OS MasterMap®
Integrated Transport Network Layer

User guide and technical specification

OS MasterMap Integrated Transport Network Layer

User guide

Contents

Preface

This user guide (hereafter referred to as the guide) is designed to provide an overview of OS MasterMap ITN 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.

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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

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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 layers are:

- OS MasterMap Topography Layer

- OS MasterMap Address Layer(s)

- OS MasterMap ITN Layer

- OS MasterMap Imagery Layer

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, text and polygons, each with their own unique reference number (the TOID®).

- A set of addresses, both postal and geographic, each with their own unique reference number, with a geographic coordinate 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 unique reference number.

- 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. The number of individual features within the OS MasterMap product as a whole (all four layers) is currently over 460 million.

- 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 with a unique reference number 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.

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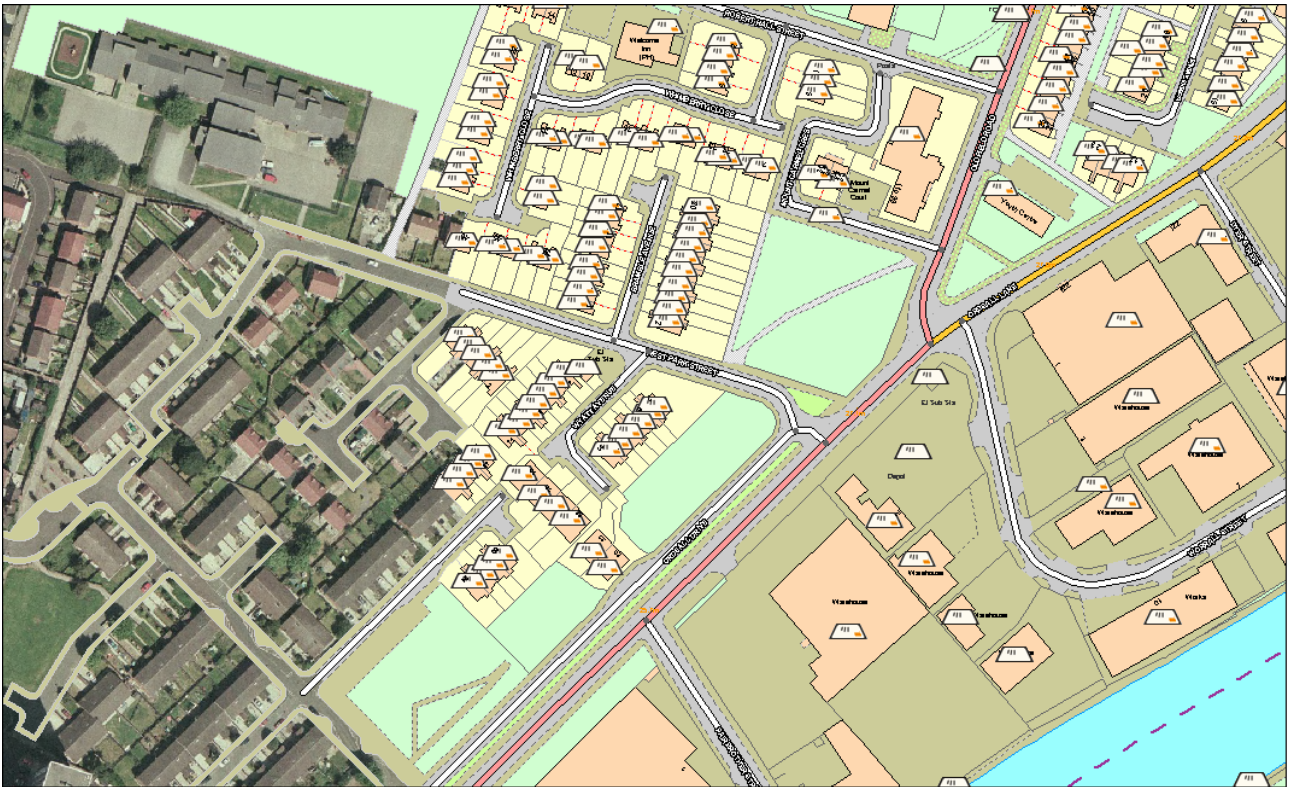
Figure 1: The four OS MasterMap layers

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).
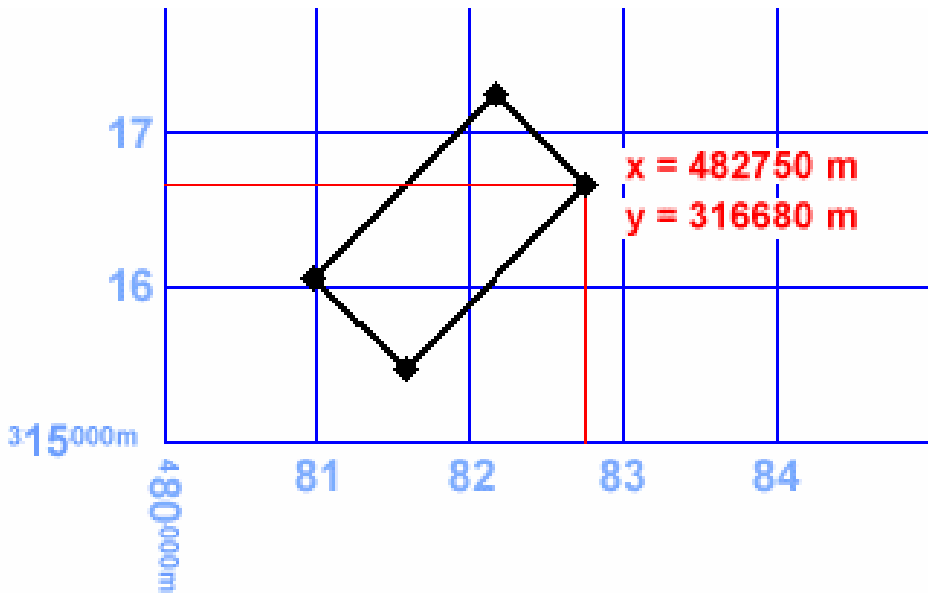
Figure 2: Vector data is stored as coordinates

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 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 that, 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 able to 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; the most appropriate system will depend on many factors, such as the amount of data being taken, resources available within the organisation, the existing and planned information technology infrastructure and 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, either 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.

There is a list of questions to ask under Systems and Software pages of the Ordnance Survey website that may help customers in choosing their system. There is also more information on handling OS MasterMap supply in chapter 6.

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

Layer	Size
Topography	32 Gb
Address Layer 1 and 2	2 Gb (GML), 2.7 Gb (CSV)
ITN	440 Mb

National cover for the Imagery Layer is due to be available in 2007. The current estimated sizes for the images only are:

- 11 300 Gb for TIFF
- 360 Gb for MrSID 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 service are detailed on the Ordnance Survey website.

For further information on the technical implications of implementing OS MasterMap, please follow the link above and see *Information sheet 3 – Technical implications* from the implementing OS MasterMap series of documents from 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 and 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.
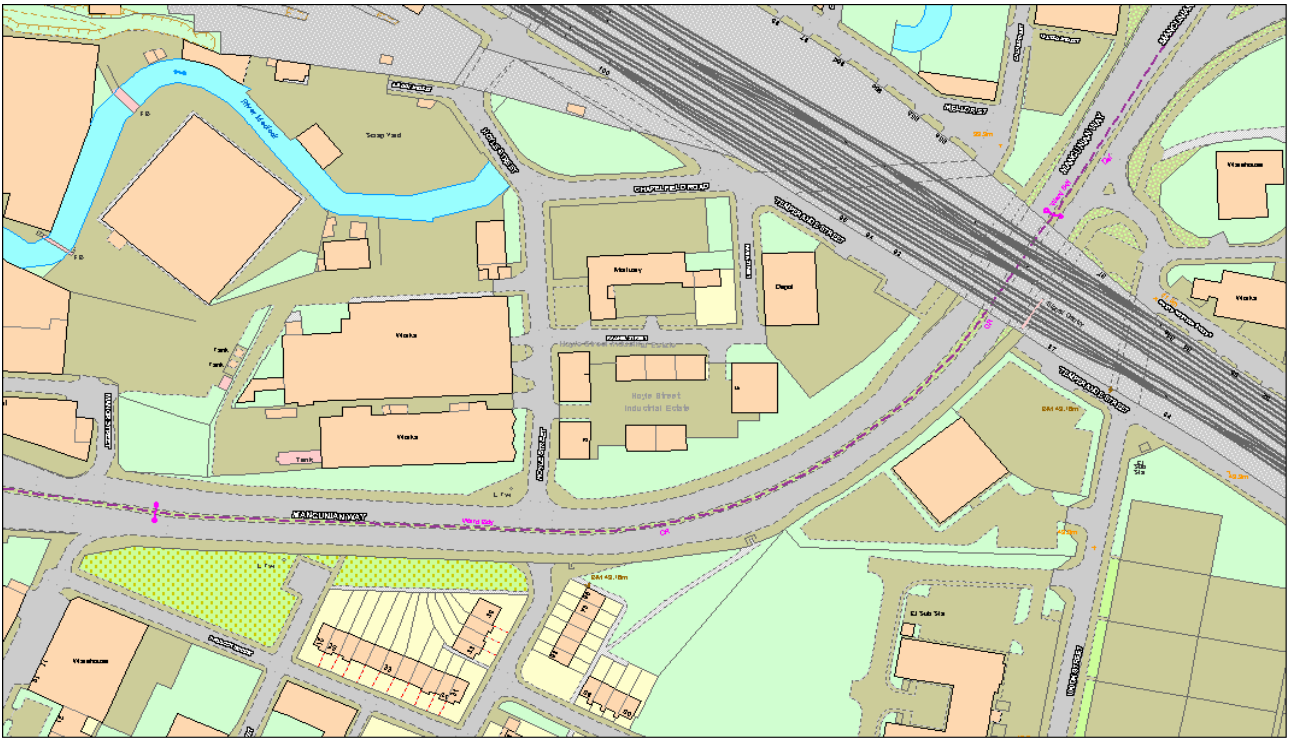
Figure 4: OS MasterMap Topography Layer

Address Layers

OS MasterMap Address Layers contain approximately 28 million geographical features in Great Britain (this includes England, Scotland and Wales, but not the Isle of Man, the Channel Islands or Northern Island). Each feature is provided with a unique identifier, a series of cross-reference identifiers to relevant features in other datasets, one or more 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.
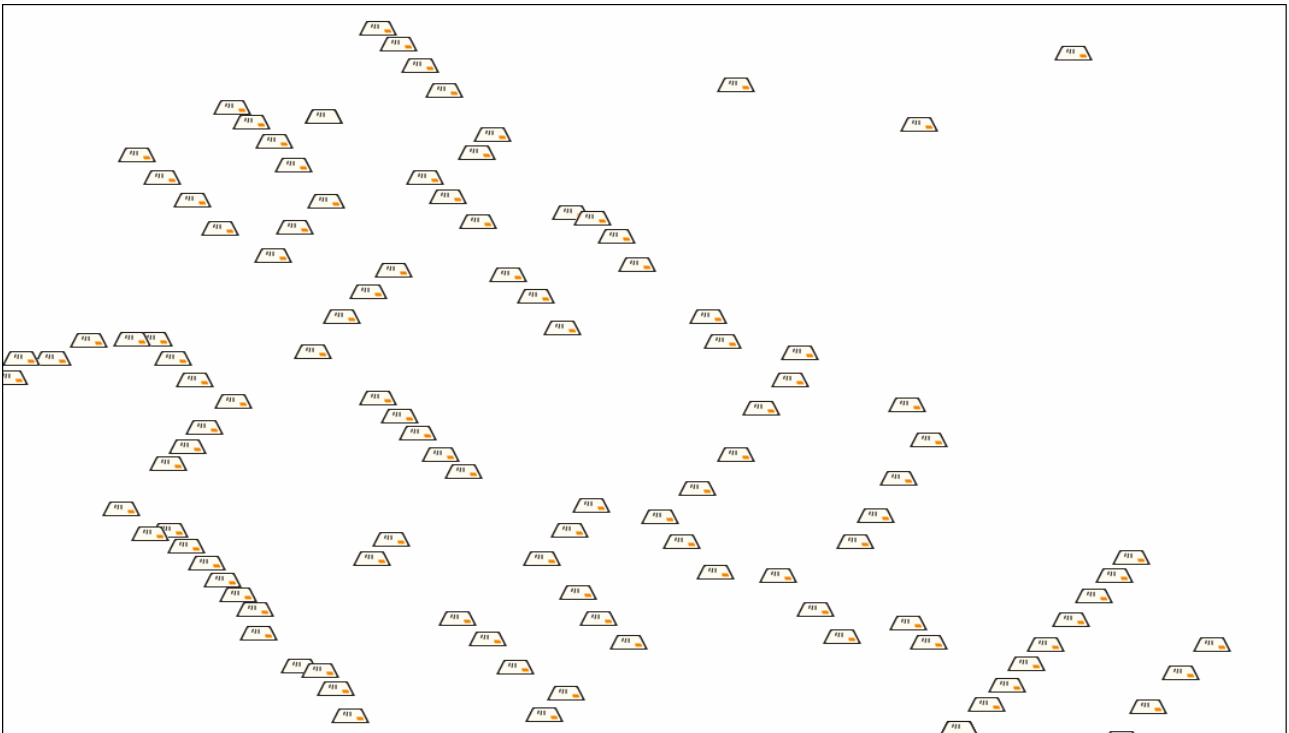
Figure 5: OS MasterMap Address Layers

Integrated Transport Network (ITN) Layer

OS MasterMap includes an ITN Layer that currently contains the Roads Network and Road Routing Information (RRI) for Great Britain. The roads 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 RRI 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 RRI. Figure 6 shows a selection of the roads 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 fixed 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 put conditions on 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.

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 metadata (data about data) for the feature, such as its life cycle and quality. Three of the most important pieces of metadata for the vector layers – the TOID, version and version date – are discussed in more detail below.

OS MasterMap provides attribution that can be searched for and queried within a GIS. Attribution makes it possible to select, for example, road links all belonging to the same Department for Transport (DfT) road classification within a certain area.

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 ITN 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 ITN Layer in more detail.

Chapter 2   Introduction to OS MasterMap ITN Layer

Introduction

OS MasterMap ITN Layer consists of a fully topologically structured link-and-node network representing the roads network of Great Britain, from motorways to pedestrianised streets. The network lines are in geometric sympathy with topographic detail available in OS MasterMap Topography Layer and aligned to aerial photographs available within the OS MasterMap Imagery Layer. Information about the factors that may influence a driver's choice of route is available as an optional theme. This is described as RRI and extends the functionality of the roads network. It is therefore only available to customers that take the roads network. Each feature is provided with a unique reference and versioning so changes to the feature can be tracked.

The product includes the following:

- road classifications;

- road names;

- forms of road;

- motorway junctions;

- information potentially relevant to routing; and

- references to the intersecting polygons from OS MasterMap Topography Layer.

Ordnance Survey aims to update the roads network following update of OS MasterMap Topography Layer, and the routing information will be updated within six months of change occurring in the real world wherever possible. An update of the data is available every six weeks.

A road is defined as a metalled way driveable by an ordinary vehicle such as a family car. Metalling is defined as the systematic application of material to assist the passage of a vehicle. Tracks are not currently included within the ITN Layer.

Public and private roads are included in the data, and the accessibility of any road section is indicated in the product's attribution.

Features are provided with attribution that provides additional information to the customer, such as the length of a road section, junction names and the type of road. Attribution on RRI is divided into three types of category known as qualifiers:

- environmental qualifiers provide information on the *physical entities* on a given part of a network – such as a level crossing – that a driver may wish to avoid;

- vehicular qualifiers provide information on the *types of vehicle* that may or may not be driven on a given part of the network, such as a stretch of road with access for buses only; and

- date/time qualifiers provide information on *when* a driver may wish (or be directed) to use or avoid a given part of the network, such as a seasonal road closure.

Purpose

OS MasterMap ITN Layer was created as a response to the increasing demand for a structured road dataset with a comprehensive, national set of routing information for Great Britain. An accurate roads network is essential as the demands on roads grow. There is an increasing need to manage the rising amount of traffic with the necessity to reduce congestion and CO_2 emissions. The commercial market is becoming more competitive, with companies requiring the ability to route accurately and efficiently to save on fuel and time. As satellite navigation systems become more widespread within private cars, there is an increasing need for digital road information data that is not tied to a particular format or software. The ITN Layer provides a comprehensive roads network with a set of routing information that can satisfy many of these different requirements.

The road itself is a very important asset that needs to be managed effectively. The roads network of Great Britain, whilst not expanding very rapidly, is in a constant state of flux. The roads network undergoes almost constant change in the form of repair, general maintenance, alteration, line painting, signing and so forth. This is usually undertaken by the county or unitary authority or by the Highways Agency. Effective management of the physical fabric of roads requires access to a digital network: roadworks nearly always affect the availability and usage of a road and those around it, and it is important to understand the impact of works. This may require altering access to other parts of the network to provide alternative routes. At the very least, notification of the planned works to the road will need to be communicated to road users.

Furthermore, there are organisations that have assets buried beneath or alongside the road. When these organisations need to undertake their own replacement, repair or maintenance on their assets, they need to coordinate with the authority responsible for the road. Upcoming legislation requires coordination on roadworks activity to decrease the disruption caused and to reduce congestion levels. This legislation affects all organisations that have an interest in roadworks, including local highways authorities.

The two themes of OS MasterMap ITN Layer contain most of the necessary information to manage both the traffic on the road and the roads themselves. As it is updated and made available to a published schedule, it also offers faster access to change than previous products. The use of unique referencing and versioning of features allows customers to identify and track changes on the network.

Applications

The data can be used either alone or combined with other Ordnance Survey products and customers' own datasets. The ITN Layer is increasingly used in commercial markets by organisations requiring a variety of information regarding Great Britain's road network. The data supports applications for routing, tracking, scheduling and fleet management and informs traffic analysis and accessibility studies. Telematics products and on-board units, such as navigation systems, use the ITN Layer to support route planning and provide turn-by-turn instructions for drivers. In conjunction with real-time congestion information, the ITN Layer data can provide the information for solutions designed to improve journey time, reduce vehicular wear and tear and lower the environmental impact of unnecessary travel time.

The ITN Layer facilitates scheduled and dynamic route planning and can be used within applications to measure the shortest distance to school, apply street-work diversions and fix the most logical refuse collection routes. In some situations, such as social service visits, dealing with abandoned vehicles and road accident diversions, reactive route planning is necessary. At a higher level, the ITN Layer can support strategic route planning, such as network resilience analysis, and can help problem-solving tasks such as assessing the possible impact on traffic following a planned road closure. The data can also aid the identification of isolated residents in an emergency-planning scenario and can be used as part of the process to notify people of alternative arrangements should they be affected by road closures. Table 2 lists some more common applications.

Table 2

Accident analysis	Asset recording and inventory management
Catchment-area analysis	Command and control for emergency services
GIS analysis, indexing and mapping	Highway design, planning and engineering
In-vehicle navigation and guidance	Derivation of street gazetteers
Logistics management	Real-time traffic control
Road and highway maintenance	Road-user charging schemes
Route planning and vehicle tracking	Scheduling and delivery
Site location	Traffic management

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 stretch of road will become a new feature in the Ordnance Survey main holding of the data and will be treated as the same feature – even if it undergoes change – until the feature 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 Ordnance Survey field surveyors collecting and attributing the features but also to provide customers with a consistent definition of how real-world change is handled by Ordnance Survey. It should be noted that very minor changes to a real-world object may not be reflected in changes to the feature.

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 to 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 would be where there is more than one road with the same name. Customers could consider grouping sets of TOIDs together into more complex features, such as the links that make up popular school runs or the routes used for refuse collection.

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 features 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 are used within Ordnance Survey 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 change 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 data 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 maintaining an archive 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 ITN 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.

Feature life-cycle rules

The flowchart below in figure 8 shows the process followed whenever a real-world object represented as an OS MasterMap 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.
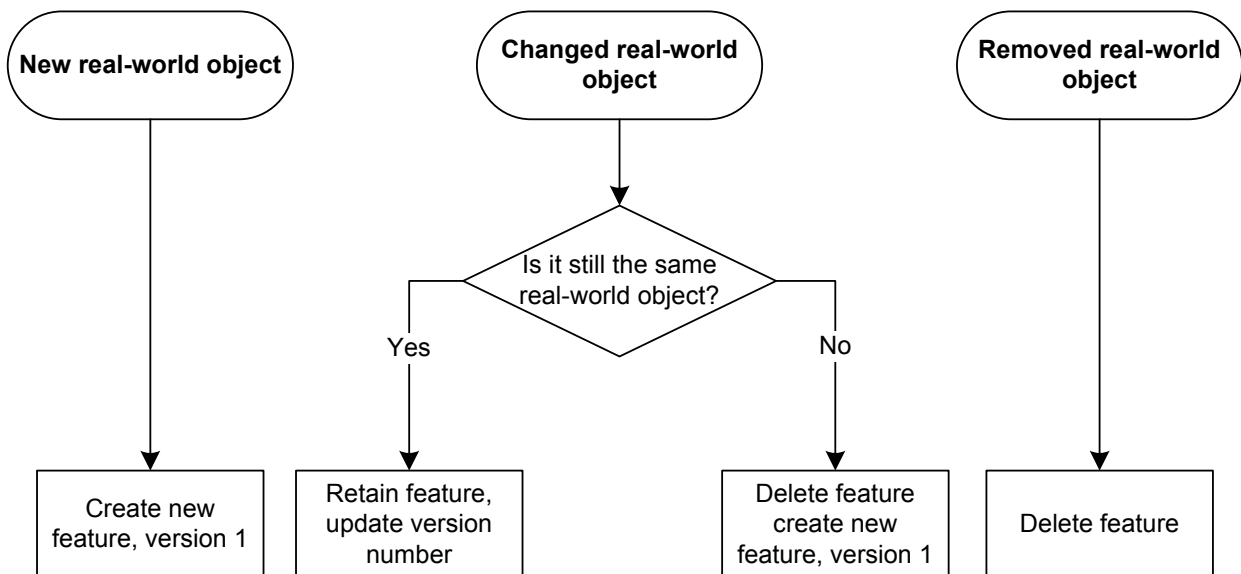
Figure 8: Feature creation in OS MasterMap

Line feature life-cycle rules

Line features are maintained by what are called topological structuring rules. 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.

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. It is not possible for the customer to 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.

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.

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.

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.

Examples of the life-cycle rules as applied to ITN Layer features

Each feature in either the Roads Network or the RRI theme belongs to one of 12 different feature types. Five feature types have a geometric element, either actual in terms of being represented by a line or a point or implied in that there is a linear connection (ferry link). The other seven provide information about the geometric feature types and are linked to them by references within their attribution. They are listed below.

Point features

- Road node.
- Information point.
- Ferry node.

Line features

- Road link.

Reference features

- Ferry link.
- Road – supplies the road name/number for any road link, or group of road links, comprising the road so named.
- Road node information – referenced to a road node. This is supplied with RRI only.
- Road link information – referenced to a single road link. This is supplied with RRI only.
- Road route information – referenced to group of road links in their entirety. This is supplied with RRI only.
- Road partial link information – referenced to a part of a road link feature. This is supplied with RRI only.
- Road partial route information – referenced to a number of links within an overall group representing a route. This is supplied with RRI only.
- Ferry terminal – indicates the embarkation and disembarkation point for a ferry service and is referenced to the ferry node point feature type.

The examples below highlight where, due to the nature of the real-world object they represent or the way the data is structured, a different approach to the general line and point life-cycle rules are followed by these feature types.

Road features

These will generally persist as named or numbered roads. Only rarely will they completely cease to exist in the real world:

- The addition or subtraction of component road link features or other change of attribution will result in the road feature persisting and its version incrementing.
- If road link features referenced by a road feature are altered (but not deleted) there is no change to the road feature.
- If a new name needs to be applied to a road feature or part of a road feature, a new feature will be created.

Road link

Road link features do not have a definitive relationship to the real world. For some users they represent simply a connection between two points whose geometry is irrelevant; for others they represent a specific section of a road that no longer exists if a degree of change occurs.

- Where a road link feature is shortened or lengthened, it will persist – the version will increase.
- A road link feature that has its alignment changed (for example, highway improvements) will persist where possible – the version will increase.
- Where any change of attributes alone has occurred, the feature will persist – the version will increase.

Change of road name or number alone will not result in update to road link features because this information is stored on the road feature.

Changes in topology

Where a road link feature is split through structuring of another road link feature or addition of a road node feature, one of the resultant features will retain the original TOID and have its version increased. The smaller section(s) will be created as new road link feature(s).

Where a road link feature is merged by removal of either a joining road link feature or a road node feature, then one of the original road link features will persist with an increased version.

Road node

A road node feature that is moved and represents broadly the same intersection of road link features will persist and the version increase.

Changes in topology

A road node feature that has additional road link features joined to it will persist with an increased version.

A road node feature that has road link features removed from it will persist provided it is still required to represent either the intersection of two or more road link features, a change/end of road name or the end of a road link feature. The version will increase.

Information point

Information point features are found at motorway junctions. As motorway junctions rarely disappear in the real world, information points will only very occasionally cease to exist.

- A changed motorway junction number will result in a new feature being created.
- If the intersecting roads change then the information point feature will be retained with a new version.

Ferry link and ferry node

Ferry link and ferry node features have a simple relationship to the real world in that they represent either ferry route or the start/end of a ferry route. In general they are simply created or deleted.

If a ferry link feature or ferry node feature previously deleted is subsequently reinstated it would be captured as a new feature.

Changes in topology

A ferry node feature that has a ferry terminal feature or ferry link feature linked to it will persist with an increased version.

A ferry node feature that has ferry terminal feature or ferry link feature removed from it will persist provided it is still required to represent the end of one or more ferry link features. If the feature persists the version will increase.

Ferry terminal

Ferry terminal features represent the interchange between networks. They generally persist unless the interchange they represent no longer exists.

Changes in topology

Where a ferry terminal feature has reference to network attributes changed to reflect additional or reduced references it will be retained and have its version increased.

Routing information

In general, changes to road routing features will result in the deletion of any existing feature and the creation of a new one except in the circumstances outlined below.

Changes to an existing feature that does not involve addition or subtraction of road link references for the feature will result in the feature being retained with an incremented version number.

Any real-world change to routing information features that involve addition or removal of road link feature references will retain the feature only if the first and last road link features are the same as the original feature. Otherwise, a feature will be deleted and a new one created.

Changes to the road network features referenced by a routing information feature may result in deletion of the original feature and capture of a new one, because the identifiers of the network features changed.

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 and how the real-world roads are represented in the network model.

Chapter 4 OS MasterMap ITN themes

There are two themes within OS MasterMap ITN Layer: the Roads Network theme and the RRI theme. The themes are built on a relational data model.

The relational model

OS MasterMap ITN Layer is based on a relational model that uses references to the TOID to associate the road routing information to the physical network. Figure 9 below shows the relationships. Using the direction of the arrows it is possible to determine how all the elements relate to each other.
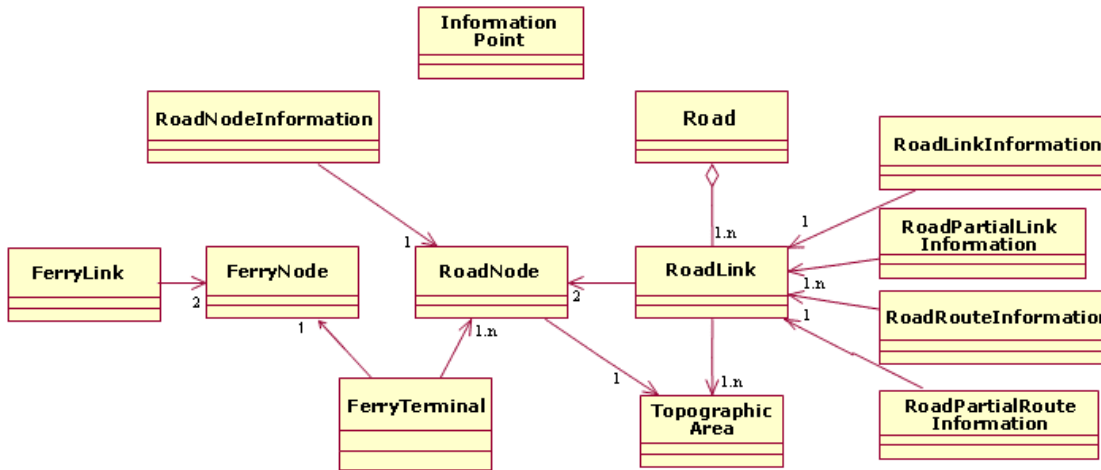
Figure 9: The relational model

The diagram in figure 9 breaks the model down into four distinct groupings.

The **network members** are physical parts of the network, such as roads and junctions, or implied parts of the network, such as the ferry link.

There is also a reference from road link and road node features to the corresponding **topographic area** polygons in the OS MasterMap Topography Layer that form the carriageway. The polygons are **not** included with the ITN Layer, so they are not considered network members.

The **road member** contains the information on road names and numbers and is therefore referenced to as many road link features as are deemed to share that name or number.

The **information point** gives the junction number and numbers of the roads that meet at that junction. This is the only element that does not reference any other member. Together, these are the elements of the Roads Network theme.

The remaining road information members form the contents of the RRI theme. It can be seen from figure 10 that the members of the RRI theme apply either to a road link or a road node.
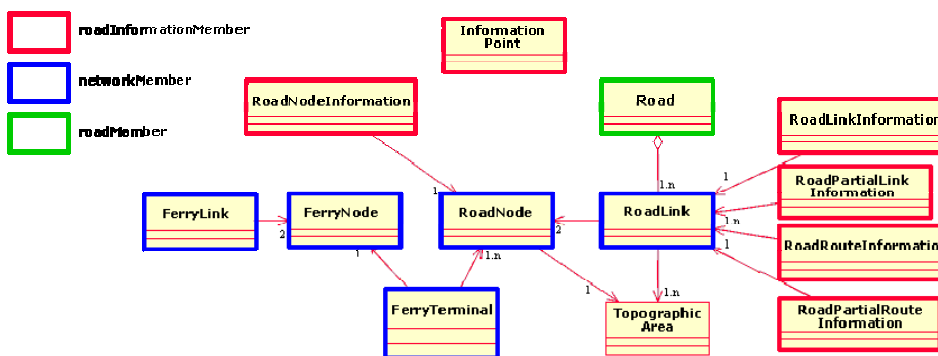
Figure 10: The relationship between theme members

The majority apply to road links. The RRI may apply to the whole link, part of the link or a specific point along the link and includes information. It may also apply to a collection of links that, taken together, form a route where direction of flow of traffic along that route is controlled.

The Roads Network theme

Within this theme a customer will find line and point features that create the road network. In addition, there is information on ferries, junctions, road names and numbers, and the type of road, such as whether it is dual or single carriage way. This theme can be purchased on its own.

Representation of the road network

The network is a representation of the real world, so the way roads are represented has to follow a set of rules to make sure that the depiction of roads is consistent throughout the product.

Road names and numbers

Named and numbered roads are captured in the Roads Network theme as road features. A road feature represents a named or DfT numbered road, for example, Romsey Road or the A38. It can comprise one or more links and can also relate to links that are not connected, as happens with some of the longer roads in Great Britain's road network. This ensures that all road links comprising a single and discrete name or numbered road can always be related to its name or number, regardless of whether all the links connect. The feature includes information on the road type (named, motorway, A road or B road), the name or number, and a set of references to the road link features that provide the network topology of the road.

The road name is that collected by Ordnance Survey ordinarily during a ground visit. DfT road numbers are based upon either a ground visit or information from the DfT.

A section of road that has both a name and number will have two independent road features, one for the name and one for the DfT number. Any single road link may be referenced by more than one road feature; it may have both a road name and/or a road number, but it will not have two names or two numbers. For example, the A3057 and Romsey Road may both refer to at least some of the same links; however, an individual link would not be referenced to two numbered roads. An exception to the above is for numbered roads that have sections classified as primary routes or trunk roads by the DfT. Unnamed and unnumbered roads are included as road link features, but are not referenced by a road feature.

A single road link can have more than one road name; an example would be where a road link has both an English and Welsh name.

Numbered roads

Road features representing DfT numbered roads reference all of the road link features that represent that classified road. These links may not be contiguous across junctions and, where a classified road consists of separate sections, they may be separated by some considerable distance.

Trunk roads and primary routes are captured as independent road features that include an attribute that describes them appropriately. They reference only the links that represent their geometry. This results in two numbered road references to the same link(s), in this case the number will be the same but one feature will have an additional attribute describing it as a trunk road or primary route.
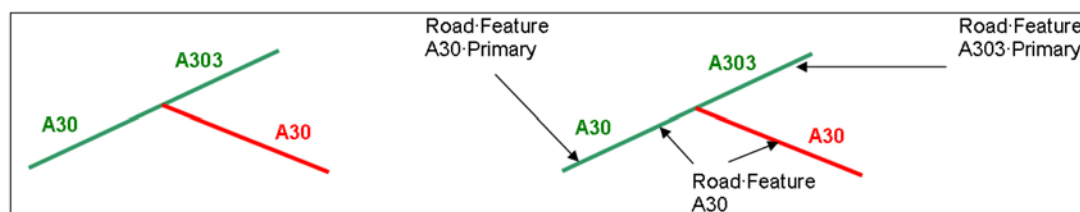
Figure 11: Numbered roads

In figure 11 above the A303 primary route joins the A30; the A30 then becomes a primary route.

Three features are required:

- the A30 representing all road links that are part of the A30;
- the A303 primary representing all road links that are part of the A303 primary route; and
- the A30 primary representing the subset of the A30 that is classified as a primary route.

Reference to road links by road features representing DfT numbered roads at roundabouts and junctions

Any road link may only be referenced by one DfT numbered road feature (with the exception of trunk roads and primary routes as described above). The following priorities are used to determine how links are referenced at road junctions, including roundabouts.

Ordnance Survey applies the road number from the DfT, if the information is available to the link.

If no information is available a hierarchy is imposed where the following priorities are applied:

1   Motorway

2   A trunk

3   A primary route

4   A road

5   B road

Where two roads of equal magnitude meet, then the lower numbered route would be used. For example, the A1 trunk would be preferred over the A11 trunk.
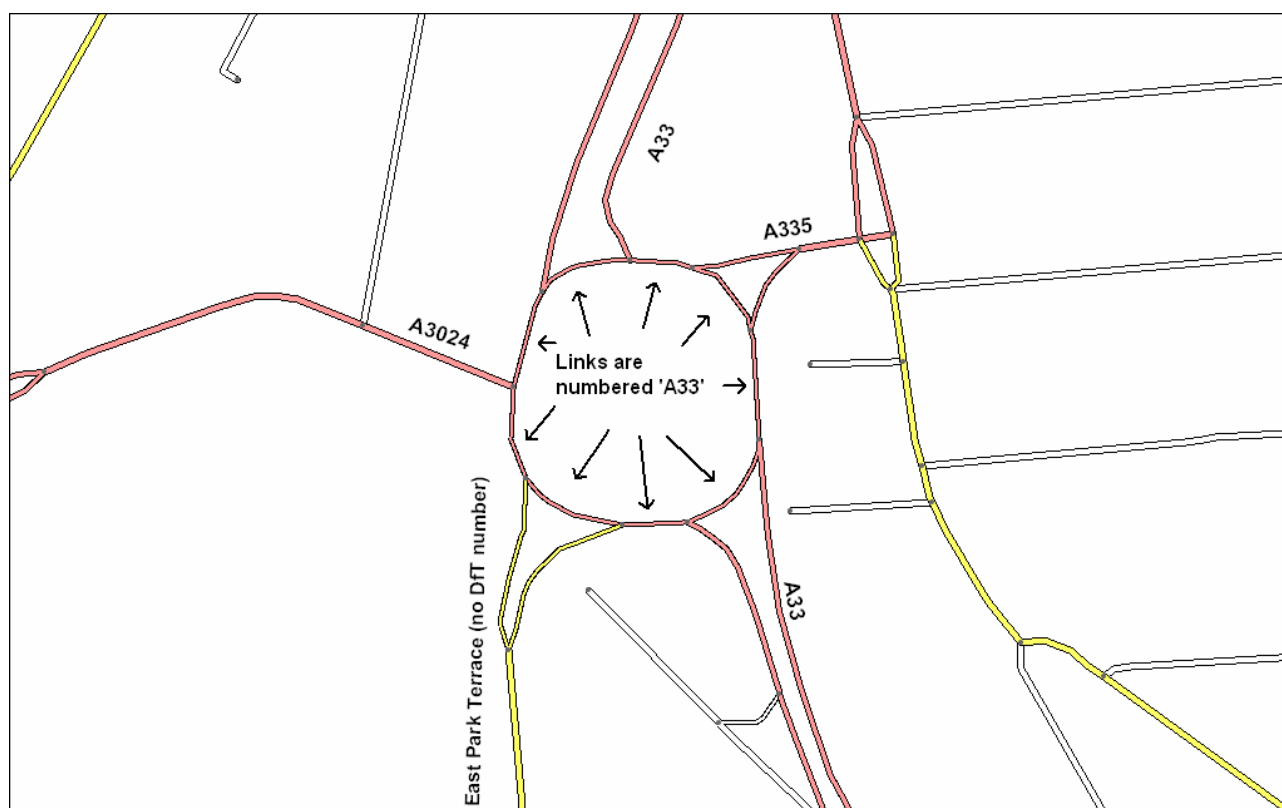
Figure 12: Numbered roads at a roundabout

In figure 12 above the A33 has priority over the A335 and A3024 at the roundabout and the road link features are referenced accordingly.

Named roads

A road feature is created for each named road. As there are many roads with the same name (for example, High Street), road features reference all of the road link features that represent the same named road within an area. To achieve this automatically a threshold is applied, where a named road is not continuous (for example, at a junction) to identify other links that may be part of the same road.

In this way a road feature is created referencing the links in an area that represent a single named road. On rare occasions, if there is a break in the road link, two (or more, depending on the nature of the break) different road name features will be created, both having the same name but referencing different links. Numbered roads reference every link that makes up their length.

Representation of roads by road link features and road features

Figure 13: The relationship between road link features and road features

In figure 13 above Crabwood Close is represented by a road feature that references the road link features numbered 1, 2 and 3 and would be recorded thus:

Road feature = Road name (Crabwood Close); and

Network members:

1 = osgb4000000023313386

2 = osgb4000000023363738

3 = osgb4000000023363720

References to road link features by road features representing named roads at roundabouts and junctions

At a roundabout or road junction any road link may only be referenced by one named road feature. The following priorities are used to determine how links are referenced at road junctions, including roundabouts:

- to reflect the real-world situation as far as possible;

- where no single named road extends either side of a roundabout, then the roundabout road links will not be referenced by any of the named road features;

- if only one of the named roads extends either side, then the roundabout road links will be referenced by that named road feature;

- if more than one named road extends either side or crosses a roundabout, then the named road that is coincident with any prioritised DfT numbered road feature will refer to the roundabout road link features;

- if more than one named road extends either side of a roundabout and no DfT road numbering hierarchy exists, then the road link features may be referenced by one of the named road features, if it can be identified as having more significance; and

- if significance cannot be identified, then the road link features at a roundabout are not referenced by any road feature.

Examples of named road features at junctions and roundabouts are on the following pages.

Named roads at roundabouts
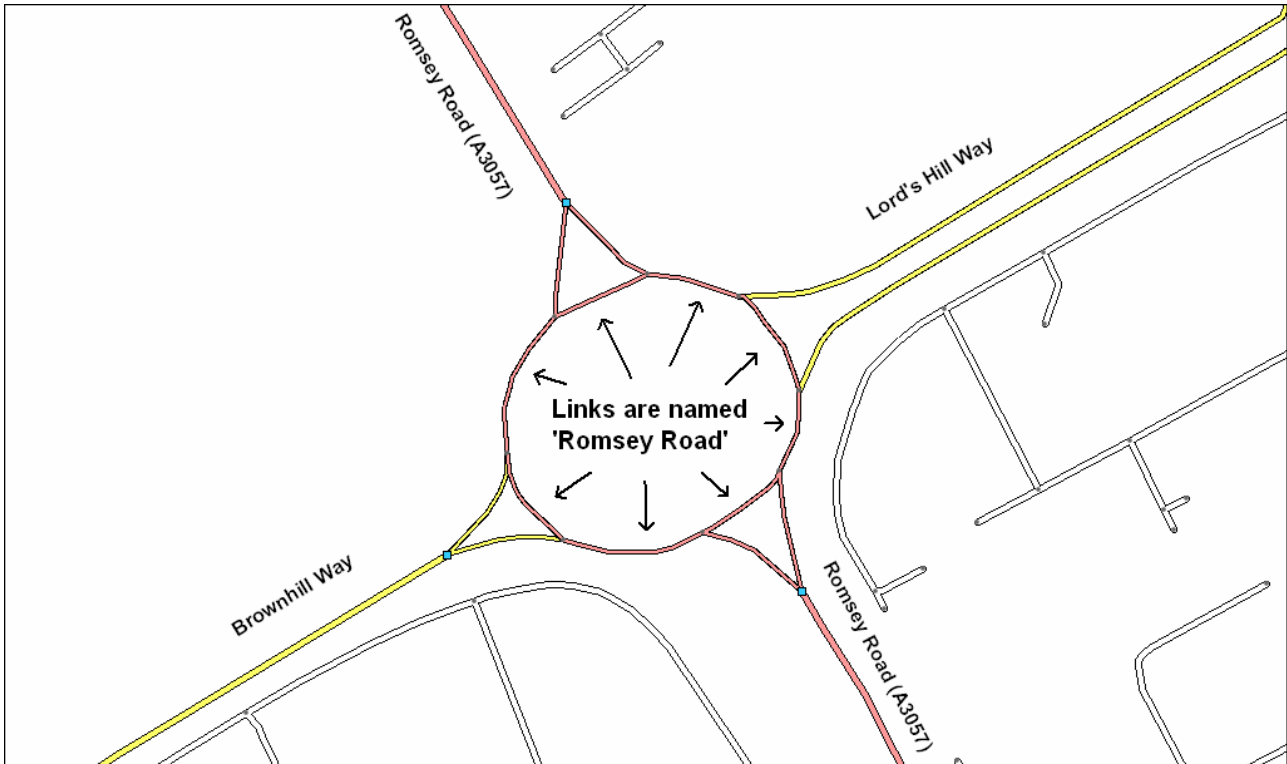
Figure 14: Named roads at roundabouts

In figure 14 only Romsey Road (A3057) extends either side of the roundabout; therefore the roundabout road link features are named and referenced by the Romsey Road feature.
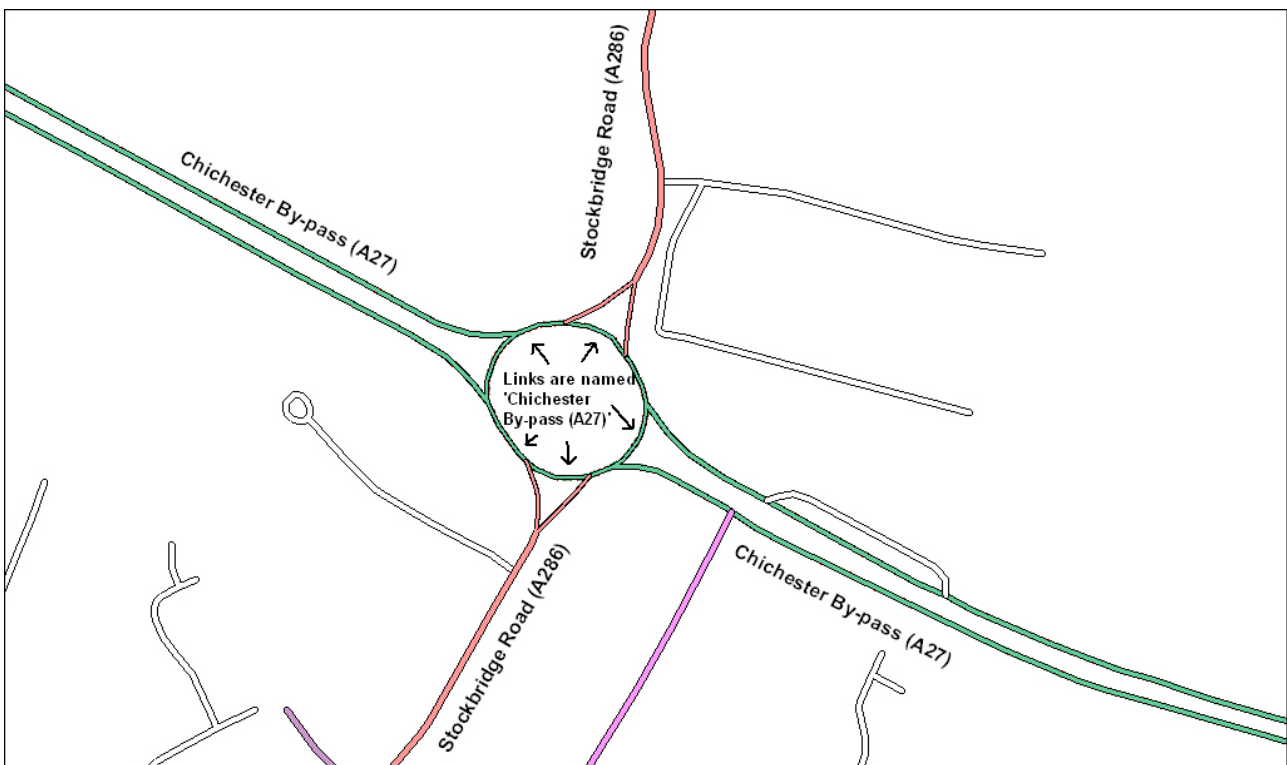
Figure 15: Example of named roads at roundabouts (2)

In figure 15 both Stockbridge Road and the Chichester By-pass extend either side of the roundabout. However, the Chichester By-pass is coincident with the A27, which takes priority over the A286, therefore the roundabout road link features are named and referenced by the Chichester By-pass feature.

Named roads at junction
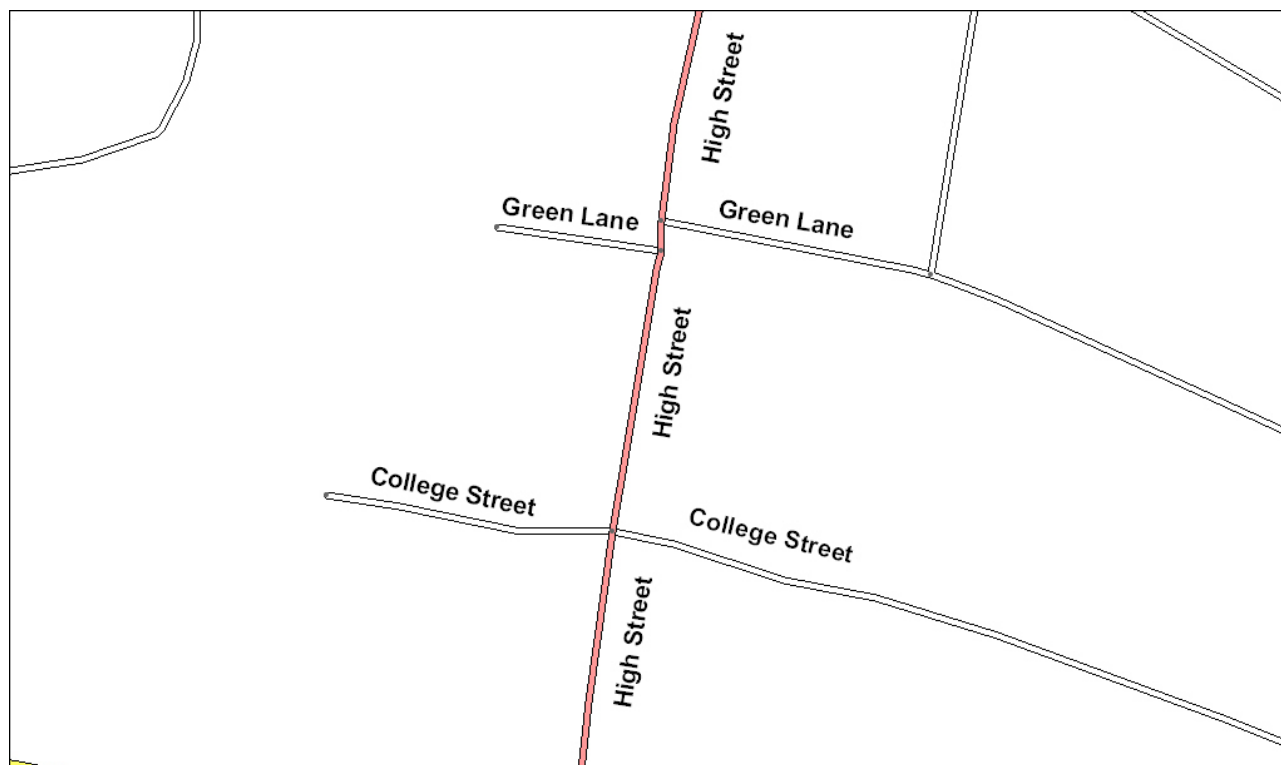
Figure 16: Names roads at junctions

In figure 16 above High Street is identified as the continuous road and the road link features will be allocated accordingly. Green Lane will be a single road feature even though it is not a continuous road.

Road geometry

The general alignment of the road carriageway is represented in the data by road link features. Road link features have information about the geometry of the link, the type of road the link represents, such as motorway, A road and so on, and information about the nature of the road the link represents, such as single carriageway, dual carriageway, slip road and so on.

Additionally, the length of the link and references to the node features at either end of the link are included. Grade separation information is included to indicate any restriction on accessibility from one link to another where they cross at bridges, flyovers and so on.

The geometry of road link features will fall within the polygons from OS MasterMap Topography Layer that represent the road carriageway, and there is a reference from the road link feature to the polygon feature or features. In figure 17 below the road link with TOID osgb4000000023363433 passes through and will reference three OS MasterMap Topography Layer polygons, with the TOIDS osgb1000002109293982, osgb1000002109293983 and osgb1000002109115793.

Figure 17: Relating road links to topographic areas

Road intersections

The road network is broken only in specific circumstances, and a road node feature is added coincident with the end of all road link features. The end of a road link feature indicates one of the following situations:

- the intersection or crossing of carriageways (including bridges, flyovers and tunnels where there is no connectivity);
- the location where a road name or number changes;
- the location where a road name or number ceases to apply;
- the start/end of a carriageway; or
- if there is a section of a road between junctions given over to a 'one-way' restriction, that section will be given a start and end node and will become, in effect, a new link.

A road node feature has point geometry and a reference to the underlying polygon from the OS MasterMap Topography Layer.

Numbered motorway junctions

Motorway junctions with a number (only) are currently represented as a single point feature described as an information point feature. Information point features include a representative location for the junction and textual details of the junction number and the roads that intersect at the junction. No other junctions are currently captured as discrete features.

Vehicular ferry routes

Vehicular ferry routes are indicated by a combination of the following three features and are comparable to the way in which the road network is represented.

Ferry link

The existence of a vehicular ferry service is represented by a ferry link. This feature does not have geometry itself but is a logical link between the locations where a ferry allows vehicles on and off. A ferry link feature necessarily includes references to the ferry node features that represent its start and finish point – a straight line can therefore be inferred from these two nodes.

Ferry node

The ends of a ferry link (this may indicate part of a ferry route for multi-stage services) are represented by a ferry node. These features represent the general location of the end of a ferry link and have a single point position. A ferry node feature may serve multiple ferry link features if more than one destination is served from the same general location.

Ferry link features do not have geometry of their own, so they cannot intersect in the way road link features do. Therefore ferry node features will only ever exist at a location where vehicles or people are permitted **on and off the ferry**.

Ferry terminal

The ferry and road networks are linked by a ferry terminal feature, which represents where a potential change of mode of transport occurs, from a road vehicle to ferry or vice versa. A ferry terminal feature has no geometry but simply provides a logical link between the road and vehicular ferry networks.

Road Routing Information (RRI)

The RRI theme provides information about a route that may affect a driver's choice of route. It could be either restriction information, such as a prohibited turn, or advisory information, such as the presence of a ford. RRI cannot be purchased separately from the Roads Network theme.

Within the ITN Layer routing information is maintained as separate features from the network. These RRI features **reference** the underlying road network features, road link or road node features to provide their location. The relationship between the RRI features and the physical features they provide information about is therefore described as a relational data model.

Simplification and priority of routing information features

Road routing information features attempt to record the effect and the nature of the real-world restriction or environmental factors. However, this is not always possible as restrictions, in particular, may be manifest in many different ways yet have the same effect.

For example, a single restriction may consist of a one-way street that has a no entry sign, no right/left turn signs and/or mandatory turn signs on the approach roads. This would be represented in the simplest way by recording a one-way street. To ensure a level of consistency, a hierarchy is used when more than one restriction that has the same effect occurs at a given location. Only the restriction that has the highest priority will be captured.

Restriction priority table

Priority	Restriction type
1	One way
2	No entry/Access prohibited to/Access limited to
3	Mandatory turns
4	No turn

Therefore RRI features primarily model the effect of any restriction in the simplest possible way and secondary to this is recording the real-world manifestation.

Explicit and implicit drive restrictions

Explicit drive restrictions are those normally displayed on road signs or painted on the roadway, such as 'Turn Right', 'Ahead Only', 'No Left Turn' and so on.

Implicit drive restrictions are turns or changes of direction that are possible, but undesirable or dangerous, because of the position of traffic islands, road markings or lane indicators. Both types of restriction are captured.

Representation of information captured

RRI features are divided into five categories of information. These are explained below.

Information coincident with road node features

RRI features that occur coincident with intersections of the base network are captured as road node information features. Typical examples would be mini roundabouts or bridges with a height restriction where one road crosses another. Height restrictions not coincident with road node features are captured as described in the following section.

Information about a road link where direction of travel is unimportant

RRI features that apply regardless of direction of travel to an entire road link or at a point along a road link are captured as road link information features. Typical examples that apply to an entire link could be access restrictions such as 'no access for unauthorised vehicles', 'residents only' or information such as the presence of traffic-calming measures.

Examples that apply to a specific location on a link regardless of direction of travel are level crossings, gates, fords and height restrictions not associated with a road bridge.

Where location along a link is relevant and available this is supplied as both National Grid coordinates and the distance along the link from its start point.

Information about a road link or number of road links specific to a given direction of travel

RRI features that apply in a specific direction of travel to single or multiple road link features are captured as road route information features.

Examples would be turn restrictions (which apply to multiple links such as no U-turn), one-way streets (which affect a single link in a specified direction) and access restrictions that apply in one direction only. Where location along a road link is relevant and available this is supplied as both National Grid coordinates and the distance along the road link feature from its start point.

Information about part of a road link where direction of travel is unimportant

RRI features that apply regardless of direction of travel to a portion of a single road link are captured as road partial link information features.

An example could be an access restriction such as a pedestrianised area that may be used by vehicles at specific times and only applies to a few hundred metres of a road link feature.

The start and finish points along the road link feature are supplied as both National Grid coordinates and the distance along the road link feature from its start point.

Information about part of a road link specific to a given direction of travel

RRI features that apply to a portion of a single road link with a direction of travel are captured as partial road route information features.

An example could be an access restriction such as a bus lane in one direction only or a one-way street that applies to a portion of a road link feature.

The start and finish points along the road link feature are supplied as both National Grid coordinates and the distance along the road link feature from its start point.

Qualifiers

The nature and applicability of RRI features is described through the use of qualifiers on each of the five RRI feature types described above.

Routing information is divided into three main areas that provide details about what the information is, to whom it applies and when it is applicable. These are known as the environment, vehicle and date/time qualifiers.

- The nature of the RRI is recorded by the use of an environment qualifier.

- To whom the RRI applies is defined by a vehicle qualifier.

- When the RRI applies is defined by a date and time qualifier.

Furthermore:

- An environment qualifier is always required.
- A date/time qualifier is optional and if not present then the routing information applies at all times.
- A vehicle qualifier is optional and if not present then the routing information applies to all vehicle types.

Environment qualifiers

The environment qualifier can provide either an instruction or classification. Examples of an instruction include No right turn or One way. Examples of classifications include Ford, Level crossing or Barrier. Additional values are specified in the technical specification.

Date and time qualifiers

A date/time qualifier specifies the date and/or time period to which the routing information applies. This may be through known named dates/times or specified dates/times. The specified dates and times could be ranges of days or times, or single days or times. Some examples are listed below.

Named period   'school hours'

                        'dusk till dawn'

Specified period'Monday'

                        'Between 8.00 am and 6.00 pm'

                        'Easter'

                        'Between Oct 1 and Nov 21'

Actual values are specified in the OS MasterMap technical specification.

Vehicle qualifiers

The vehicle qualifier indicates whether the instruction applies or does not apply to specific types of vehicle. The vehicle qualifiers currently describe a vehicle by use, load or type and height information.

Examples of use include:

- taxi;
- school bus; and
- emergency vehicle.

Examples of load include:

- wide loads; and
- explosives.

Examples of type include:

- buses;
- coaches; and
- HGVs.

Height records a maximum vehicle height.

Further examples of RRI features are contained in annexe A.

This chapter has described the two themes that comprise the ITN Layer and how the network in the product represents the real-world road network. It has indicated the contents of each theme so that customers can determine whether they need the Roads Network or both Roads Network and RRI for their applications. The next chapter explains the relationship between the feature types in each theme and the attribution provided with each feature.

Chapter 5   OS MasterMap ITN Layer attribution

Attribution

In chapter 3 the 12 different feature types were introduced. As there are different types of geometry and different types of features, having different feature types allows each type to have its own particular set of attribution. By having this particular structure, Ordnance Survey can provide more meaningful and more detailed 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 unique reference. The descriptive group is a property of the real-world object; the reference is a property of the OS MasterMap feature. This chapter explains each attribute provided with OS MasterMap ITN Layer features and its purpose or value to the customer. The values that are associated with the attribute are listed in the technical specification.

Some attributes are optional and some may occur multiple times on the same feature. Table 3 shows the attribution available with each feature type that has actual or implied geometry. Ferry link, for example, has a start and end node but no line feature as the ferry is not as constrained in where it can go as it crosses water, unlike a road vehicle. The attributes are listed alphabetically. Many attributes are common to all features, but some are specific to a particular type. Table 4 shows the attribution available for feature types that reference the 'geometric' feature types.

Table 3: Feature types with actual/or implied geometry

Attribute	Road link	Road node	Ferry node	Ferry link	Information point
Change date	✓	✓	✓	✓	✓
Descriptive group	✓	✓	✓	✓	✓
Descriptive term	✓				
Directed node	✓			✓	
Grade separation		✓			
Junction name					✓
Length	✓				
Nature of road	✓				
Point		✓	✓		✓
Polyline	✓				
Reason for change	✓	✓	✓	✓	✓
Reference to topographic area	✓	✓			
Theme	✓	✓	✓	✓	✓
TOID	✓	✓	✓	✓	✓
Version	✓	✓	✓	✓	✓
Version date	✓	✓	✓	✓	✓

Table 4: Feature types referencing geometry

Attribute	Road	Ferry terminal	Road node information	Road link information	Road route information	Road partial link information	Road partial route information
Bounded by	✔						
Change date	✔	✔	✔	✔	✔	✔	✔
Date/time qualifier			✔	✔	✔	✔	✔
Descriptive group	✔	✔	✔	✔	✔	✔	✔
Descriptive term	✔	✔					
Directed link					✔		✔
Distance from start				✔	✔		
Environ-mental qualifier			✔	✔	✔	✔	✔
Network member	✔						
Point				✔	✔		
Reason for change	✔	✔	✔	✔	✔	✔	✔
Reference to network		✔					
Reference to road link				✔		✔	
Reference to road node			✔				
Road name	✔						
Subsection distance						✔	✔
Subsection point						✔	✔
Theme	✔	✔	✔	✔	✔	✔	✔
TOID	✔	✔	✔	✔	✔	✔	✔
Vehicle qualifier			✔	✔	✔	✔	✔
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 Roads Network or RRI, as described in chapter 4.

TOID

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

Life-cycle metadata

Version

The version number of the ITN 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 the GML.

Other attributes

These attributes are not common to all feature types. Please refer to tables 3 and 4 above to see which features have which set of attributes. The values that are associated with the attributes are listed in the OS MasterMap ITN Layer technical specification.

Bounded by

A minimum bounding rectangle covering all the road link features referenced by the road feature.

Date/time qualifier

A date/time qualifier specifies the date and/or time period to which the routing information applies. This may be known named dates/times such as 'school hours', or specified dates/times, or as a particular day (Sunday), specified dates range, a particular time, or a specified time range.

Descriptive group

The classification of the feature, which will be one of the following: 'Named road', 'Motorway', 'A road' or 'B road'. If there is no name or number for the links, as sometimes occurs on roads within estates, the links are included but no road name feature is created.

Descriptive term

This attribute, if present, gives further classification information about the feature.

Directed link on road route information features and road partial route information features

An ordered set of references to the road link features to which road link or road route information applies.

Directed node

The road node at the start or finish of a road link or the ferry node at the start or finish of a ferry link. The node is referenced by its TOID to the road link. The start node has a negative direction and the end node a positive direction. A directed node could also be a reference to a ferry node feature. The directed node on road link features also indicates the level of grade separation.

Distance from start

This is the distance, from the start node, along a road link that an RRI feature occurs.

Environmental qualifier

This specifies any known environmental conditions useful for routing such as the existence of a ford or level crossing.

Junction name

The distinctive name applied to a motorway road junction and the classified roads not included in the junction number that intersect with the motorway, such as M4 J16/A38. (Currently, coverage is limited to numbered motorway junctions.) On occasions, junctions have more than one name. Such junctions are described as follows: M4 J20/M5 J15.

Length

The length of the road link in metres calculated from the planimetric coordinates making up the road link.

Nature of road

Defines the type of road feature that a road link represents, such as single or dual carriage way.

Network member

A collection of road link features that make up this distinct road. This collection is an unordered set of features referenced by their TOID. This attribute is used to attach the road links to the road name or number.

Point

A coordinate pair in the British National Grid reference frame.

Polyline

A set of coordinate pairs in the British National Grid reference frame.

Reference to network

References to the road node and ferry node features. The TOIDs of the relevant road or ferry node feature referenced to the appropriate road or ferry link.

Reference to node

A reference to the TOID of the road node to which the road node information point relates.

Reference to road link

A reference to the road link to which the road link information or road partial link information feature relates.

Reference to topographic area

The TOID or TOIDs of the topographic area polygons from OS MasterMap Topography Layer that intersect with the road link or road node feature.

Road name

The distinctive name or DfT number applied to the road, such as 'Romsey Road', 'M25', 'A43' and 'B336'. Where Ordnance Survey has names in more than one language – such as Welsh or Gaelic – each name is represented.

Subsection distance

Where required, the distances from the start of a link that an RRI feature begins and ends.

Subsection point

Where required, the National Grid eastings and northings of the start and end points of the routing information. These are coincident with vertices on the underlying **road link.**

Vehicle qualifier

A vehicle qualifier identifies the vehicles that the information applies to by specifying the defining attributes of a vehicle, such as its use, size, weight and contents.

Understanding and using RRI

There are two concepts that underpin how RRI in general is applied to the road link or road node and they are central to understanding and using RRI. These are the concept of the directed node and directed link.

Each road link has a road node at each end. These road nodes are called the road link's directed nodes; they indicate the start and end of the link in terms of the direction in which the link was created by Ordnance Survey. The road node that is the start node is indicated in the GML by value of a minus sign (-) and the end node by the plus sign (+).The directed nodes **do not** indicate a direction of traffic flow.

RRI on road links

RRI can apply to either a specific location on a road link, part of the road link or the whole road link.

If the RRI applies to a specific location on a link, that location is indicated by the value in the 'distance from start' attribute on the road link Information feature. The 'start' in question is the 'start' directed node.

If the RRI applies to part of the link, the information can be found in the subsection distance and subsection point attribute of the road partial link information feature type. The subsection distance attribute gives the distance, in metres, from the road link's start directed node to which the routing information applies. There will be two subsection points that give the coordinates of the point at which the routing starts (which will be coincident with the subsection distance) and the point at which the routing information no longer applies. This is shown in figure 18 below, where the white line is a road link and the red points indicate the subsection of the link to which routing information applies.
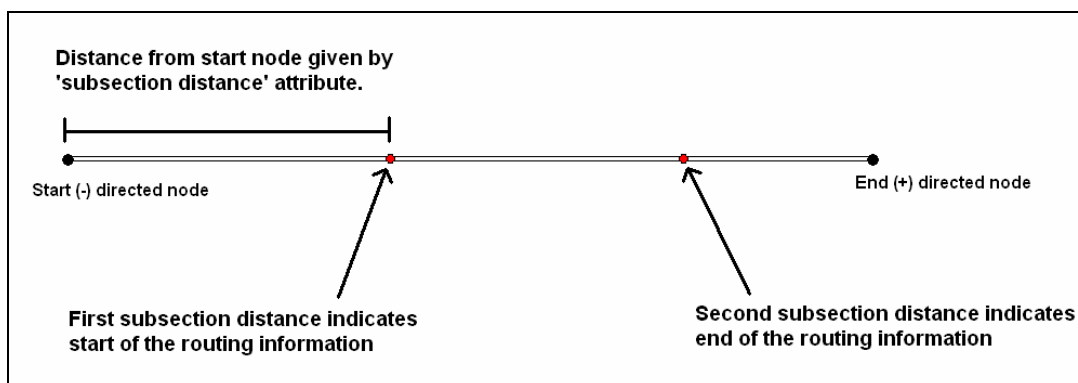

Figure 18: The subsection attributes

RRI on road routes

Routes are collections of links where specific direction of traffic flow is controlled. If RRI applies to a given location in a specific direction on a part of a route, for example, a restricted access along one link in a one-way system, the location of that restricted access will be recorded in the 'distance from start' attribute for the road route information feature type and will also reference the TOID of the particular road link within the route that the location falls within. As above, the start in question is the road link's start directed node.

If the direction of flow along a road link is controlled, either for the entire link or in part, that link is considered to be a directed link. The road route information and road route partial information feature types have a 'directed link' attribute. This attribute stores the information about the direction of flow and has two values recorded against it.

The first value is an orientation, or direction of flow, given relative to the direction of the road link's creation as indicated by the road link's directed nodes.

- If the flow of traffic is the same as the direction of creation, the value is given as a plus (+).
- If the traffic is directed to flow in the opposite direction to the direction of creation, the value will be minus (-).

The second value is the TOID of the road link in question.

Figure 19 shows an access restriction on a road link against the direction of creation.
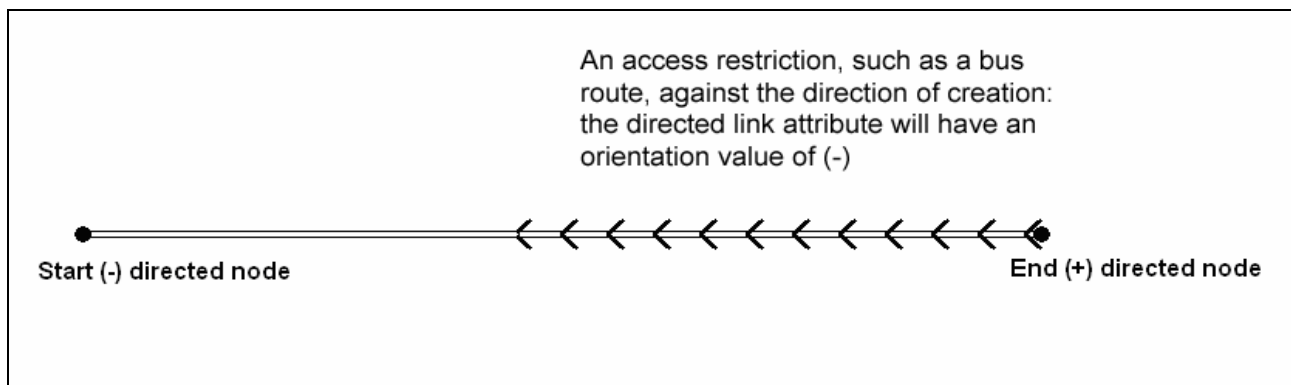
Figure 19: Directed link against the direction of creation

If the control on traffic flow applies to a route (more than one link) the TOID and orientation for each link is supplied.

If the RRI applies to part of the route, the information can be found in the subsection distance and subsection point attribute of the road route partial link information feature type. This operates in the same way as for along a road link as described in the above section.

So, a road link feature refers to its two nodes to indicate which is the start or end node in terms of the direction in which the link was created. Road route information features apply an orientation to road link features, indicating whether they should be interpreted as being in the same direction as the direction of creation (start node to end node) or reversed (end node to start node) state.

Grade separation

The grade separation enables the end-user to determine which road link is above another: if two road links have different values then it is not possible to move between them at that point.

The grade of separation is recorded as a value of between 1 for the first level above ground level up to a theoretical possible value of 6, although 3 is the highest currently existing within the Great Britain road network. Ground level is considered to be the normal level and therefore any part of the network at ground level does not have a grade separation value. Sometimes, however, software may insert a value of 0 when the data is translated and customers should check their holdings to see if this has been done.

The grade separation value is recorded on the directed node attribute of a road link. In figure 20 below two road links (in red) forming Central Bridge passing over another two road links forming Royal Crescent (in white) are shown over OS MasterMap Imagery Layer. The road nodes are shown in black. The road node where the two roads cross has the TOID **4000000023091716.**
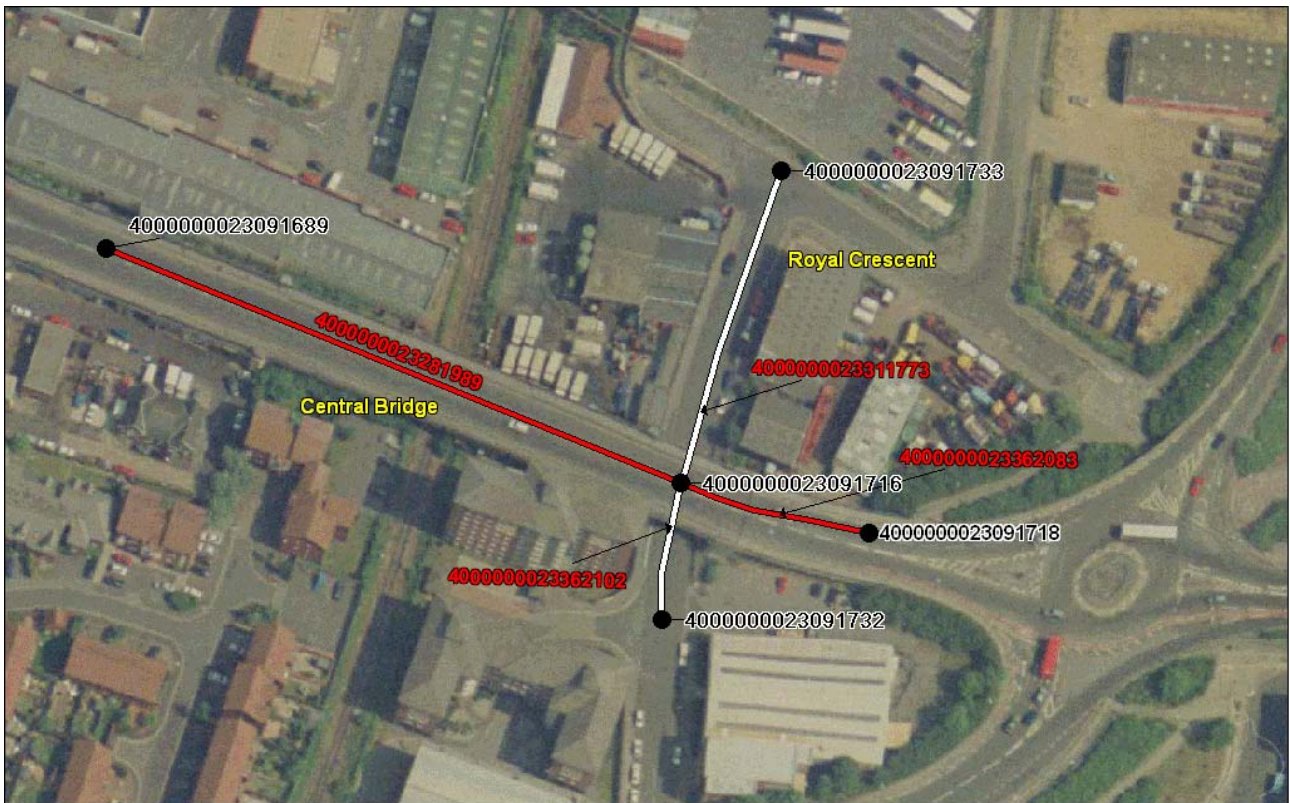
Figure 20: Grade separation and directed nodes

Table 5: Directed attributes for road links forming Central Bridge

TOID	Road name	Start node	Start grade separation	End node	End grade separation
osgb4000000023281989	CENTRAL BRIDGE	**osgb4000000023091716**	**1**	osgb4000000023091689	
osgb4000000023362083	CENTRAL BRIDGE	osgb4000000023091718		**osgb4000000023091716**	**1**

Table 6: Directed attributes for road links forming Royal Crescent

TOID	Road name	Start node	Start grade separation	End node	End grade separation
osgb4000000023311773	ROYAL CRESCENT ROAD	osgb4000000023091733		**osgb4000000023091716**	
osgb4000000023362102	ROYAL CRESCENT ROAD	**osgb4000000023091716**		osgb4000000023091732	

Tables 5 and 6 show the relevant attributes from Central Bridge and Royal Crescent. Road node **4000000023091716** is the *start* directed node for road link **4000000023281989** and road node **4000000023091689** is the *end* directed node of road link **4000000023281989**.

The start node **4000000023091716** also marks the point where a grade separation occurs on the road link. Central Bridge goes over Royal Crescent. As they cross at different levels, the directed node **4000000023091716** has a grade separation of 1 where it is referenced by the links of Central Bridge and no value where the node is referenced by Royal Crescent, which is at ground level.

From the tables it is possible to see that road node **4000000023091716** is also a directed node for Royal Crescent's road links. These links will have the road node referenced as a directed node but it maybe either a start node or an end node to them. As these road links are at the normal level there will be no grade separation recorded in the references to the node.

If a grade separation occurs at a bridge there may be information on height or width restrictions available in the RRI theme.

Commercial attributes

Customers taking RRI theme as well as the Roads Network can have supplementary information on weight and width restrictions. This is provided as a separate CSV file free of charge to customers taking RRI. Weight and width restrictions typically indicate real-world objects such as weak bridges, narrow bridges or 'pinch points' along a road where the carriageway narrows significantly. It is envisioned that this information will be of most use to commercial users of the road with larger vehicles, such as HGV drivers and haulage firms, and hence are referred to as 'commercial attributes'.

The attributes are not features in their own right and are not attributes of existing RRI features, although they may become so in the future. Therefore, they do not have a TOID themselves. They have grid coordinates that allow GIS to create and display the attributes against a point. The grid coordinates record a position on or very near to the relevant road link feature. To reduce any possible ambiguity over which road link feature the weight or width restriction applies, the TOID of the road link is supplied along with the road name and/or number.

This chapter has explained how the different feature types allow for different attribution and has described the nature of that attribution and indicated how it might be used to understand the representation of the network. The next chapter describes how OS MasterMap is supplied to customers.

Chapter 6   OS MasterMap supply

An online service has been created to supply OS MasterMap. All OS MasterMap ITN 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

The OS MasterMap ITN Layer's Roads Network and RRI themes are available in GML format version 2.1.2. GML was developed by the Open GIS Consortium, now known as the Open Geospatial Consortium (OGC™), a global organisation of developers and users that aims to maximise the benefit of geographic information. GML is a spatially enabled dialect of XML schema.

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 ITN Layer. More information on the standards and the bodies governing the standard can be found on the following links:

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

Information specific to OS MasterMap can be found on the Ordnance Survey website under the following headings:

- XML schema repository
- Service and GML schema version
- 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 OS MasterMap ITN Layer. 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 scales tend to be divided into tiles. This results in the artificial splitting of features across one or more tiles. OS MasterMap vector layers are 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 change-only update (COU) supply

Initial supply refers to the first order that a customer takes of OS MasterMap. 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 (features that have been deleted or may have moved outside the order area). 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 change information service.

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 (hyperlink) 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 an 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 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).

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 COUs, by ordering a single COU with a change-since date that precedes the problem updates.

For a fuller discussion of managing COU and guidance on using the online service, customers are advised to consult the Ordnance Survey 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, is 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 21 below illustrates how geographic chunks work.
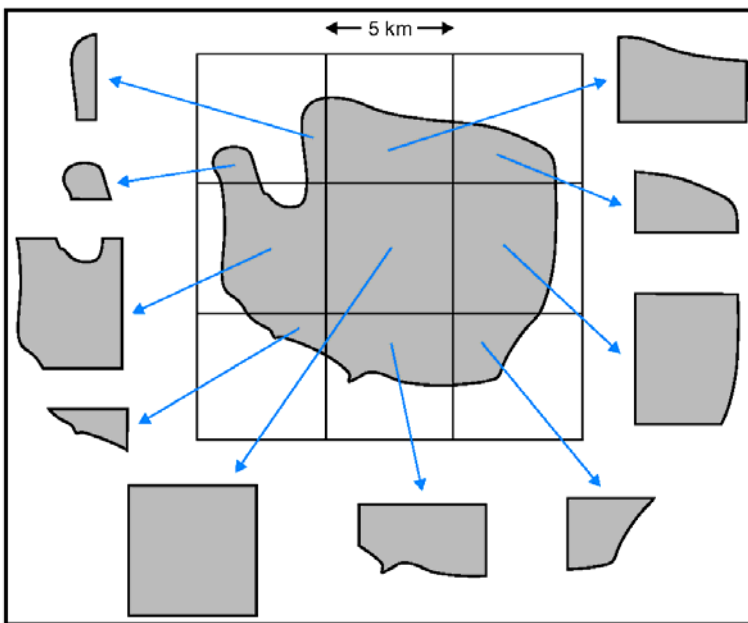
Figure 21: Chunking

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 this case 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 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.

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 National Grid area. The customer selects the compressed file size from options of 10 Mb, 30 Mb or 50 Mb via the online system.

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.

Figure 22(a) shows geographic chunking. All the features within or crossing the boundary of the chunk (denoted by the black rectangle) will be delivered in this chunk. In figure 22(b) non-geographic chunking features not adjacent to each other can be delivered in the same chunk. It should also be noted that if a road crosses the boundary of the customer's area of interest, the road name feature will still contain the names of all the relevant road links, including those that lie outside the area of interest, which the customer will not receive.
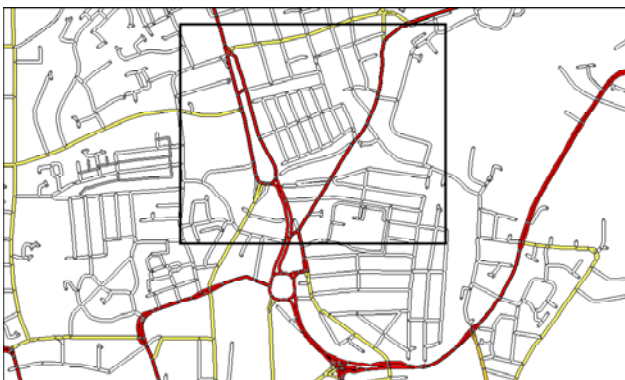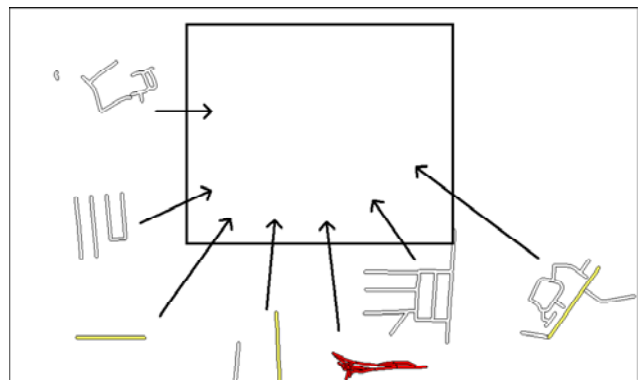

Figure 22(a): Geographic chunking

Figure 22(b): 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, containing the order information specified by the customer, will be supplied with all OS MasterMap vector data orders. This information includes:

- the order number;
- query extent polygon(s) of the order;
- the order type: 'Full Supply' or 'Change-only Update';
- 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 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 of departed features 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.

1 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.

2 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's 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.

3   Reason for departure

Departed features report whether they are (a) deleted – the feature no longer exists within OS MasterMap or (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 it 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 file name.

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 23 below shows what happens in the instance of a selection polygon that falls within a chunk square twice.
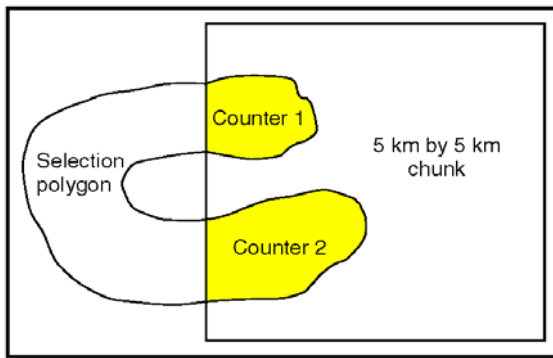
Figure 23: Explaining counters in file names

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

File supplied with an order

When a customer receives an order, whether on media or via FTP, the following files will be supplied.

At the top-level directory of the media that is a *README.txt* file that provides a summary of the disk's structure and content and *ORDER_INDEX.txt*, which contains a list of all the data files that should be on the disk.

Within the DATA directory will be found the chunk files and the FVDS files, if ordered.

The DOC directory contains both standard and product-specific document files that describe what has been supplied in the order, including:

- the *summary.gml* file;
- *Disc_Contents.txt* containing details of what is in the order; and
- *Label Information.txt*, which contains information about the order itself, including the extraction date – which is important for placing COUs.

There is also an EXE directory in case any program executables need to be supplied with the data. This will be empty for OS MasterMap orders.

With an FTP order, the same information is supplied but the file names will be slightly different, reflecting the FTP order number.

This chapter has described how OS MasterMap ITN Layer is supplied, including descriptions of the new online ordering system and data format, the system of chunking required to supply 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, which 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 ITN 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 ITN 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 ITN 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 situations – 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, 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 ITN 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.

Examples of the types of information that can be associated to OS MasterMap ITN Layer include:

- using the data to create street gazetteers; and
- creating bus routes by amalgamating the road links and attaching timetable information to them.

This chapter has discussed some of the issues surrounding change management and data association and has indicated how customers may derive additional value from OS MasterMap ITN Layer through exploring the options change information and data association provide. The following chapter outlines the types of measures that Ordnance Survey uses to assess the data it collects.

Chapter 8   Data measures

Ordnance Survey measures the data in its products in one or more of the ways set out in table 7 below.

Table 7: 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 ITN Layer can be found under technical information on the Ordnance Survey website.

Annexe A   Examples of RRI

Examples of RRI features

One-way
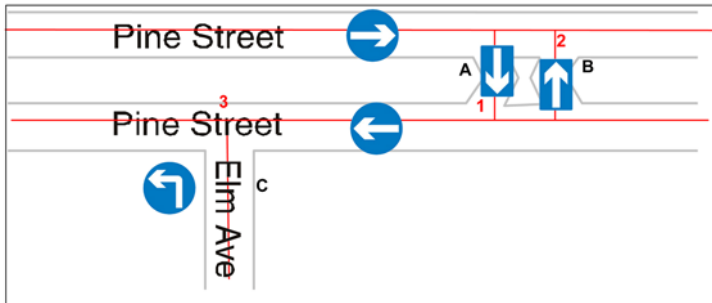
Figure 24: Dual carriageway with turning roads (A and B) and joining road (C)

In figure 24 Pine Street consists of two carriageways where traffic is only permitted in one direction on each carriageway.

There will be a road route information feature for each of the road link features that is one-way. The references to the road link features specify the direction that the restriction applies in.

RoadRouteInformation attributes:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = One way
- vehicleQualifier   n/a

The routing features are directed indicating the direction of the one-way route. There is no requirement to capture any mandatory left-turn features at points 1, 2 or 3 because this information is already available by the presence of the one-way information on the links being joined.

Where a traffic island over 8 m² interrupts traffic flow at a junction of a road, the link is split (figure 25).
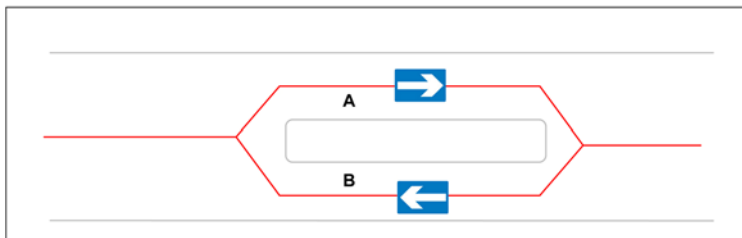
Figure 25: Traffic islands

In figure 25 there will be two road route information features to represent the one-way restrictions either side of the traffic island.

Road route information attributes:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = One way
- vehicleQualifier   n/a

There are 'no turn' restrictions to indicate that access from A to B and B to A may be impossible, undesirable or dangerous.

Partial one-way and time-dependent No entry
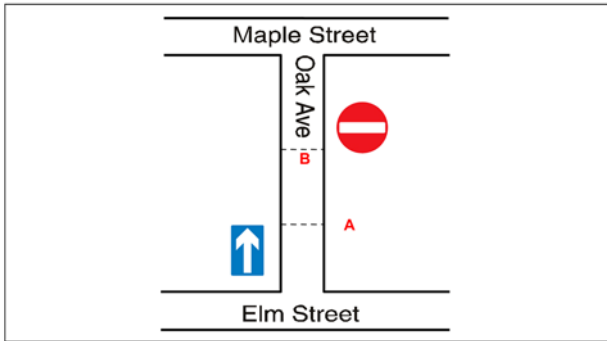
Figure 26: Partial links

A single road link may be subject to a one-way segment that only applies to part of the link (figure 26).

Road partial route information attributes:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = One way
- vehicleQualifier   n/a

In this case, the start location (A) and finish location (B) of the restriction along the road link are supplied as part of the feature. The direction of the restriction is specified in the relationship to the road link.
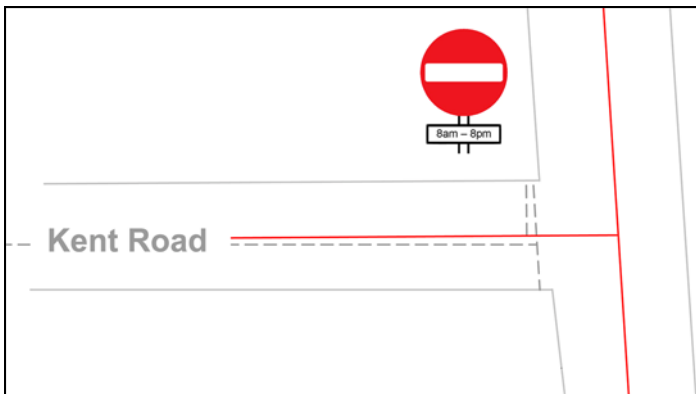
Figure 27: No entry

In figure 27 there is a No entry restriction into Kent Road between the hours of 8 am and 8 pm. Kent Road is not a one-way street.

Road route information attributes:

- dateTimeQualifier   specifiedTime
    - startTime = 08:00
    - endTime = 20:00
- environmentQualifier   Instruction = No entry
- vehicleQualifier   n/a

The road route information feature is directed indicating the end of the link the No entry applies to.

Turn restrictions and mandatory turns

Turn information consists of mandatory turns or restricted turns. These are added when required because their effect is not supplied by traffic-flow restrictions, for example, one-way streets or access restrictions such as no entries.

In figure 28 there is a no right turn into Oak Lane (A) and traffic coming from Elm Lane must turn left into Lily Avenue (B).
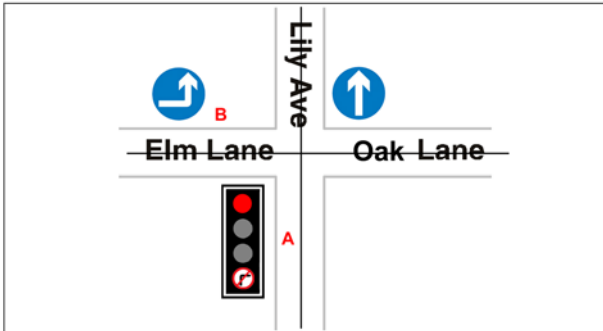
Figure 28: Turn restrictions and mandatory turns

RoadRouteInformation attributes for feature A:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = No turn
- vehicleQualifier   n/a

Road route information attributes for feature B:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = Mandatory turn
- vehicleQualifier   n/a

The road link features referred to are ordered and directed indicating the direction of the restriction.
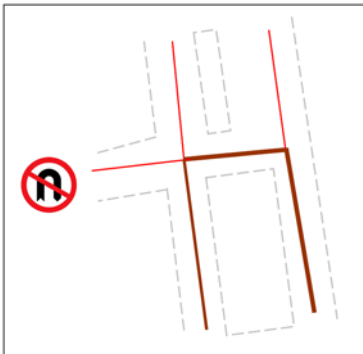
Figure 29: Turn routing consisting of a No U turn.

Road route information attributes for no U turn information:

- dateTimeQualifier   n/a
- environmentQualifier   Instruction = No turn
- vehicleQualifier   n/a

This feature includes references to the three directed links highlighted in brown in the diagram.

Road route information features at specific locations
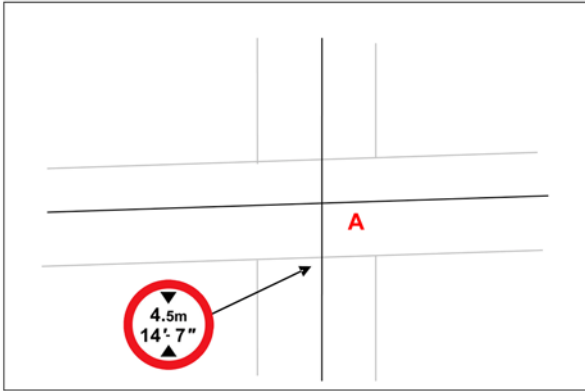
Figure 30: Height restriction coincident with intersection of road link features.

Road node information attributes for feature low bridge (figure 30) at A:

- dateTimeQualifier   n/a
- environmentQualifier   classification = Bridge over road
- vehicleQualifier   maxHeight (uom = metres) = 4.5
- maxCompositeHeight   feet (uom = feet) = 14
- inches   (uom = inches) = 7
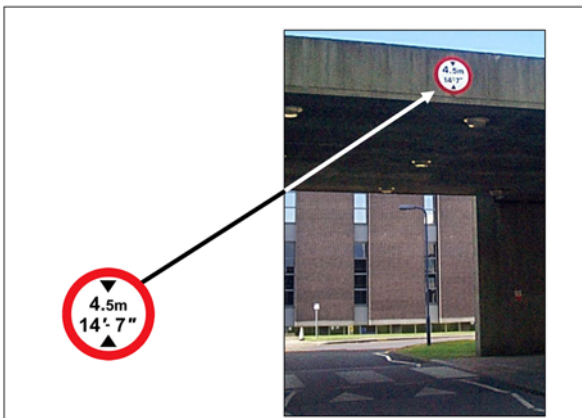
Figure 31: Height restriction enforced by a structure such as a railway bridge or footbridge.

Road node information attributes for feature low bridge (figure 31) at A:

- dateTimeQualifier   n/a
- environmentQualifier   classification = Bridge over road
- vehicleQualifier   maxHeight (uom = metres) = 4.5
- maxCompositeHeight   feet (uom = feet) = 14
- inches   (uom = inches) = 7
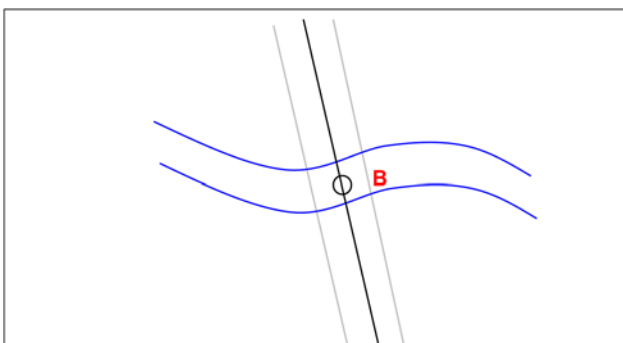
Figure 32: Ford

In figure 32 a road passes through a stream.

Road link information attributes for feature at B:

- dateTimeQualifier   n/a
- environmentQualifier   classification = Ford
- vehicleQualifier   n/a

The distance along the link and the National Grid coordinates of the ford, where the network line intersects the river, are given as part of the road link information feature.

Figure 33: Through route

Where the priority at a junction cannot be inferred, either by the geometry or classification of the intersecting roads, then road route information feature with an environmentQualifier classification of Through route is captured (figure 33). It is assumed that higher DfT classification roads have priority over lower classification roads.

In this example traffic can travel unhindered from the A38 onto the B3181 in both directions as indicated by the road markings.

RoadRouteInformation attributes for through route information:

- dateTimeQualifier   n/a
- environmentQualifier   classification = Through route
- vehicleQualifier   n/a

This feature includes references to the road link features forming the through route.

Use of qualifiers and exceptions on RRI

Qualifiers are used to indicate if routing information applies to anything less than all vehicles at all times. The default in the absence of a vehicleQualifier or dateTimeQualifier is that the routing information applies to all vehicles at all times. All road route information features have environment qualifiers to indicate the nature of the information. Where the information only applies at specific times a dateTimeQualifier is used. Where the use, type, load or vehicle height are relevant to the applicability of the information then a vehicleQualifer is used.

In some cases, routing information specifically does not apply to certain vehicles. This is indicated by the use of an 'exceptFor' clause, which if set to true indicates that the information does not apply to the specified class of vehicle use, type or load.

It should be noted that routing information is not necessarily restrictive, for example, *Access limited to* indicates the vehicles that can access a road link as opposed to *Access prohibited to*, which indicates those vehicles that cannot.

- exceptFor clauses only apply to the use, type or load parts of a vehicleQualifier.
- exceptFor = false – this is the default, the routing information applies to the specified type(s) of vehicle only.
- exceptFor = true – the routing information does not apply to the specified type(s) of vehicle.

Road route information with exceptions

Figure 34: Exemptions

In figure 34 there is a pedestrian zone indicated by the 'No motor vehicles' sign that has time and vehicle type exemptions.

RoadRouteInformation attributes:

- dateTimeQualifier　　　　　specifiedTime

    - startTime = 08:00

    - endTime = 18:00

- environmentQualifier　　　instruction = Access prohibited to

- vehicleQualifier

    - type (exceptFor = True) = Buses

    - use (exceptFor = True) = Taxis

    - use (exceptFor = True) = Permit holders

Figure 35: Specified vehicles

In figure 35 only the specified vehicles are allowed access into a road. It is assumed that the same restriction applies to traffic in either direction.

Road route information attributes:

- dateTimeQualifier　　　　　n/a

- environmentQualifier　　　instruction = Access limited to

- vehicleQualifier

    - type (exceptFor = False) = Buses

    - type (exceptFor = False) = Cycles

    - use (exceptFor = False) = Taxis

NOTE: The vehicleQualifier values are not exceptions because the 'Access limited to' is an inclusive or 'positive' feature.

Further examples of road route information features with exceptions

No entry except for buses

The restriction here is 'No entry' for all vehicles except buses.

- dateTimeQualifier   n/a
- environmentQualifier   instruction = No entry
- vehicleQualifier   type (exceptFor = True) = Buses

No access except emergency vehicles

The restriction is an 'Access prohibited to' all vehicles except for the specified vehicles.

- dateTimeQualifier   n/a
- environmentQualifier   instruction = Access prohibited to
- vehicleQualifier   type (exceptFor = True) = Emergency vehicles

No motor vehicles or motorcycles 8 am to 6 pm except buses, taxis and permit holders.

The restriction is an 'Access prohibited to' for the specified vehicles.

- dateTimeQualifier   n/a
- environmentQualifier   instruction = Access prohibited to
- vehicleQualifier

  - type (exceptFor = True) = Buses
  - use (exceptFor = True) = Taxis
  - use (exceptFor = True) = Permit holders

One-way street for buses only

The restrictions here are one way and access limited to buses, two features are captured.

Feature one:

- dateTimeQualifier   n/a
- environmentQualifier   instruction = One way
- vehicleQualifier   n/a

Feature two:

- dateTimeQualifier   n/a
- environmentQualifier   instruction = Access limited to
- vehicleQualifier   type (exceptFor = False) = Buses

NOTE: The vehicleQualifier for the Access limited to has the exception set to 'false' to indicate that it applies to 'Buses' as a vehicle type only. In this example all other vehicles are not subject to the restriction, therefore it is inferred that there is no access to any vehicles other than those specified (buses).

Permit holders only

The restriction is 'Access limited to' permit holders.

- dateTimeQualifier   n/a
- environmentQualifier   instruction = Access limited to
- vehicleQualifier   type (exceptFor = False) = Permit holders

NOTE: The vehicleQualifier for the Access limited to has the exception set to 'false' to indicate it applies to 'Permit holders' as a vehicle use only. In this example all other vehicles are not subject to the restriction, therefore it is inferred that there is no access to any vehicles other than those specified (permit holders).

Annexe B   Product and service performance report form

Ordnance Survey welcomes feedback from its customers about OS MasterMap Integrated Transport Network 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 Integrated Transport Network 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 Integrated Transport Network Layer

Technical specification

Contents

v1.0 – 04/2007

Introduction

Purpose of this specification and disclaimer

This is the technical specification (hereafter referred to as the specification) applicable to the OS MasterMap ITN 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.

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Chapter 1   Key concepts

This section outlines the three core concepts underlying the OS MasterMap vision as it relates to the provision of network 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 is a useful reference base for users.
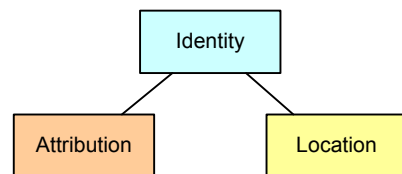
Feature life cycles

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:
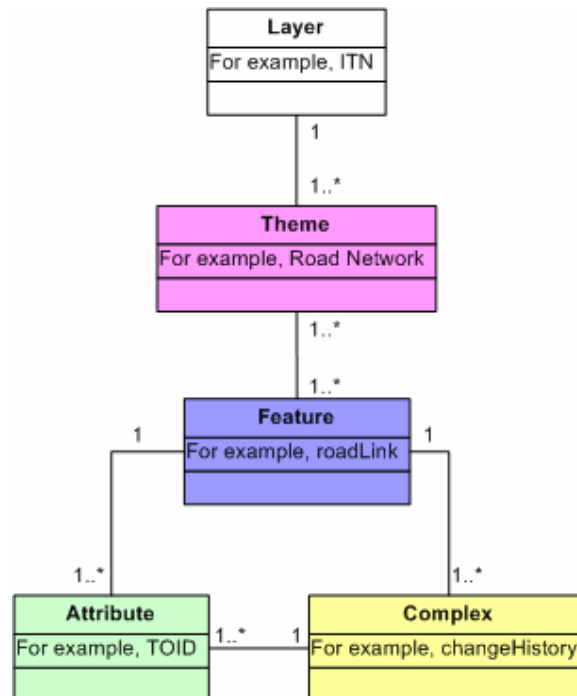
Layers

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 ITN Layer features belong to one of two themes, which are detailed in chapter 3 Theme definitions. 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.

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 ITN Layer data and gives example of real-world objects that are represented within these.

Definitions

Roads Network

Description: The topological network representing driveable roads and vehicle ferries (not international routes) within Great Britain.

Theme rule: theme = 'Road Network'.

Features: Road; RoadLink; RoadNode; FerryLink; FerryNode; FerryTerminal; and InformationPoint.

Road Routing Information

Description: Information referencing features in the Roads Network theme that may influence a driver's choice of route.

Theme rule: theme = 'Road Routing Information'.

Features: RoadNodeInformation; RoadLinkInformation; RoadRouteInformation; RoadPartialLinkInformation; RoadPartialRouteInformation.

Chapter 4   Feature attribution

In OS MasterMap ITN 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 OS MasterMap ITN Layer contains the following features in the Roads Network theme:

Road	A compound feature that represents a road with a name or number. This may be a Department for Transport (DfT) classified road, such as the A38, or a named road such as Romsey Road. The feature consists of a set of references to **RoadLink** features that provide the network topology of the road.
	Classified roads reference all of the **RoadLink** features that represent that classified road. The links may not be contiguous either across junctions or where a classified road consists of separate sections, which may be separated by some considerable distance. Classified roads that have sections that are trunk roads or primary routes have these portions identified as separate **Road** features; these reference only the elements that make up the trunk road or primary route.
	Named roads reference all of the **RoadLink** features that represent the same contiguous named road, where **RoadLink** features may be separated by a given threshold. On occasion, RoadLink features separated in excess of this tolerance may result in two **Road** features being created.
	Unnamed and unnumbered roads are included as **RoadLink** features, but are not referenced by a **Road** feature.
RoadLink	A road network line representing the general alignment of the road carriageway where the only option for a vehicle is to travel along the link or leave the road network, for example, onto a petrol station forecourt or onto private land
RoadNode	A point having topology with at least one RoadLink. A **RoadNode** represents:

- the intersection or crossing of carriageways;
- the point where a road name or number changes;
- the point where a road name or number ceases to apply;
- the point where a one-way restriction ceases to apply; or
- the start/end of a carriageway.

FerryLink	A network link representing a vehicular ferry route between two ferry terminals.
FerryNode	A feature representing the terminal of a vehicular ferry route or section of ferry route. A **FerryNode** has topology with at least one **FerryLink**.
FerryTerminal	A feature used to represent the complex where vehicles embark and disembark from ferries.
InformationPoint	A point feature not attached to the network that represents a numbered motorway junction.

The OS MasterMap ITN Layer contains the following features in the Road Routing Information theme:

RoadNodeInformation	Information that may influence a driver's choice of route that applies to a **RoadNode** feature in the network.
	Examples would be a mini roundabout at a **RoadNode** representing the intersection of carriageways or a restricted height clearance at a **RoadNode** representing the crossing of carriageways where a bridge carries one road over another.

RoadLinkInformation	Information that may influence a driver's choice of route, which applies to a single **RoadLink** feature in any direction of travel. Such information may apply to an entire **RoadLink** or be information that relates to a point along a **RoadLink.**
	Examples of restrictions potentially applying to an entire link could be access restrictions such as 'no access for unauthorised vehicles', 'residents only' or information such as the presence of traffic-calming measures along a **RoadLink**.
	Restrictions related to a single **RoadLink,** where the location of the information in relation to the **RoadLink** is important, include features such as level crossings, gates, fords and height restrictions not associated to a road bridge. Where location along a link is relevant and available this is supplied as both National Grid coordinates and the distance along the **RoadLink** from its start point.
RoadRouteInformation	Information that may influence a driver's choice of route that applies to one or more **RoadLink** features in a specified direction of travel.
	Examples would be turn restrictions (which apply to multiple links), one-way streets (which affect a single link in a specified direction) and access restrictions that apply in one direction only.
	Where location along a **RoadLink** is relevant and available this is supplied as both National Grid coordinates and the distance along the **RoadLink** from its start point.
RoadPartialLinkInformation	Information that may influence a driver's choice of route that applies to a portion of a single **RoadLink** feature in any direction of travel.
	An example could be an access restriction, such as pedestrianised area, that may be used by vehicles at specific times and only applies to 'x' amount of **RoadLink**.
	Location along the **RoadLink** is supplied as both National Grid coordinates and the distance along the **RoadLink** from its start point, to the start and end of the section the information applies to.
RoadPartialRouteInformation	Information that may influence a driver's choice of route that applies to a portion of a single **RoadLink** feature in a specified direction of travel.
	An example could be an access restriction that applies to a portion of a **RoadLink**.
	Location along the **RoadLink** is supplied as both National Grid coordinates and the distance along the **RoadLink** from its start point, to the start and end of the section the information applies to.

In addition, if 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 ITN Layer user guide.

Feature type attributes

This section defines the attributes associated with each OS MasterMap ITN 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 (..).

Road

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	The classification of the feature. Values: 'Named Road', 'Motorway', 'A Road' or 'B Road'	1
descriptiveTerm	Indicates that this feature represents the trunk road or primary route sections of a road. Where a trunk road or primary route classification applies, in addition to the above classifications, to sections sharing the same roadName will be captured as a separate feature Values: 'Trunk Road' or 'Primary Route'	0..1
roadName	The distinctive name or DfT number applied to the Road, for example, 'Romsey Road', 'M25' 'A43 and B336'. Where Ordnance Survey has names in more than one language the cardinality of this property is > 1 with each name represented.	1
networkMember	A collection of RoadLink features that make up this distinct road. This collection is an unordered set of features referenced by TOID.	1..*
boundedBy	A minimum bounding rectangle of the features referenced by this road.	1
theme	'Road Network'	1

RoadLink

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Topology'	1
descriptiveTerm	Text string identifying the class of a road. See Values of descriptiveTerm Attributes for RoadLink Features	1
natureOfRoad	Defines the type of road feature that the RoadLink represents. See Values of natureOfRoad for RoadLink Features	1
length	The length of the RoadLink in metres calculated from the planimetric coordinates making up the RoadLink.	1
polyline	The geometry for the RoadLink. A set of coordinate pairs in the British National Grid reference frame.	1
directedNode	The RoadNode at the start or finish of this link reference by its TOID. The start node has a negative direction and the end node a positive direction. This reference includes a grade separation.	2
referenceToTopographicArea	The unique identifiers of the topographic road area polygons that intersect with this link.	0..*
theme	'Road Network'	1

RoadNode

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Topology'	1
point	The geometry for the node. A coordinate pair in the British National Grid reference frame.	1
referenceToTopographicArea	The unique identifier of the topographic road area polygon this node is related to.	1
theme	'Road Network'	1

FerryLink

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Ferry Connection'	1
directedNode	A reference to a FerryNode feature	2
theme	'Road Network'	1

FerryNode

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Ferry Connection'	1
point	The geometry for the node. A coordinate pair in the British National Grid reference frame.	1
theme	'Road Network'	1

Ferryterminal

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Network Connection'	1
descriptiveTerm	This is the name of each connected network. Values:- 'Road', 'Ferry'	*
referenceToNetwork	References to the RoadNode and FerryNode features.	*
theme	'Road Network'	1

InformationPoint

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Information Point'	1
point	A coordinate pair, consisting of eastings and northings in the British National Grid reference frame.	1
junctionName	The distinctive name applied to a road junction and the classified roads not included in the junction number that intersect with the motorway. Currently, coverage is limited to numbered motorway junctions. For example, 'M4 J16/A38' On occasion junctions have more than one name. Such junctions are described as follows: 'M4 J20/M5 J15'	1
theme	'Road Network'	1

RoadNodeInformation

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Routing Information'	1
referenceToRoadNode	A reference to the RoadNode this information relates to. This includes grade separation.	1
dateTimeQualifier	See dateTimeQualifier	0..*
vehicleQualifier	See vehicleQualifier	0..*
environmentQualifier	See environmentQualifier	0..*
theme	'Road Routing Information'	1

RoadLinkInformation

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Routing Information'	1
referenceToRoadLink	A reference to the RoadLink to which this information applies.	1
dateTimeQualifier	See dateTimeQualifier	0..*
vehicleQualifier	See vehicleQualifier	0..*
environmentQualifier	See environmentQualifier	0..*
distanceFromStart	Where required, the distance from the start of a link that a feature occurs.	0..1
point	Where required, the National Grid eastings and northings of a feature coincident with a vertex on the underlying **RoadLink.**	0..1
theme	'Road Routing Information'	1

NOTE: If position is required, then distanceFromStart and point are both supplied.

RoadRouteInformation

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Routing Information'	1
directedLink	An ordered set of directed references to the RoadLink features this information applies to.	1..*
dateTimeQualifier	See dateTimeQualifier	0..*
vehicleQualifier	See vehicleQualifier	0..*
environmentQualifier	See environmentQualifier	0..*
distanceFromStart	Where required, the distance from the start of a link that a feature occurs.	0..1
point	Where required, the National Grid eastings and northings of a feature coincident with a vertex on the underlying **RoadLink.**	0..1
theme	'Road Routing Information'	1

NOTE: If position is required, then distanceFromStart and point are both supplied. Also, if the directedLink cardinality is >1, then point and distanceFromStart are not supplied.

RoadPartialLinkInformation

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Routing Information'	1
referenceToRoadLink	A reference to a RoadLink to which this information applies.	1
dateTimeQualifier	See dateTimeQualifier	0..*
vehicleQualifier	See vehicleQualifier	0..*
environmentQualifier	See environmentQualifier	0..*
subsectionDistance	Where required, the distances from the start of a link that a feature begins and ends.	2
subsectionPoint	Where required, the National Grid eastings and northings of the start and end points of the routing information. These are coincident with vertices on the underlying **RoadLink**.	2
theme	'Road Routing Information'	1

RoadPartialRouteInformation

Attribute	Definition	Occurrence
TOID	See Chapter 5 Attribute definitions	1
Version	See Chapter 5 Attribute definitions	1
versionDate	See Chapter 5 Attribute definitions	1
changeHistory	See Chapter 5 Attribute definitions	*
descriptiveGroup	'Road Routing Information'	1
referenceToRoadLink	A reference to a RoadLink to which this information applies.	1
dateTimeQualifier	See dateTimeQualifier	0..*
vehicleQualifier	See vehicleQualifier	0..*
environmentQualifier	See environmentQualifier	0..*
subsectionDistance	Where required, the distances from the start of a link that a feature begins and ends.	2
subsectionPoint	Where required, the National Grid eastings and northings of the start and end points of the routing information. These are coincident with vertices on the underlying **RoadLink**.	2
theme	'Road Routing Information'	1

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.
Point	A pair of easting and northing coordinates in metres, defining a horizontal location in the British National Grid spatial reference system.
Polyline	An ordered set of points that are connected with a straight line between each pair.
Real	A floating point number.
Rectangle	A rectangle defined in the British National Grid.
String	An ordered set of characters.
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 ITN features.

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.
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.
descriptiveTerm	String	This attribute, if present, gives further classification information about the feature.
point	Point	A pair of easting and northing ordinates in metres, defining a horizontal location in the British National Grid spatial reference system.
reasonForChange	String	The reason for a change made to a feature. Forms part of the feature's complex attribute *changeHistory*.
reasonForDeparture	String	This is set to 'Deleted' or 'Vacated' to indicate whether a feature has physically been deleted from the database or is no longer relevant due to change in COU supply.
theme	String	A theme that the feature belongs to.

Simple attribute name	Type	Description
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.

Complex type	Description
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).

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
srsName	'osgb:BNG'	Specifies that reference system of the geometry types (British National Grid).	point, polyline and polygon

Chapter 6   Attribute values

Values of descriptiveTerm attributes for RoadLink features

Road type	Description
Motorway	A multi-carriageway public road connecting important cities, always numbered with no addresses.
A road	A public road, classified as an A road by the DfT, connecting areas of regional importance, always numbered, sometimes named, often with addresses.
B road	A public road, classified as a B road by the DfT, connecting places of local significance, always numbered, sometimes named, often with addresses.
Minor road	A public road without a DfT classification of motorway, A or B that connects the roads defined below to B and higher classification roads*. In urban areas usually named, often with addresses. In rural areas sometimes named and sometimes with addresses.
Local street	A public road that provides access to land and/or houses, usually named with addresses. Generally not intended for through traffic*.
Alley	A road without access restrictions that provides alternate/secondary vehicular access to land or houses. They may be named but are usually without addresses. They are usually not intended for through traffic, though they may be accessible from more than one location. Typical examples are those that run behind rows of houses. Roads that lead to areas of metalled surface for parking or to blocks of garages (often within housing estates) are not captured as alleys, unless they also provide vehicular access to land or buildings other than blocks of garages. Currently, coverage is limited to roads formerly described as 'Private' in previous Ordnance Survey road products but reclassified following ground visits.
Private road – publicly accessible	A privately maintained road or a road within a property boundary where access by the public is considered usual for at least some part of the day. For example, a road within a hospital, sports centre or school. They may extend through a site if more than one entrance exists. If only one entrance exists they are normally created to extend to the principal building within a single site or the boundary of the last property served for features accessing more than one addressed or otherwise identifiable property*. They may be captured outside this definition if required to provide connectivity to a track or path.
Private road – restricted access	A privately maintained road or a road within a property boundary where access by the public is restricted by physical (for example, gate) or administrative (for example, sign) means or is not considered usual. For example, roads within a military base, an oil refinery, within a private residential garden or leading to two private properties*. Such roads are captured only where they exceed 100 m in length or serve more than one addressed or otherwise identifiably separate property. Roads are normally created to extend to the principal building within a single site or the boundary of the last property served for roads serving multiple properties. Two exceptions to this exist: where a track or path exists that the road is connected to, the road must be extended to that point; and where roads within a private residential garden extend for more than 100 m from the property boundary.
Pedestrianised street	Roads that have been altered for use principally by pedestrians but may provide some access for certain types of vehicle *. (Details of specific routing access restrictions will be within the RRI theme.)

* Note all descriptions of this type are based upon a visual assessment by the Ordnance Survey data collector, either from a ground visit, inspection of aerial photography or by interpretation of the underlying OS MasterMap topographic data. No formal investigations are made with third parties to classify these types of road.

Values of natureOfRoad for RoadLink features

natureOfRoad	Definition
Single carriageway	Default link type. A road consisting of a single carriageway with traffic in one or both directions. There may be more than one lane in any particular direction.
Dual carriageway	A road consisting of two separate carriageways with separate flow directions. The carriageways are partitioned by physical features, such as a barrier and/or verge.
Slip road	An exit or entry point to and from the major road network, including motorways.
Roundabout	A method of controlling traffic flow by allowing vehicles from a particular direction priority.
Enclosed traffic area link	Car parks and similar areas through which traffic passes but are not generally considered to be a road. Only the entrances and exits of car parks will be captured.
Traffic island link at junction	Where an island that is over 8 m² exists in the middle of a road on the approaches to a junction, the road link is split around it. The split links will carry this attribute value.
Traffic island link	Where an island that is over 8 m² exists in the middle of a road, the road link is split around it. The split links will carry this attribute value.

Chapter 7   Modelling Road Routing Information (RRI)

The concept behind the RRI model

In ITN the primary role of routing information is to provide information about the environment and routing regulations that may affect a choice of route. Secondary to this is the way those restrictions are manifest in the real world.

Routing information is divided into three main areas, which provide information about what the information is, to whom it applies and when it is applicable. These are known as the date/time, vehicle and environment qualifiers.

RRI qualifiers
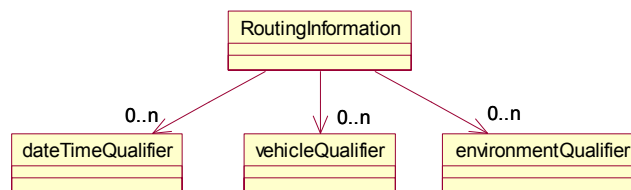
dateTimeQualifier

A date/time qualifier specifies the date and/or time period that the routing information applies to. This may be through known named dates/times or specified dates/times.
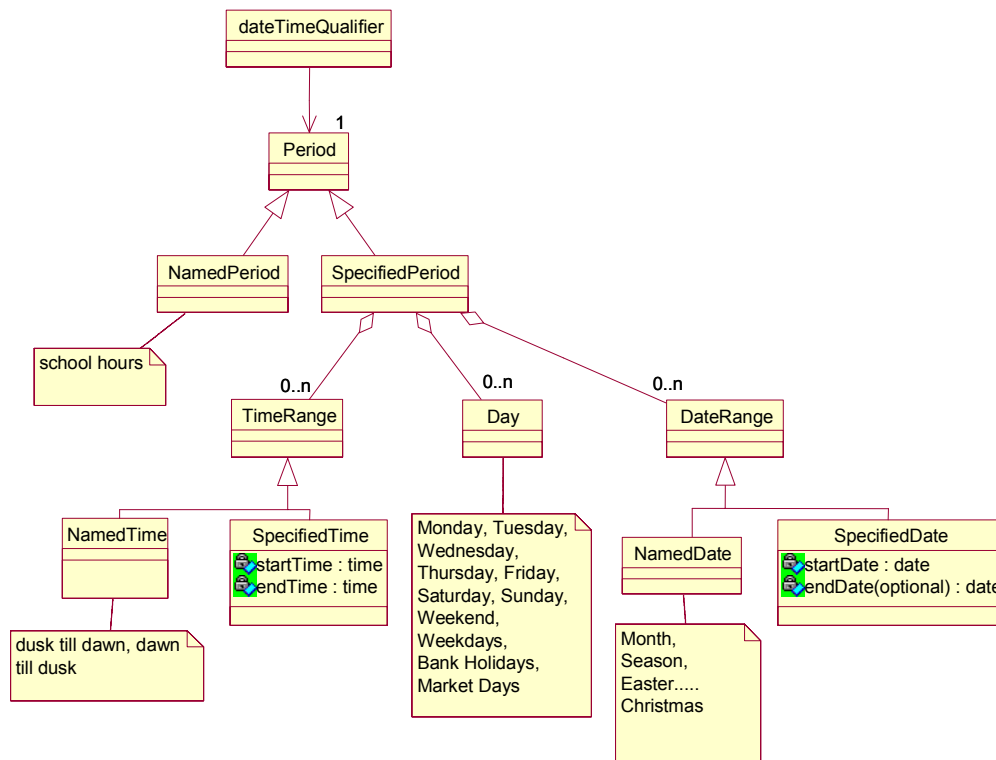
NOTE: that lists of possible attribute values are not complete.

vehicleQualifier

A vehicle qualifier identifies the vehicles that the information applies to by specifying the defining attributes of a vehicle such as its use, size, weight and contents.
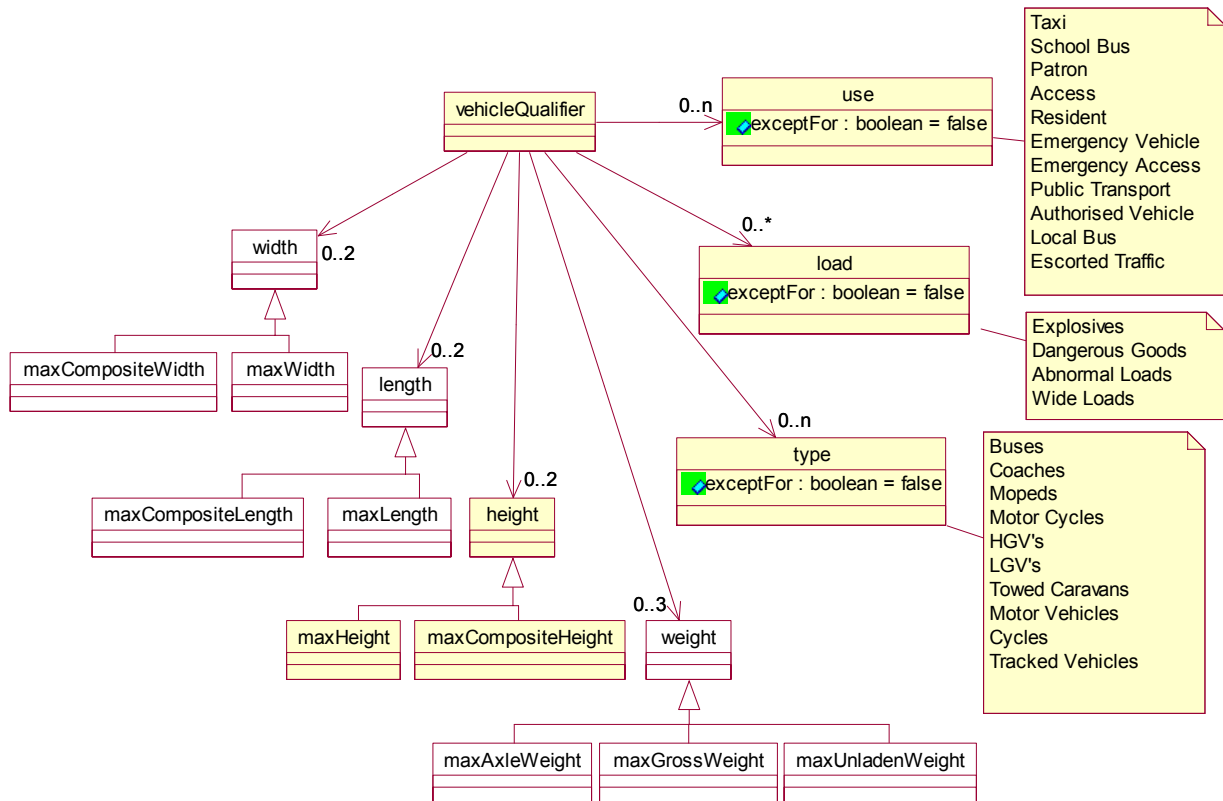
NOTE: that only coloured boxes are currently populated and lists of possible attribute values are not complete.

environmentQualifier

This specifies any known environmental conditions useful for routing.
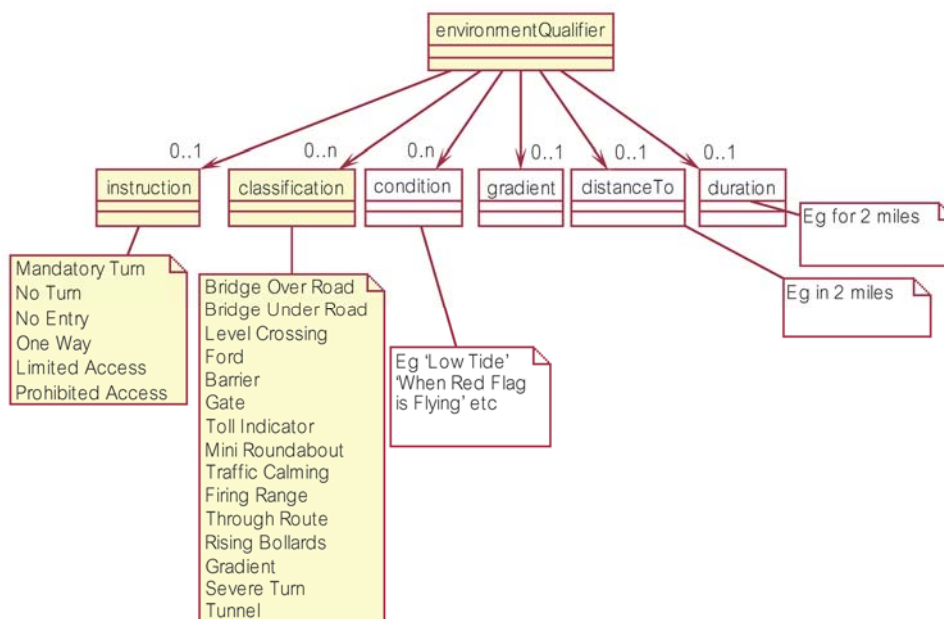
NOTE: that only coloured boxes are currently populated and lists of possible attribute values are not complete.

Chapter 8   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

ITN Layer related information

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

Chapter 4 Feature attribution

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 ITN 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/v5/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/v5/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	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
networkMember	RoadLink, RoadNode, FerryLink, FerryNode, FerryTerminal
roadMember	Road
roadInformationMember	InformationPoint, RoadNodeInformation, RoadLinkInformation, RoadouteInformation, RoadPartialLinkInformation, RoadPartialRouteInformation
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:networkMember>
        <osgb:RoadLink fid='osgb4000000023256308'>
                        ....
        </osgb:RoadLink>
</osgb:networkMember>
```

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 definitions). 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>A Road</osgb:descriptiveGroup>
        <osgb:descriptiveTerm>Trunk Road</osgb:descriptiveTerm>
        <osgb:roadName>A34</osgb:roadName>
        <osgb:networkMember xlink:href='#osgb4000000013178758'/>
        <osgb:networkMember xlink:href='#osgb4000000013178759'/>

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.

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.
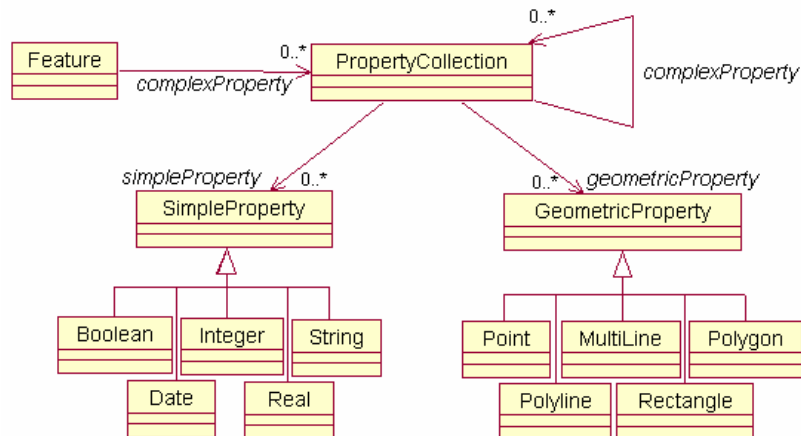
XML mapping

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:changeHistory>
        <osgb:changeDate>2006-08-02</osgb:changeDate>
        <osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
```

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='osgb4000000023028486'>
        <osgb:boundedBy>
        <gml:Box srsName='osgb:BNG'>
        <gml:coordinates>442388.000,111050.000 442485.000,111082.000</gml:coordinates>
        </gml:Box>
        </osgb:boundedBy>
        <osgb:theme>Road Routing Information</osgb:theme>
        <osgb:reasonForDeparture>Deleted</osgb:reasonForDeparture>
        <osgb:deletionDate>2006-11-20</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

Annexe A   Glossary

The purpose of this annexe 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 premise

A permanent or non-permanent location with an address being a potential delivery point for Royal Mail®. Examples of an addressed premise 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 have 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.

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 h 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 COU 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 shares common characteristics and that is managed as a subset of the data within a database.

departed feature

A feature supplied as part of a COU supply, which 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 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 geographical 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.

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 type

A high-level grouping of features that are treated in a similar way, for example, topographic point 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).

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.

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.

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.

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 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.

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.

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.

planimetry, planimetric

The measurement of horizontal surfaces in two dimensions.

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.

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 features 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.

topology

Properties of geometric forms that remain invariant when the forms are deformed or transformed by bending, stretching or shrinking. Among the topological properties of concern in GIS are connectivity, order and neighbourhood.

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.

vertex

An intermediate point along a line.

XML

Extensible Mark-up Language. A flexible way to create common information formats and to 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 Road feature

```
<osgb:roadMember>
<osgb:Road fid='osgb4000000023465669'>
<osgb:version>4</osgb:version>
<osgb:versionDate>2006-11-18</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2003-03-13</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2004-12-07</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2006-10-18</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Named Road</osgb:descriptiveGroup>
<osgb:roadName>LEE LANE</osgb:roadName>
<osgb:networkMember xlink:href='#osgb4000000023257055'/>
<osgb:networkMember xlink:href='#osgb4000000023260271'/>
<osgb:networkMember xlink:href='#osgb4000000023260285'/>
<osgb:networkMember xlink:href='#osgb4000000023267900'/>
<osgb:networkMember xlink:href='#osgb4000000023282466'/>
<osgb:networkMember xlink:href='#osgb4000000023363153'/>
<osgb:networkMember xlink:href='#osgb4000000023726367'/>
<osgb:boundedBy>
<gml:Box srsName='osgb:BNG'>
<gml:coordinates>436123.623,116466.657 436398.624,119895.000</gml:coordinates>
</gml:Box>
</osgb:boundedBy>
</osgb:Road>
</osgb:roadMember>
```

2 A typical RoadLink feature

```
<osgb:networkMember>
<osgb:RoadLink fid='osgb4000000023256309'>
<osgb:version>8</osgb:version>
<osgb:versionDate>2006-01-26</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2002-12-07</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2005-02-14</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2005-11-04</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Topology</osgb:descriptiveGroup>
<osgb:descriptiveTerm>Minor Road</osgb:descriptiveTerm>
<osgb:natureOfRoad>Single Carriageway</osgb:natureOfRoad>
<osgb:length>1995.35</osgb:length>
<osgb:polyline>
<gml:LineString srsName='osgb:BNG'>
<gml:coordinates>435575.107,133944.938 435572.190,133930.441 435564.313,133880.906
435557.800,133839.596 435548.800,133808.596 435542.990,133771.641 435542.653,133770.000
435535.562,133735.427 435533.390,133724.841 435519.800,133669.598 435515.800,133654.597
435515.327,133642.828 435516.527,133637.428 435519.927,133632.828 435528.527,133628.428
435536.577,133625.208 435538.527,133624.428 435538.671,133624.301 435541.850,133621.496
435541.927,133621.428 435543.990,133617.041 435544.800,133610.600 435543.800,133600.598
435540.809,133580.701 435534.800,133545.598 435531.190,133533.841 435520.911,133486.157
435518.313,133474.106 435504.790,133425.841 435496.990,133387.041 435486.390,133326.841
435484.597,133318.094 435480.990,133308.441 435477.615,133299.187 435472.327,133287.028
435459.727,133261.028 435455.483,133250.000 435451.590,133241.241 435425.522,133185.807
435418.390,133168.641 435409.416,133144.319 435400.034,133110.000 435399.990,133109.841
435394.010,133092.665 435375.308,133040.792 435362.568,133004.024 435361.845,133000.000
435360.990,132995.241 435360.875,132966.358 435359.578,132956.456 435357.617,132947.297
435346.127,132913.828 435335.927,132890.228 435306.927,132821.228 435303.313,132812.306
435286.701,132765.083 435280.763,132744.969 435275.152,132726.858 435273.292,132720.449
435268.140,132705.824 435262.127,132687.028 435246.178,132652.076 435239.327,132636.428
435215.140,132584.820 435196.040,132546.200 435192.950,132539.491 435171.036,132461.180
435163.573,132436.564 435161.550,132426.938 435159.004,132416.600 435156.569,132402.913
435153.866,132375.320 435154.630,132365.629 435159.098,132354.362 435161.094,132350.309
435165.983,132343.850 435171.009,132338.412 435172.995,132336.764 435185.421,132331.341
435187.119,132330.976 435209.322,132329.029 435232.915,132327.816 435239.424,132327.324
435261.776,132326.096 435364.140,132317.817 435403.140,132313.822 435418.140,132310.826
435439.190,132310.041 435449.390,132308.241 435458.140,132305.827 435461.925,132304.690
</gml:coordinates>
</gml:LineString>
</osgb:polyline>
<osgb:directedNode orientation='-' xlink:href='#osgb4000000023618734'/>
<osgb:directedNode orientation='+' xlink:href='#osgb4000000023704334'/>
<osgb:referenceToTopographicArea xlink:href='#osgb1000002027201063'/>
</osgb:RoadLink>
</osgb:networkMember>
```

3 A typical RoadNode feature

```
<osgb:networkMember>
<osgb:RoadNode fid='osgb4000000023088602'>
<osgb:version>3</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2002-11-06</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2004-10-12</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Topology</osgb:descriptiveGroup>
<osgb:point>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>436282.204,110056.514</gml:coordinates>
</gml:Point>
</osgb:point>
<osgb:referenceToTopographicArea xlink:href='#osgb1000002027213985'/>
</osgb:RoadNode>
```

4 A typical FerryLink feature

```
<osgb:networkMember>
<osgb:FerryLink fid='osgb4000000023510558'>
<osgb:version>3</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2003-03-19</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2005-05-27</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Ferry Connection</osgb:descriptiveGroup>
<osgb:directedNode orientation='-' xlink:href='#osgb4000000023671913'/>
<osgb:directedNode orientation='+' xlink:href='#osgb4000000026200640'/>
</osgb:FerryLink>
</osgb:networkMember>
```

5 A typical FerryNode feature

```
<osgb:networkMember>
<osgb:FerryNode fid='osgb4000000023671913'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2005-05-27</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Ferry Connection</osgb:descriptiveGroup>
<osgb:point>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>441857.345,110892.565</gml:coordinates>
</gml:Point>
</osgb:point>
</osgb:FerryNode>
</osgb:networkMember>
```

6 A typical FerryTerminal feature

```
<osgb:networkMember>
<osgb:FerryTerminal fid='osgb4000000023671914'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2005-05-27</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Network Connection</osgb:descriptiveGroup>
<osgb:descriptiveTerm>Road</osgb:descriptiveTerm>
<osgb:descriptiveTerm>Ferry</osgb:descriptiveTerm>
<osgb:referenceToNetwork xlink:href='#osgb4000000023581896'/>
<osgb:referenceToNetwork xlink:href='#osgb4000000023671913'/>
</osgb:FerryTerminal>
</osgb:networkMember>
```

7 A typical InformationPoint feature

```
<osgb:roadInformationMember>
<osgb:InformationPoint fid='osgb4000000023465603'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2006-06-12</osgb:versionDate>
<osgb:theme>Road Network</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2002-11-21</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2006-06-07</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Information Point</osgb:descriptiveGroup>
<osgb:junctionName>M3 J11/A3090</osgb:junctionName>
<osgb:point>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>447249.035,125725.572</gml:coordinates>
</gml:Point>
</osgb:point>
</osgb:InformationPoint>
</osgb:roadInformationMember>
```

8 A typical RoadNodeInformation feature

```
<osgb:roadInformationMember>
<osgb:RoadNodeInformation fid='osgb4000000023028690'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2002-11-10</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:environmentQualifier>
<osgb:classification>Mini Roundabout</osgb:classification>
</osgb:environmentQualifier>
<osgb:referenceToRoadNode xlink:href='#osgb4000000023092238'/>
</osgb:RoadNodeInformation>
</osgb:roadInformationMember>
```

9 A typical RoadLinkInformation feature

```
<osgb:roadInformationMember>
<osgb:RoadLinkInformation fid='osgb4000000023543025'>
<osgb:version>3</osgb:version>
<osgb:versionDate>2006-02-06</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2004-02-03</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2005-12-08</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:vehicleQualifier>
<osgb:maxCompositeHeight>
<osgb:feet>10</osgb:feet>
<osgb:inches>0</osgb:inches>
</osgb:maxCompositeHeight>
</osgb:vehicleQualifier>
<osgb:environmentQualifier>
<osgb:classification>Bridge Over Road</osgb:classification>
</osgb:environmentQualifier>
<osgb:referenceToRoadLink xlink:href='#osgb4000000023256528'/>
<osgb:distanceFromStart>328.13</osgb:distanceFromStart>
<osgb:point>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>448232.492,132713.121</gml:coordinates>
</gml:Point>
</osgb:point>
</osgb:RoadLinkInformation>
</osgb:roadInformationMember>
```

10 A typical RoadRouteInformation feature

```
<osgb:roadInformationMember>
<osgb:RoadRouteInformation fid='osgb4000000023027753'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2005-09-12</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2003-02-04</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:environmentQualifier>
<osgb:instruction>One Way</osgb:instruction>
</osgb:environmentQualifier>
<osgb:directedLink orientation='-' xlink:href='#osgb4000000023281497'/>
</osgb:RoadRouteInformation>
</osgb:roadInformationMember>
<osgb:roadInformationMember>
<osgb:RoadRouteInformation fid='osgb4000000023027755'>
<osgb:version>3</osgb:version>
<osgb:versionDate>2006-02-06</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2002-11-06</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:changeHistory>
<osgb:changeDate>2002-11-06</osgb:changeDate>
<osgb:reasonForChange>Modified</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:environmentQualifier>
<osgb:instruction>No Turn</osgb:instruction>
</osgb:environmentQualifier>
<osgb:directedLink orientation='+' xlink:href='#osgb4000000023310851'/>
<osgb:directedLink orientation='-' xlink:href='#osgb4000000023443654'/>
<osgb:directedLink orientation='+' xlink:href='#osgb4000000023310848'/>
</osgb:RoadRouteInformation>
</osgb:roadInformationMember>
```

11 A typical RoadPartialLinkInformation feature

```
<osgb:roadInformationMember>
<osgb:RoadPartialLinkInformation fid='osgb4000000030579945'>
<osgb:version>2</osgb:version>
<osgb:versionDate>2005-09-14</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2003-05-01</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:vehicleQualifier>
<osgb:use exceptFor='false'>Emergency Access</osgb:use>
</osgb:vehicleQualifier>
<osgb:environmentQualifier>
<osgb:instruction>Access Limited To</osgb:instruction>
</osgb:environmentQualifier>
<osgb:referenceToRoadLink xlink:href='#osgb4000000030336163'/>
<osgb:subsectionDistance>58.30</osgb:subsectionDistance>
<osgb:subsectionPoint>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>530708.971,168116.849</gml:coordinates>
</gml:Point>
</osgb:subsectionPoint>
<osgb:subsectionDistance>65.29</osgb:subsectionDistance>
<osgb:subsectionPoint>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>530714.385,168121.246</gml:coordinates>
</gml:Point>
</osgb:subsectionPoint>
</osgb:RoadPartialLinkInformation>
</osgb:roadInformationMember>
```

12 A typical RoadPartialRouteInformation feature

```
<osgb:roadInformationMember>
<osgb:RoadPartialRouteInformation fid='osgb4000000030994505'>
<osgb:version>1</osgb:version>
<osgb:versionDate>2006-01-28</osgb:versionDate>
<osgb:theme>Road Routing Information</osgb:theme>
<osgb:changeHistory>
<osgb:changeDate>2005-11-15</osgb:changeDate>
<osgb:reasonForChange>New</osgb:reasonForChange>
</osgb:changeHistory>
<osgb:descriptiveGroup>Road Routing Information</osgb:descriptiveGroup>
<osgb:vehicleQualifier>
<osgb:type exceptFor='false'>Buses</osgb:type>
</osgb:vehicleQualifier>
<osgb:environmentQualifier>
<osgb:instruction>Access Limited To</osgb:instruction>
</osgb:environmentQualifier>
<osgb:directedLink orientation='-' xlink:href='#osgb4000000030189835'/>
<osgb:subsectionDistance>28.86</osgb:subsectionDistance>
<osgb:subsectionPoint>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>528648.472,152094.408</gml:coordinates>
</gml:Point>
</osgb:subsectionPoint>
<osgb:subsectionDistance>11.59</osgb:subsectionDistance>
<osgb:subsectionPoint>
<gml:Point srsName='osgb:BNG'>
<gml:coordinates>528650.117,152111.571</gml:coordinates>
</gml:Point>
</osgb:subsectionPoint>
</osgb:RoadPartialRouteInformation>
</osgb:roadInformationMember>
```

13 A typical Departed RoadLink feature (COU)

```
<osgb:departedMember>
<osgb:DepartedFeature fid='osgb4000000023311695'>
<osgb:boundedBy>
<gml:Box srsName='osgb:BNG'>
<gml:coordinates>442371.000,111004.000 442388.000,111082.000</gml:coordinates>
</gml:Box>
</osgb:boundedBy>
<osgb:theme>Road Network</osgb:theme>
<osgb:reasonForDeparture>Deleted</osgb:reasonForDeparture>
<osgb:deletionDate>2006-11-20</osgb:deletionDate>
</osgb:DepartedFeature>
</osgb:departedMember>
<osgb:departedMember>
<osgb:DepartedFeature fid='osgb4000000023314175'>
<osgb:boundedBy>
<gml:Box srsName='osgb:BNG'>
<gml:coordinates>444840.000,112895.000 444897.000,112944.000</gml:coordinates>
</gml:Box>
</osgb:boundedBy>
<osgb:theme>Road Network</osgb:theme>
<osgb:reasonForDeparture>Deleted</osgb:reasonForDeparture>
<osgb:deletionDate>2006-11-20</osgb:deletionDate>
</osgb:DepartedFeature>
</osgb:departedMember>
<osgb:departedMember>
```

Annexe C   Character set

The following is a list of characters and accents that will be found in OS MasterMap ITN 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