyline	An ordered set of points that are connected with a straight line between each pair. See chapter 7, Geometry and topology for details.
Real	A floating point number.
Rectangle	A rectangle defined in the British National Grid.
String	An ordered set of characters. See annexe D for characters used in Topography Layer.
TOID	OS MasterMap unique feature identifier.

Simple attributes

A simple attribute is one that contains a single piece of information that may be qualified by associated information such as its units of measure. Geometric attributes are considered to be simple. The following simple attributes occur in OS MasterMap features.

Simple attribute name	Type	Description
accuracyOfHeightAboveDatum	String	The accuracy of a height above datum in metres at the 95% confidence level. Attribute format as for accuracyOfPosition with Unknown as a valid value. Part of the heightAboveDatum complex attribute.
accuracyOfHeightAboveGroundLevel	String	The accuracy of a height above ground level in metres at the 95% confidence level. Attribute format as for accuracyOfPosition with Unknown as a valid value. Part of the heightAboveGroundLevel complex attribute.
accuracyOfPosition	String	The accuracy of a horizontal position in metres at the 95% confidence level. See Attribute values:Accuracyofposition.
anchorPoint	Point	The coordinate position that a piece of text is positioned relative to. Measured in metres in the British National Grid spatial reference system.
anchorPosition	Integer	Part of the *textRendering* complex attribute. A number between 0 and 8 that specifies which part of the text is bound to the anchorPoint. See Attribute values:anchorPosition.

Simple attribute name	Type	Description
boundedBy	Rectangle	The minimum enclosing rectangle that encompasses a geometry. For departedFeatures this encompasses all geometries that a feature has had in its life cycle.
calculatedAreaValue	Real	The calculated area of an area feature polygon in square metres.
changeDate	Date	The date a change was made to the feature by an editor. Forms part of the feature's complex attribute changeHistory. *NOTE: This may not match the versionDate attribute.*
deletionDate	Date	The date the feature was deleted from the Ordnance Survey maintenance database.
descriptiveGroup	String	This is the primary classification attribute of a feature. It assigns a feature to one or more of 21 groups, most of which are categories of real-world topographic objects such as path, building or natural environment; others are categories of supportive or administrative features such as network or polygon closing geometry and political or administrative. In general, values of this attribute are not specific to particular feature types. Due to limitations in the source data from which OS MasterMap was created, there are some exceptions to this principle. For instance, the *descriptiveGroup* buildings or structure contains text describing or naming buildings and structures, while the topographic features have the *descriptiveGroup* values of building, glasshouse or structures.
descriptiveTerm	String	This attribute, if present, gives further classification information about the feature. A feature may have multiple *descriptiveTerm* attributes, but this is little used at present. Most features have zero or one *descriptiveTerm* attributes. A situation where multiple *descriptiveTerm* attributes are used is where area features have a *descriptiveGroup* with the value of Natural Environment. These features can have one or more *descriptiveTerm* attributes specifying the natural land cover types present in the area.
featureCode	String	Topographic features have a numerical feature code (a five-digit integer) assigned to each feature. This feature code is wholly determined by the feature type (see Feature type earlier in this chapter), the descriptive group(s) and the descriptive term(s). The feature code does not add any information to that contained in these attributes. The *physicalLevel*, *physicalPresence* and *make* attributes do not affect the feature code. The feature code itself is arbitrarily assigned, and is therefore not informative without the look-up table that gives the feature type and attribute values corresponding to each feature code. This table is in the section Attribute values:featureCode in chapter 5.

Simple attribute name	Type	Description
font	Integer	Part of the *textRendering* complex attribute. A value of 0, 1, 2 or 3 that can be used as a basis for determining which font to use when displaying the text. For example a user application could associate Verdana® with 2 to display all text with a font of 2 in Verdana.
height	Integer	Part of the *textRendering* complex attribute. The height of CartographicText. The height is expressed as the distance on the ground covered by the text, in metres.
heightAboveDatum	Real	The height of the feature above the Ordnance Datum Newlyn (ODN) vertical datum, in metres. Part of the *heightAboveDatum* complex attribute.
heightAboveGroundLevel	Real	Height of the feature above ground level, in metres. Part of the *heightAboveGroundLevel* complex attribute.
make	String	Where known indicates whether the real-world nature of the feature is man-made or natural. See Attribute values: make.
nonBoundingLine	Boolean	Indicates that a TopographicLine feature is not on the boundary of a TopographicArea feature.
orientation	Integer	The orientation of text or symbol features for cartographic placement, and for text forms part of the *textRendering* complex attribute. Given in tenths of a degree anticlockwise from due east (0–3599).
physicalLevel	Integer	This attribute states whether the feature is underground, obscured below normal cartographic level, at normal cartographic level, or overhead. Normal cartographic level is that perceived to be the normal surface level. Where area features overlie others – for example, bridges – they are at normal cartographic level and the features below them are recorded as obscured. Indicates the physical level of a feature with reference to the normal cartographic surface level. Only four values are used. -1 = Underground detail 49 = Obscured detail below the normal cartographic level 50 = Detail at the normal cartographic level 51 = Overhead detail above normal cartographic level
physicalPresence	String	This attribute indicates the nature of the object represented by the feature. This normal used for TopographicLine, for example, a value of obstructing indicates that the feature prevents pedestrian access, whereas a value of edge/limit means that the feature represents a change of surface type and does not generally impede access. This attribute is also used to identify admin boundary and inferred line features, and moveable area feature (for example, moveable cranes). See Attribute values:physicalPresence.

Simple attribute name	Type	Description
point	Point	A pair of easting and northing ordinates in metres, defining a horizontal location in the British National Grid spatial reference system.
polygon	Polygon	Specifies a polygon bounding an area feature. See polygon data type above, and see chapter 7, Geometry and topology for details.
polyline	Polyline/ Multiline	This is either a Polyline or a Multiline geometry. In TopographicLine features this will only be a Multiline if there is a problem with the geometry that is indicated by the broken metadata flag. See Metadata section. See chapter 7, Geometry and topology for details.
reasonForChange	String	The reason for a change made to a feature. Forms part of the feature's complex attribute *changeHistory*. See Attribute values:reasonForChange.
reasonForDeparture	String	This is set to 'Deleted' or 'Vacated' to indicate whether a feature has physically been deleted fro the database or is no longer relevant due to change in COU supply. See COU chapter.
referenceToFeature	TOID	A reference by TOID to a related feature. In topographic features this is used to point from a heighted feature to an unheighted feature. In cartographic symbol features, it is used to point from the symbol feature to the topographic feature to which it refers.
textString	String	Textual information which can be rendered using the textRendering attribute.
theme	String	A theme that the feature belongs to. See Theme definitions.
TOID	TOID	The unique 16-digit reference number of a feature. In the GML this is prefixed with 'osgb' to comply with XML identifier rules.
version	Integer	The version number of the feature (in the range 1 to 4294967295). This uniquely identifies a specific version of a feature with a given TOID.
versionDate	Date	The date on which this version of the feature became the current version. This is the date on which the feature was changed in the database, and is not the date of any associated real-world change.

Complex attributes

A complex attribute is an attribute that consists of two or more simple attributes that go together to convey some composite information about a feature.

changeHistory

Information about the change history of a feature and comprises the reason for the change (*reasonForChange* attribute) and the date for this change (*changeDate* attribute).

heightAboveGroundLevel

This defines the height above ground level of a feature (*heightAboveGroundLevel* attribute) and defines the accuracy of this where known (*heightAboveGroundLevel* attribute).

heightAboveDatum

This contains information about the height above OND (*heightAboveDatum* attribute) and where known the accuracy of this value (*accuracyOfHeightAboveDatum* attribute).

textRendering

Provides the information to graphically display a text string in harmony with the underlying map detail, and consists of anchorPosition, font, height and orientation.

Attribute metadata

A few attributes have associated metadata that provides extra information about some aspect of the attribute. These attributes are as follows:

Metadata	Values	Description	Attributes
broken	'true', 'false'	Indicates that there is a problem with the geometry. See chapter 7, Geometry and topology for details. The default value for this is 'false'.	polyline, polygon
srsName	'osgb:BNG'	Specifies that reference system of the geometry types (British National Grid).	point, polyline and polygon

Chapter 6   Attribute values

Attribute values

accuracyOfPosition

Value	Description
1.0 m	Urban data capture standards (1:1250 scale). This is the nominal accuracy of a point position at the 99% confidence level.
2.5 m	Rural data capture standards (1:2500 scale). This is the nominal accuracy of a point position at the 99% confidence level.
6.0 m	Rural overhaul data capture standards. This is the nominal accuracy of a point position at the 99% confidence level. This is the accuracy to be expected in areas of original 1:2500 scale overhaul mapping that have not been subject to positional accuracy improvement.
8.0 m	Mountain and moorland data capture standards (1:10 000 scale). This is the nominal accuracy of a point position at the 99% confidence level.
Unknown	The expected positional accuracy is unknown.

NOTE: These values differ by a small amount from the actual values; see Absolute accuracy for more details.

anchorPosition

Each text string that is captured with cartographic information has a location in the text string, known as its anchorPosition, which is bound to the digitised coordinate, known as its anchorPoint. There are nine defined locations, identified by the numbers 0–8, which are shown in the diagram below.
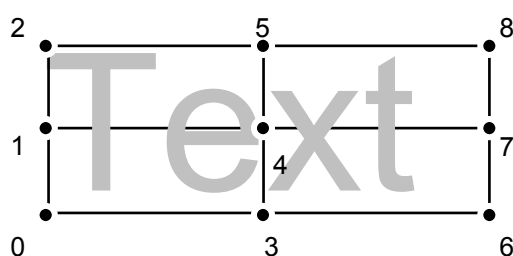
descriptiveGroup

Value	Description
Building	Features representing buildings (not including glasshouses).
Buildings Or Structure	Text features describing or naming buildings and structures.
Built Environment	Geographic areas and extents of man-made environments, terrain and communication links.
General Feature	General topographic features and minor detail.
General Surface	Features representing, describing or limiting areas of land not covered by buildings or structures.
Glasshouse	Features representing glasshouses.
Height Control	Features with height information.
Historic Interest	Features of heritage value.
Inland Water	Features representing, describing or limiting areas of water that are not tidal.
Landform	Features representing, describing or limiting areas of landform, for example, slopes or cliffs.

Value	Description
Natural Environment	Features representing geographic areas and extents of natural environments and terrain.
Network Or Polygon Closing Geometry	Features used to close polygons.
Path	Features representing and limiting the extent of pathways.
Political Or Administrative	Features representing political or electoral boundaries.
Rail	Features representing, describing or limiting the extents of railways.
Road Or Track	Features representing, describing or limiting the extents of roadways and tracks.
Roadside	Features representing, describing or limiting the extents of roadside detail.
Structure	Features representing, describing or limiting structures other than buildings or glasshouses.
Terrain And Height	Features giving information about the altitude at a location or changes of level of the ground surface.
Tidal Water	Features representing, describing or limiting areas of water that are tidal.
Unclassified	Topographic features that have not been given a description yet.

descriptiveTerm

The valid descriptiveTerm values appropriate to Topography Layer data are listed below.

descriptiveTerm	descriptiveTerm	descriptiveTerm
Archway	Foreshore	Road Name Or Classification
Bench Mark	Heath	Road Related Flow
Bottom Of Cliff	Inferred Property Closing Link	Rock
Bottom Of Slope	Marsh Reeds Or Salt marsh	Rock (Scattered)
Boulders	Mean High Water (Springs)	Rough Grassland
Boulders (Scattered)	Mean Low Water (Springs)	Scree
Boundary Half Mereing	Multi Surface	Scrub
Boundary Post Or Stone	Narrow Gauge	Site Of Heritage
Buffer	Nonconiferous Trees	Slope
Cliff	Nonconiferous Trees (Scattered)	Spot Height
Compound	Orchard	Standard Gauge Track
Coniferous Trees	Outline	Step
Coniferous Trees (Scattered)	Overhead Construction	Structure
Coppice Or Osiers	Parish	Switch
County	Parliamentary	Top Of Cliff
Course Of Heritage	Polygon Closing Link	Top Of Slope
Culvert	Positioned Boulder	Track
Direction Of Flow	Positioned Coniferous Tree	Traffic Calming
District	Positioned Nonconiferous Tree	Triangulation Point Or Pillar
Disused Feature	Public	Tunnel Edge
Division	Pylon	Unmade Path Alignment
Electoral	Ridge Or Rock Line	Upper Level Of Communication

The following table clarifies the usage of selected descriptive terms.

Value	Description
Archway	A covered passageway through a building or structure that vehicles can be driven through.
Compound	Indicates that the feature covers a geographical area and encompasses a mixture of other features.
Course Of Heritage	The alignment of a heritage or antiquity feature, for example, the course of a Roman road.
Inferred Property Closing Link	The feature has been inferred from the surrounding topographic features in order to divide large polygons.
Overhead Construction	A structure clear of the ground to allow access beneath it, for example, electricity transmission lines, cable car cables.
Upper Level Of Communication	Upper level of through public communication, for example, in multilevel shopping centres.

featureCode

The table below gives descriptions for each feature code value. The feature code itself is arbitrarily assigned and so carries no information without this table.

Where features have multiple descriptive groups and/or descriptive terms, a single feature code is allocated. If the feature has multiple descriptive groups, the descriptive group nearest the top of the table is used to assign the feature code.

In the descriptive term column of the following table, a blank box means multiple, other or none. This code is used for features with multiple descriptive terms, with no descriptive term, or with one descriptive term that does not have its own feature code.

The column feature type in the following table has been abbreviated by omitting the words topographic, boundary and cartographic from the feature type names. Where 'line' appears in this column it includes both TopographicLine and BoundaryLine feature types.

Descriptive group	Feature type	Descriptive term	Feature code
Building	Area		10021
Building	Line		10017
Building	Point		10022
Building	Symbol		10016
Building	Text		10020
Building	Line	Division	10018
Building	Line	Outline	10019
Buildings Or Structure	Area		10025
Buildings Or Structure	Line		10023
Buildings Or Structure	Point		10024
Buildings Or Structure	Symbol		10027
Buildings Or Structure	Text		10026
Buildings Or Structure	Text	Compound	10028
Built Environment	Area		10031
Built Environment	Line		10032
Built Environment	Point		10029
Built Environment	Symbol		10030
Built Environment	Text		10034
Built Environment	Text	Compound	10033
General Feature	Area		10044
General Feature	Line		10046
General Feature	Point		10045

Descriptive group	Feature type	Descriptive term	Feature code
General Feature	Symbol		10042
General Feature	Text		10043
General Feature	Point	Positioned Boulder	10051
General Feature	Point	Positioned Coniferous Tree	10050
General Feature	Point	Positioned Nonconiferous Tree	10048
General Feature	Line	Tunnel Edge	10041
General Surface	Area		10056
General Surface	Line		10052
General Surface	Point		10057
General Surface	Symbol		10055
General Surface	Text		10059
General Surface	Area	Multi Surface	10053
General Surface	Area	Step	10054
General Surface	Line	Step	10058
Glasshouse	Area		10062
Glasshouse	Line		10064
Glasshouse	Point		10063
Glasshouse	Symbol		10061
Glasshouse	Text		10060
Height Control	Area		10065
Height Control	Line		10071
Height Control	Point		10068
Height Control	Symbol		10070
Height Control	Text		10069
Height Control	Point	Bench Mark	10067
Height Control	Symbol	Bench Mark	10066
Historic Interest	Area		10076
Historic Interest	Line		10075
Historic Interest	Point		10080
Historic Interest	Symbol		10073
Historic Interest	Text		10074
Historic Interest	Text	Compound	10077
Historic Interest	Point	Site Of Heritage	10072
Inland Water	Area		10089
Inland Water	Line		10087
Inland Water	Point		10088
Inland Water	Symbol		10084
Inland Water	Text		10090
Inland Water	Text	Compound	10086
Inland Water	Line	Culvert	10092
Inland Water	Point	Culvert	10085
Inland Water	Symbol	Culvert	10091
Inland Water	Symbol	Direction Of Flow	10082
Inland Water	Line	Tunnel Edge	10083
Landform	Area		10093
Landform	Line		10095
Landform	Point		10094
Landform	Symbol		10106
Landform	Text		10102
Landform	Line	Bottom Of Cliff	10103

Descriptive group	Feature type	Descriptive term	Feature code
Landform	Line	Bottom Of Slope	10097
Landform	Area	Cliff	10099
Landform	Text	Compound	10105
Landform	Point	Disused Feature	10100
Landform	Line	Ridge Or Rock Line	10101
Landform	Area	Slope	10096
Landform	Line	Top Of Cliff	10104
Landform	Line	Top Of Slope	10098
Natural Environment	Area		10111
Natural Environment	Line		10110
Natural Environment	Point		10109
Natural Environment	Symbol		10108
Natural Environment	Text		10107
Network Or Polygon Closing Geometry	Area		10116
Network Or Polygon Closing Geometry	Line		10115
Network Or Polygon Closing Geometry	Point		10118
Network Or Polygon Closing Geometry	Symbol		10117
Network Or Polygon Closing Geometry	Text		10112
Network Or Polygon Closing Geometry	Line	Inferred Property Closing Link	10114
Network Or Polygon Closing Geometry	Line	Polygon Closing Link	10113
Path	Area		10123
Path	Line		10124
Path	Point		10120
Path	Symbol		10121
Path	Text		10122
Path	Area	Step	10119
Path	Line	Tunnel Edge	10125
Political Or Administrative	Area		10126
Political Or Administrative	Line		10137
Political Or Administrative	Point		10132
Political Or Administrative	Symbol		10134
Political Or Administrative	Text		10133
Political Or Administrative	Symbol	Boundary Half Mereing	10130
Political Or Administrative	Point	Boundary Post Or Stone	10129
Political Or Administrative	Line	County	10127
Political Or Administrative	Line	District	10131
Political Or Administrative	Line	Electoral	10128
Political Or Administrative	Line	Parish	10136
Political Or Administrative	Line	Parliamentary	10135
Rail	Area		10167
Rail	Line		10155
Rail	Point		10159
Rail	Symbol		10161
Rail	Text		10166

Descriptive group	Feature type	Descriptive term	Feature code
Rail	Line	Buffer	10160
Rail	Text	Compound	10156
Rail	Line	Narrow Gauge	10164
Rail	Line	Standard Gauge	10162
Rail	Line	Standard Gauge Track	10163
Rail	Point	Structure	10158
Rail	Symbol	Switch	10165
Rail	Line	Tunnel Edge	10157
Road Or Track	Area		10172
Road Or Track	Line		10175
Road Or Track	Point		10176
Road Or Track	Symbol		10170
Road Or Track	Text		10171
Road Or Track	Line	Public	10168
Road Or Track	Text	Road Name Or Classification	10169
Road Or Track	Symbol	Road Related Flow	10177
Road Or Track	Line	Tunnel Edge	10173
Roadside	Area		10183
Roadside	Line		10180
Roadside	Point		10182
Roadside	Symbol		10181
Roadside	Text		10178
Roadside	Point	Structure	10179
Structure	Area		10185
Structure	Line		10195
Structure	Point		10186
Structure	Symbol		10194
Structure	Text		10184
Structure	Area	Archway	10190
Structure	Line	Network Closing Link	10188
Structure	Area	Pylon	10193
Structure	Line	Pylon	10189
Structure	Point		10192
Structure	Point	Structure	10191
Structure	Area	Upper Level Of Communication	10187
Terrain And Height	Area		10199
Terrain And Height	Line		10201
Terrain And Height	Point		10200
Terrain And Height	Symbol		10196
Terrain And Height	Text		10198
Terrain And Height	Point	Air Height	10202
Terrain And Height	Point	Spot Height	10197
Tidal Water	Area		10210
Tidal Water	Line		10208
Tidal Water	Point		10209
Tidal Water	Symbol		10206
Tidal Water	Text		10204
Tidal Water	Text	Compound	10207
Tidal Water	Area	Foreshore	10203
Tidal Water	Text	Foreshore	10205

Descriptive group	Feature type	Descriptive term	Feature code
Tidal Water	Line	Mean High Water (Springs)	10211
Tidal Water	Line	Mean Low Water (Springs)	10212
Unclassified	Area		10217
Unclassified	Line		10216
Unclassified	Point		10215
Unclassified	Symbol		10214
Unclassified	Text		10213

Make

Value	Description
Manmade	Features that have been constructed, for example, areas of tarmac or concrete.
Multiple	Features that are a mixture of makes but are not depicted separately within the data, for example, the area around a dwelling may be a mixture of made and unmade surfaces.
Natural	Features that are not man-made but possibly man altered, for example, cliffs, areas of water and uncultivated/cultivated vegetation.
Unclassified	Features that have not had a make allocated.
Unknown	Features the make of which is not known.

physicalPresence

Value	Description
Boundary	Indicates that the feature is a political or administrative boundary, for example, European region, county, ward, civil parish and so on. *NOTE: The physicalPresence for a BoundaryLine will always be 'Boundary'.*
Closing	Feature not physically present. This may have been surveyed or inferred to close a polygon for reasons of classification or identity.
Edge/Limit	The feature is a physical definition of the edge of an area but does not obstruct pedestrian access.
Extent	The feature identifies a geographic area with unknown or poorly defined limits.
Indicator	The feature is a symbolic representation of the characteristics of physical features, for example, direction of river flow or site of a heritage feature.
Minor Detail	The feature is subsidiary to surrounding detail.
Moveable	Indicates that the object can move within the extent of the feature, for example, a moveable crane.
Network	Feature represented is part of a transport network, for example, narrow-gauge railway track.
Obstructing	Indicates that feature is normally more than 0.3 m high and forms an obstruction to passage on foot.
Overhead	This value indicates that the alignment of a feature is defined by something that is above the physical level of the feature. For example, this value is used if part of a building is on stilts. In that case, the PhysicalLevel attribute would be 50 (normal cartographic level).

reasonForChange

Value	Description
New	This is a new feature in the database.
Position	Feature has changed geometry and/or position due to an improvement in its absolute accuracy, that is its relationship to the National Grid (positional accuracy improvement). This type of feature change is not associated with real-world change.
Modified	The feature has been edited by an operator. Used in the following cases: 1 The geometry of a topographic feature is changed following real-world change. 2 The geometry of a non-topographic feature, for example, inferred link or BoundaryLine feature is changed. 3 A cartographic symbol feature is repositioned. 4 A CartographicText feature is repositioned.
Software	Feature has been adjusted by an automatic software process. Includes geometric adjustment, cleaning, squaring, paralleling (text and lines) and reversing direction of digitising.
Reclassified	The descriptive attributes of a feature have changed. The feature code may have changed.
TextChange	Text string of text feature has changed. Applied to text features where the text string has been: 1 Modified for a minor change in spelling, due to original error or name change, where text string is a distinctive name. 2 Modified for changes to a descriptive name due to original error or change of specification. 3 Modified by the addition or removal of an accent.
Restructured	New line feature(s) have been created from parts of existing feature(s). Applied to line features where: 1 The feature is split into two or more features. 2 Two or more features are joined together.
Attributes	Applied to features that have had only non-geometric attributes changed, except those covered by TextChange and Reclassified values.
Incomplete	The feature is incomplete. Identifies an incomplete line feature or an area that relates to the incomplete feature returning from a revision process. Incomplete line features are not used to construct polygons.

Chapter 7   Geometry and topology

Introduction

This chapter defines the geometric data types used by the attributes of the OS MasterMap Topography Layer. The treatment of features on the boundaries of data supply areas is specified. Unified Modelling Language (UML) diagrams are used to support the data type descriptions.

Features and spatial data types

The following table details the geometric attributes of OS MasterMap Topography Layer features. Each feature type has a spatial attribute shown in the second column. The data type of this attribute is given in the third column of the table. For full details of the feature types and their attribute sets, see chapter 4, Feature attribution.

Feature type	Spatial attribute	Data type of attribute
TopographicArea	polygon	Polygon
TopographicLine	polyline	Polyline or Multiline
BoundaryLine	polyline	Polyline or Multiline
TopographicPoint	point	Point
CartographicSymbol	point	Point
CartographicText	anchorPoint	Point

The following sections give more information on these data types.

Coordinate reference systems

The GML specification provides for the use of a variety of coordinate reference systems. At present only the British National Grid (BNG) is used in OS MasterMap.

British National Grid (BNG)

The BNG spatial reference system uses the OSGB36® geodetic datum and a single Transverse Mercator projection for the whole of Great Britain. Positions on this projection are described using easting and northing coordinates in units of metres.

The BNG is a horizontal spatial reference system only; it does not include a vertical (height) reference system. In OS MasterMap data heights are given by real valued feature attributes that are separate from the geometric feature attributes such as point, polyline, and polygon. The geometric attributes therefore contain horizontal geometry only. Several orthometric height datums are used in OS MasterMap data to define vertical spatial reference systems. The most common of these is Ordnance Datum Newlyn (ODN), which is used throughout mainland Britain. Height attributes in OS MasterMap features do not specify which vertical reference system is used.

Introductory material on the BNG and ODN and the full definition of the BNG (OSGB36 National Grid) is available on the Ordnance Survey OS Net® GPS site:

- http://www.ordnancesurvey.co.uk/oswebsite/gps/

Geometric data types

Point

A point is used to specify a single horizontal location by a coordinate pair in a given spatial reference system.

Example

A point defined in the BNG reference system has easting and northing ordinates in units of metres, where the easting is in the range 0 to 700000 and the northing is in the range 0 to 1300000. Ordinates are output to mm precision and are output in the data as float64 real types.

✕

(BNG: 176554.565, 987654.545)

Example class model

Point
(from BNG)
- easting : float64
- northing : float64
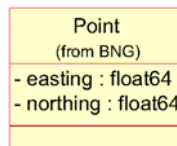
Polyline

A polyline is an ordered set of points that are interpolated linearly. A polyline may not intersect itself or contain repeated points.

Example

(BNG: 176579.205. 987663.345)

✕

✕   ✕

(BNG: 176554.565, 987654.545)   (BNG: 176575.685, 987654.545)

Example class model

Polyline	+points	Point
(from BNG)		(from BNG)
- nofPoints : int	2..n	- easting : float64
		- northing : float64
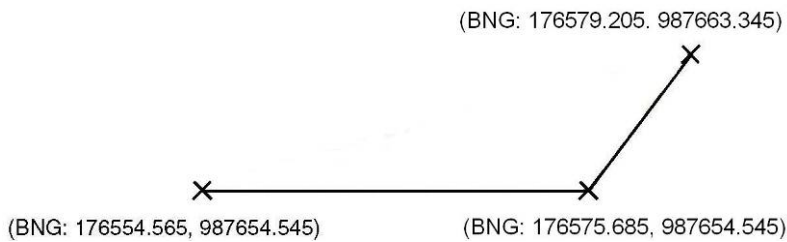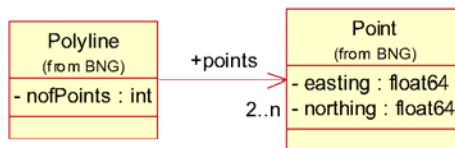
Multiline

A multiline is a collection of polyline geometries. There are no specific semantics or rules applied to the collection.

Example

Example class model

```
┌─────────────────┐  +polyline  ┌─────────────────┐
│   Multiline     │─────────────▶│    Polyline     │
│   (from BNG)    │              │   (from BNG)    │
├─────────────────┤        1..*  ├─────────────────┤
│ - nofPolylines : int │         │ - nofPoints : int │
└─────────────────┘              └─────────────────┘
```
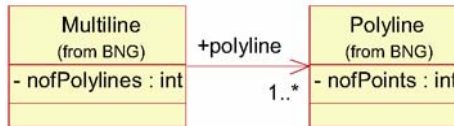
Rectangle

A rectangle is a pair of points that are used to define a rectangular area that is aligned to the National Grid. One point defines the minimum easting and northing of the rectangle, the other defines the maximum easting and northing.

Example

Example class model

```
┌─────────────┐              ┌──────────────────────┐
│  Rectangle  │              │        Point         │
│  (from BNG) │              │      (from BNG)      │
├─────────────┤─────────────▶├──────────────────────┤
│             │          2   │ - easting : float64  │
│             │              │ - northing : float64 │
└─────────────┘              └──────────────────────┘
```
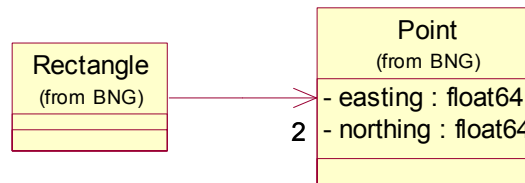
Geometric ring

A geometric ring is an ordered set of four or more points that are interpolated linearly, where the first point is the same as the last point. A ring is not permitted to intersect itself or contain other repeated points.

Example

(BNG: 176579.205. 987663.345)

(BNG: 176554.565, 987654.545)

(BNG: 176575.685, 987654.545)

Example class model

```
┌─────────────┐  +points     ┌──────────────────────┐
│    Ring     │              │        Point         │
│  (from BNG) │              │      (from BNG)      │
├─────────────┤─────────────▶├──────────────────────┤
│ - nofPoints : int │   4..n  │ - easting : float64  │
│             │              │ - northing : float64 │
└─────────────┘              └──────────────────────┘
```
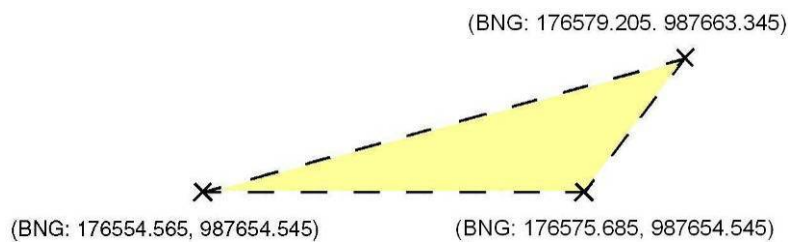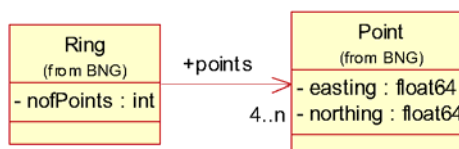
Polygon

A polygon is a single closed region on the spatial reference system projection plane, defined by a set of geometric rings that represent the boundaries. A polygon has one outer boundary and zero or more inner boundaries (holes in the polygon). The inner boundaries must not cross each other or contain other inner boundaries. Coordinates in outer boundaries are oriented in an anticlockwise direction; coordinates in inner boundaries are oriented in a clockwise direction.

Example
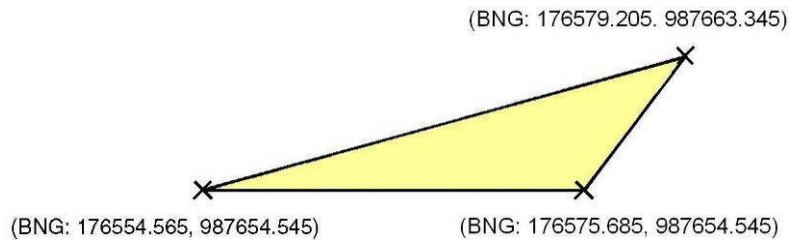
Example class model
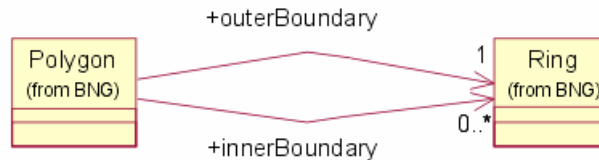
Topological structuring layers

Within the Topography Layer there are three topological structuring layers that determine how area features interact. A structuring layer contains features that do not cut across each other and are permitted to connect to each other spatially, sharing common geometry at their edges. For example, most topographic features participate in a single topological structuring layer, but features that are underground or above cartographic level, or that represent pylons, cliffs and slopes are not considered to interact with other features in the Topography structuring layer. During capture and maintenance of the data processes ensure that vertices of the geometry of features are coincident where they should be, so that the features topologically structure with each other. The full structuring layer definitions are given in the following table.

Structuring layer	Rule
Topography	Feature Type = 'TopographicLine' or 'TopographicArea' descriptiveGroup not equal to 'Landform' physicalLevel = '50' physicalPresence = 'Closing', 'Edge/Limit', 'Obstructing' or 'Overhead'
Landform	Feature Type = 'TopographicLine' or 'TopographicArea' descriptiveGroup = 'Landform' physicalPresence = 'Closing', 'Edge/Limit', 'Obstructing' or 'Overhead'
Pylons	Feature Type = 'TopographicLine' or 'TopographicArea' physicalLevel = '51' physicalPresence = 'Closing', 'Edge/Limit', 'Obstructing' or 'Overhead'
Boundaries	Feature Type = 'BoundaryLine' or 'CartographicSymbol' descriptiveGroup = 'Political Or Administrative'

Seamless data supply

A principle of OS MasterMap is that data is seamless, that is there are no fixed units of data supply. The nominal boundary of each packet of OS MasterMap data is defined by the user's data selection polygon, and by the data chunking method applied to break the supply into manageable units (if used).

With respect to the nominal boundary, data is supplied unclipped. This means that all features whose geometry overlaps the nominal boundary are supplied in their entirety.

Inconsistent features

There are occasions when data update will temporarily leave a feature in an inconsistent state. This occurs when neighbouring data are updated and the edits are applied to the seamless database at different times. According to the type of feature the following results may be realised:

Polygon boundary duplication

A break in a polygon boundary on the edge of an update area will cause neighbouring features to take on identical geometric properties and the broken line work to be removed from all polygon structuring. Once the update is completed the polygons will resume their respective boundaries.

Example

a) before update   b) during update   c) after update
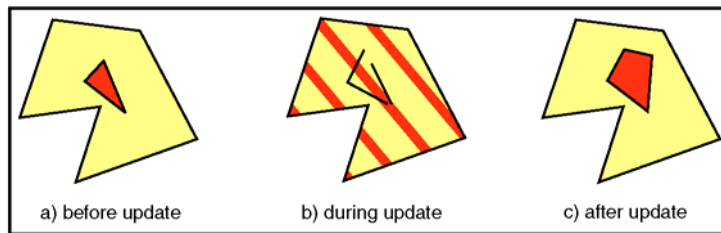
Disappearing polygon features

Where a polygon boundary is broken and there is no neighbouring polygon, the feature will be temporarily removed from supply. A query on this area between updates will not return the broken feature. A change-only query will return a departed feature to indicate that this feature has been removed from supply. Once the complete edit has been applied to the database the feature will be supplied with its original identity and history.

Broken lines

A polyline that crosses an updated area boundary may occasionally be broken by a partial update. Where this occurs the line is flagged as broken and the component parts output separately in a multiline geometry.

Intersecting polygon boundaries

Some polygons have inner boundaries that have a common point with each other or with the outer boundary. In this case each loop formed where the boundary returns to the common point is treated as a separate boundary.

Example
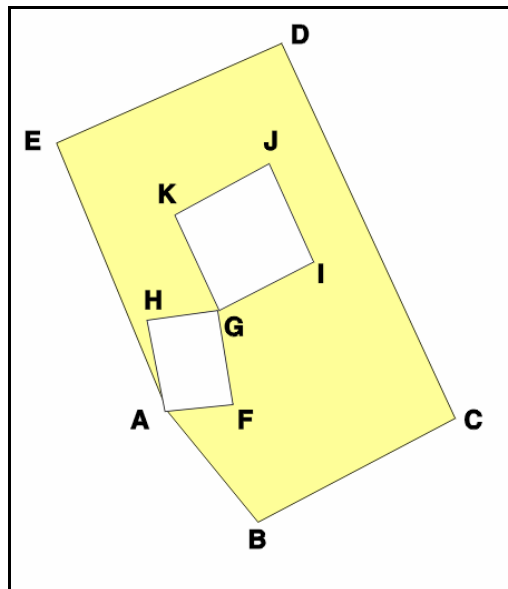
This polygon has an outer boundary (ABCDEA) and two inner boundaries (AHGFA and GKJIG).

Chapter 8 Change-only update (COU)

What is COU?

COU is data that is provided to bring a user's data holdings up to date with the most recent data available from Ordnance Survey. COU contains, for a user's defined area, only the features that are new or have changed, as well as departed features (those that have moved or been deleted from the user's data extent). Any feature that is new or changed since the COU date the user provides will be supplied in its latest version and departed features will indicate which features have been moved or deleted since that date.

COU will not provide intermediate versions of features that have existed between the previous order and the most recent version. Conversely, COU may supply departed information for features that that the user has never had, as they have appeared and subsequently disappeared between order dates.

COU data format

COU data is supplied in GML 2.1.2 format as detailed in COU section of chapter 9. Inclusion of features in the COU file is triggered by a new version of a feature appearing in the database with a version date between the previous and new order dates. In the data these new and modified features are represented in the same way they would for a full supply. Departed features are a specific feature type only present in COU supply and which represent features to be removed from a user's holding. The departed features records contain the TOID of the deleted feature, its bounding rectangle, its theme or themes and the date and reason for its departure. For further detail of these attributes and their content please see chapter 5 Attribute definitions.

Applying COU

All the information to update a user's holding is provided in the COU file. How this is processed by the user's software is obviously critical to ensuring that these changes are correctly applied. The basic principles that need to be followed to help ensure consistency are:

- Ensure initial supply or latest full supply or COU has been correctly loaded. This can be checked with the FVDS (Feature validation dataset), which gives a full list of the TOIDs that should be in a user's current holding at time of full supply.

- Ensure that the COU to be applied covers the period from the date of last supply ('Extraction date') through to the update date required.

- Apply the COU to existing holding. How this is applied will be dependent upon the user's system.

- Check holding using FVDS at appropriate intervals to ensure currency and consistency of data holdings.

Chapter 9   GML output format

The OS MasterMap Topography Layer product is supplied in GML (Geography Mark-up Language) version 2.1.2. This chapter describes how OS MasterMap is defined in GML. An understanding of XML (eXtensible Mark-up Language) and XML schema is required.

GML overview

Topography Layer related information

The following chapters contain the definitions of the data content supplied in GML format:

Chapter 4 Feature attribution

Chapter 7 Geometry and topology

Chapter 8 Change-only update

The following Open GIS Consortium (OGC) document is required to use this chapter:

Geography Markup Language v2.1.2

The XML specifications that GML is based on are available from the World Wide Web Consortium (W3C) website: http://www.w3.org.

Information about Unicode and UTF-8, the character encoding we have chosen, is available on the Unicode Consortium website: http://www.unicode.org/.

Use of examples

Any examples in this chapter that mention specific data content are to be taken as examples only. All data content is defined in the Topography Layer separately and the examples are not necessarily in harmony with the data specification.

Clarification of terms used in this chapter

Feature attribute

Attribute as defined in annexe A, OS MasterMap glossary, is called a feature attribute.

XML attribute

Attribute as used in an XML context is referred to as an XML attribute.

Property

Most feature attributes are encoded as GML properties – property means a GML property.

Query

Each GML output provided by Ordnance Survey is in response to a request for data from a data user. The original request from the data user may have been split into multiple requests based on supply requirements, for example, chunks. In this chapter each part of the data request is called a query.

Extent

As part of a request for data, the user can specify a polygon or rectangle that delimits the area of data required, which is called the query extent in this chapter. If the query has been broken down into parts (chunks) for reasons of supply, then the query extent will be the geometry of the partial query.

Format description

XML declaration

The XML declaration to all query results is:

<?xml version='1.0' encoding='UTF-8'?>

Document type

All information returned from a query is provided in an osgb:FeatureCollection. If no features lie inside a query then an empty collection is returned with its required collection properties.

The document defines the XML namespaces:

osgb	http://www.ordnancesurvey.co.uk/xml/namespaces/osgb
gml	http://www.opengis.net/gml
xsi	http://www.w3.org/2001/XMLSchema–instance
xlink	http://www.w3.org/1999/xlink

The location of the schema is defined as:
http://www.ordnancesurvey.co.uk/xml/namespaces/osgb
http://www.ordnancesurvey.co.uk/xml/schema/vX/OSDNFFeatures.xsd

The fid is set to the Ordnance Survey identifier given to the query.

For example:

<osgb:FeatureCollection

xmlns:osgb='http://www.ordnancesurvey.co.uk/xml/namespaces/osgb'

xmlns:gml='http://www.opengis.net/gml'

xmlns:xlink='http://www.w3.org/1999/xlink'

xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'

xsi:schemaLocation='http://www.ordnancesurvey.co.uk/xml/namespaces/osgb

http://www.ordnancesurvey.co.uk/xml/schema/vX/OSDNFFeatures.xsd'

fid='queryId'>

...

</osgb:FeatureCollection>

Query result properties

The gml:description element is the first property of the feature collection; this contains a copyright statement and the date of the query.

The gml:boundedBy element is the next property of the feature collection; this contains a gml:null element with the value of unknown.

The start time of the query is specified at GMT as a feature property. The name of the property is queryTime.

The following optional properties are provided for the osgb:FeatureCollection if they were provided as part of the query. The ordering of these properties is according to the order they appear in the table:

Name	Type	Format	Description
queryExtent	Geometric property	gml:Polygon or osgb:Rectangle (see geometric properties in Geometry).	The query extent provided as part of a spatial query.
queryChangeSinceDate	Date	CCYY-MM-DD	The date that was given as part of a change-only query.

For geographically chunked data, if there are features in the collection, the last element in the feature collection is an osgb:boundedBy element. This is a gml:Box defining the minimum bounding rectangle of all items in the collection, including the query extent. If the collection is empty, no osgb:boundedBy element is provided.

For example:

```
<osgb:FeatureCollection
xmlns:osgb='http://www.ordnancesurvey.co.uk/xml/namespaces/osgb'
xmlns:gml='http://www.opengis.net/gml'
xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
xmlns:xlink=http://www.w3.org/1999/xlink
xsi:schemaLocation='http://www.ordnancesurvey.co.uk/xml/namespaces/osgb
http://www.ordnancesurvey.co.uk/xml/schema/v3/OSDNFFeatures.xsd'
fid='queryId'>
        <gml:description>
                OrdnanceSurvey, (C) CrownCopyright. All rights reserved, 2002-05-16
        </gml:description>
        <gml:boundedBy><gml:null>unknown</gml:null></gml:boundedBy>
        <osgb:queryTime>2001-03-28T14:31:54</osgb:queryTime>
        <osgb:queryExtent'>
                <osgb:Rectangle srsName='osgb:BNG'>
                        <gml:coordinates>4000000,3094763 4000010,3094820</gml:coordinates>
                </osgb:Rectangle>
        </osgb:queryExtent>
        <osgb:queryChangeSinceDate>2001-01-31</osgb:queryChangeSinceDate>
        <!-features go here-->
        <osgb:boundedBy>
                <gml:Box srsName='osgb:BNG'>
                        <gml:coordinates>3999350,3089542 4005602,3095673</gml:coordinates>
                </gml:Box>
        </osgb:boundedBy>
</osgb:FeatureCollection>
```

Features

Each feature within the osgb:FeatureCollection is encapsulated in one of the following member elements according to its feature type:

Member element	Feature type
boundaryMember	BoundaryLine
cartographicMember	CartographicText, CartographicSymbol
topographicMember	TopographicPoint, TopographicLine, TopographicArea
departedMember	DepartedFeature (*see COU section later in this chapter*)

Each member element contains a single feature element that has the name of the feature type, for example, TopographicPoint, TopographicLine and so on.

The TOID of the feature is provided in the XML attribute field of the osgb:Feature element. A TOID has a maximum of 16 digits and is prefixed with osgb. The osgb prefix is required to form a valid XML ID type.

A feature element does not contain a name, description or boundedBy element.

For example:

```
<osgb:topographicMember>
        <osgb:TopographicPoint fid='osgb15789329786'>
                        ....
        </osgb:TopographicPoint>
</osgb:topographicMember>
```

Properties

Our application schema defines three main types of properties that are present inside a feature element. These are simple, complex and geometric properties.

The ordering of properties within a feature element is important as XML validation is reliant on elements being in a specified order. The order of properties is specified within the XML schema.

Each type of property may additionally have associated metadata encoded using an XML attribute. This metadata provides some qualification of the status or accuracy of the content provided in the attribute. To see what metadata is currently encoded in this way see Attribute metadata in chapter 5, Classification and attributes of OS MasterMap features.

Simple

A simple property is one that contains a single piece of non-geometric information. These properties correspond to the simple feature attributes defined (see chapter 5, Attribute descriptions). The value of each feature attribute is enclosed in an element that takes its name from the feature attribute.

A feature association is a special type of simple property that defines a relationship between one feature and another. The feature association is defined by the XML attribute xlink:href. This shall refer to a feature as if it was locally available, even though this is not guaranteed to be the case; that is, it shall be set to the character '#' followed by 'osgb' and then the TOID of the feature being referenced.

For example:

<osgb:descriptiveGroup>Rail</osgb:descriptiveGroup>
<osgb:calculatedAreaValue>13254</osgb:calculatedAreaValue>
<osgb:referenceToFeature xlink:href='#osgb5798572675343543'/>

Geometry

A geometric property is one that describes a specific geometry. All geometric properties are encoded according to the GML specification. We have extended the GML v2.1.2 specification to include a rectangle that is defined by two points. The first point defines the minimum coordinate whilst the second point defines the maximum coordinate.

All geometric properties are encoded by placing the GML geometry elements inside an element that takes its name from the feature attribute.

The XML attribute srsName shall be set to osgb:BNG (BNG stands for British National Grid), which uses eastings and northings specified in metres.

If a line is broken or a polygon has bled into another because of a partial update (see chapter 7, Geometry and topology) then the XML attribute broken shall be set to true. A line that is broken will be encoded as a gml:MultiLineString.

All polygon outer boundaries have an anticlockwise orientation and all inner boundaries have a clockwise orientation.

For example:

```
<osgb:anchorPoint>
        <gml:Point srsName='osgb:BNG'>
                <gml:coordinates>12365.563,8975.676</gml:coordinates>
        </gml:Point>
</osgb:anchorPoint>
<osgb:queryExtent>
        <osgb:Rectangle srsName='osgb:BNG'>
                <gml:coordinates>0,0 700000,1300000</gml:coordinates>
        </osgb:Rectangle>
</osgb:queryExtent>
<osgb:polyline broken='true'>
        <gml:MultiLineString srsName='osgb:BNG'>
                <gml:lineStringMember>
                        <gml:LineString>
                                <gml:coordinates>
                                        01289.2,970344.5 301300.0,970352.6
                                </gml:coordinates>
                        </gml:LineString>
                </gml:lineStringMember>
                <gml:lineStringMember>
                        <gml:LineString>
                                <gml:coordinates>
                                        301300.0,970354.1 301304.6,970369.8
                                </gml:coordinates>
                        </gml:LineString>
                </gml:lineStringMember>
        </gml:MultiLineString>
</osgb:polyline>
```

Complex

A complex property is one that contains more than one piece of information. These properties correspond to the complex feature attributes defined in chapter 5, Attribute descriptions.

Class model

The definition of a complex property here is recursive, so complex properties may be nested. Currently, within OS MasterMap this recursion is not used.
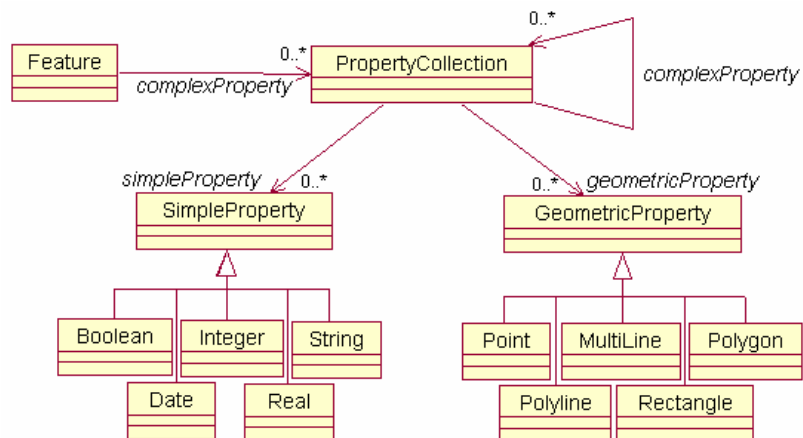
XML mapping

The complex property element takes its name from the complex feature attribute. Each part of a complex property shall be encoded as a simple, complex, geometry or topology property, as appropriate, inside the complex property element.

For example:

```
<osgb:textRendering>
        <osgb:anchorPosition>4</osgb:anchorPosition>
        <osgb:font>2</osgb:font>
        <osgb:height>24</osgb:height>
        <osgb:orientation>3476</osgb:orientation>
</osgb:textRendering>
<osgb:heightAboveDatum>
        <osgb:heightAboveDatum>3456</osgb:heightAboveDatum>
        <osgb:accuracyOfPosition>2.0m</osgb:accuracyOfPosition>
</osgb:heightAboveDatum>
```

COU

COU requires that information be provided for features that were present in a spatial query but no longer meet the query criteria. Such features may have changed theme so that they are no longer in any of the themes being requested, had their geometry modified between queries so that they no longer meet the spatial criteria, or been deleted. These features are represented using the DepartedFeature feature type. These are encoded the same way as other features.

For example:

```
<osgb:departedMember>
        <osgb:DepartedFeature fid='osgb1000000334379755'>
        <osgb:boundedBy><gml:Box srsName='osgb:BNG'>
        <gml:coordinates>278543.400,187665.800 278545.900,187666.450</gml:coordinates>
        </gml:Box></osgb:boundedBy>
        <osgb:theme>Roads Tracks And Paths</osgb:theme>
        <osgb:reasonForDeparture>Deleted</osgb:reasonForDeparture>
        <osgb:deletionDate>2005-07-16</osgb:deletionDate>
        </osgb:DepartedFeature>
</osgb:departedMember>
```

XML schema

Schema overview and Internet location

XML schemas are used to validate the format and content of the GML. The GML 2.1.2 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 Ordnance Survey application schemas, which are referenced by the data, are available from our website at http://www.ordnancesurvey.co.uk/xml/schema.

These schemas make use of XSDs (XML Schema Definitions) and DTDs (Document Type Definitions) produced by the W3C, which are available from the W3C website at http://www.w3.org/XML/1998/namespace.html.

NOTE: Some recent parsers now fail to validate OS MasterMap using these schemas as working practices and XML schema specification clarifications have led to GML 2.1.2 being rendered invalid.

Schema descriptions

The W3C-provided XSDs and DTDs are:

- **xml.xsd** – to allow the use of the xml:lang attribute for language qualification.
- **XMLSchema.dtd** – required by xml.xsd.
- **datatypes.dtd** – required by XMLSchema.dtd.

The OGC-provided schemas are:

- **feature.xsd** – the feature and property constructs.
- **geometry.xsd** – the geometric constructs such as polygon and point.
- **xlinks.xsd** – a schema based on the W3C XLINK recommendation provided by the OGC to make use of the XLINK constructs.

The Ordnance Survey application schemas are:

- **OSDNFFeatures.xsd** – the definition of the Ordnance Survey features and their properties.
- **OSComplexTypes.xsd** – the complex property types, including changeHistoryType.
- **OSSimpleTypes.xsd** – the basic property types, including descriptiveGroupType and accuracyOfPositionType.
- **OSMeasures.xsd** – the definition of measure qualified types used in OS MasterMap data.
- **OSQueryresult.xsd** – the definition of a query result with its properties.
- **OSGeometryTopology.xsd** – geometry and topology extensions to the GML 2.1.2 specification required by Ordnance Survey, including rectangles and polygon topology.

XML namespaces

xlink – http://www.w3.org/1999/xlink

gml – http://www.opengis.net/gml

osgb – http://www.ordnancesurvey.co.uk/xml/namespaces/osgb

xml – http://www.w3.org/XML/1998/namespace

Chapter 10   Cartographic styling

This chapter provides a guide to applying styles defined in annexe C, Cartographic style definitions, to Topography Layer features.

There is not a style provided for every feature, so some features are not drawn when the default styling is applied. This may be for one of several reasons, which include:

- Information is already rendered by another feature.

- Information is not easily positioned or styled.

- The information if drawn would be cluttered or confusing.

- The information is structural in the data but adds little value for the user by its cartographic depiction.

TopographicArea

Mapping table (no or single descriptiveTerm)

descriptiveGroup	descriptiveTerm	make	Style name
Building		Manmade	buildingFill
Building	Archway	Manmade	buildingFill
General Surface		Manmade	madeSurfaceFill
General Surface		Multiple	multipleSurfaceFill
General Surface		Natural	naturalSurfaceFill
General Surface		Unknown	madeSurfaceFill
General Surface	Multi Surface	Multiple	multipleSurfaceFill
General Surface	Step	Manmade	stepFill
Glasshouse		Manmade	glasshouseFill
Historic Interest			heritageFill
Inland Water		Natural	inlandWaterFill
Landform		Manmade	manmadeLandformPattern
Landform		Natural	naturalLandformPattern
Landform	Cliff	Natural	naturalLandformPattern
Landform	Slope	Manmade	manmadeLandformPattern
Natural Environment	Boulders	Natural	naturalEnvironmentFill and bouldersPattern
Natural Environment	Boulders (Scattered)	Natural	naturalEnvironmentFill and scatteredBouldersPattern
Natural Environment	Coniferous Trees	Natural	naturalEnvironmentFill and coniferousTreesPattern
Natural Environment	Coniferous Trees (Scattered)	Natural	naturalEnvironmentFill and scatteredConiferousTreesPattern
Natural Environment	Coppice Or Osiers	Natural	naturalEnvironmentFill and coppicePattern
Natural Environment	Heath	Natural	naturalEnvironmentFill and heathPattern
Natural Environment	Marsh Reeds Or Saltmarsh	Natural	naturalEnvironmentFill and marshPattern
Natural Environment	Nonconiferous Trees	Natural	naturalEnvironmentFill and nonconiferousTreesPattern
Natural Environment	Nonconiferous Trees (Scattered)	Natural	naturalEnvironmentFill and scatteredNonconiferousTreesPattern
Natural Environment	Orchard	Natural	naturalEnvironmentFill and orchardPattern
Natural Environment	Rock	Natural	naturalEnvironmentFill and rocksPattern
Natural Environment	Rock (Scattered)	Natural	naturalEnvironmentFill and scatteredRocksPattern
Natural Environment	Rough Grassland	Natural	naturalEnvironmentFill and roughGrassPattern
Natural Environment	Scree	Natural	naturalEnvironmentFill and screePattern
Natural Environment	Scrub	Natural	naturalEnvironmentFill and scrubPattern
Path		Manmade	pathFill
Path	Step	Manmade	stepFill
Rail		Manmade	railFill
Rail		Unknown	madeSurfaceFill
Rail		Natural	naturalSurfaceFill
Road Or Track		Manmade	roadFill
Road Or Track	Traffic Calming	Manmade	roadFill

descriptiveGroup	descriptiveTerm	make	Style name
Roadside		Manmade	madeSurfaceFill
Roadside		Unknown	madeSurfaceFill
Roadside		Natural	naturalSurfaceFill
Structure			structureFill
Structure		Manmade	structureFill
Structure	Overhead Construction	Manmade	structureFill
Structure	Pylon	Manmade	structureFill
Structure	Upper Level Of Communication	Manmade	structureFill
Tidal Water		Natural	tidalWaterFill
Tidal Water	Foreshore	Natural	tidalWaterFill and foreshorePattern

Property application logic (no or single descriptiveTerm)

This section defines the overall logic for applying the style. The order of the property in the condition list below is the order that it is applied; once applied the condition loop is exited.

This example below shows the notation for filtering using the descriptiveGroup and descriptiveTerm attributes; features with multiple descriptiveTerm attributes are discussed in the next subsection.

	if	*descriptiveGroup = 'Landform'*		*and*	
		descriptiveTerm = 'Pylon'		*then apply*	
if	descriptiveGroup = 'Building'		then apply	buildingFill
or	descriptiveTerm = 'Step'		then apply	stepFill
or	descriptiveGroup = 'Glasshouse'		then apply	glasshouseFill
or	descriptiveGroup = 'Historic Interest'		then apply	heritageFill
or	descriptiveGroup = 'Inland Water'		then apply	inlandWaterFill
or	descriptiveGroup = 'Natural Environment'		then apply	naturalEnvironmentFill
or	descriptiveGroup = 'Path'		then apply	pathFill
or	descriptiveGroup = 'Road Or Track'		then apply	roadFill
or	descriptiveGroup = 'Structure'		then apply	structureFill
or	descriptiveGroup = 'Tidal Water'		then apply	tidalWaterFill
or	descriptiveGroup = 'Unclassified'		then apply	unclassifiedFill
or	descriptiveGroup = 'Rail' and make = 'Manmade'		then apply	railFill
or	make = 'Manmade'		then apply	madeSurfaceFill
or	make = 'Natural'		then apply	naturalSurfaceFill
or	make = 'Unknown'		then apply	madeSurfaceFill
or	make = 'Multiple'		then apply	multipleSurfaceFill
else			apply	unclassifiedFill

Property application logic (multiple descriptiveTerm)

This section deals with the techniques for styling features with a descriptiveGroup value of Natural Environment that have multiple descriptiveTerm attributes. This section only provides a selection of combinations that were prominent in a study of descriptiveTerm occurrences on natural environment features. The patterns and symbols used are all defined in the style definitions section. The logic to apply is as follows:

	if	*descriptiveGroup = 'Natural Environment'*	*then*	
If	Number of descriptiveTerm attributes = 3	then apply	relevant pattern for type combinations (see Pattern definitions)
or	Number of descriptiveTerm attributes = 2	then apply	relevant pattern for type combinations (see Pattern definitions)
or	Number of descriptiveTerm attributes = 1	then apply	relevant pattern for type
else		apply	multiVegetationPattern (see Pattern definitions)

TopographicLine

Mapping table

descriptiveGroup	descriptiveTerm	physicalPresence	make	Style name
Building	Outline	Obstructing	Manmade	buildingLine
Building	Outline	Overhead	Manmade	buildingOverheadLine
Building	Division	Obstructing	Manmade	buildingLine
General Feature		Obstructing		defaultLine
General Feature	Overhead Construction			structureOverheadLine
General Feature		Edge/Limit		defaultDashedLine
General Feature		Minor Detail		defaultLine
General Feature	Tunnel Edge	Edge/Limit		defaultUndergroundLine
General Surface		Edge/Limit	Natural	defaultDashedLine
General Surface	Step	Edge/Limit	Manmade	defaultLine
General Surface	Step		Manmade	defaultLine
Historic Interest	Course Of Heritage			defaultLine
Historic Interest		Minor Detail		defaultLine
Inland Water	Tunnel Edge	Edge/Limit		defaultUndergroundLine
Inland Water		Minor Detail	Manmade	waterLine
Inland Water	Culvert		Manmade	waterLine
Inland Water		Edge/Limit		waterLine
Landform	Top Of Slope	Edge/Limit	Manmade	landformBoldLine
Landform		Edge/Limit	Natural	landformLine
Landform		Edge/Limit	Manmade	landformLine
Landform	Bottom Of Cliff	Edge/Limit	Natural	landformLine
Landform	Ridge Or Rock Line		Natural	landformLine
Landform	Top Of Cliff	Edge/Limit	Natural	landformBoldLine
Landform	Bottom Of Slope	Edge/Limit	Manmade	landformLine
Network Or Polygon Closing Geometry	Inferred Property Closing Link	Closing		closingLine
Network Or Polygon Closing Geometry	Polygon Closing Link	Closing		closingLine
Path	Tunnel Edge	Edge/Limit	Manmade	defaultUndergroundLine
Political Or Administrative	District	Boundary		districtLine
Political Or Administrative	Electoral	Boundary		electoralLine
Political Or Administrative	Parliamentary	Boundary		parliamentaryLine
Political Or Administrative	County	Boundary		countyLine
Political Or Administrative	Parish	Boundary		parishLine
Rail	Narrow Gauge	Network		narrowGaugeRailwayAlignmentLine
Rail	Standard Gauge Track			standardGaugeRailLine
Rail	Buffer		Manmade	defaultLine
Rail		Minor Detail		defaultLine
Rail	Tunnel Edge	Edge/Limit	Manmade	defaultUndergroundLine
Road Or Track	Tunnel Edge	Edge/Limit	Manmade	defaultUndergroundLine
Road Or Track	Public	Edge/Limit	Manmade	defaultDashedLine
Road Or Track	Traffic Calming	Edge/Limit	Manmade	defaultDashedLine
Roadside		Minor Detail		defaultLine
Structure		Minor Detail	Manmade	defaultLine
Structure	Pylon	Edge/Limit	Manmade	defaultLine
Tidal Water	Mean High Water (Springs)	Edge/Limit	Natural	waterBoldLine
Tidal Water	Mean Low Water (Springs)	Edge/Limit	Natural	waterDashedLine

Property application logic

This section defines the overall logic for applying the style. The order of the property in the condition list below is the order that it is applied; once applied the condition loop is exited.

If	descriptiveGroup = 'Building' and physicalPresence = 'Overhead'	then apply	buildingOverheadLine
or	descriptiveTerm = 'Overhead Construction'	then apply	structureOverheadLine
or	descriptiveTerm = 'Tunnel Edge'	then apply	defaultUndergroundLine
or	descriptiveGroup = 'Building'	then apply	buildingLine
or	descriptiveTerm = ' Mean High Water (Springs)'	then apply	waterBoldLine
or	descriptiveTerm = ' Mean Low Water (Springs)'	then apply	waterDashedLine
or	descriptiveGroup = 'Inland Water'	then apply	waterLine
or	descriptiveTerm = 'Narrow Gauge'	then apply	narrowGaugeRailwayAlignmentLine
or	descriptiveTerm = 'Standard Gauge Track'	then apply	standardGaugeRailLine
or	descriptiveGroup = 'Landform' and descriptiveTerm = 'Top Of Slope'	then apply	landformBoldLine
or	descriptiveGroup = 'Landform' and descriptiveTerm = 'Top Of Cliff'	then apply	landformBoldLine
or	descriptiveGroup = 'Landform' and descriptiveTerm = 'Bottom Of Slope'	then apply	landformLine
or	descriptiveGroup = 'Landform' and descriptiveTerm = 'Bottom Of Cliff'	then apply	landformLine
or	descriptiveTerm = 'Parish'	then apply	parishLine
or	descriptiveTerm = 'Electoral'	then apply	electoralLine
or	descriptiveTerm = 'County'	then apply	countyLine
or	descriptiveTerm = 'Parliamentary'	then apply	parliamentaryLine
or	descriptiveTerm = 'District'	then apply	districtLine
or	physicalPresence = 'Edge/Limit'	then apply	defaultDashedLine
or	physicalPresence = 'Closing'	then apply	closingLine
Else		apply	defaultLine

TopographicPoint

descriptiveGroup	descriptiveTerm	make	Style name
General Feature	Positioned Nonconiferous Tree	Natural	positionedNonconiferousTreeSymbol
General Feature	Positioned Coniferous Tree	Natural	positionedConiferousTreeSymbol
General Feature	Positioned Boulder	Natural	positionedBoulderSymbol
Historic Interest	Site Of Heritage		heritageSiteOfSymbol
Historic Interest	Structure		pointSymbol
Inland Water		Manmade	waterPointSymbol
Landform		Manmade	pointSymbol
Landform	Disused Feature	Natural	landformDisusedSymbol
Landform		Natural	pointSymbol
Political Or Administrative	Boundary Post Or Stone		boundaryPostSymbol
Rail	Switch		railwaySwitchSymbol
Rail	Structure		pointSymbol
Roadside			pointSymbol
Structure		Manmade	pointSymbol
Structure	Structure	Manmade	pointSymbol
Structure	Triangulation Point Or Pillar	Manmade	triangulationStationSymbol
Terrain And Height	Spot Height		spotHeightSymbol
Tidal Water			waterPointSymbol

CartographicText

descriptiveGroup	descriptiveTerm	Style hex value	Font style
Buildings Or Structure	Compound	000000	Normal
Buildings Or Structure		000000	Normal
Built Environment	Compound	000000	Normal
General Feature		000000	Normal
General Surface		000000	Normal
Height Control	Bench Mark	000000	Normal
Historic Interest		000000	*Italic*
Inland Water		0099FF	Normal
Landform		000000	Normal
Natural Environment		000000	Normal
Political Or Administrative		FF00FF	Normal
Rail		000000	Normal
Road Or Track	Road Name Or Classification	000000	Normal
Roadside		000000	Normal
Structure		000000	Normal
Terrain And Height		000000	Normal
Tidal Water	Foreshore	0099FF	Normal
Tidal Water		0099FF	Normal

CartographicSymbol

descriptiveGroup	descriptiveTerm	Style (from style guide)
Height Control	Bench Mark	benchMarkSymbol
Inland Water	Culvert	culvertSymbol
Inland Water	Direction Of Flow	flowArrowSymbol
Political Or Administrative	Boundary Half Mereing	boundaryMereingChangeSymbol
Road Or Track	Road Related Flow	roadFlowSymbol

Chapter 11   Data supply service

The OS MasterMap Topography Layer product is supplied via the OS MasterMap online service.

Themes

The product can only be purchased as an integrated set of all themes, although users can select which themes get delivered to them.

Format

The product is available in GML format only.

File compression is performed using the UNIX® gzip utility.

Chunking

Data can be supplied as geographic or non-geographic chunks. Geographic chunking is performed using standard Ordnance Survey National Grid (military grid).

Area selection

Customers can define their area of interest (AOI) using *predefined* or *customer-defined* polygons.

Predefined

National sets: A national set of the Topography Layer data is extracted from the database at the beginning of each six-week cycle and stored on hard disk to create customer orders from.

Partial sets: These will be created on demand. Customers are able to select from the following areas:

Countries	Postcode areas (for example, *SO*)
Counties	Govt Office Regions (England)
London boroughs	GB
Metropolitan districts	Metropolitan counties
Unitary authorities	M25 with 2 km buffer
Districts	

Customer defined

Customers may provide their own AOI in any standard GIS format.

File name convention

The convention determines that the file names are constructed from the following parts:

Order number	Only present for specific orders. Not present for national datasets.
Sequence number Military grid, lower left of the square	The sequence number is provided for non-geo-chunked files, incrementing from 000001. The alternative for geo-chunked files is the military grid reference of the lower-left corner of the square.
Chunk size	A number representing either geo-chunked grid size (for example, 25) or the non-geo-chunked file size (for example, 30)
Completion indicator	Valid only for geo-chunked data files. '*c*' indicates complete coverage and '*i*' indicates incomplete coverage in the grid square.
Format type	GML formatted data.

Full details will be found in the readme.txt accompanying the supply, but example file names for the available options are as follows:

Ordered, GML, geo-chunked	1234-SX2575-25c.gz
Ordered, GML, non-geo-chunked	1234-000001-30.gz
National, GML, geo-chunked	SX2575-25.gz
National, GML, non-geo-chunked	000001-30.gz

Annexe A   Glossary

The purpose of this chapter is to provide a glossary of terms used in the definition of products, services, licensing and other terms and conditions for OS MasterMap and OS MasterMap-based products.

Where terms refer to other terms within the glossary, they are connected by means of hyperlink to the relevant entries.

address, addressed premises
A permanent or non-permanent location with an address being a potential delivery point for Royal Mail. Examples of addressed premises are a house, a flat within a block of flats, a caravan site, a bollard to which several houseboats may be moored or an organisation occupying the whole or part of a building.

area of interest
The spatial extent that a customer has access to for a specific product. This area of interest may include a number of different spatial extents. The area of interest is an integral part of a TOID.

associated data
A dataset held by third parties that has been linked to features within OS MasterMap by means of identifiers (TOIDs).

attribute
Any item of information packaged in an OS MasterMap feature. The TOID and the geometry of the feature are both attributes of the feature. In GML and XML documents and specifications this term is used in a different way. This usage is noted in the OS MasterMap specification as appropriate.

attribute set
A group of attributes that can legitimately and logically be used together. Each feature type uses a particular attribute set.

cartographic surface level
Where one level of detail exists cartographic surface level is the same as general surface level. Where more than one level of detail exists the cartographic surface level is defined as the upper surface level of surveyed detail. All features surveyed at levels below cartographic surface level are captured using obscured detail or underground detail feature codes.

change-only update (COU)
The ability to supply to a customer only those features that have been created or changed since a specified date. Change-only supply includes a list of the TOIDS of departed features. In the OS MasterMap context the selection of changed data will be by change-since date (that is, all change since 00.00 hours on the specified date). It is not possible to select change since your last update. Therefore the customer's system must recognise repeatedly supplied features.

change-since date
The date used when requesting change-only update that indicates the date since which change is required. This will result in the supply of all change in the database, since the beginning (00.00 hours) of that day. It is also known as the extraction date.

chunking, chunk
The process of breaking up the area of interest into manageable, physical unit of supply (files) for the customer.

complex feature
A feature that is a collection of other features. An example could be a feature representing a river, composed of many area and line features representing parts of the river. Complex features are not currently a part of OS MasterMap.

contract
The agreement that a customer has for access to Ordnance Survey products and services. An OS MasterMap contract will be defined for each layer in terms of an area of interest, a list of themes (where appropriate), a time period, the number of terminals the data will be used on and a set of terms and conditions.

customer
An organisation or individual that makes use of Ordnance Survey's data supply facilities. This includes both direct sales customers of Ordnance Survey and Ordnance Survey Mapping and Data Centres as well as customers of Licensed Partners. It does not include anyone, or any organisation, that has access to Ordnance Survey material without charge.

dataset
An identifiable set of data that share common characteristics and that are managed as a subset of the data within a database.

delivery mechanism
The method of supply of data to a customer, for example, offline and online.

departed feature
A feature supplied as part of a COU supply that has either been deleted, has changed theme or has moved outside of the area of interest since the specified change date.

descriptive group
Attribute with descriptive information about the feature.

descriptive text
Descriptive text is defined within the Topography Layer as a generic name given to a feature where a distinctive name does not apply, for example, drain, boundary post or car park. Where the function or purpose of some features are not clear it is possible that they will be described with both a distinctive and descriptive name, for example, Sandy Lane (Track) or Old Thatched House (PH).

descriptive term
Attribute with descriptive information about the feature.

Digital National Framework (DNF)
A nationally consistent geographic referencing framework for Great Britain, comprising the National Grid and the National Geographic Database, that defines each geographic feature as it exists in the real world with a maintained unique reference allocated to each feature. The DNF is not a product; it is the framework on which our future products will be based.

distinctive text
Distinctive text is defined within the Topography Layer as a name given to a feature or place to distinguish it from other features or places of a similar nature, for example, River Avon, Hill Lane Surgery, Leeds or New Forest.

feature
An abstraction of a real-world object. It is not the real-world object itself. The OS MasterMap product is composed of discrete vector features, each of which has a feature type, geometry, and various feature attributes.

feature code
A numerical feature code (a five-digit integer) assigned to each feature with the Topography Layer. This feature code is wholly determined by the feature type, the descriptive group(s) and the descriptive term(s).

feature type
A high-level grouping of features that are treated in a similar way, for example, TopographicPoint features.

FTP
File transfer protocol. A protocol that allows a user on one computer to transfer files to and from another computer over a TCP/IP network such as the Internet.

generalised
Generalisation is the task of deriving maps or geodata products at a smaller scale, starting with more detailed existing mapping or source data. It involves exaggerating those aspects that are important for a particular purpose and scale, and removing irrelevant detail that would clutter the product and confuse the user.

georectified imagery
The georectification method is a very simple process that uses detail points visible in the image and on the map. The image is then warped to fit the map on those points. There is no information to ensure that the image fits the map elsewhere.

GML
Geography Mark-up Language. An XML encoding for the transport and storage of geographic information, including both the geometry and attributes of geographic features.

GPS
Global Positioning System. A satellite-based navigational system allowing the determination of any point on the Earth's surface with a high degree of accuracy, given a suitable GPS receiver.

ground surface level
The definition of ground surface level is usually self evident. Where more than one level of detail exists, ground surface level is defined as the lowest level of surveyable detail that can be surveyed in relation to other detail, but is not underground. Those features that are less than 0.3 m in height are given different coding to distinguish them from those above 0.3 m. These are usually features that do not pose an obstacle to pedestrians, such as kerbs.

history
In the context of geospatial data, the storage of deleted features and superseded versions of features.

identifier
An identifier that is primarily intended to provide unique and unambiguous feature identification for the purposes of exchanging feature-based information between computer systems, or associating data within a computer system.

indefinite detail
Indefinite detail is defined as those physical features that are significantly important and have an outline that is either liable to change or not defined precisely by any surveyable feature, for example, vegetation limits or man-made slopes. The nature of vegetation is shown, except for trees and scrub (bushes, brambles and undergrowth) growing in permanent water. Indefinite detail is not surveyed precisely. The accuracy of survey is related to the degree of definition on the ground.

independent supply
The supply structure used for OS MasterMap product feature geometry, in which the data is simplified into area, point and line features with no relationship between them, and with their own explicit geometry. For example, the bounding line between two areas will be represented three times, each with their own description of the geometry; once as a line feature, once as part of the bounding line of the first area feature, and once as part of the bounding line of the second area feature.

inferred links
Line features representing inferences about the real world rather than topographic statements of fact. These sensibly subdivide certain types of polygon feature where there is no appropriate topographic detail. They are normally used to:

- divide road sections;

- separate individual garden plots in residential areas where no dividing fence, hedge or wall exists;

- close junctions between roads and car parks or hard-standing areas; and

- close fields that have simple breaks in the hedge or wall rather than gates.

layer
A layer is a group of related OS MasterMap themes. A layer may consist of one or more themes. For instance, the Topography Layer is composed of nine themes, whereas the Address Layer contains three themes.

Licensed Partner
Any organisation that has entered into a formal licence agreement with Ordnance Survey to market map information or to incorporate map data with their application or service.

life cycles
The series of events that occur in the life of a real-world object or the OS MasterMap feature(s) that represents it. This will always include those events that result in creation and deletion, and may also include events that result in amendments or change.

line
The straight line segment between two given points.

line feature
The OS MasterMap abstraction of a linear object such as a wall or riverbank. The geometry of a line feature is a polyline – an ordered string of points. A particular line feature will often represent only part of an object. For example, a line feature may represent a linear entity (for example, part or all of a fence), the boundary of an area (for example, a house) or both (for example, a fence around a field).

local holdings
The situation where a customer has to hold and manage data that is supplied to them.

make
An attribute indicating whether the land surface is natural or man-made.

media supply
See offline supply.

metadata
Graphical or textual information about the content, quality, condition, origins, and characteristics of data.

National Geographic Database
The source of data for Ordnance Survey's products.

National GPS Network
The infrastructure of active and passive GPS reference stations that allow surveyors to determine precise coordinates in GPS and British National Grid spatial reference systems. The National GPS Network provides the physical definition of the British National Grid, the primary spatial reference system used in OS MasterMap. A central component of the Digital National Framework.

National Grid
A unique referencing system that can be applied to all Ordnance Survey maps of Great Britain at all scales. It provides an unambiguous spatial reference for any place or entity in Great Britain.

object-based data
Data in which one whole feature or a collection of whole features represents one real-world object, for example, a building or land parcel.

obscured level
Where more than one level of detail exists, all detail that meets the specification for capture positioned below cartographic surface level and either at or above ground surface level is captured as obscured detail. For example, detail under bridges is obscured whilst the bridge itself is normal cartographic level.

offline supply
The supply of data to a customer on physical media (examples: CD and DVD).

online supply
The supply of data to a customer using Internet technologies.

order
A request from a customer for the supply of data. The scope of an order may be constrained by an agreement for a period licence service.

Ordnance Datum Newlyn
The mean sea level at Newlyn in Cornwall calculated between 1915 and 1921, taken as a reference point for the height data on Ordnance Survey maps.

orthorectified imagery
The Imagery Layer is orthorectified. An ortho-image is achieved through a rigorous mathematical modelling of the camera position/direction and the terrain surface at the moment of image exposure. A software process is then able to move each of the pixels in the image individually into its correct National Grid position. The process eliminates displacements due to image perspective and pointing direction (the aircraft is moving and rolls around all axes) and topographic relief and therefore results in an image having the same geometric properties as a map projection.

overhead level
Features that exist above the ground surface level are defined as overhead detail. Examples of overhead features include electricity transmission lines, ropeways, gantries, ski lifts and some pipelines. This does not include bridges, which are classified as cartographic surface level. Overhead features, such as pipes within an industrial installation, are not shown where they form an integral part of that installation. Depiction of overhead features entering such installations is terminated at the first support or building within the perimeter.

parallel features
Where a fence, hedge or wall runs approximately parallel to another feature and so close that they cannot both be plotted correctly at scale of survey then only one feature is shown in OS MasterMap. In determining which feature to include, the following hierarchy is used by the surveyor:

- include if the feature is used to mere an administrative boundary;

- include if the feature appears to define the extent of a property; and

- include if the feature appears more important, for example, if there is a hedge next to a cattle protection fence, show the hedge.

permanent detail
Permanent detail is defined as physical features that it is reasonable to assume will remain in position for at least 10 years, taking into account the nature of construction or character. Natural relief features, such as hills, are not normally shown, although they may be named. Detail that is too small to be shown at scale, but is sufficiently important or prominent, is shown by a symbol. All administrative boundaries are shown.

physical level
An attribute giving an ordinal classification applied to vertical relationships between various features or within feature collections. In the OS MasterMap context, this is the level at which the feature lies (that is, underground, obscured, ground level, or a level above ground).

physical presence
A feature attribute indicating whether a feature represents an obstructing or non-obstructing real-world object. Also includes several other possible values.

point
A pair of coordinates.

point feature
A feature representing a real-world object. The geometry of a point feature is a single point (a pair of coordinates) with optional size and orientation.

polygon
Polygons are representations of areas. A polygon is defined as a closed line or perimeter that completely encloses a contiguous space and is made up of one or more lines.

polygon feature
A polygonised representation of a real-world object. A polygon feature may be used to represent a building, field, lake, administrative area and so on.

positional accuracy
The accuracy of the feature geometry relative to the coordinate spatial reference system.

real-world object
The real thing represented by a feature; for instance, a building, a section of fence, the boundary of a wood, a sharp change of gradient. For comparison, an example of a non-real-world object would be the line of an administrative boundary.

seamless database
In the OS MasterMap context, this refers to a geospatial database in which there is no concept of geographically splitting the data for management purposes. All features are complete, and there is no underlying tile structure.

spatial reference system
The term used in GML (and hence in OS MasterMap specifications) for the definition that allows each spatial position to be stated as a tuple. The only spatial reference system currently used in OS MasterMap is the British National Grid.

supply format
The file format in which the data is supplied to the customer.

surface make
See make.

symbology
The use of symbols.

theme
A collection of features that form some logical set, for example, buildings, water, land. In the OS MasterMap context, themes are a collection of feature that are either similar in nature or are related to specific usage. A single feature may be in one or more themes. They are designed to allow the easy selection of features. They do not form part of the classification of the feature. The theme exists purely to facilitate customer data selection.

tile
A self-contained rectangular subset of digital data, used to subdivide that data into manageable units. OS MasterMap data has no tiles.

TOID
An identifier that uniquely identifies every feature.

tuple (coordinate tuple)
A set of n coordinates representing a point in n-dimensional space, as defined by a spatial reference system. The British National Grid reference system is 2-D only, so coordinate tuples consist of an easting and a northing coordinate.

unclipped (data supply)
All features that wholly or partly lie within the query area are supplied, and the full geometry of each of these features will be included in the supply. OS MasterMap data is supplied unclipped.

underground level
Detail that has required excavation below the ground surface, either without disturbance of the ground surface above or where a replacement of the ground surface occurred after excavation. This does not include obscured detail, but it does include tunnels and subways. Because of their nature, tunnel alignments are not captured to the same accuracy as features on the surface.

unit of supply
The definition of the way in which the area of interest is broken up into manageable, physical units (files) for supply to the customer.

version date
The date the version of the feature was created by Ordnance Survey within their master database of OS MasterMap.

version number
A version number will identify that a feature has been altered. Version numbers will be allocated sequentially, with version 1 representing the creation of the feature.

XML
Extensible Mark-up Language. A flexible way to create common information formats and share both the format and the data on the Internet, Intranets and elsewhere. XML is extensible because, unlike HTML, the mark-up tags are unlimited and self-defining. XML is a simpler and easier to use subset of the Standard Generalised Mark-up Language (SGML), the standard for how to create a document structure.

Annexe B   GML examples

1   A typical TopographicArea feature as shown in the GML supply:

```
<osgb:topographicMember>
<osgb:TopographicArea fid='osgb1000002039092674'>
<osgb:featureCode>10053</osgb:featureCode>
<osgb:version>1</osgb:version>
<osgb:versionDate>2001-11-10</osgb:versionDate>
<osgb:theme>Land</osgb:theme>
<osgb:calculatedAreaValue>624.472992</osgb:calculatedAreaValue>
<osgb:changeHistory>
<osgb:changeDate>2000-07-25</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>General Surface</osgb:descriptiveGroup>
<osgb:descriptiveTerm>Multi Surface</osgb:descriptiveTerm>
<osgb:make>Multiple</osgb:make>
<osgb:physicalLevel>50</osgb:physicalLevel>
<osgb:polygon>
<gml:Polygon srsName='osgb:BNG'>
<gml:outerBoundaryIs><gml:LinearRing><gml:coordinates>
446177.050,108565.150 446178.400,108561.850
446181.750,108563.350 446185.100,108555.550
446202.000,108563.050 446219.650,108532.080
446224.800,108523.050 446230.400,108525.750
446229.000,108525.500 446228.800,108525.600
446228.600,108525.750 446228.500,108525.850
446228.300,108526.000 446228.150,108526.100
446228.000,108526.300 446227.600,108526.750
446227.300,108527.150 446227.000,108527.600
446226.800,108528.050 446226.650,108528.150
446226.300,108528.850 446224.800,108531.600
446224.300,108532.600 446223.800,108533.950
446222.950,108535.600 446221.050,108539.500
446218.400,108545.700 446215.200,108553.600
446210.000,108565.850 446206.350,108564.350
446202.900,108572.900 446206.450,108574.350
446203.650,108581.100 446195.550,108577.600
446197.600,108572.900 446191.800,108570.300
446191.400,108571.100 446184.400,108567.900
446182.650,108571.850 446175.600,108568.650
446177.050,108565.150 </gml:coordinates>
</gml:LinearRing></gml:outerBoundaryIs>
</gml:Polygon>
</osgb:polygon>
</osgb:TopographicArea>
</osgb:topographicMember>
```

2   The deletion of this feature is given in the COU file through reference to its TOID:

```
<osgb:departedMember>
<osgb:DepartedFeature fid='osgb1000002039092674'>
<osgb:boundedBy><gml:Box srsName='osgb:BNG'>
<gml:coordinates>446175.600,108523.050 446230.400,108581.100 </gml:coordinates>
</gml:Box></osgb:boundedBy>
<osgb:theme>Land</osgb:theme>
<osgb:reasonForDeparture>Deleted </osgb:reasonForDeparture>
<osgb:deletionDate>2006-04-01 </osgb:deletionDate>
</osgb:DepartedFeature>
</osgb:departedMember>
```
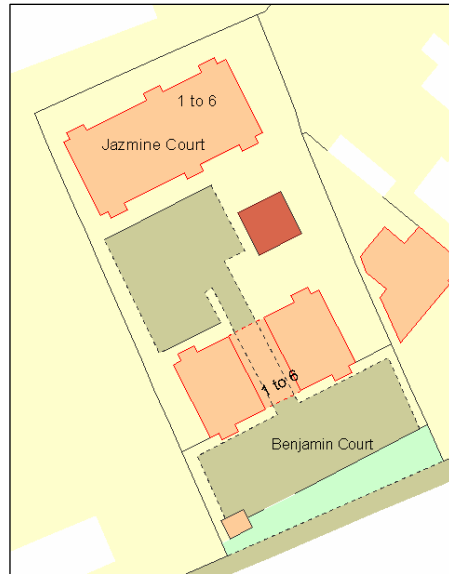
3   A new feature in the same area is added to a data holding in the COU file:


```
<osgb:topographicMember>
<osgb:TopographicArea fid='osgb1000002685008338'>
<osgb:featureCode>10021</osgb:featureCode>
<osgb:version>1</osgb:version>
<osgb:versionDate>2006-04-01</osgb:versionDate>
<osgb:theme>Buildings</osgb:theme>
<osgb:calculatedAreaValue>35.967400
</osgb:calculatedAreaValue>
<osgb:changeHistory>
<osgb:changeDate>2006-03-27</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Building</osgb:descriptiveGroup>
<osgb:make>Manmade</osgb:make>
<osgb:physicalLevel>50</osgb:physicalLevel>
<osgb:polygon>
<gml:Polygon srsName='osgb:BNG'>
<gml:outerBoundaryIs><gml:LinearRing><gml:coordinates>
446201.240,108556.040 446203.960,108550.700
446209.310,108553.420 446206.590,108558.760 446201.240,108556.040
</gml:coordinates></gml:LinearRing></gml:outerBoundaryIs>
</gml:Polygon>
</osgb:polygon>
</osgb:TopographicArea>
</osgb:topographicMember>
```

Annexe C   Cartographic style definitions

This annexe defines the default styles for the presentation of data within OS MasterMap. This specifies the colours, fonts, symbols and line styles used for visual display and printing of OS MasterMap. The styles are defined using the SVG (Scalable Vector Graphics) syntax.

Associated with this chapter is an SVG encoding of the styles for display in an SVG viewer, which is available from the style and XML examples section of our website.

See http://www.w3c.org for information on SVG. The SVG provided has only been tested with the browser plug-in provided by Adobe. Chapter 10, Cartographic styling, provides the required information to apply the styles of this chapter to features.

Style principles

These definitions covers data supplied to customers as part of OS MasterMap by Ordnance Survey.

The SVG document associated with this chapter is intended only as an aid to developers writing software to meet this specification.

A style is not provided for all of the information in OS MasterMap due to limitations of generic styling and cartographic information available for specific feature types.

Use of coordinates, stroke-widths and text sizes

All coordinates in this chapter are specified in eastings and northings in units of metres in the British National Grid. See chapter 7, Geometry and topology, for further information.

Stroke-widths and text sizes are also specified in units of metres on the ground.

Colour palette

Ordnance Survey has chosen to use colours that are consistent in the Internet environment. The particular colours used are defined with both their RGB and hexadecimal values in colour palette.

Text

The fonts selected by Ordnance Survey to display text are those that are commonly used with web browsers. A brief description as to how a font is used in SVG is given in the Fonts section.

Symbols

There are two different uses of symbols as defined in the following sections. A base symbol set is defined in the Shared Symbol Geometry section; these may be aggregated to form compound symbols as defined in Compound symbols. Patterns formed from repeating symbols on a predefined grid are specified in Pattern definitions.

Point symbols

Point symbols are used to represent the position of particular features within the data, such as a telephone call box or bollard. The symbol represents the location and type of feature.

Point symbols are applied to the visual representation by translating them to the location of the feature they are representing and rotating them, if the orientation attribute is present, by a given amount.

Fill symbols

Fill symbols are used to represent some attribution of a polygon feature and are distributed as a pattern fill across the polygon. For example, the symbol may represent information about the topographic surface such as the vegetation type.

Because of the overheads of applying pattern fills in many current software systems, it is noted that pattern fills are optional according to the user requirements and system capabilities. For example, if a user does not require each mixed vegetation type to be identified graphically it is envisaged that the multiVegetationPattern, as defined in Pattern definitions, may be used to represent all mixed vegetation features.

Line styles

Line styles are used to allow a user to distinguish between different types of linear feature, for example, distinctions may be made to emphasise:

- Obstructing detail
- Non-obstructing detail
- Underground detail
- Overhead detail
- Building outlines

- Water limits and linear features
- Landform detail
- Narrow-gauge railways
- Statutory boundaries.
- Polygon-closing features

Some lines, particularly those representing the road network, are drawn twice, using first a background style and then an overlay to achieve a multicoloured result. Styles have been defined in this way to produce effects like lines with outlines. This chapter defines the two components as separate styles. For example, a minor road is first drawn as a black background (carriagewayOutline) that is then overlain with a yellow foreground (minorRoadLine) as below:

The line styles are defined in Line styles.

Colour palette

	Hex (r,g,b)	Style name
	000000 (0,0,0)	
	333333 (51,51,51)	
	0000CC(0,0,204)	
	FF0000 (255,0,0)	
	009966 (0, 153, 102)	
	666666 (102,102,102)	
	669966 (102, 153, 102)	
	FF0099 (255, 0, 153)	
	FF9900 (255,153,0)	
	0099FF (0,153,255)	
	00CCFF (0, 204, 255)	
	999999 (153, 153, 153)	
	FFD7C3 (255,215,195)	structureFill
	DCDCBE (220,220,190)	heritageFill
	66CCCC (102, 204, 204)	
	FFFF00 (255, 255, 0)	
	FF00FF (255,0,255)	
	D2D2AA (210,210,170)	madeSurfaceFill, stepFill
	D7D7D7 (215,215,215)	roadFill
	CCCCCC (204,204,204)	pathFill, railFill
	FFDCAF (255,220,175)	buildingFill
	FFCC99 (255,204,153)	glasshouseFill
	D2FFB4 (210,255,180)	naturalSurfaceFill
	DCFFBE (220,255,190)	naturalEnvironmentFill
	BEFFFF (190,255,255)	inlandWaterFill, tidalWaterFill
	FFFFCC (255,255,204)	multipleSurfaceFill
	FFFFFF (255,255,255)	unclassifiedFill

Fonts

The gml2svg.xsl declares the use of the Arial® font for Ordnance Survey's standard depiction of text string. Within the XSL file the text colour is dictated by the descriptiveGroup, as is the use of italics. The textRendering complex attribute for a CartographicText feature contains information on the placement, orientation and height for rendering the text.

NOTE: A font value of 0, 1, 2, or 3 as used in Land-Line® is also provided that can optionally be used for depiction. The suggested fonts for cartographic display are:

0 – Lutheran (used for non-Roman antiquities)

1 – Normal – medium Roman font

2 – Light Roman font (used primarily for building numbers, Roman antiquities, and some administrative names particularly in 1:10 000 areas)

3 – Suppressed text not supplied in Land-Line due to space limitations.

Shared symbol geometry

boulderGeometry

```
<polyline points='-0.154,0.236 -0.111,0.365 -0.116,0.501 -
0.165,0.616 -0.170,0.627 -0.264,0.724 -0.490,0.826 -0.682,0.889
-0.885,0.900 -1.083,0.858 -1.264,0.767 -1.415,0.631 -1.521,0.466
-1.558,0.199 -1.538,-0.071 -1.462,-0.329 -1.333,-0.566 -1.156,-
0.771' />
<polyline points='1.755,-0.819 1.534,-0.804 0.832,-0.857 0.129,-
0.824 -0.450,-0.769 -1.032,-0.767 -1.612,-0.819' />
<polyline points='1.640,-0.804 1.620,-0.589 1.392,-0.388 1.122,-
0.248' />
<polyline points='0.311,-0.526 0.520,-0.573 0.732,-0.554 0.930,-
0.472 1.093,-0.335 1.097,-0.329 1.101,-0.323 1.105,-0.317
1.108,-0.311 1.111,-0.304 1.113,-0.298 1.115,-0.291 1.117,-0.284
1.118,-0.277 1.118,-0.270 1.119,-0.263 1.118,-0.256 1.118,-0.249
1.117,-0.242 1.115,-0.235 1.113,-0.229 1.111,-0.222 1.108,-0.216
1.105,-0.209 1.101,-0.203 1.097,-0.198 1.093,-0.192 1.088,-0.187
1.083,-0.182 1.078,-0.177 1.073,-0.173 1.067,-0.169 1.061,-0.165
1.054,-0.162 0.637,0.198 0.393,0.388 0.118,0.530 -0.165,0.616 -
0.178,0.619' />
```

circleFillGeometry

```
<circle r='0.05' cx='0' cy='0.0'/>
```

circleGeometry

```
<circle r='0.375' cx='0' cy='0'/>
```

coniferousTreeGeometry

Arc geometry:
```
<polyline points='0,1.45 0,-1.55' />
<path d='M-1.3,-0.95a2 2 0 0 1 1.3 1.05a2 2 0 0 1 1.3 -1.05' />
<path d='M-0.9,0.3a2 2 0 0 1 0.9 0.85a2 2 0 0 1 0.9 -0.85' />
```

Linear geometry:
```
<polyline points='0.000,1.45 0.000,-1.55'/>
<polyline points='-1.303,-0.970 -1.168,-0.927 -1.037,-0.874 -
0.909,-0.814 -0.785,-0.746 -0.666,-0.670 -0.552,-0.586 -0.444,-
0.496 -0.342,-0.398 -0.246,-0.295 -0.156,-0.185 -0.074,-0.070
0.000,0.050 0.074,-0.070 0.156,-0.185 0.246,-0.295 0.342,-0.398
0.444,-0.496 0.552,-0.586 0.666,-0.670 0.785,-0.746 0.909,-0.814
1.037,-0.874 1.168,-0.927 1.303,-0.970'/>
<polyline points='-0.890,0.296 -0.769,0.364 -0.652,0.440 -
0.541,0.523 -0.435,0.613 -0.335,0.709 -0.241,0.811 -0.154,0.919
-0.073,1.032 0.000,1.150 0.072,1.034 0.151,0.923 0.236,0.816
0.328,0.715 0.427,0.620 0.530,0.531 0.639,0.449 0.753,0.374
0.871,0.306'/>
```

crossGeometry

```
<polyline points='0.000,-0.775 0.000,0.775'/>
<polyline points='-0.775,0.000 0.775,0.000'/>
```

nonconiferousTreeGeometry

Arc geometry:
```
<path d='M0,-1.6L-0.2,-0.8a0.6 0.6 0 1 0 -0.8 0.86a0.55 0.55 0 0
0 0.45 0.89a0.56 0.56 0 0 0 1.1 -0.0a0.55 0.55 0 0 0 0.45 -
0.89a0.6 0.6 0 1 0 -0.8 -0.86L0,-1.6z' />
```

Linear geometry:
```
<polyline points='-1.074,0.097 -1.210,-0.031 -1.299,-0.194 -
1.334,-0.377 -1.312,-0.561 -1.233,-0.730 -1.106,-0.866 -0.944,-
0.957 -0.761,-0.993 -0.576,-0.972 -0.407,-0.894 -0.270,-0.768 -
0.269,-0.765 -0.068,-1.539 0.012,-1.539 0.193,-0.756 0.193,-
0.756 0.329,-0.887 0.499,-0.969 0.685,-0.993 0.870,-0.959
1.036,-0.869 1.164,-0.731 1.244,-0.561 1.267,-0.374 1.230,-0.189
1.138,-0.025 0.999,0.102 1.087,0.259 1.119,0.436 1.094,0.615
1.012,0.775 0.883,0.901 0.720,0.979 0.541,1.000 0.541,1.000
0.464,1.184 0.331,1.331 0.156,1.427 -0.040,1.461 -0.236,1.427 -
0.411,1.331 -0.544,1.184 -0.621,1.000 -0.801,0.978 -0.964,0.900
-1.093,0.773 -1.175,0.611 -1.199,0.431 -1.164,0.254 -
1.074,0.097'/>
```

Point symbols

airHeightSymbol

Style:
```
stroke:#0099ff; fill:none; stroke-width:0.087
```

Geometry:

`crossGeometry` (see Shared symbol geometry)

benchMarkSymbol

Style:
```
stroke:#000000;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points='0.707,0.707 0.0,0.0 0.707,-0.707'/>
<line x1='1.42' y1='0.0' x2='0.0' y2='0.0'/>
```

boundaryMereingChangeSymbol

Style:
```
stroke:#ff00ff;fill:none;stroke-width:0.087
```

Geometry:
```
<circle r='0.625' cx='2.875' cy='0.0'/>
<line x1='0.0' y1='0.0' x2='2.25' y2='0.0'/>
```

boundaryPostSymbol

Style:
```
stroke:#ff00ff;fill:none;stroke-width:0.087
```

Geometry:

circleGeometry (see Shared symbol geometry)

culvertSymbol

Style:
```
stroke:#0099ff;stroke-width:0.087
```

Geometry:
```
<polyline points='-0.5,0 0.5,0'/>
```

flowArrowSymbol

Style:
```
stroke:#0099ff;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points=`0.0,0.0 3.438,0.0' />
<polyline points='0.5,0.5 0.0,0.0 0.5,-0.5' />
<polyline points='3.35,0.5 2.85,0.0 3.35,-0.5' />
<polyline points='3.938,0.5 3.438,0.0 3.938,-0.5' />
```

heritageSiteOfSymbol

Style:
```
stroke:#000000;fill:none;stroke-width:0.087
```
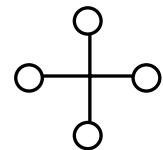
Geometry:
```
<polyline points='-2.25,0.0 2.25,0'/>
<polyline points='0.0,-2.25 0.0,2.25'/>
<circle r='0.625' cx='0' cy='2.875'/>
<circle r='0.625' cx='0' cy='-2.875'/>
<circle r='0.625' cx='2.875' cy='0'/>
<circle r='0.625' cx='-2.875' cy='0'/>
```

landformDisusedSymbol

Style:
```
stroke:#666666;fill:none;stroke-width:0.087
```

Geometry:

circleGeometry (see Shared symbol geometry)

pointSymbol

Style:
stroke:#000000;fill:#000000;stroke-width:0.087

Geometry:

circleGeometry (see Shared symbol geometry)

positionedBoulderSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:

boulderGeometry (see Shared symbol geometry)

positionedConiferousTreeSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:

coniferousTreeGeometry (see Shared symbol geometry)

positionedNonconiferousTreeSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:

nonConiferousTreeGeometry (see Shared symbol geometry)

railwaySwitchSymbol

Style:
stroke:#000000;stroke-width:0.087

Geometry:
<polyline points='-0.72,0 0.72,0'/>

roadFlowSymbol

Style:
stroke:#000000;fill:none;stroke-width:0.087
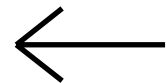
Geometry:
<polyline points='0.707,0.707 0.0,0.0 0.707,-0.707'/>
<line x1='2.42' y1='0.0' x2='0.0' y2='0.0'/>

spotHeightSymbol

Style:
stroke:#ff0000; fill:none; stroke-width:0.087

Geometry:

crossGeometry (see Shared symbol geometry)

triangulationStationSymbol

Style:
```
stroke:#000000;stroke-width:0.087
```

Geometry:
```
<polyline style='fill:none' points='0,-0.794 -1.375,-0.794
0.0,1.588 1.375,-0.794 0,-0.794'/>
<circle style='fill:#000000' r='0.0875' cx='0' cy='0.0'/>
```

waterPointSymbol

Style:
```
stroke:#0099ff;fill:#0099ff;stroke-width:0.087
```

Geometry:

circleGeometry (see Shared symbol geometry)

Fill symbols

boulderFillSymbol

Style:
```
stroke:#666666;fill:none;stroke-width:0.087
```

Geometry:
boulderGeometry (see Shared symbol geometry)

bushFillSymbol

Style:
```
stroke:#669966;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points='1,-1.493 -0.076,-1.493 0.452,-0.893 0.584,-
0.683 0.666,-0.449 0.693,-0.202 0.668,-0.088 0.596,0.005
0.491,0.058 0.284,0.082 0.078,0.046 -0.109,-0.046 -0.396,-0.268
-0.151,-0.027 0.055,0.248 0.218,0.55 0.335,0.873 0.35,1.027
0.311,1.176 0.224,1.303 0.016,1.447 -0.23,1.503 -0.391,1.485 -
0.54,1.421 -0.663,1.316 -0.866,1.029 -1.004,0.704 -1.07,0.358 -
1.061,0.006 -0.982,-0.383 -0.849,-0.758 -0.666,-1.111 -0.435,-
1.434 -0.396,-1.5' />
```

coniferousTreeFillSymbol

Style:
```
stroke:#669966;fill:none;stroke-width:0.087
```

Geometry:
coniferousTreeGeometry (see Shared symbol geometry)

coppiceFillSymbol

Style:
```
stroke:#669966;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points='0.000,-1.219 0.000,1.819' />
<polyline points='-0.567,1.330 -0.556,1.035 -0.492,0.746 -
0.377,0.473 -0.214,0.226 -0.010,0.012' />
<polyline points='-0.547,-1.248 -0.567,-0.817 -0.639,-0.392 -
0.762,0.022' />
<polyline points='0.010,0.627 0.207,0.736 0.372,0.890
0.494,1.078 0.567,1.292 0.586,1.516' />
<polyline points='0.489,-0.291 0.364,-0.768 0.313,-1.258' />
<polyline points='0.752,-0.789 0.653,-1.009 0.616,-1.248' />
```

foreshoreFillSymbol

Style:
```
stroke:#0099ff;fill:#0099ff;stroke-width:0.087
```

Geometry:
```
circleFillGeometry
```
(see Shared symbol geometry)

heathFillSymbol

Style:
```
stroke:#669966;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points='-1.487,-0.75 -1.601,-0.208' />
<polyline points='-0.996,-0.613 -1.121,0.405' />
<polyline points='-0.499,-0.545 -0.55,0.695' />
<polyline points='0,-0.536 0,0.732' />
<polyline points='0.499,-0.545 0.55,0.695' />
<polyline points='0.996,-0.613 1.121,0.405' />
<polyline points='1.487,-0.75 1.601,-0.208' />
```

manmadeLandformFillSymbol

Style:
```
stroke:#669966;fill:none;stroke-width:0.087
```

Geometry:
```
<polyline points='-1,-1 25,25'/>
```

marshFillSymbol

Style:
```
fill:none;stroke-width:0.087
```

Geometry:
```
<g style='stroke:#0099ff'>
<polyline points='4.258,0.000 0.452,0.000' />
<polyline points='-4.250,0.000 -0.444,0.000' />
<polyline points='-1.318,-0.517 1.317,-0.517' />
</g>
<g style='stroke:#669966;'>
<polyline points='-0.444,0.000 -0.534,1.0' />
<polyline points='0.452,0.000 0.541,1.0' />
<polyline points='-0.001,0.013 -0.001,1.177' />
<polyline points='0.880,0.000 1.118,0.675' />
<polyline points='-0.873,0.000 -1.110,0.675' />
<coppline points='-1.318,0.000 -1.440,0.269' />
<polyline points='1.326,0.000 1.447,0.269' />
</g>
```

multiVegetationFillSymbol

Style:
`stroke:#669966;fill:669966;stroke-width:0.087`

Geometry:
`circleFillGeometry` (see Shared symbol geometry)

naturalLandformFillSymbol

Style:
`stroke:#666666;fill:none;stroke-width:0.087`

Geometry:
`<polyline points='0,25 25,0'/>`

nonconiferousTreeFillSymbol

Style:
`stroke:#669966;fill:none;stroke-width:0.087`

Geometry:
`nonConiferousTreeGeometry`

(see Shared symbol geometry)

orchardFillSymbol

Style:
`stroke:#669966;fill:none;stroke-width:0.087`

Arc geometry:
`<path d='M0,0a0.7 0.7 0 1 0 -0.6 1.1a0.7 0.7 0 1 0 1.2,0.0a0.7 0.7 0 1 0 -0.6 -1.1z' />`
`<polyline points='0,-0.88 0,0' />`

Linear geometry:
`<polyline points='0.804,0.471 0.869,0.666 0.875,0.872 0.822,1.071 0.714,1.247 0.560,1.383 0.373,1.470 0.169,1.500 -0.034,1.470 -0.221,1.382 -0.374,1.245 -0.482,1.069 -0.535,0.870 -0.528,0.664 -0.462,0.469'/>`
`<polyline points='-0.462,0.469 -0.665,0.428 -0.847,0.332 -0.994,0.186 -1.092,0.005 -1.135,-0.197 -1.117,-0.403 -1.041,-0.594 -0.913,-0.756 -0.744,-0.875 -0.548,-0.939 -0.342,-0.945 -0.143,-0.891 0.033,-0.781 0.169,-0.626'/>`
`<polyline points='0.169,-0.626 0.169,-0.626 0.305,-0.780 0.480,-0.889 0.679,-0.943 0.885,-0.937 1.080,-0.873 1.249,-0.755 1.377,-0.594 1.453,-0.402 1.472,-0.197 1.430,0.004 1.332,0.186 1.187,0.331 1.006,0.429 0.804,0.471'/>`
`<polyline points='0.171,-0.629 0.171,-1.497'/>`

rockFillSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:
```
<polyline points='-1.85,-0.834 -0.812,-0.834 -0.588,-0.766 -
0.4,-0.508' />
<polyline points='1.824,-0.834 1.272,-0.78 0.908,-0.666 0.888,-
0.658 0.866,-0.65 0.846,-0.644 0.824,-0.64 0.802,-0.636 0.78,-
0.634 0.758,-0.632 0.736,-0.632 0.714,-0.634 0.692,-0.636 0.67,-
0.64 0.662,-0.642 0.648,-0.646 0.628,-0.654 0.438,-0.786 0.622,-
0.66 0.662,-0.642 1.126,-0.438 1.48,-0.298 1.494,-0.292 1.510,-
0.284 1.524,-0.276 1.536,-0.268 1.550,-0.258 1.562,-0.248
1.574,-0.236 1.586,-0.224 1.596,-0.212 1.606,-0.198 1.614,-0.186
1.622,-0.170 1.628,-0.156 1.636,-0.142 1.640,-0.126 1.644,-0.110
1.648,-0.094 1.650,-0.078 1.650,-0.062 1.652,-0.046 1.650,-0.012
1.646,0.022 1.64,0.054 1.634,0.086 1.624,0.118 1.612,0.15
1.6,0.18 1.584,0.21 1.568,0.24 1.55,0.268 1.368,0.488 1.356,0.5
1.344,0.512 1.33,0.522 1.316,0.532 1.302,0.54 1.286,0.548
1.27,0.554 1.254,0.56 1.238,0.566 1.222,0.568 1.206,0.572
1.188,0.574 1.172,0.574 1.154,0.574 1.138,0.572 1.12,0.57
1.104,0.566 1.088,0.562 1.072,0.556 1.056,0.55 0.4,0.298 -
0.014,0.136 0.218,0.236 0.582,0.398 0.594,0.404 0.604,0.410
0.616,0.418 0.626,0.424 0.636,0.432 0.644,0.442 0.654,0.452
0.662,0.46 0.668,0.472 0.676,0.482 0.682,0.494 0.688,0.504
0.692,0.516 0.696,0.528 0.698,0.552 0.702,0.554 0.704,0.566
0.704,0.58 0.704,0.592 0.704,0.604 0.702,0.618 0.7,0.63
0.696,0.642 0.692,0.654 0.688,0.666 0.682,0.678 0.676,0.69
0.67,0.7 0.662,0.71 0.552,0.842 0.546,0.848 0.54,0.854
0.532,0.858 0.526,0.864 0.518,0.868 0.512,0.872 0.504,0.874
0.496,0.878 0.488,0.88 0.48,0.882 0.472,0.884 0.464,0.886
0.454,0.886 0.446,0.886 0.438,0.886 0.43,0.884 0.422,0.882
0.414,0.88 0.406,0.878 0.398,0.876 0.39,0.872 0.198,0.812 -
0.378,0.6 -0.794,0.408 -1.046,0.316 -1.058,0.31 -1.07,0.302 -
1.082,0.292 -1.094,0.282 -1.104,0.272 -1.114,0.262 -1.122,0.25 -
1.13,0.238 -1.138,0.226 -1.144,0.212 -1.15,0.2 -1.156,0.186 -
1.16,0.172 -1.164,0.158 -1.166,0.142 -1.168,0.128 -1.168,0.114 -
1.168,0.098 -1.166,0.084 -1.164,0.07 -1.16,0.056 -1.158,0.042 -
1.152,0.028 -1.146,0.014 -1.134,-0.014 -1.118,-0.04 -1.102,-
0.066 -1.084,-0.09 -1.066,-0.114 -1.046,-0.138 -1.028,-0.156 -
1.01,-0.172 -0.99,-0.188 -0.968,-0.202 -0.946,-0.216 -0.924,-
0.228' />
```

roughGrassFillSymbol

Style:
stroke:#669966;fill:none;stroke-width:0.087

Geometry:
```
<polyline points='0.000,-0.349 0.000,0.349' />
<polyline points='-0.416,-0.422 -0.444,0.261' />
<polyline points='0.416,-0.422 0.444,0.261' />
<polyline points='0.883,-0.436 0.935,0.199' />
<polyline points='-0.883,-0.436 -0.935,0.199' />
<polyline points='-1.342,-0.459 -1.412,0.096' />
<polyline points='1.342,-0.459 1.412,0.096' />
<polyline points='-1.769,-0.492 -1.843,-0.049' />
<polyline points='1.769,-0.492 1.843,-0.049' />
<polyline points='-2.187,-0.633 -2.249,-0.334' />
<polyline points='2.187,-0.633 2.249,-0.334' />
```

screeFillSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:
```
<polyline points='1.449,-1.302 1.777,-0.894 1.582,-0.574 1.445,-
0.628 1.170,-0.400 0.895,-0.608 0.803,-0.734 0.924,-1.075 1.449,-
1.302' />
<polyline points='-1.033,-1.217 -0.841,-0.786 -1.085,-0.544 -
1.195,-0.625 -1.497,-0.488 -1.741,-0.865 -1.545,-1.136 -1.033,-
1.217' />
<polyline points='0.273,-1.429 0.834,-1.207 0.690,-0.817 0.460,-
0.673 0.022,-0.867 0.158,-1.005 0.104,-1.235 0.273,-1.429' />
<polyline points='-0.208,-1.302 -0.039,-0.986 -0.235,-0.768 -
0.636,-0.831 -0.844,-1.108 -0.864,-1.296 -0.555,-1.374 -0.392,-
1.255 -0.207,-1.302' />
<polyline points='-0.009,-0.716 0.228,-0.562 0.315,-0.122 -
0.050,0.053 -0.266,-0.147 -0.199,-0.244 -0.323,-0.492 -0.009,-
0.716' />
<polyline points='0.665,-0.616 0.960,-0.387 1.008,-0.077
0.949,0.078 0.652,0.002 0.579,-0.161 0.408,-0.206 0.421,-0.529
0.667,-0.614' />
<polyline points='-1.254,-0.316 -1.173,-0.016 -0.809,0.123 -
0.634,0.010 -0.665,-0.154 -0.814,-0.145 -1.006,-0.470 -1.254,-
0.316' />
<polyline points='-0.690,-0.763 -0.762,-0.731 -0.853,-0.531 -
0.697,-0.271 -0.402,-0.341 -0.433,-0.632 -0.690,-0.763' />
<polyline points='-0.428,-0.069 -0.136,0.125 -0.266,0.331 -
0.408,0.381 -0.643,0.214 -0.541,0.151 -0.546,0.017 -0.428,-0.069'
/>
<polyline points='-0.147,0.459 0.049,0.547 0.122,0.457
0.245,0.451 0.365,0.290 0.280,0.213 0.079,0.159 -0.135,0.283 -
0.147,0.459' />
<polyline points='0.658,0.150 0.953,0.220 0.877,0.387 0.758,0.419
0.714,0.518 0.505,0.477 0.480,0.308 0.658,0.150' />
<polyline points='-0.224,0.698 -0.210,0.940 0.047,0.990
0.191,0.892 0.137,0.671 -0.029,0.683 -0.063,0.624 -0.224,0.698'
/>
<polyline points='0.336,0.825 0.392,0.881 0.376,1.152 0.131,1.317
0.099,1.161 0.336,0.825' />
<polyline points='-0.521,0.432 -0.320,0.480 -0.304,0.705 -
0.463,0.796 -0.596,0.619 -0.521,0.432' />
<polyline points='0.345,0.487 0.570,0.575 0.426,0.791 0.243,0.712
0.306,0.653 0.275,0.561 0.345,0.487' />
<polyline points='-0.012,1.409 -0.021,1.589 0.049,1.624
0.007,1.696 -0.084,1.696 -0.187,1.542 -0.151,1.405 -0.012,1.405'
/>
<polyline points='-0.203,1.021 -0.054,1.084 -0.011,1.292 -
0.145,1.292 -0.271,1.226 -0.304,1.086 -0.203,1.021' />
<polyline points='0.370,-0.090 0.546,-0.048 0.550,0.132
0.426,0.220 0.311,0.067 0.370,-0.090' />
<polyline points='-0.350,0.850 -0.304,0.956 -0.363,1.016 -
0.467,1.028 -0.525,0.938 -0.480,0.866 -0.350,0.850' />
<polyline points='0.041,1.759 0.097,1.853 0.198,1.835 0.259,1.777
0.212,1.669 0.085,1.691 0.041,1.759' />
<polyline points='-0.742,0.247 -0.650,0.283 -0.614,0.371 -
0.622,0.410 -0.704,0.414 -0.783,0.369 -0.805,0.288 -0.740,0.247'
/>
<polyline points='0.103,1.400 0.198,1.457 0.164,1.569 0.068,1.585
0.031,1.477 0.103,1.4' />
<polyline points='1.102,-0.328 1.206,-0.301 1.211,-0.186 1.127,-
0.141 1.059,-0.228 1.102,-0.328' />
<polyline points='0.239,1.339 0.246,1.411 0.408,1.386 0.444,1.321
0.316,1.278 0.239,1.339' />
<polyline points='0.032,1.923 -0.009,2.025 0.050,2.109
0.147,2.063 0.139,1.950' />
<polyline points='0.032,1.919 0.139,1.948' />
```

smallBoulderFillSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:
<polyline points='-0.077,0.118 -0.055,0.183 -0.058,0.25 -
0.082,0.308 0.085,0.313 -0.131,0.362 -0.245,0.413 -0.341,0.445 -
0.443,0.45
0.542,0.429 0.632,0.384 -0.708,0.316 -0.760,0.233 -0.779,0.1 -
0.769, -0.036 -0.731,-0.170 -0.667,-0.283 -0.578,-0.386'/>
<polyline points='0.876,-0.41 0.767,-0.402 0.417,-0.429 0.065,-
0.412 0.225, 0.385 -0.516,-0.384 -0.806,-0.41'/>
<polyline points='0.82,-0.402 0.81,-0.295 0.696,-0.194 0.561,-
0.124'/>
<polyline points='0.155,-0.263 0.26,-0.286 0.366,-0.277 0.465,-
0.236 0.546, 0.167 0.548,-0.165 0.55,-0.162 0.553,-0.158 0.554,-
0.155 0.555,-0.152 0.556, -0.149 0.557,-0.146 0.558,-0.142
0.559,-0.139 0.559,-0.135 0.559,-0.132 0.559,-0.128 0.559,-0.125
0.559,-0.121 0.557,-0.117
0.557,-0.115 0.555, 0.111 0.554,-0.108 0.553,-0.105 0.550,-0.102
0.548,-0.099 0.547,-0.096 0.544,-0.094 0.542,-0.091 0.539,-0.089
0.535,-0.086 0.534,-0.085 0.530, 0.083 0.527,-0.081 0.318,0.099
0.196,0.194 0.059,0.265 -0.083,0.308 0.089,0.309'/>

smallBushFillSymbol

Style:
stroke:#669966;fill:none;stroke-width:0.087

Geometry:
<polyline points='0.5,-0.746 -0.038,-0.746 0.226,-0.446 0.292,-
0.341 0.333,-0.224 0.346,-0.101 0.334,-0.044 0.298,0.002
0.245,0.029 0.142,0.041 0.039,0.023 -0.054,-0.023 -0.198,-0.134
-0.075,-0.013 0.027,0.124 0.109,0.275 0.167,0.436 0.175,0.513
0.155,0.588 0.112,0.651 0.008,0.723 -0.115,0.751 -0.195,0.742 -
0.27,0.71 -0.331,0.658 -0.433,0.514 -0.502,0.352 -0.535,0.179 -
0.53,0.003 -0.491,-0.191 -0.424,-0.379 -0.333,-0.555 -0.217,-
0.717 -0.198,-0.75' />

smallConiferousTreeFillSymbol

Style:
stroke:#669966;fill:none;stroke-width:0.087

Arc geometry:
<polyline points='0,0.725 0,-0.775' />
<path d='M-0.65,-0.475a1 1 0 0 1 0.65 0.502a1 1 0 0 1 0.65 -
0.502' />
<path d='M-0.45,0.15a1 1 0 0 1 0.45 0.425a1 1 0 0 1 0.45 -0.425'
/>

Linear geometry:
<polyline points='0.0,0.725 0.0,-0.775'/>
<polyline points='-0.651,-0.485 -0.584,-0.463 -0.517,-0.437 -
0.454,-0.407 -0.392,-0.373 -0.333,-0.335 -0.276,-0.293 -0.222,-
0.248 -0.171,-0.199 -0.123,-0.147 -0.078,-0.092 -0.037,-0.035
0.0,-0.025 0.037,-0.035 0.078,-0.097 0.123,-0.147 0.171,-0.199
0.222,-0.248 0.276,-0.293 0.333,-0.335 0.392,-0.373 0.454,-0.407
0.517,-0.437 0.584,-0.463 0.651,-0.485'/>
<polyline points='-0.445,0.148 -0.384,0.182 -0.316,0.22 -
0.27,0.261 -0.217,0.306 -0.167,0.354 -0.120,0.405 -0.077,0.459 -
0.036,0.516 0.0,0.575 0.036,0.516 0.077,0.459 0.120,0.405
0.167,0.354 0.217,0.306 0.27,0.261 0.316,0.22 0.384,0.182
0.445,0.148'/>

smallNonconiferousTreeFillSymbol

Style:
stroke:#669966;fill:none;stroke-width:0.087

Arc geometry:
<path d='M0,-0.8L-0.1,-0.4a0.3 0.3 0 1 0 -0.4 0.43a0.275 0.275 0
0 0 0.225 0.445a0.28 0.28 0 0 0 0.55 -0.0a0.275 0.275 0 0 0
0.225 -0.445a0.3 0.3 0 1 0 -0.4 -0.43L0,-0.8z' />

Linear geometry:
<polyline points='-0.537,0.087 -0.552,0.076 -0.566,0.064 -
0.580,0.052 -0.592,0.038 -0.604,0.024 -0.615,0.008 -0.625,-0.007
-0.634,-0.024 -0.642,-0.041 -0.649,-0.058 -0.655,-0.076 -0.660,-
0.094 -0.663,-0.112 -0.665,-0.131 -0.667,-0.149 -0.667,-0.168 -
0.666,-0.187 -0.663,-0.205 -0.660,-0.224 -0.655,-0.242 -0.650,-
0.259 -0.643,-0.277 -0.635,-0.294 -0.626,-0.310 -0.616,-0.326 -
0.605,-0.341 -0.593,-0.356 -0.581,-0.369 -0.567,-0.382 -0.553,-
0.394 -0.538,-0.405 -0.522,-0.415 -0.506,-0.424 -0.489,-0.433 -
0.471,-0.440 -0.454,-0.445 -0.436,-0.450 -0.417,-0.454 -0.399,-
0.456 -0.380,-0.458 -0.362,-0.458 -0.343,-0.457 -0.324,-0.455 -
0.306,-0.451 -0.288,-0.447 -0.270,-0.441 -0.253,-0.435 -0.236,-
0.427 -0.219,-0.418 -0.203,-0.408 -0.188,-0.397 -0.173,-0.386 -
0.160,-0.373 -0.147,-0.359 -0.135,-0.345 -0.134,-0.344 -0.033,-
0.731 -0.006,-0.731 0.097,-0.339 0.097,-0.339 0.195,-0.423
0.320,-0.457 0.447,-0.436 0.553,-0.364 0.619,-0.253 0.632,-0.124
0.590,-0.003 0.500,0.090 0.554,0.203 0.552,0.329 0.495,0.441
0.395,0.516 0.271,0.539 0.213,0.658 0.109,0.740 -0.019,0.769 -
0.148,0.740 -0.252,0.658 -0.310,0.539 -0.434,0.516 -0.535,0.440
-0.592,0.327 -0.592,0.201 -0.537,0.087'/>

smallRockFillSymbol

Style:
stroke:#666666;fill:none;stroke-width:0.087

Geometry:
```
<polyline points='-0.925,-0.417 -0.406,-0.417 -0.294,-0.383 -0.200,-
0.254' />
<polyline points='0.912,-0.417 0.636,-0.390 0.454,-0.333 0.444,-0.329
0.433,-0.325 0.423,-0.322 0.412,-0.320 0.401,-0.318 0.390,-0.317
0.379,-0.316 0.368,-0.316 0.357,-0.317 0.346,-0.318 0.335,-0.320
0.331,-0.321 0.324,-0.323 0.314,-0.327 0.219,-0.393 0.311,-0.330
0.331,-0.321 0.563,-0.219 0.740,-0.149 0.747,-0.146 0.755,-0.142
0.762,-0.138 0.768,-0.134 0.775,-0.129 0.781,-0.124 0.787,-0.118
0.793,-0.112 0.798,-0.106 0.803,-0.099 0.807,-0.093 0.811,-0.085
0.814,-0.078 0.818,-0.071 0.820,-0.063 0.822,-0.055 0.824,-0.047
0.825,-0.039 0.825,-0.031 0.826,-0.023 0.825,-0.006 0.823,0.011
0.820,0.027 0.817,0.043 0.812,0.059 0.806,0.075 0.800,0.090
0.792,0.105 0.784,0.120 0.775,0.134 0.684,0.244 0.678,0.250
0.672,0.256 0.665,0.261 0.658,0.266 0.651,0.270 0.643,0.274
0.635,0.277 0.627,0.280 0.619,0.283 0.611,0.284 0.603,0.286
0.594,0.287 0.586,0.287 0.577,0.287 0.569,0.286 0.560,0.285
0.552,0.283 0.544,0.281 0.536,0.278 0.528,0.275 0.200,0.149 -
0.007,0.068 0.109,0.118 0.291,0.199 0.297,0.202 0.302,0.205
0.308,0.209 0.313,0.212 0.318,0.216 0.322,0.221 0.327,0.226
0.331,0.230 0.334,0.236 0.338,0.241 0.341,0.247 0.344,0.252
0.346,0.258 0.348,0.264 0.349,0.271 0.351,0.277 0.352,0.283
0.352,0.290 0.352,0.296 0.352,0.302 0.351,0.309 0.350,0.315
0.348,0.321 0.346,0.327 0.344,0.333 0.341,0.339 0.338,0.345
0.335,0.350 0.331,0.355 0.276,0.421 0.276,0.421 0.273,0.424
0.270,0.427 0.266,0.429 0.263,0.432 0.259,0.434 0.256,0.436
0.252,0.437 0.248,0.439 0.244,0.440 0.240,0.441 0.236,0.442
0.232,0.443 0.227,0.443 0.223,0.443 0.219,0.443 0.215,0.442
0.211,0.441 0.207,0.440 0.203,0.439 0.199,0.438 0.195,0.436
0.099,0.406 -0.189,0.300 -0.397,0.204 -0.523,0.158 -0.529,0.155 -
0.535,0.151 -0.541,0.146 -0.547,0.141 -0.552,0.136 -0.557,0.131 -
0.561,0.125 -0.565,0.119 -0.569,0.113 -0.572,0.106 -0.575,0.100 -
0.578,0.093 -0.580,0.086 -0.582,0.079 -0.583,0.071 -0.584,0.064 -
0.584,0.057 -0.584,0.049 -0.583,0.042 -0.582,0.035 -0.580,0.028 -
0.579,0.021 -0.576,0.014 -0.573,0.007 -0.567,-0.007 -0.559,-0.020 -
0.551,-0.033 -0.542,-0.045 -0.533,-0.057 -0.523,-0.069 -0.514,-0.078
-0.505,-0.086 -0.495,-0.094 -0.484,-0.101 -0.473,-0.108 -0.462,-
0.114' />
```

Compound symbols

The symbols defined in the section Fill symbols may be combined to form aggregated symbols. In order to do this the coordinates of the original symbols are translated by a specified offset. Compound symbols may be used as components to make up other compound symbols.

For example:

To define a scrub fill symbol we combine the bushFillSymbol and smallBushFillSymbol. The translations used to do this are:

- bushFillSymbol: translate(-0.8 1)

- smallBushFillSymbol: translate(1.2 –1.2)

The combined result, a scrubFillSymbol, is then drawn as:

To define the mixed vegetation type of scrub and rough grass the scrubFillSymbol produced above is used in conjunction with the roughGrassFillSymbol:

- roughGrassFillSymbol: translate(-1 -1)

- scrubFillSymbol: translate(1 1)

To produce a roughGrassAndScrubFillSymbol:

Definitions

Transformation 1

Symbol 1 – translate(-1 0.3)

Symbol 2 – translate(1.75 -1)

Name: bouldersFillSymbol

Symbol 1: boulderFillSymbol

Symbol 2: smallBoulderFillSymbol

Name: rocksFillSymbol

Symbol 1: rockFillSymbol

Symbol 2: smallRockFillSymbol

Transformation 2

Symbol 1 – translate(-0.8 1)

Symbol 2 – translate(1.2 –1.2)

Name: coniferousTreesFillSymbol

Symbol 1: coniferousTreeFillSymbol

Symbol 2: smallConiferousTreeFillSymbol

Name: nonconiferousTreesFillSymbol

Symbol 1: nonconiferousTreeFillSymbol

Symbol 2: smallNonconiferousTreeFillSymbol

Name: scrubFillSymbol

Symbol 1: bushFillSymbol

Symbol 2: smallBushFillSymbol

Transformation 3

Symbol 1 – translate(-1 -1)

Symbol 2 – translate(1 1)

Name: coniferousTreesAndScrubFillSymbol

Symbol 1: coniferousTreesFillSymbol

Symbol 2: scrubFillSymbol

Name: heathAndScrubFillSymbol

Symbol 1: heathFillSymbol

Symbol 2: scrubFillSymbol

Name: heathAndScatteredRocksFillSymbol

Symbol 1: heathFillSymbol

Symbol 2: smallRockFillSymbol
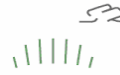
Name: nonconiferousTreesAndConiferousTreesFillSymbol

Symbol 1: nonconiferousTreesFillSymbol

Symbol 2: coniferousTreesFillSymbol

Name: nonconiferousTreesAndCoppiceFillSymbol

Symbol 1: nonconiferousTreesFillSymbol

Symbol 2: coppiceFillSymbol

Name: nonconiferousTreesAndScrubFillSymbol

Symbol 1: nonconiferousTreesFillSymbol

Symbol 2: scrubFillSymbol

Name: nonconiferousTreesAndScatteredRocksFillSymbol

Symbol 1: nonconiferousTreesFillSymbol

Symbol 2: smallRockFillSymbol

Name: coniferousTreesAndScatteredRocksFillSymbol

Symbol 1: coniferousTreesFillSymbol

Symbol 2: smallRockFillSymbol

Name: roughGrassAndBouldersFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: bouldersFillSymbol

Name: roughGrassAndConiferousTreesFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: coniferousTreesFillSymbol

Name: roughGrassAndHeathFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: heathFillSymbol

Name: roughGrassAndMarshFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: marshFillSymbol

Name: roughGrassAndNonconiferousTreesFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: nonconiferousTreesFillSymbol

Name: roughGrassAndRocksFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: rocksFillSymbol

Name: roughGrassAndScatteredBouldersFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallBouldersFillSymbol

Name: roughGrassAndScatteredNonconiferousTreesFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallNonconiferousTreeFillSymbol

Name: roughGrassAndScatteredRocksFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallRockFillSymbol

Name: roughGrassAndScrubFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: scrubFillSymbol

Name: scatteredNonconiferousTreesAndScatteredConiferousTreesFillSymbol

Symbol 1: smallNonconiferousTreeFillSymbol

Symbol 2: smallConiferousTreeFillSymbol

Name: scrubAndScatteredNonconiferousTreesFillSymbol

Symbol 1: scrubFillSymbol

Symbol 2: smallNonconiferousTreeFillSymbol

Transformation 4

Symbol 1 – translate(-2 -2)

Symbol 2 – translate(-0.5 0.5)

Symbol 3 – translate(2 2)

Name: rocksRoughGrassAndBouldersFillSymbol

Symbol 1: rocksFillSymbol

Symbol 2: roughGrassFillSymbol

Symbol 3: bouldersFillSymbol

Name: roughGrassNonconiferousTreesAndConiferousTreesFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: nonconiferousTreesFillSymbol

Symbol 3: coniferousTreesFillSymbol

Name: roughGrassNonconiferousTreesAndScrubFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: nonconiferousTreesFillSymbol

Symbol 3: scrubFillSymbol

Name: scrubNonconiferousTreesAndCoppiceFillSymbol

Symbol 1: scrubFillSymbol

Symbol 2: nonconiferousTreesFillSymbol

Symbol 3: coppiceFillSymbol

Name: scrubConiferousTreesAndNonconiferousTreesFillSymbol

Symbol 1: scrubFillSymbol

Symbol 2: coniferousTreesFillSymbol

Symbol 3: nonconiferousTreesFillSymbol

Transformation 5

Symbol 1 – translate(0 -1)

Symbol 2 – translate(-2 1)

Symbol 3 – translate(2 1)

Name: roughGrassScatteredRocksAndBouldersFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallRockFillSymbol

Symbol 3: bouldersFillSymbol

Name: roughGrassScatteredRocksAndHeathFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallRockFillSymbol

Symbol 3: heathFillSymbol

Name: roughGrassScatteredRocksAndScatteredBouldersFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallRockFillSymbol

Symbol 3: smallBoulderFillSymbol

Name: roughGrassScatteredNonconiferousTreesAndScrubFillSymbol

Symbol 1: roughGrassFillSymbol

Symbol 2: smallNonconiferousTreeFillSymbol

Symbol 3: scrubFillSymbol

Name: scatteredConiferousTreesScatteredNonconiferousTreesAndScrubFillSymbol

Symbol 1: smallConiferousTreeFillSymbol

Symbol 2: smallNonconiferousTreeFillSymbol

Symbol 3: scrubFillSymbol

Pattern definitions

Creating a pattern

The symbols defined in Symbols and Compound symbols that end with the term FillSymbol are all used for pattern fills. The name of the pattern is taken from the symbol name by replacing FillSymbol with the term Pattern. The exceptions to this principle are:

- scatteredBouldersPattern   uses   smallBoulderFillSymbol
- scatteredRocksPattern   uses   smallRockFillSymbol
- scatteredConiferousTreePattern   uses   smallConiferousTreeFillSymbol
- scatteredNonconiferousTreePattern   uses   smallNonconiferousTreeFillSymbol

To produce a particular pattern, the appropriate fill symbol is distributed on a grid that is repeated to cover the polygon being drawn. Currently the following grids are in use:

Landform grid

Size: (25,25)

Suitable symbols: manmadeLandformFillSymbol, naturalLandformFillSymbol

Symbol coordinates: 0,-21 0,-18 0,-15 0,-12 0,-9 0,-6 0,-3 0,0 0,3 0,6 0,9 0,12 0,15 0,18 0,21

Fill colour: none

Patterns: manmadeLandformPattern
                    naturalLandformPattern

Small regular grid

Size: (3,3)

Suitable symbols: foreshoreFillSymbol, multiVegetationFillSymbol

Symbol coordinates: 2,2

Fill colour: for foreshorePattern – ccffff (RGB 204,255,255)
                otherwise – ccffcc (RGB 204,255,204)

Patterns: foreshorePattern
                multiVegetationPattern

Regular grid

Size: (6 6)

Suitable symbols: orchardFillSymbol

Symbol coordinates: 3,3

Fill colour: ccffcc (RGB 204,255,204)

Patterns: orchardPattern

Natural environment grid

Size: (50,50)

Suitable symbols: All natural vegetation and surface cover symbol types except for orchard.

Symbol coordinates: 5,3 5,25 10,12 10,35 25,45 42,15 37,27 27,14 36,37 42,45 39,3 18,33

Fill colour: ccffcc (RGB 204,255,204)

Patterns: roughGrassPattern

                heathPattern

                marshPattern

                scatteredBouldersPattern

                scatteredRocksPattern

                scatteredConiferousTreePattern

                scatteredNonconiferousTreePattern

                coppicePattern

                orchardPattern

                bouldersPattern

                rocksPattern

                screePattern

                scrubPattern

                coniferousTreesPattern

                nonconiferousTreesPattern

                coniferousTreesAndScatteredRocksPattern

                coniferousTreesAndScrubPattern

                heathAndScrubPattern

                heathAndScatteredRocksPattern

                nonconiferousTreesAndConiferousTreesPattern

                nonconiferousTreesAndCoppicePattern

   nonconiferousTreesAndScatteredRocksPattern

nonconiferousTreesAndScrubPattern

roughGrassAndBouldersPattern

roughGrassAndConiferousTreesPattern

roughGrassAndHeathPattern

roughGrassAndMarshPattern

roughGrassAndNonconiferousTreesPattern

roughGrassAndRocksPattern

roughGrassAndScatteredBouldersPattern

roughGrassAndScatteredNonconiferousTreesPattern

roughGrassAndScatteredRocksPattern

roughGrassAndScrubPattern

scatteredNonconiferousTreesAndScatteredConiferousTreesPattern

scrubAndScatteredNonconiferousTreesPattern

rocksRoughGrassAndBouldersPattern

roughGrassNonconiferousTreesAndConiferousTreesPattern

roughGrassNonconiferousTreesAndScrubPattern

roughGrassScatteredRocksAndBouldersPattern

roughGrassScatteredRocksAndHeathPattern

roughGrassScatteredRocksAndScatteredBouldersPattern

roughGrassScatteredNonconiferousTreesAndScrubPattern

scrubConiferousTreesAndNonconiferousTreesPattern

scrubNonconiferousTreesAndCoppicePattern

scatteredConiferousTreesScatteredNonconiferousTreesAndScrubPattern

Example

For example, the heathAndScrubPattern uses the natural environment grid to produce the pattern below:

this is then applied as a polygon fill:
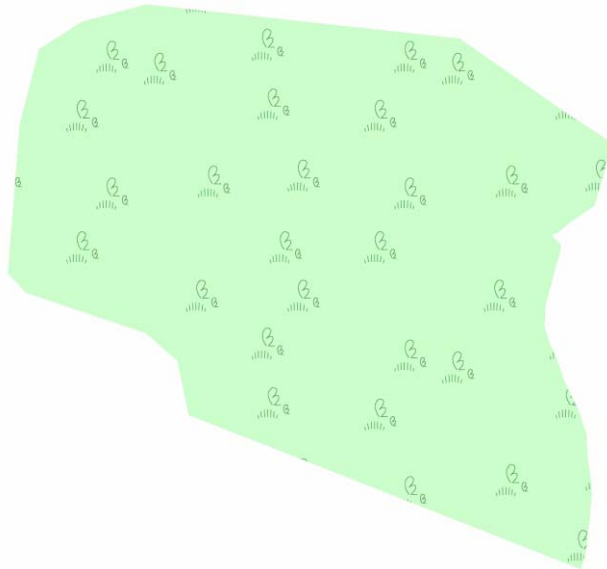
Line styles

Default

Name – defaultLine

stroke-width – 0.07

Default dashed

Name – defaultDashedLine

stroke-width – 0.1

stroke-dasharray – 0.5, 0.5

Building

Name – buildingLine

stroke-width – 0.07

Building overhead

Name – buildingOverheadLine

stroke-width – 0.1

stroke-dasharray – 0.5, 0.5

Water bold

00CCFF
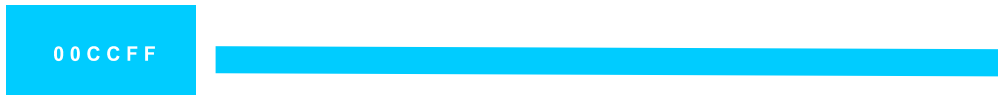
Name – waterBoldLine

stroke-width – 0.4

Water dashed

00CCFF

Name – waterDashedLine

stroke-width – 0.1

Water

0099FF

Name – waterLine

stroke-width – 0.07

Underground

333333

Name – defaultUndergroundLine

stroke-width – 0.2

stroke-dasharray – 3.0, 1.0

Structure overhead

CC9966

Name – structureOverheadLine

stroke-width – 0.2

stroke-dasharray – 2.0, 1.0

Landform bold

D06800

Name – landformBoldLine

stroke-width – 0.3

stroke-dasharray – 0.8, 0.8

Landform

E07000

Name – landformLine

stroke-width – 0.1

stroke-dasharray – 0.8, 0.8

Narrow-gauge railway alignment

333333

Name – narrowGaugeRailwayAlignmentLine

stroke-width – 0.3

Standard-gauge rail

333333

Name – standardGaugeRailLine

stroke-width – 0.15

Parish

FF00FF

Name – parishLine

stroke-width – 0.4

stroke-dasharray – 0.4, 0.8

Electoral

FF00FF

Name – electoralLine

stroke-width – 0.2

stroke-dasharray – 1.5, 0.5

County

FF00FF

Name – countyLine

stroke-width – 0.4

stroke-dasharray – 2.0, 1.0

Parliamentary

Name – parliamentaryLine

stroke-width – 0.4

stroke-dasharray – 1.8, 0.5

District

Name – districtLine

stroke-width – 0.3

stroke-dasharray – 1.5, 0.8

Closing

Name – closingLine

stroke-width – 0.05

stroke-dasharray – 0.5, 0.5

Annexe D   Character set

The following is a list of characters and accents that will be found in OS MasterMap Topography Layer data.

a b c d e f g h i j k l m n o p q r s t u v w x y z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

0 1 2 3 4 5 6 7 8 9

	Space
!	*Exclamation mark*
"	*Quotation mark*
#	*Number sign*
$	*Dollar sign*
%	*Percent sign*
&	*Ampersand*
'	*Apostrophe*
(	*Left parenthesis*
)	*Right parenthesis*
*	*Asterisk*
,	*Comma*
-	*Hyphen/minus*
.	*Full stop*
/	*Slash (also known as Solidus)*
:	*Colon*
;	*Semicolon*
<	*Less than sign*
=	*Equals sign*
>	*More than sign*
?	*Question mark*
@	*Commercial at*
[	*Left square bracket*
\	*Backslash (also known as Reverse solidus)*
]	*Right square bracket*
^	*Circumflex (also known as Caret)*
_	*Underscore (also known as Low line)*
`	*Grave*
{	*Left curly bracket*
|	*Vertical line*
}	*Right curly bracket*
~	*Tilde*
¢	*Cent sign*
£	*Pound sign*
+	*Plus sign*

Acute accent on the following (for example '´'):

A E I O U

a e h i o r u

Grave accent on the following (for example '`'):

A B D E I M O R U

a c d e g h i l m n o r s t u w y

Circumflex on the following (for example '^'):

A B C D E G I L M O P R S T U W Y

a c d e g i l n o r u w y

Diaeresis on the following (for example '¨'):

A E I O U

a e i o u