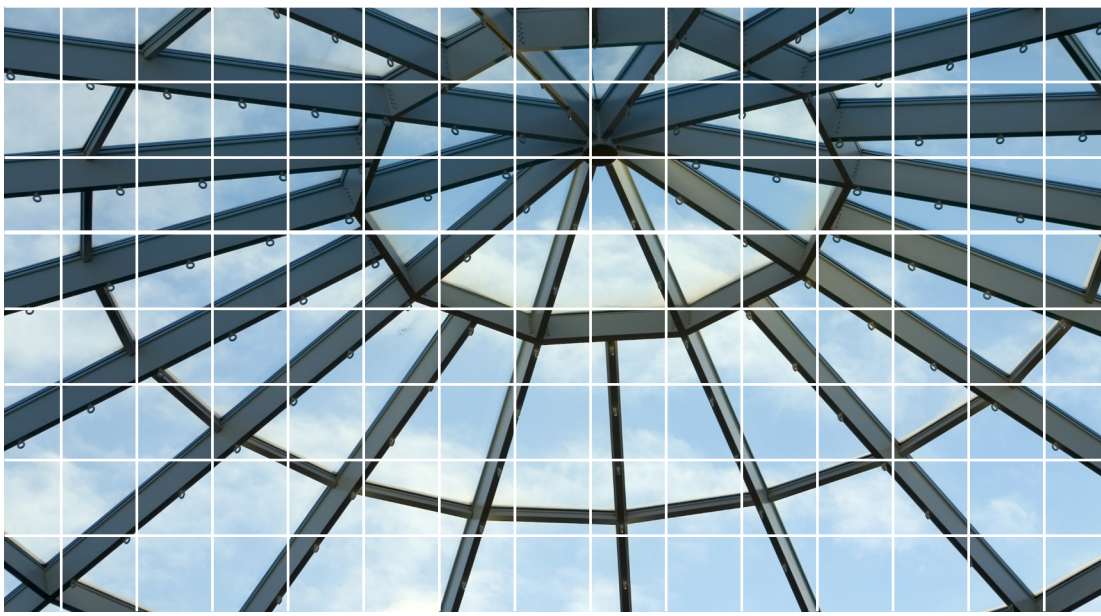
ESRI UK
Visionary Thinking

## Additional notes

- OSM is created and maintained by the user community, its level of content is not homogeneous. There are areas where information is scant at best. So it cannot be assumed that the rich content available for urbanised areas such as London, Cambridge, Oxford and other similar metropolis would be also found in rural, isolated areas.
- When using the OSM data is needs to be credited. Guidance notes on this can be found at http://wiki.openstreetmap.org/wiki/Legal_FAQ and at http://www.opengeodata.org/2008/01/07/the-licence-where-we-are-where-were-going/

# Working with

# OpenStreetMap in ArcGIS



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**This document presents a number of methodologies for working with OpenStreetMap data in ArcGIS. It should be noted that OpenStreetMap is an evolving project and as such new approaches will, over time, become available and supersede others. Please take note of the document publishing date when using this guide and refer to some of the key websites referenced for the most up to date information. This guide was written and based around working with ArcGIS 9.3.1**

## What is OpenStreetMap data and how is it licensed?

OpenStreetMap (OSM) is a free, editable map of the world, which was created in 2004 by Steve Coast, after he became frustrated by the lack of freely available maps in the UK. Because the OSM user community edits and maintains the data, it can be considered as the Wikipedia of geographic data.

OSM data can be downloaded as vector graphics and/or rendered images under the Creative Commons ShareAlike 2.0 (CCSBYSA) license. However, the OpenStreetMap Foundation is recommending the adoption of a new license, the Open Database License, in order to overcome some known problems with the CCSBYSA license.


## Downloading data for the UK

The full OSM dataset is available for download from the OpenStreetMap website. Data normally comes as OSM data .osm files. To download directly from OSM the easiest way is via Planet.osm, which is a snapshot of the OSM database. When downloading smaller subsets of the data, OSM describe a number of methodologies.

An easier way to access subsets of the data can be through one of three mirrors that offer extracts of data for almost all of the UK. Of these mirrors Geofabrik and Cloudmade are entities that are committed to providing value added services and support to the OpenStreetMap project and its user community. The third mirror is maintained by Nick Whitelegg, the developer of Freemap.

The following table summarises the properties of the three mirrors:

| Mirror | Data Formats | Areas | Updates |
|---|---|---|---|
| Geofabrik | OSM Planet (bz2 compressed); shapefile | GB; Isle of Man | Daily |
| Cloudmade | OSM Planet (bz2 compressed); shapefile; POI (.gpx); Garmin (.img); others. | GB; Isle of Man; England; Scotland; Wales; Some counties; London (Enfield) | Weekly |
| Nick | OSM Planet (bz2 compressed) only | GB; various regions | Weekly |

*Note: OSM Planet files are in XML, and compressed into the bz2 format. The OSM loader described later in this article can use the compressed files directly. Other conversion tools however, such as the ArcGIS Data Interoperability extension, or Safe Software's FME, require the data to be in its uncompressed state. Use a program such as WinZip, 7-Zip, or IZArc to uncompress the file.*

None of the mirrors listed above include a proper set of data for Northern Ireland. The Geofabrik extract covers only Great Britain, while the Cloudmade and Nick extracts come with varying sized chunks of the Irish mainland included.

It is important to note that both Geofabrik and Cloudmade offer the same OSM Planet extracts in shapefile format. The shapefile downloads however are limited in comparison to the OSM Planet extracts; Geofabrik only contains some features and Cloudmade lacks useful attribution. The python script below allows working with the OSM bz2 format and maintains more of the attribution.

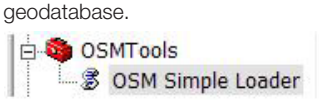
# Workflow for processing the UK OSM Planet file

Once downloaded from any of the mirror sites, the OSM bz2 file can be loaded directly into a file geodatabase using the OSM Loader, a geoprocessing utility (toolbox and script) developed for this purpose. Once downloaded, the readme document contains instructions on how to install the toolbox into ArcGIS.

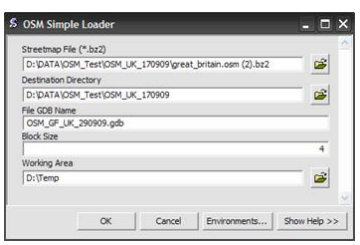
By default, OSM Planet snapshots are in the WGS84 projection, so data for the UK should be projected to British National Grid using the OSGB 1936 Petroleum transformation. Alternatively, if it is intended to be used in conjunction with Bing Maps or Google data, it should be projected to Web Mercator projection instead.

The workflow for processing a UK OSM Planet file using the OSM Simple Loader Geoprocessing tool is as follows:

1. **Download** the desired OSM Planet snapshot (e.g. great_britain.bz2)
2. **Run** the OSM Simple Loader to load the Planet data into a file geodatabase.

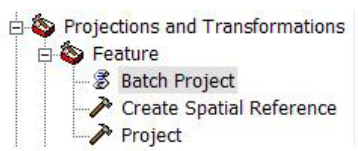



In the following example, the planet file great_britain.osm(2).bz2 is to be loaded into a file geodatabase named OpenStreetMapPlanet.gdb (the default name):

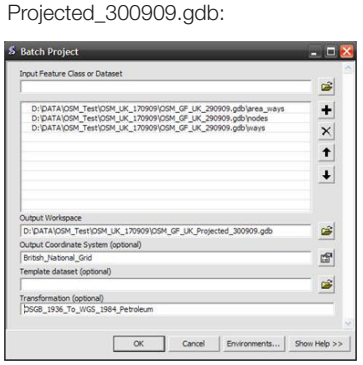



After the data is loaded, the geodatabase will look as follows:


3. **Project** the data to British National Grid. By default, the data in the geodatabase is in the same projection as in the Planet file, which is WGS84. Use the Batch Project geoprocessing tool. This tool is under Data Management Tools > Projections and Transformations > Feature > Batch Project, in the ArcToolbox:




Create a new empty file geodatabase to hold the projected feature classes. In the following example, the three projected feature classes will be stored in OSM_GF_UK_Projected_300909.gdb:




Make sure to enter the corresponding code for the correct transformation for the UK and GB, in this case 'OSGB_1936_To_WGS_1984_Petroleum'

4. **Create** a coastline polygon feature class to build the mainland polygon outline.

   One slight problem with OSM data is that there are some areas that do not 'close'. Most notable instances of this anomaly for the UK are the polygons representing the mainland. To work around this, a polygon of the mainland can be created from the OSM ways representing the coastline. In ArcMap use a definition query to isolate the coastline line features ("osm_way_tags_natural"='coastline'). This can then be converted into a polygon feature class using the topology tools. There are still some issues with missing features, most obviously, the 'Outer Hebrides'.

   The following example shows the completed file geodatabase, including the mainland polygon:

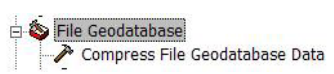

5. **Create** attribute indexes for the feature classes. Since all of the symbolisation and labelling of the layers in the map document (mxd) are based on attribute queries, creating indexes for the queried attributes should improve overall performance.

   To create attribute indexes, run the Add Attribute Index geoprocessing tool, which can be found in the ArcToolbox, under Data Management Tools > Indexes > Add Attribute Index:


Run the tool for each of the feature classes, and index the following attributes:

- Area_ways: _highway; _railway; _waterway; _name; _ref.
- Nodes: place; name.
- Ways: _landuse; _leisure; _amenity; _natural; _power; _waterway; _shop; _name; _military.

6. **Compress** the file geodatabase. This will both result in an increase in performance and a reduction in the size of the file geodatabase. Use the Compress File Geodatabase Data in the ArcToolbox, which can be found under Data Management Tools > File Geodatabase > Compress File Geodatabase Data:




As an illustration, compressing the file geodatabase used in the previous examples resulted in a 1/3 reduction in size, from 352MB to 123MB. Also, performance while navigating through the data in ArcMap was greatly improved.

## The Map Document (mxd): What is in it and why?

The main objective behind the creation of the Map Document was to generate the base definition for a cached map service for the UK that could be used as base map in a variety of web mapping applications, either by itself, or by mashing it up with other cached or dynamic map services. Consequently, it was decided to leave out of the base map all Points of Interest (POI) related information that is included in the geodatabase. One of the most important factors that need to be considered in the design of a cached map service is the selection of the scales at which the map is to be cached. In this instance it was decided to use the cache schema used by both Google and Microsoft on their own web mapping services, Google Maps and Bing Maps respectively.

The symbology used in the creation of the map has been based on the rendering used in the online OSM service when viewed using the Mapnik rendering.

The Map Document contains 12 groups of layers plus an additional layer which corresponds to the mainland polygon. Each of the 12 groups corresponds to a cache scale. Therefore the content and rendering of each group has been put together so that it emulates the corresponding scale in the OSM online service. The following table shows the correspondence between OSM cache level, the Map Document Group Layer, and the cache scale:

| OSM Scale Level | MXD Group Layer | Cache Scale |
|---|---|---|
| Z 6 | Level 6 | 1:4,622,325 |
| Z 7 | Level 7 | 1:2,311,162 |
| Z 8 | Level 8 | 1:1,155,581 |
| Z 9 | Level 9 | 1:577,581 |
| Z 10 | Level 10 | 1:288,895 |
| Z 11 | Level 11 | 1:144,448 |
| Z 12 | Level 12 | 1:72,224 |
| Z 13 | Level 13 | 1:36,112 |
| Z 14 | Level 14 | 1:18,056 |
| Z 15 | Level 15 | 1:9,028 |
| Z 16 | Level 16 | 1:4,514 |
| Z 17 | Level 17 | 1:2,257 |

The OSM planet files contain a very large number of feature types, which are assigned to the basic OSM elements. In this instance it was regarded prohibitive to use all of the feature types in the creation of the Map Document and it was decided to use the features that were deemed to be the most relevant to the purpose of creating a base map. As mentioned earlier, no Points of Interest (POI) were considered. The following table lists the feature types that were selected as representative of each of the three feature classes; nodes, ways, and area_ways (closed ways),and included in the map:

| Feature Class | Layer Group | Themes |
|---|---|---|
| Node | Place | Hamlet, Suburb, Village, Town, City, Capital*, Country |
| Ways | Highway | Motorway, Trunk, Primary, Secondary, Tertiary, Residential, Unclassified, Service, Road, Unsurfaced |
| | Rights of way# | Track, Pedestrian, Cycleway, Footway, Bridleway, Byway, Steps |
| | Railway | Rail, Tram, Preserved, Light Rail |
| | Waterway | River, Stream |
| | Aeroway | Runway |
| Area_ways | Amenity | College, Fuel, Grave_yard, Hospital, Library, Parking, Public_building, School, Theatre, University |
| | Landuse | Industrial, Railway, Residential, Allotments, Cemetery, Quarry, Recreation_ground, Grass, Brownfield, Commercial, Farm, Forest, Reservoir, Retail, Wood, Military, Landfill |
| | Leisure | Common, Garden, Golf_course, Park, Pitch, Playground, Sports_centre, Stadium |
| | Natural | Beach, Scrub, Water, Wood |
| | Power | Station, Sub_station |
| | Shop | All+ |
| | Waterway | Riverbank, Dock |
| | Military | Airfield, Danger_area, Barracks |

**Capital: Filter used on values of city equal to London, Cardiff and Edinburgh.*

*#Rights of way belong to the Highway category, but have been separated into a group of their own on the basis of their function.*

*+All shop categories have been combined into a single group sporting the same rendering.*

For a complete list of the OSM map features, follow this link.

The mainland polygon, named Mainland, is rendered with a single symbol and displayed at all scales. This polygon, together with the blue rendition of the map frame background, make up the overall background of the map.

The labelling of polygons, roads and place features in the map document also closely follows that of the Mapnik rendering of the original OSM online map. The text for the labels comes from the value of the ‘name’ attribute field for the Node feature class, while for the Ways and Area_ways, it comes from the ‘osm_way_tags_name’ attribute field. In addition, Motorways, Trunk roads, Primary, and Secondary roads are also labelled using their road numbers (i.e. M25, A308), which come from the ‘osm_way_tags_ref’attribute field.

Due to the nature of the segmentation of the original OSM data and the replication of polygon data (i.e. a landuse polygon in some instances can be an amenity polygon as well), many label conflicts were initially realised. The Maplex labelling engine was utilised to resolve the label conflicts in the best way possible. Consequently, the use of the Maplex ArcGIS extension is required to be able to load the OSM map document in ArcMap.

## How to use the provided layer files with your own OSM File Geodatabase

The easiest way to implement the OSM symbology provided is to implement the base OSM Map Document (MXD). Open the MXD in ArcMap and the fix the paths to the data in the usual way, pointing the source on any of the layers to the location of the source of your own OSM file geodatabase. Alternatively, you may elect to use one or more of the layer files that were created from the base MXD.

A series of ArcGIS layer files have been created from the base OSM MXD. Each layer file represents a complete layer group for the scale threshold as per the table above. For instance, layer file OSM_Layer 12.lyr corresponds to group layer Level 12, which is for cache scale 1:72,224.

There is also a layer file for the mainland polygon; OSM_Mainland.lyr.

To use a layer file, do the following:

1. Start an empty session of ArcMap.
2. Set the Coordinate System property of the Layers frame to British National Grid.
3. Click the Add Data button and add the layer file in the same way you would if it were a data source.
4. Fix the broken path to the data source in the usual way.

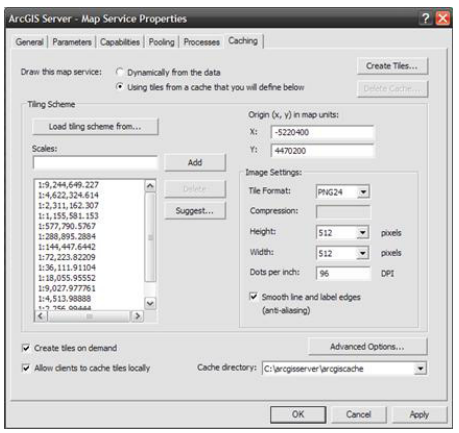
## How to create a cached map service using the OSM Map Document

To create a cached map service using the OSM MXD, do the following:

1. Start ArcCatalog.

   Create a standard ArcGIS Server map service.

3. Start the service, if not already running.
4. Right click on the running map service and select 'Service Properties...'
5. On the Map Service Properties dialog, click the 'Caching' tab.
6. Click 'Using tiles from a cache that you will define bellow' from Draw this map service:
7. For Tiling Scheme, click on the 'Load tiling scheme from...' button.
8. On the Load Tiling Scheme window, select 'A tiling scheme file' option from the 'Load From: ' combo box.
9. Navigate to the location of the OSM_Cache_Conf.xml file. Select it and click Add.
10. From Image Settings: select PNG24 for the Tile Format:
11. Check the option to 'Smooth line and label edges (anti-aliasing)'
12. Check the option to 'Create tiles on demand'
13. Make sure the Caching tab form looks like this:




Click OK to finish.

14. You will be asked if you want to create the tiles now. Click No.

The newly created cached service will have no tile caches created at this point since you selected the option to create the tiles on demand. To begin creating the tiles for the cache, access the ArcGIS Services directory, click on the name of the cache service you created above, then on the ArcGIS JavaScript link. This will open a new browser window with a new map. This map is made out of the first tiles created for your service. As you zoom in and out and pan around, new tiles for the scale in question will be created on demand.