Ordnance Survey®

OS MasterMap® Imagery Layer

User guide and technical specification

OS MasterMap Imagery Layer

User guide

Contents

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Preface

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

Introduction

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

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

- Individual real-world topographic features represented by points, lines and polygons, each with their own unique reference, called a TOID®.
- A set of addresses, both postal and geographic, each with their own TOID, with a geographic coordinate and cross-referenced to physical features within OS MasterMap and to other address references.
- A structured network representing the road system and routing information related to it that may affect a driver's choice of route, with each feature having its own TOID.
- Seamless orthorectified aerial images of Great Britain taken at a resolution of 25 cm, being both geometrically accurate and colour balanced to create the clearest image possible.
- An online ordering system that allows the customer to order the exact area of interest, with the option for online or media delivery of data.
- Employing a scale of data capture appropriate to the density of features – the higher the number of features within an area, the larger the scale used to survey them – ensuring the detail of individual features can be shown and with coordinates delivered in British National Grid. There are over 460 million individual features within the OS MasterMap product as a whole (all four layers).
- Developed, managed and maintained by Ordnance Survey within one of the world's largest spatial databases.
- Each feature is uniquely referenced and also has attributes that record the feature's life cycle. The feature's life cycle is linked to the life cycle of the real-world object it represents. The life cycle records certain types of changes to the feature that occur over time.

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

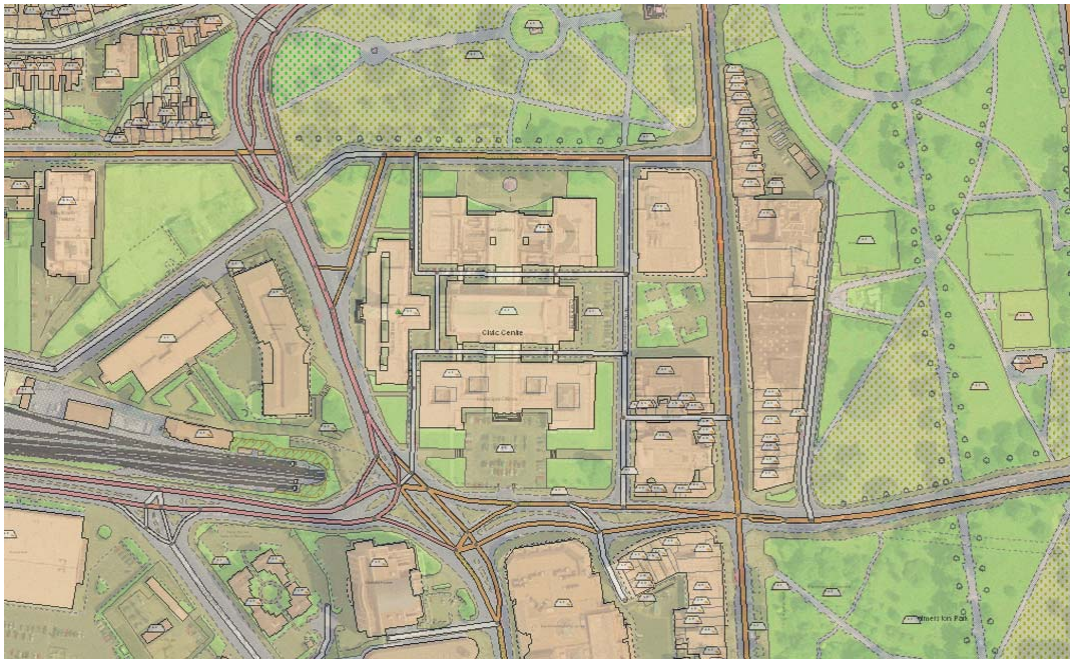


Figure 1: The four OS MasterMap layers.

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

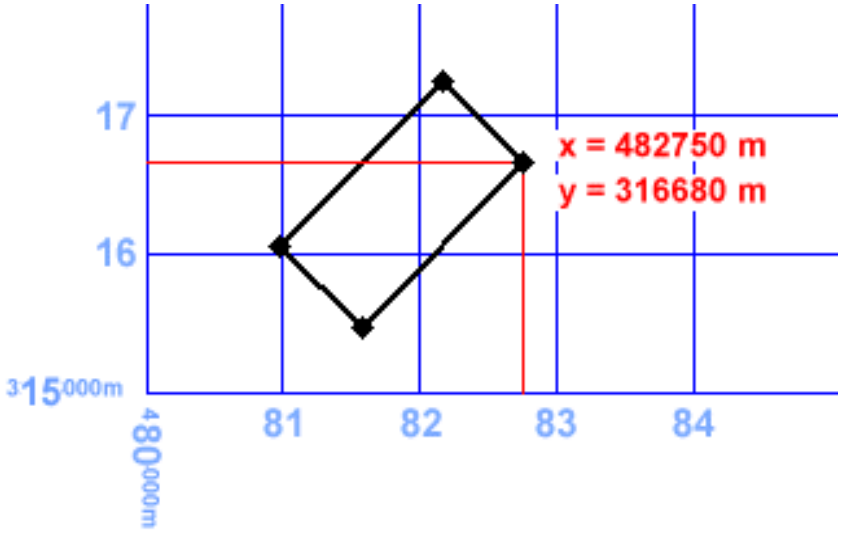


Figure 2: Vector data is stored as coordinates.

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

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

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

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

The Digital National Framework (DNF)

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

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

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

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

Ultimately, this has the potential to evolve into a network of information 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 who can incorporate OS MasterMap in their systems please see the systems/software page on the Ordnance Survey website.

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

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

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

Ordnance Survey has produced a list of questions to ask system suppliers that may help customers in choosing their system. There is also more information on handling OS MasterMap in chapter 3 on the supply of OS MasterMap.

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

Table 1: OS MasterMap data volumes

Layer	**Size**
Topography	37 Gb
Address Layer	0.9 Gb
Address Layer 2	2 Gb (GML) 1.4 Gb (CSV)
ITN	515 Mb

Average file sizes for the four imagery formats are:

- TIFF 46.9 Mb
- JPEG 4.2 Mb
- ECW 4.2 Mb
- MrSID 4.5 Mb

With imagery, additional space should be allowed for metadata and georeferencing files.

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

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

Layers

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

Topography Layer

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

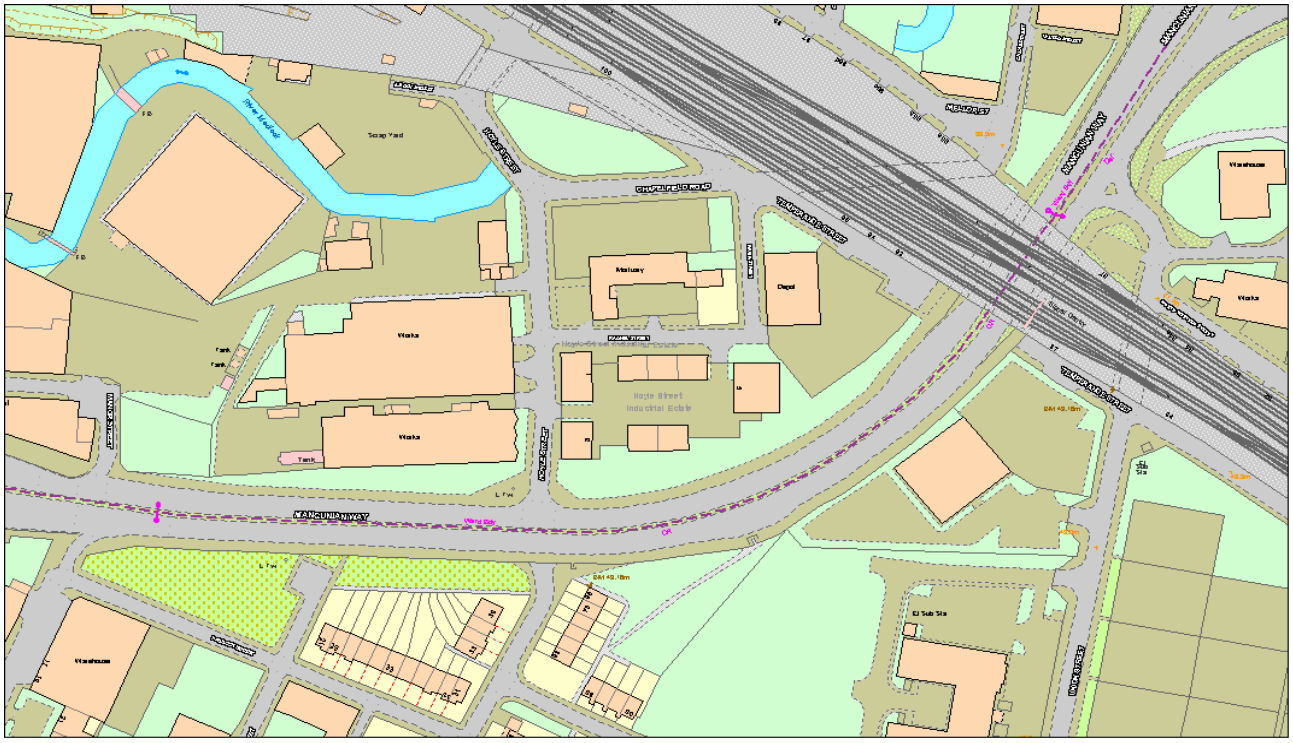


Figure 4: OS MasterMap Topography Layer.

Address Layers

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

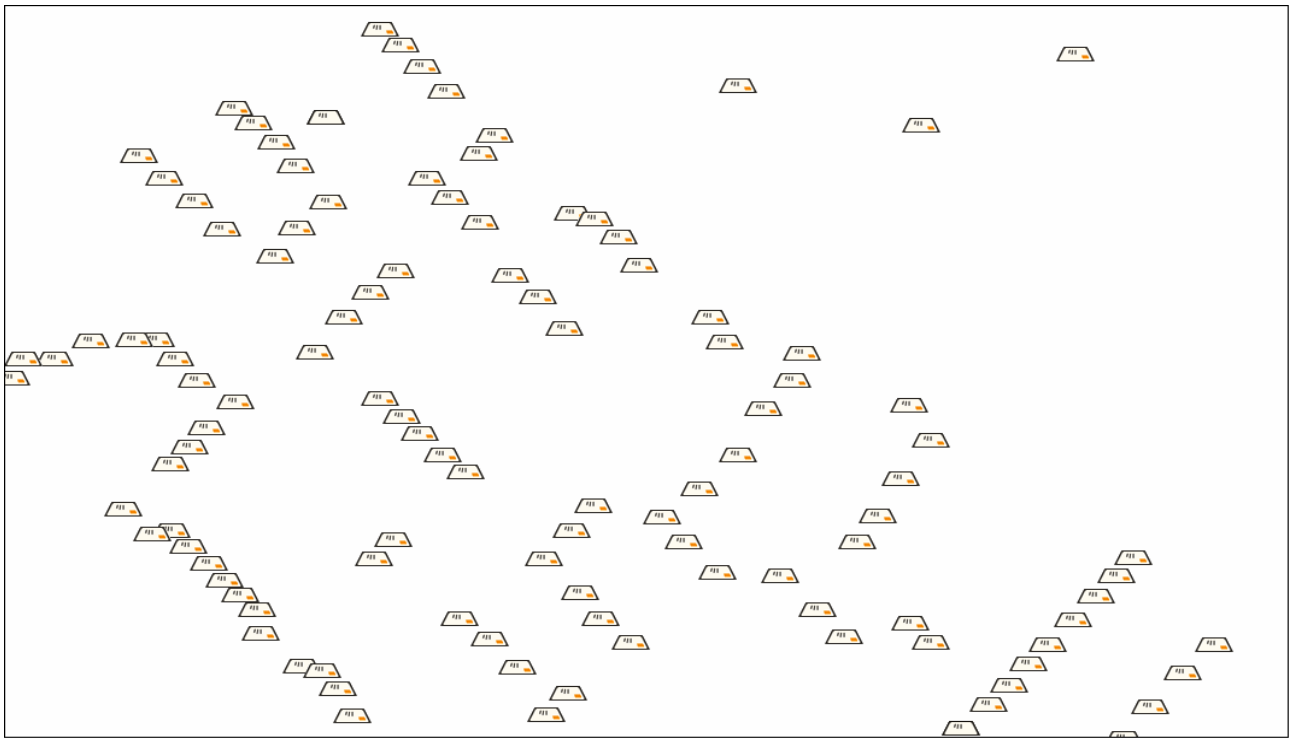


Figure 5: OS MasterMap Address Layers.

Integrated Transport Network (ITN) Layer

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

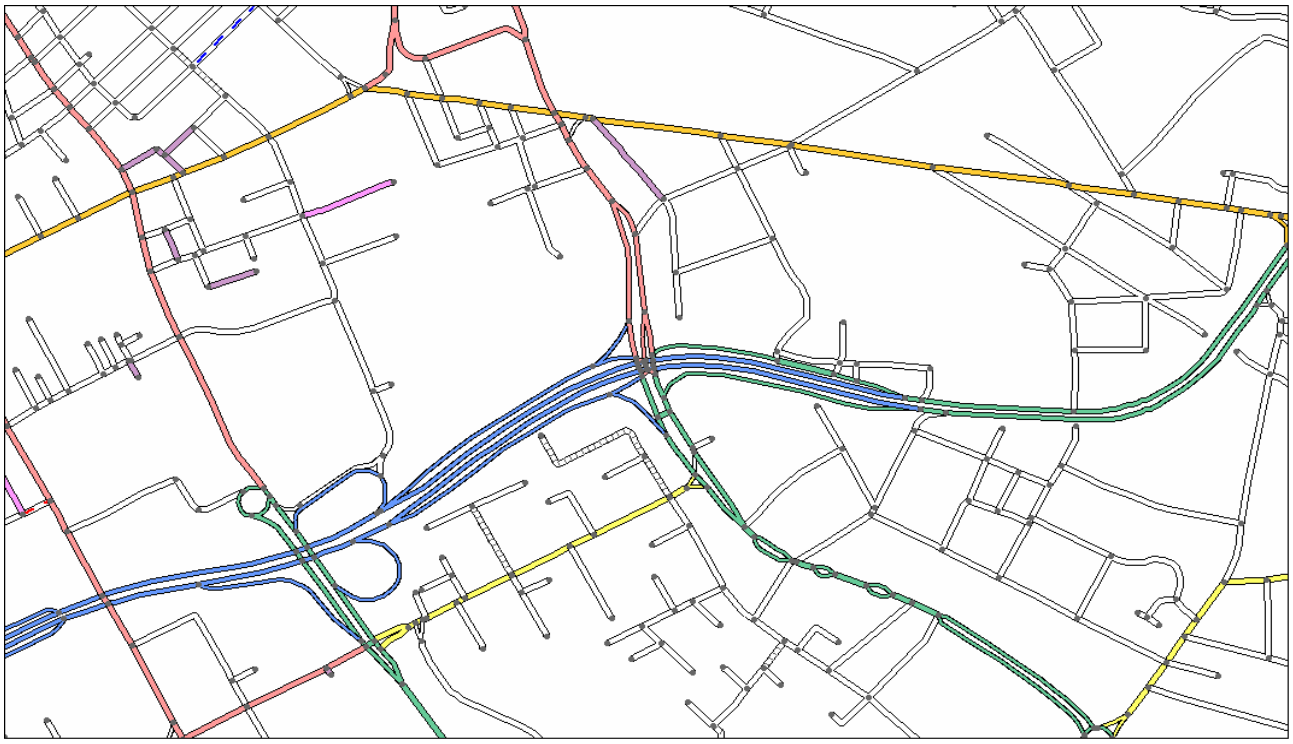


Figure 6: OS MasterMap ITN Layer.

Imagery Layer

The Imagery Layer comprises of a selection of the best available aerial images which have been edgematched together to create seamless coverage of Great Britain. An example of the Imagery Layer is shown in figure 7. The images have been orthorectified so that the features in the other MasterMap 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 conditions to minimise obscuration by shadows and cloud. Each image is also colour balanced with its adjacent images and carefully edgematched to minimise any differences caused by variations in atmospheric conditions at time of capture. Rigorous quality checks ensure that the Layer maintains a consistent standard of both positional accuracy and image quality.

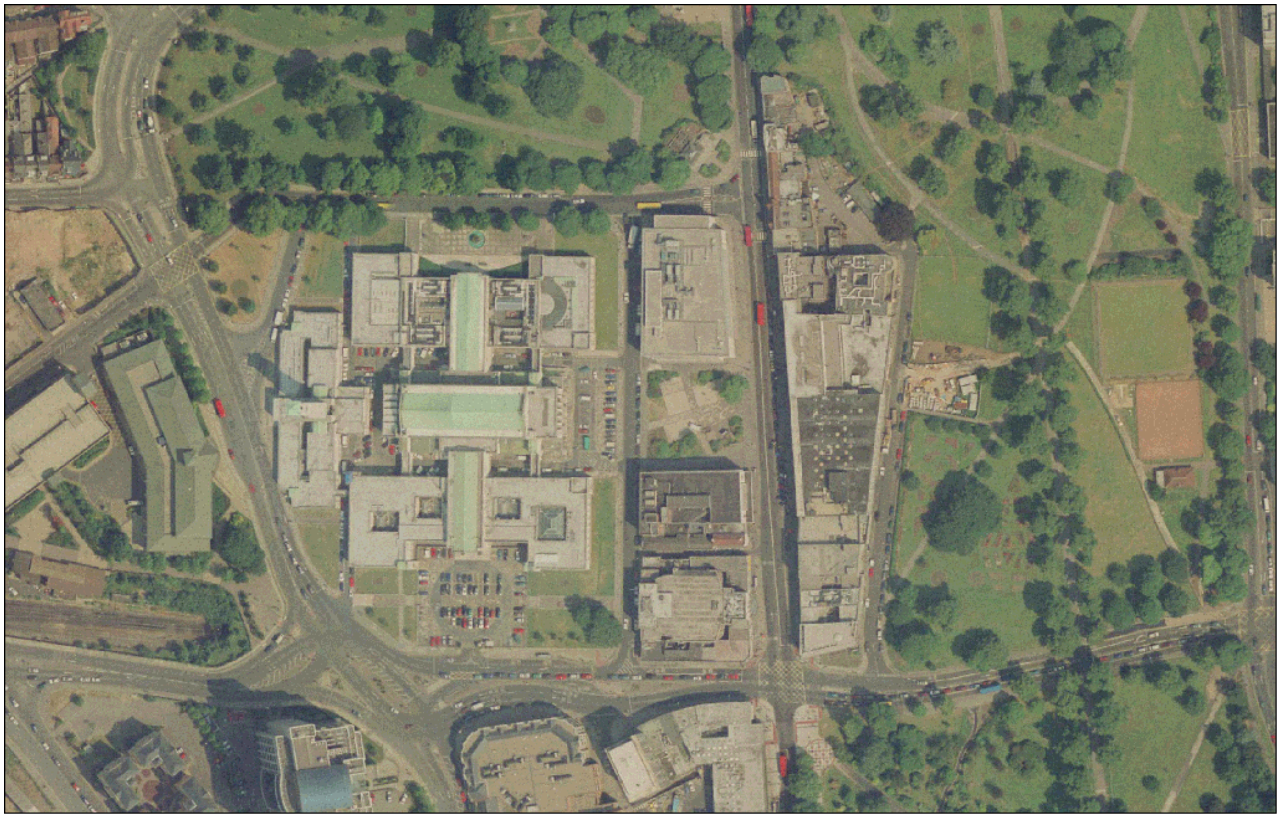


Figure 7: OS MasterMap Imagery Layer.

This chapter has outlined the main features and layers of the OS MasterMap product as a whole. OS MasterMap Imagery Layer provides a seamless source of orthorectified aerial photography that can be visually related to the other layers in OS MasterMap. The following chapter looks at OS MasterMap Imagery Layer in more detail.

Chapter 2 Introduction to OS MasterMap Imagery Layer

Introduction

The OS MasterMap Imagery Layer adds a visualisation and contextual capability to the other vector data layers in OS MasterMap.

Ordnance Survey has set the specification and quality levels for the OS MasterMap Imagery Layer with the aim of providing a reliably consistent source of orthorectified aerial photography for general business use in Great Britain. The Imagery Layer will provide users with a consistent, seamless source of imagery data that integrates with other layers in the OS MasterMap family.

The key features of the Imagery Layer are:

- Imagery is supplied to the customer in tiles that are 1 km by 1 km in 24-bit colour.
- Each image file is accompanied by XML metadata files and georeferencing files appropriate to the image format.
- Imagery is sourced from aerial photography with a ground resolution of between 15 and 20 cm before being processed to create a high quality 25 cm ground resolution. All of the imagery supplied is orthorectified using National Grid control or Global Positioning System (GPS) data with a suitable transformation. The terrain model used is at or above the specification for the Ordnance Survey Land-Form PROFILE® product.

Ordnance Survey seeks to ensure that OS MasterMap Imagery Layer is consistent in its quality across all of Great Britain by adopting a set of standards in relation to:

- the image capture (to follow RICS® specifications 89 or 2001 or equivalent);
- film and camera;
- nominal photo scale;
- orthorectification procedures, including quality of the terrain model to be used;
- geometric accuracy;
- image appearance, including thresholds for cloud cover and artefacts within the image; and
- mosaicking, including quality of joins and colour balance that significantly enhance the captured image.

Ordnance Survey recognises that advances in imagery technology and techniques should further enhance the standard of aerial imagery. The standards set for newer imagery (from January 2003 onward) therefore reflect those advances, particularly in absolute and radiometric accuracy.

The result is a product that has greatly increased utility and value through the levelling of many of those variations in colour, contrast and alignment that occur in aerial images, typically as a result of differences in process or technique in the original image capture and processing, rather than substantial changes or natural variations on the ground.

Purpose

As the use of GI and GIS spreads to a wider community of users, imagery has an important part to play with its powerful visualisation properties. It is especially attractive to customers who are less familiar with looking at and interpreting information from maps. It is becoming commonly available, at much lower resolutions, through Internet mapping applications.

In addition, it has the valuable ability to expose additional detail, including small, temporary or unmapped items, such as road furniture, car park spaces, foliage, moored boats, or cleared development sites, which cannot be derived from maps.

Differences in factors such as time and date of flying, the flying conditions and post-capture processing techniques can reduce the ability to derive information from aerial images through mismatches between colours and even alignment between features that cross the edges of images.

In the Imagery Layer Ordnance Survey has adopted production processes that are aimed at minimising the joins between the separate images. The product is colour balanced and edge matched such that analysis of information across image boundaries is not seriously hampered by misalignment or inconsistency.

Variations because of time of day differences (for example, lengthening shadows, colour changes), time of year differences (for example, vegetation changes, river levels) and age differences (for example new developments, road changes) mean that some variation is inevitable. An overzealous attempt at imposing an artificial evenness would be misleading and deter from the natural colours of real-world features in the imagery. The successful integration of imagery that has been captured and processed by several suppliers has required considerable skill and investment in time and resources.

Applications

OS MasterMap Imagery Layer can be used in applications such as property insurance risk analysis, asset management, land-use analysis, agricultural land use and crops inventory, vegetation cover, property management, planning applications, route planning and accessibility assessment, and location-based services.

Combined together, these two properties are frequently useful for site evaluations, vegetation studies and environmental analysis without the need for costly site visits.

Table 2 below provides some additional applications. Further information on using imagery in applications can be found on the OS MasterMap Imagery Layer website.

Table 2: Imagery applications

Asset management	Risk evaluation for insurance
Land use and cover analysis	Planning applications
Site evaluation	Route planning
Property management	Location-based services

Chapter 3 Supply

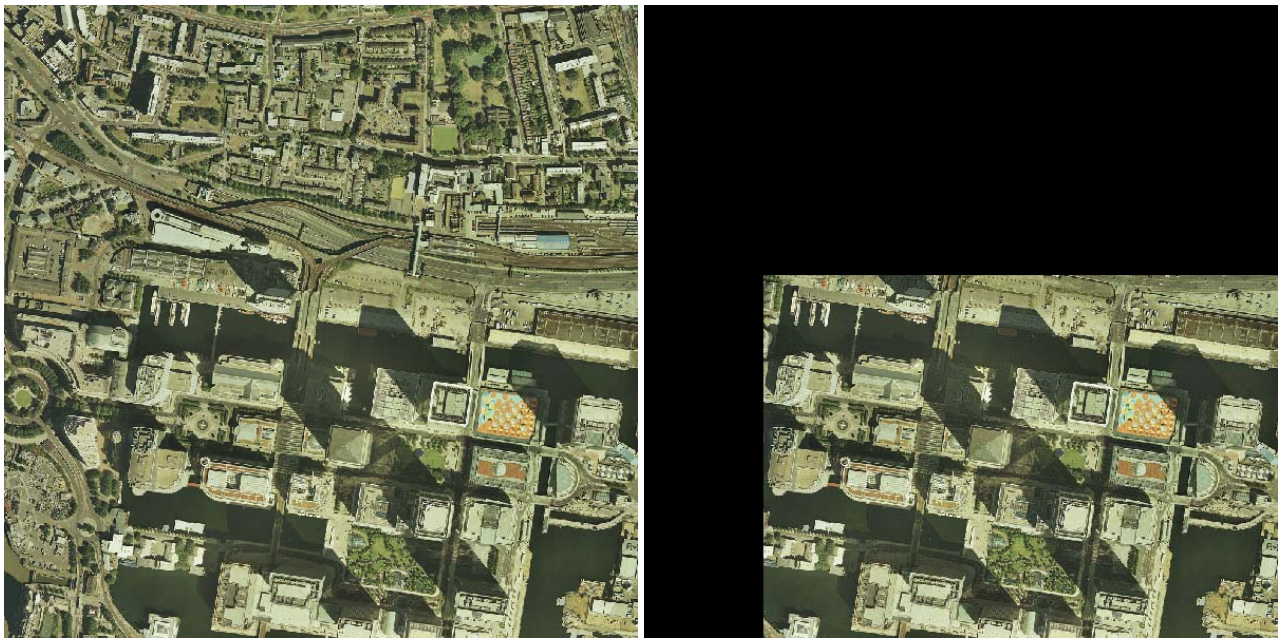
Imagery will be supplied with the exact specified area, excepting areas that did not have imagery coverage at the time the estimate was created.

Chunking

Chunking is the term given to the method of splitting OS MasterMap, which is envisaged as a seamless collection of features, into manageable file sizes. The concept of chunking is different in Imagery compared with other OS MasterMap layers in that it is delivered in 1 km by 1 km tiles that are aligned to an unchanging grid, the British National Grid.

As with the vector layers, though, the customer can define their own, irregular shaped area of interest.

The tiles are not 'cut' to match the outline of the area of interest; it would make it more difficult to align the irregular shape with the National grid if this was done. Instead, the part of the tile not within the area of interest is blacked out. In the example below figure 8 shows the 1 km covering Canary Wharf in London. As the complex only occupies the south-eastern corner of the image, the customer can define this as their own area of interest. The rest of the square would be delivered blacked out (figure 9).



Figures 8 and **9:** Selection and delivery of an area of interest.

Seamless

As stated above, OS MasterMap is envisaged as seamless representation of Great Britain, so although Imagery is delivered in 1 km by 1 km tiles, it is intended to be viewed seamlessly. Most viewing software, with the aid of georeferencing files can mosaic the customer's tiles together into a seamless image of their area of interest. It is also possible to view tiles singly, if using software that does not allow for the geographic nature of the image, for example, a desktop publishing package that can read one or more of the supply formats.

To reduce the appearance of the tile edges, a number of enhancement processes are carried out on the images. This is discussed in the technical specification.

Files and formats

Imagery is available in four formats:

- Tagged Image File Format (TIFF);
- Joint Photographic Experts Group (JPEG);
- Enhance Compression Wavelet (ECW); and
- Multi-resolution Seamless Image Database (MrSID).

Only one format can be supplied per order. Files supplied in TIFF are delivered uncompressed. The other three formats are compressed. A fuller explanation of compression is given in annexe A of this user guide. In summary the higher the amount of compression, the smaller the file size but the image will lose definition. The amount of compression is expressed as a ratio. For the formats, compression ratios are given in the table below, along with some average file sizes for a single 1 km by 1 km tile.

Details of format and compression ratios are as shown in table 3.

Table 3: Format and compression ratios

Image format	Compression type	Target compression ratio	Average file size
TIFF	Uncompressed	-	46.9 Mb
JPEG	Jpeg compression	20:1	4.2 Mb
ECW	ECW wavelet compression	10:1	4.2 Mb
MrSID	MrSID wavelet compression	10:1	4.5 Mb

For both ECW and MrSID files, a plug-in is normally required. Customers are advised to consult the suppliers of their image viewing software to discuss format requirements prior to placing an order for imagery.

File names

OS MasterMap imagery files follow a naming convention set out in table 4 with file extension denoting the image format and associated files.

Table 4: Naming conventions

Ordnance Survey layer reference	Separator	1 km ref to south-west corner of chunk	Separator	Date imagery flown yyyy-mm-dd	Separator	Version	Completeness of km – part incomplete	File extension
OSIM	–	SU1212	–	2002-05-01	–	5	_Part incomplete	.TIF; .JPEG; .ECW; .SID
OSIM	–	SU1212	–	2002-05-01	–	5	_Part incomplete	.XML
OSIM	–	SU1212	–	2002-05-01	–	5	_Part incomplete	.TFW; .JPGW; .EWW; .SIDW

Example of file name using above convention for a TIFF image:

- OSIM_SU1212_2002-05-01_5.TIF for a complete km of imagery
- OSIM_SU1212_2002-05-01_5.XML XML metadata file
- OSIM_SU1212_2002-05-01_5.TFW TIFF world file for georeferencing

Information on TIFF header files can be found in the technical specification.

Media type

Imagery orders are delivered by FTP, CD, DVD, or hard disk. The following data volume limits define the allowable media delivery option.

Medium	Max and min order size	Notes
FTP	<400 Mb	FTP orders are retained on the server for 22 days. FTP orders are compressed using ZIP.
CD	<50 Gb	
DVD	<250 Gb	
Hard disk	>10 Gb	

Image georeferencing

To view the images in geographic relationship to each other, the images have to be registered within the viewing software to the British National Grid. To enable customers to register files quickly and accurately, Ordnance Survey provides georeferencing files, also called World files, with each imagery order. Each file has a corresponding georeferencing file and there is a full set for each of the four formats. A georeferencing file basically provides the coordinates of a particular corner of an image and the viewing software uses this information to sort all the images into the right order, so that the images make a coherent geographic image when viewed collectively, as in the mosaic.

Georeferencing files are provided for each image file. Information on the contents of the georeferencing files can be found in the technical specification.

Metadata files

Metadata files are provided for each image file. They are supplied in eXtensible Mark-up Language (XML), which can be read like a text file in TextPad, for example, or in a web browser.

Further information on the contents of the metadata files can be found in the technical specification.

Image capture and enhancement

Capturing the images

Ordnance Survey captures images the initial photography as part of the Integrated Capture Programme using aeroplanes and both analogue and digital cameras. The analogue camera is now used much less as the intention is to move to a fully digital flowline. Cameras are carefully calibrated and fly with a large amount of overlap on each path, so that only the most central part of the image – where the least distortion is likely to occur – is used in the orthorectified process and to create the final 1-km tile.

Images are captured from the planes by flying in swaths or regular paths across a designated part of the country. The images are captured under very strict flying conditions which stipulates that imagery captured must be flown with the sun angle being 20 degrees to the horizon or greater to minimise the light distortion from a low sun. The flying season is typically between the months of March and November to minimise the amount of cloud cover and shadows whilst still achieving the currency demanded by customers.

Images are also supplied from contractors that are able to deliver the images to the same capture specification as Ordnance Survey.

The Imagery Layer comprises existing imagery and new imagery, which are defined as follows:

- **Existing imagery** – orthorectified imagery suitable for the OS MasterMap Imagery Layer, created prior to 1 January 2003.
- **New imagery** – orthorectified imagery suitable for the OS MasterMap Imagery Layer, created after 1 January 2003.

Completeness

Definition

Completeness is a measure of the planned national coverage against the actual imagery coverage achieved.

The current available coverage is updated monthly on the Coverage page of OS MasterMap Imagery Layer website.

Assessment and enhancement of images

- Ordnance Survey assesses the images against a range of criteria before they are accepted into the product. There are certain processes that are used to further enhance image appearance. These processes include:
  - Geometric fidelity
  - Image appearance
  - Absolute accuracy
  - Radiometric accuracy
  - Mosaicking and edgematching

These are described in the technical specification.

Chapter 4 Data management

Whether a customer wishes to hold a national set or small parts of a 1-km tile, there are a number of considerations that will determine the most appropriate method of storing and managing the data in terms of distributing the images around the organisation and also in terms of updating the image. The main issues to consider are discussed in the following sections.

Ordering updates

Ordnance Survey will provide updates of the images. After an area has been reflown, Ordnance Survey will make updates of each 1-km tile available for order. Customers can order just the changed tiles or their entire area. If customers order updates from the online service, the updates will comprise all the images that have been added to the product since the customer's last Imagery Layer order. This includes new imagery and edgematched surrounding imagery, to ensure that the updates are added seamlessly to existing holdings. Information on the currently available coverage is updated monthly on the Coverage page of the OS MasterMap Imagery Layer website.

Archiving

Ordnance Survey only supply previous imagery tile. Customers wishing to view historical images are advised to archive previous versions of images.

Mosaicking

For anyone holding Imagery of continuous geographic area or areas, building a mosaic of the images is recommended as a way to manage the files effectively and efficiently. This method arranges all the images together in correct geographic relationship to each other into one seamless or composite file. The advantages of managing the imagery tiles in this way are as follows:

- only a single file has to be opened to view all the imagery files; this is quicker than loading each tile individually into an application;
- images cannot easily get out of place;
- any updates are immediately available to all;
- it makes the most of the edgematching and colour balancing enhancements; and
- viewing the images seamlessly aides analysis and interpretation of the features.

Creating a mosaic usually requires all the images to be stored in the same file directory, so it is important to keep separate back-ups of the images.

Large area and national holdings

Customers taking very large geographic areas or Great Britain coverage will probably require substantial amount of storage, especially if taking the uncompressed TIFF.

Mosaicking the images is still a recommended first step in managing very large imagery holdings, where customers may wish to view large geographic areas involving tens of tiles at a time.

There are other technologies now available to assist with storing, mosaicking and distributing large amounts of imagery, including spatial databases and image servers. If considering ordering a very large geographic area, customers are advised to contact their system suppliers to discuss options for data management.

Small area or fragmented holdings

Some customers may hold very small areas – less than 1 km in size – that are not adjacent to each other, such as development sites, or office or asset location sites. The management of this type of holdings requires a different approach.

When a customer defines an area of interest that is less than or not coincident with the imagery 1-km tile, the rest of the 1-km tile is delivered but the area not requested is blacked out. This is done because without the whole of the tile delivered, the customer may experience difficulties in aligning the image to the National Grid with the world files.

If a customer subsequently wishes to order another part of the same 1-km tile, it is advised that the new area be added by expanding the existing contract area. The customer should then request a full resupply of the areas affected by the expanded contract.

If a customer were to order the new part of the tile separately, as a new contract, the supplied tile would be blacked out in the area of their previous order on the tile. As both tiles would have the same tile name and the same world file, one tile would sit over the other when both are loaded/displayed, making it harder to view both imagery areas/orders at the same time without applying transparency effects to black pixels.

Annexe A Image formats

TIFF

TIFF (Tagged Image File Format) is one of the most commonly used *lossless* image formats. TIFF is primarily designed for raster data interchange, and is supported by numerous image-processing applications. It also has the ability to decompose an image by tiles rather than scan lines. This permits much more efficient access to very large imagery that has been compressed, since an entire scan line does not have to be decompressed.

JPEG

A JPEG image, named after the Joint Photographic Experts Group, uses a lossy compression format. It is designed for compressing either full-colour or greyscale images of natural, real-world scenes and so works well on photographs. It has become the de facto standard for photographs on the web.

JPEG files achieve much greater compression than is possible with lossless methods such as TIFF. As JPEG is designed to exploit known limitations of the human eye, notably the fact that small colour changes are perceived less accurately than small changes in brightness, JPEG is intended for compressing images that will be looked at by humans. If the images are to be analysed by computer programs, the small errors introduced by JPEG may affect the results, even if they are invisible to the eye.

A disadvantage of JPEG files is that, due to its lossy compression, the images will lose their quality each time they are saved, closed and then reopened (the image is compressed each time). As repeated saves in TIFFs will not degrade picture quality, and it is therefore advisable to use a lossless format (TIFF) while editing the image, then save as a JPEG to store it or to send out on the Internet. If further edits are anticipated at a later stage, a user is advised to retain an original, unedited lossless master copy to work from.

ECW

The Enhanced Compressed Wavelet (ECW) raster image compression software has been designed to compress, display, Internet serve and distribute imagery. The key characteristic of wavelet-based compressions is that they are able to preserve a very good quality of the image with high compression ratios.

This compression format uses mathematical wavelet transformations to store image data, rather than storing a grid of values for image pixels such as TIFF or other common formats. This allows a great reduction in the amount of disk space it takes to store large images, whilst retaining nearly all the original image's quality, colour and detail.

ECW is a lossy format, meaning that some information is lost when the image is converted from its original format to the ECW format. However, wavelet compression is very good at retaining the character of images, so the amount of loss is very small.

MrSID

MrSID (Multi-resolution Seamless Image Database) is a wavelet-based image compressor, viewer and file format for large raster images that enables instantaneous viewing and manipulation of images locally and over networks while maintaining maximum image quality.

Annexe B Product and service performance report form

Ordnance Survey welcomes feedback from its customers about OS MasterMap Imagery 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 Imagery Layer Product Manager, Ordnance Survey, Adanac Drive, SOUTHAMPTON, SO16 0AS.

If you wish to return it by fax, please dial +44 (0)8450 990494.

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 Imagery Layer

Technical specification

Contents

v1.4 – 12/2010

Introduction

Purpose of this specification and disclaimer

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

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

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

Copyright in this specification

Chapter 1 TIFF header files

TIFF header files

TIFF is delivered with TIFF header information. The information provided is given in table 1.

Table 1: TIFF header files

TIFF header
Tag 256 (image width)
Tag 257 (image length)
Tag 258 (bits per sample)
Tag 259 (compression)
Tag 262 (photometric interpretation)
Tag 269 (document name)
Tag 273 (strip offsets)
Tag 274 (orientation)
Tag 277 (samples per pixel)
Tag 278 (rows per strip)
Tag 279 (strip byte counts)
Tag 284 (planar configuration)
Tag 305 (software)
Tag 306 (date time)
Tag 33550 (model pixel scale tag)
Tag 33922 (model tie point tag)
Tag 34735 (GeoKey directory tag)

Chapter 2 Georeferencing files

The information contained in the georeferencing files is given in table 2.

Table 2: Georeferencing files

Image format	Georeferencing file	Description	Example
TIFF	*.TFW	TIFF world file states the X,Y coordinate of the centre of the north-west pixel.	0.250000 0.000000 0 -0.25000 297000 125000 570999.875000
JPEG	*.JGW	JPEG world file states the X,Y coordinate of the centre of the north-west pixel.	0.250000 0 0 -0.250000 467000.125000 98999.875000
ECW	*.EWW	ECW world file states the X,Y coordinate of the centre of the north-west pixel.	0.250000 0 0 -0.250000 176000.125000 827999.875000
MrSID	*.SDW	ECW world file states the X,Y coordinate of the centre of the north-west pixel.	0.250000 0 0 -0.250000 176000.125000 827999.875000

Chapter 3 Metadata files

Metadata information is given in table 3.

Table 3: Metadata

Metadata property (as xml tags)	Value examples	Cardinality	Notes
copyright	Ordnance Survey, © Crown copyright	1	
kmReference	SU3608	1	
version	5	1	
dateFlown	2002-07-21	1.2	Single date shown as: CCYY-MM-DD Date range shown as dateFlown Earliest Date dateFlown Latest Date As shown in example in below
kmRectangle	436000,108000 437000,109000	1	Coords in metres
lensFocalLength	150.352	1	Millimetres
nominalFlyingHeight	1 800	1	Metres
nominalImageScale	1:10 000	1	Calculated from lens focal length and nominal flying height.
resolution	0.25	1	Metres
fileSize	46.877	1	Megabytes to three decimal places
control	'GPS and OSTN02'	1	Choice of 'GPS and OSTN02™', 'NG from traditional control' or 'Land-Line®'.
createdBy	'Ordnance Survey'	1	Name of supplier
correctionType	'Orthorectified'	1	Fixed value

Where imagery has been merged from more than one source with different flying dates it is possible that small areas of imagery within a 1-kilometre square will not match the metadata values, particularly in rural areas where variations are not significant.

The files are encoded in XML according to an XML schema definition that is available at: http://www.ordnancesurvey.co.uk/oswebsite/xml/schema/index.html.

The geometry components make use of GML 2.1.2 geometry definitions. An example is outlined below:

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

<!-- Metadata for file OSIM_NX9770_2005-05-13_05.TIF (unique tile ID 67500) -->

<!-- Created on 2006-08-29 16:40:18 -->

<osgb:OSIMProductMetadata 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' xsi:schemaLocation='<http://www.ordnancesurvey.co.uk/xml/namespaces/osgb OSIMProductMetadata.xsd>'>

<osgb:copyright>Ordnance Survey, (c) Crown Copyright</osgb:copyright>

<osgb:kmReference>NX9770</osgb:kmReference>

<osgb:version>5</osgb:version>

<osgb:dateFlown>2005-05-13</osgb:dateFlown>

<osgb:kmRectangle>

<osgb:Rectangle srsName='osgb:BNG'>

<gml:coordinates>297000,570000 298000,571000</gml:coordinates>

</osgb:Rectangle>

</osgb:kmRectangle>

<osgb:lensFocalLength
uom='http://www.ordnancesurvey.co.uk/xml/resource/units.xml#millimetres'>152.754</osgb:lensFocalLength>

<osgb:nominalFlyingHeight
uom='http://www.ordnancesurvey.co.uk/xml/resource/units.xml#metres'>1300</osgb:nominalFlyingHeight>

<osgb:nominalImageScale>1:8500</osgb:nominalImageScale>

<osgb:resolution uom='http://www.ordnancesurvey.co.uk/xml/resource/units.xml#metres'>0.25</osgb:resolution>

<osgb:fileSize uom='http://www.ordnancesurvey.co.uk/xml/resource/units.xml#MegaBytes'>46.877</osgb:fileSize>

<osgb:control>GPS and OSTN02</osgb:control>

<osgb:createdBy>Ordnance Survey</osgb:createdBy>

<osgb:correctionType>Orthorectified</osgb:correctionType>

</osgb:OSIMProductMetadata>

Chapter 4 Image enhancement

Geometric fidelity

Geometric fidelity is the trueness of features in the Imagery Layer to the shapes and alignments of the real-world objects they represent. Normally, geometric fidelity takes priority over relative and absolute accuracy.

Geometric fidelity is judged on the following factors:

- Detail that is square on the ground is represented as square in the Imagery Layer, and shapes must be visually accurate.
- Alignments that are straight in the real world are represented as straight lines within the Imagery Layer.
- Lines of sight that pass through ground points should, when viewed at actual pixel resolution (1:1 scale), pass through the plan positions of the corresponding points in the Imagery Layer.
- Adjacent features are in sympathy with each other as regards alignment and orientation.

Image appearance

There are a number of factors that can degrade the overall appearance and quality of the image. Each image is assessed for the following defects before being accepted.

- An **artefact** is the term given to small objects that might appear on the imagery but are not related to real world conditions; examples include dust and fibres. The existence of an artefact may not render the image unacceptable if they do not have a significant impact on the actual image – for example, they do not obscure objects/features – but their impact must be minimal. Any images with artefacts that obscure objects/features are rejected. The increasing use of digital imagery ensures that the occurrence of artefacts is rare.
- **High pixel counts at the extremes of the histogram** curve may be detrimental to the image appearance. This is particularly so with the presence of high pixel count spikes within 10 greyscale levels of either 0 or 255 (**high pixel counts** are regarded as spikes of counts over 16 000 pixels in this case for digital imagery). Where these high pixel counts are present they will be judged under image appearance rules. In some cases high pixel counts may be acceptable due to attributable specific features. Examples of specific features where this can occur are white-roofed buildings, building shadow, caravan parks, inland water and dense urban areas.
- **Cloud and snow cover** must be less than 3% per 5 km by 5 km block, and less than 5% per 1 km image. Any detail within the 1 km image that is obscured must not be of high significance (examples of high significance detail being all urban areas and housing or roads in rural areas). In mountainous areas these criteria may be relaxed to 10% obscured per 5 km by 5 km block and less than 15% per 1 km image and is provided only small amounts of ground detail are affected.
- **Colour and light balance** must be consistent across the image with an absence of banding caused by vignetting or hot spots caused by excessive light. The colour within the image must be a realistic representation of the true colour on the ground.
- **Contrast** must be consistent across the image.
- **Sharpness and image smearing** – the image should be sharp when viewed at actual pixel resolution (1:1 scale) and should not show unnecessary pixilation or softness due to flying conditions (for example, haze) or image processing. Image smearing, blurring or ghosting are not acceptable, except in exceptional circumstances where it does not have a detrimental affect on the overall image appearance.
- **Obscuring shadow** is shadow that is pure black and in which no information is available. Obscuring shadow must be less than 1% per sq km for naturally occurring features such as cliff faces, and no more than 0.05% per sq km within built-up areas (for example, farms, hamlets or larger communities). This is also reflected in a high pixel count at the low end of the histogram (levels 0 to 10). Furthermore:
  - in mountainous areas obscuring shadow must be less than 3% per sq km for naturally occurring features such as cliff faces, and no more than 0.05% per sq km within built-up areas (for example, farms, hamlets or larger communities); and
  - within any non-obscuring shadow area it must be possible to interpret and identify topographic features such as street furniture, road markings, access routes and extent of buildings.
- **Missing pixels** – missing pixels appear black in the image and will not be accepted.

- **Image flaring** – an example of where this may occur is from expanses of glass, such as greenhouses or car windscreens, where substantial reflection can cause flaring. This must be kept to a minimum and not have a detrimental effect on the image appearance or obscure any permanent feature.
- **Colour bleeding** occurs where colour moves outside of its real-world object in the image into the surrounding pixels. This must be kept to a minimum and not be detrimental to the image appearance when viewed at true scale (that is 1:1).
- **Colour misregistration** happens where one colour band has systematically shifted in relation to the others. This must be kept to a minimum and not have a detrimental effect on the image appearance.
- **Rainbow effects** are caused by image processing and can be visible at the border of bright areas. This must be kept to a minimum and not be detrimental to the image appearance when viewed at true scale (that is 1:1).
- **Image burnout** happens where white surfaces appear 'bleached' and information has become obscured. This is also reflected in a high pixel count at the high end of the histogram (levels 245 to 255). This must be kept to a minimum and not obscure detail in the image.
- **Pixels that are stretched,** especially in near vertical slopes and cliffs during the orthorectification process must be minimised to avoid detrimental image appearance.

Absolute accuracy

Absolute accuracy is a measure that indicates how closely the coordinates of a point in the Imagery Layer agree with the true coordinates of the same point on the ground in Ordnance Survey National Grid and is measured by comparing the position recorded in the Imagery Layer and the true position of the feature on the ground. It is expressed in terms of root mean square error (RMSE).

There are different values of attribute accuracy, depending on when the imagery was created. This difference has occurred through the change to more advanced techniques in 2003.

Two data capture standards apply to the Imagery Layer:

- Urban and rural areas encompassing all 1:1250 scale and most 1:2500 scale topographic basic-scale areas, as well as a few small 1:10 000 scale topographic basic-scale areas.
- Designated sparsely populated areas encompassing the majority of 1:10 000 scale mountain and moorland and some 1:2500 scale topographic basic-scale areas.

Absolute accuracy of existing imagery

Existing imagery refers to imagery created prior to 1 January 2003: the absolute accuracy is described in table 4.

Table 4: Existing imagery

Data capture standards	RMSE
Urban and rural areas	2.5 m
Mountain and moorland areas	4.0 m

Absolute accuracy of new imagery

New imagery refers to imagery created after 1 January 2003: the absolute accuracy of new imagery is given in table 5.

Table 5: New imagery

Data capture standards	RMSE
Urban and rural areas	1.1 m
Designated sparsely populated areas	4.0 m*

* 3.4 m applies to any imagery created from photography flown in areas of designated sparsely populated areas after 1 March 2004.

Radiometric accuracy

Definition

Radiometric accuracy is a measure of the colour balance, luminosity and contrast of the image. Luminosity being the luminance of the composite channel as measured in Adobe Photoshop®.

In all areas, detail in shadow must be visible.

The following measurables apply to each separate km tile:

- The mean histogram (luminosity).
- The mean of the individual colour bands.
- The standard deviation for each colour band.

Radiometric accuracy of new and existing imagery

The mean histogram (luminosity) has a value between 100 and 128 +/- 10% (90 to 141).

Red band mean = 110 +/-15% (94 to 126); SD ≥ 30.

Green band mean = 118 +/-15% (100 to 136); SD ≥ 28.

Blue band mean = 90 +/-20% (72 to 108); SD ≥ 23.

Colour band must conform across the whole block that is supplied.

The specification values ensure consistent balanced imagery. In areas where the specification could not be met (in areas of homogeneous colour, for example woodland) the shadow areas show detail and generally have greyscale values of 30 or less, and highlight areas show detail and generally have greyscale values over 225. The colour balance will be consistent with the surrounding area.

Radiometric accuracy of digital camera imagery

In line with the continuous improvement of the product, the definition of the radiometric accuracy has been improved for images captured using digital photogrammetric cameras from 2007 onwards.

The radiometric properties of the ortho-images within the OS MasterMap Imagery Layer will vary depending on the predominant nature of the topography within each kilometre tile. These have been categorised as follows:

- **Urban/built topography**

  All land that has been built on, including all urban areas, airports, industrial complexes and so on.

- **Mixed rural topography**

  All land that has a topography that contains a predominant natural or agricultural coverage, for example, woodland, fields.

- **Monotone topography**

  All land that contains little variation in terrain appearance. This presence is likely to skew the tonal representation. Examples could be in rural, moorland or mountainous areas.

- **Urban/built topography**
  - The mean histogram (luminosity) has a value between 90 and 141.
  - Red band mean = 107± 18% (89 to 126); standard deviation >30 and <60.
  - Green band mean = 118 ± 15% (100 to 136); standard deviation >28 and <58.
  - Blue band mean = 94 ± 21% (74 to 115); standard deviation >15 and <53.
  - Colour band must conform across the whole block that is supplied.

- **Mixed rural topography**

  To reflect the nature of the topography, the standard deviation values are lowered to produce acceptable imagery, as specified below:

  - The mean histogram (luminosity) has a value between 90 and 141.
  - Red band mean = 107 ± 18% (89 to 126); standard deviation >20 and <50.
  - Green band mean = 118 ± 15% (100 to 136); standard deviation >20 and <48.
  - Blue band mean = 92 ± 20% (74 to 110); standard deviation >9 and <43.
  - Colour band must conform across the whole block that is supplied.

- **Monotone topography**

  To reflect the nature of the topography the standard deviation values are not applicable and are replaced by the image appearance criteria. The radiometric test for these areas is specified below:

  - The mean histogram (luminosity) has a value between 90 and 141.
  - Red band mean = 107 ± 18% (89 to 126)
  - Green band mean = 118 ± 15% (100 to 136)
  - Blue band mean = 92 ± 20% (74 to 110)
  - Colour band must conform across the whole block that is supplied.

Mosaicking and edgematching

Mosaicking and edgematching are two processes that check the overall appearance not just of a single image but of images when viewed alongside each other in the National Grid alignment.

Mosaicking is the process of creating a single image of a defined geographic area from a number of smaller images of the same geographic area.

Block edgematching is the process of joining adjacent blocks of imagery captured at different times so as to remove visible joins and merge colour differences to prevent obvious edge lines.

These processes involve looking for:

- visible joins within a block and between different blocks;
- colour and contrast balance within a block and between different blocks; and
- ortho-image consistency within a block and between different blocks.

Sea only tiles are an exception, as it is not practical to create an entirely seamless mosaic. Sea-only tiles should have a minimal feathering applied between images.

The above information provides a summary of the very detailed acceptable quality levels that all imagery suppliers adhere to. In essence, the customer must be able to extract information from the imagery and this should remain as true as possible to the real world.

Annexe A Glossary

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

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

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

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

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

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

colour band
This will be red, green or blue.

colour balancing
The process to balance the colour bands within the image to match the surrounding and existing imagery to achieve the best visual effect.

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.

contrast
The difference in tone between adjacent areas.

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

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

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

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

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.

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.

ghosting
Where a feature in the image appears to have a dimmer, offset copy of itself.

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

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

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

histogram
A graph showing the number of pixels plotted against the lightness value of the pixel from black (0) to white (255).

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.

luminosity
The lightness of a colour.

media supply
See offline supply.

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

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

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

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

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

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

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

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.

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.

root mean squared error (RMSE)
The square root of the sum of the squares of the errors between observations.

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.

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.

TOID
An identifier that uniquely identifies every feature.

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.