

ORDNANCE SURVEY GB

OS MASTERMAP HIGHWAYS NETWORK™ – GETTING STARTED GUIDE

Version history

Version	Date	Description
1.0	02/2018	Initial release
1.1	03/2021	Addition of Scottish Street information
1.2	02/2022	Introduction of GeoPackage and vector tiles formats to the product.
1.3	07/2023	Removal of Section 5.2 'FME' from the document. Sections 1 and 2 combined. Improvements made to contents of Annex B. Section on Cadcorp completely replaced with new procedures.

Purpose of this document

This document provides information about and insight into the OS MasterMap Highways Network product family and its potential applications. For information on the contents and structure of OS MasterMap Highways Network family, please refer to the Product Guide and the Technical Specifications.

The terms and conditions on which OS MasterMap Highways Network family is made available to you and your organisation are contained in that Ordnance Survey customer contract. Please ensure your organisation has signed a valid current customer contract to be able to use OS MasterMap Highways Network family.

We may change the information in this document at any time, giving you the notice period set out in your contract. We do not accept responsibility for the content of any third-party websites referenced or accessed in or through this document.

This document has been screened according to Ordnance Survey's Equality Scheme. If you have difficulty reading this information in its current format and would like to find out how to access it in a different format (braille, large print, computer disk or in another language), please contact us on +44 (0)3456 05 05 05.

Copyright in this document

© Ordnance Survey Limited 2023. This document (including for the avoidance of doubt, any mapping images reproduced within it) is protected by copyright and apart from the rights expressly granted within this document to use the content, all rights are reserved. Any part of this document may be copied for use internally in your organisation or business so that you can use OS MasterMap Highways Network family under the terms of your licence (but not otherwise).

No part of this document may be reproduced or transmitted in any form or by any means (including electronically) for commercial exploitation, onward sale or as free promotional material without getting the written consent of Ordnance Survey beforehand.

Trade marks

Ordnance Survey, OS, the OS Logos, OS MasterMap, AddressBase, GeoPlace, and TOID are registered trade marks. ITN, OSGB36, and OS MasterMap Highways Network are trade marks of Ordnance Survey, Britain's mapping agency.

BaseMap is a registered trade mark of Basemap Ltd.

OGC is a registered trade mark of Open Geospatial Consortium, Inc.

Contact details

[OS website 'Contact us' page \(https://www.ordnancesurvey.co.uk/contact-us\)](https://www.ordnancesurvey.co.uk/contact-us).

Contents

1.	Introduction to the product family	5
1.1	Product benefits.....	6
1.2	Product applications	7
2.	What do I need to use this data?	8
2.1	System requirements.....	8
2.2	Backup provision of the product.....	8
2.3	Typical data volumes	8
2.4	OS MasterMap Highways Network schema files.....	9
3.	Structure of the supplied data.....	10
3.1	Supply format	10
3.2	Supply media.....	10
3.3	Coverage	10
3.4	Non-geographic chunks	10
3.5	Product packaging	11
3.6	File naming	11
3.6.1	GML file names	11
3.6.2	GeoPackage file names.....	12
3.6.3	Vector tiles file names.....	12
3.7	How do I unzip the GML files?.....	12
3.8	How do I unzip the GeoPackage and vector tiles files?	12
4.	How do I load the OS MasterMap Highways Network products into a GIS?	13
4.1	QGIS.....	14
4.1.1	Loading and displaying the GML supply	14
4.1.2	Translating GML using QGIS	16
4.2	ArcMap	17
4.2.1	Loading and displaying the GML supply using the 'Quick Import' tool.....	17
4.2.2	Loading untranslated GML into ArcMap	24
4.2.3	Loading translated GML into ArcMap	26
4.2.4	Creating relationships in an ESRI File Geodatabase.....	27
4.3	MapInfo Professional.....	30
4.3.1	Using the Universal Translator Tool to translate GML data to TAB files.....	30
4.3.2	Setting the application schema.....	32
4.3.3	Opening the translated files in MapInfo Professional.....	34
4.3.4	Creating and using OGC GeoPackage in MapInfo Professional.....	35
4.4	Cadcorp SIS Desktop	37
4.4.1	Loading Highways Data with OS MasterMap Highways Network.....	37
4.4.2	Loading Highways Data using Drag & Drop	39
4.4.3	Loading Highways Data using Ordnance Survey (GB) Networks Manager	39
4.4.4	Adding OS MasterMap Highways Network Paths Data	43
5.	Using Snowflake to load the data into a database.....	45

Annex A: Relationships between Highways tables.....48
Annex B: Product support links55

I. Introduction to the product family

Ordnance Survey, GeoPlace and Improvement Service have collaborated to bring together Ordnance Survey's detailed road and path information, the National Street Gazetteer (NSG), the Trunk Road Street Gazetteer (TRSG), and the Scottish Street Gazetteer (SSG) to create an authoritative road and path network for Great Britain: OS MasterMap Highways Network.

OS MasterMap Highways Network integrates the Unique Street Reference Number (USRN) from the gazetteers with the most detailed definitive geometry from Ordnance Survey (Figure 1). It is produced in partnership with GeoPlace and the Local Government Association, and as of March 2021, contains data created and maintained by Scottish Local Government.

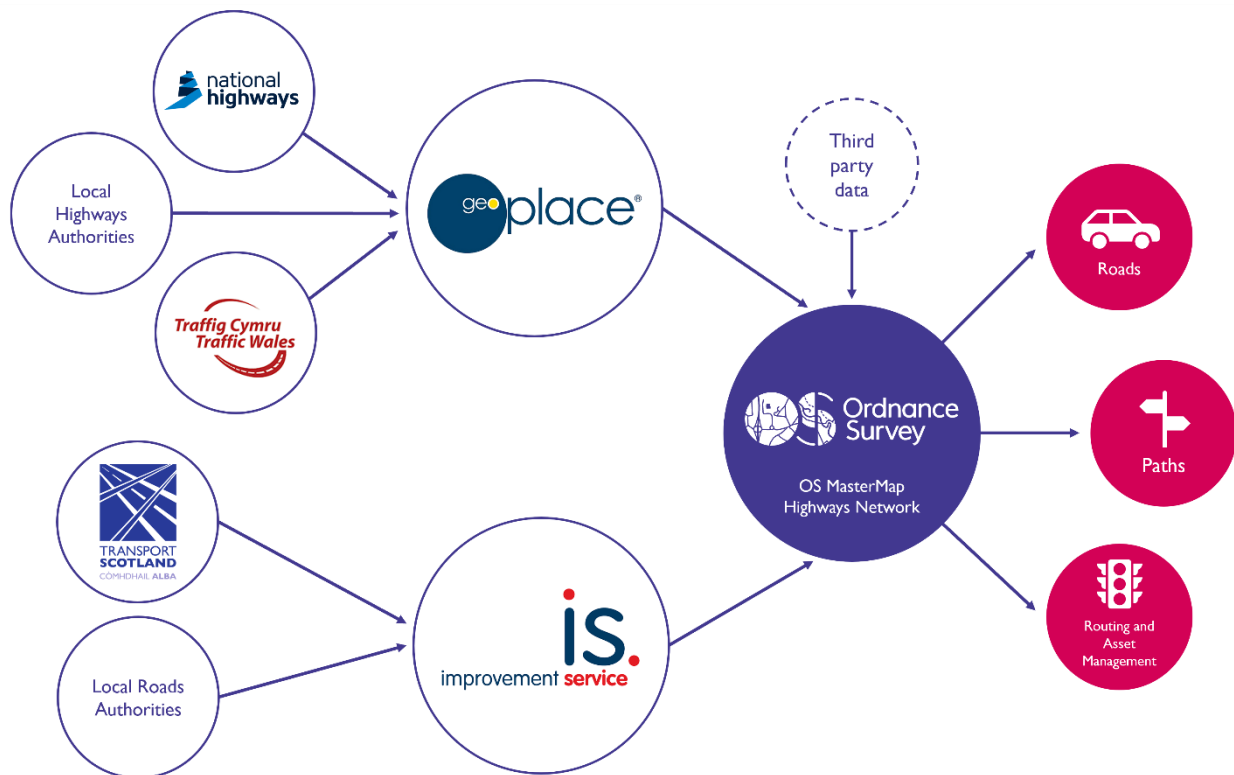


Figure 1. Bringing together data to create OS MasterMap Highways Network.

The OS MasterMap Highways Network product family includes three core products:

- OS MasterMap Highways Network – Roads
- OS MasterMap Highways Network – Routing and Asset Management Information (RAMI)
- OS MasterMap Highways Network – Paths

OS MasterMap Highways Network products contain a wide range of features, including:

- Unique Street Reference Number (USRN)
- Road names from the naming and numbering authority
- Department for Transport (DfT) road classifications
- Road maintenance authority
- Motorway junction to junction information
- Routing information
- Information on height, weight, width and length restrictions
- Special designations
- Road reinstatement information
- Connected network across Great Britain (GB), including islands through the Ferry Network

1.1 Product benefits

- OS MasterMap Highways Network is a single authoritative view of the road and path network that underpins decision making across government as it:
 - Reduces duplication of effort on maintaining highways information across multiple departments and datasets
 - Facilitates data-sharing
- The product provides OS detailed geometry and routing information on highways together with the best asset management information from authoritative sources into one central location.
- It enables planning, routing and navigation for a variety of vehicle types.
- The USRN as the key identifier for a Street enables systems to share information about the same entities without the need to match multiple datasets. With the USRN, you can also easily link to OS's AddressBase products, which lets you search for or navigate to an address and find the property access and delivery points.
- The product provides accurate and precise asset management information on who maintains the road network, special designations and the type of surface reinstatement value.

1.2 Product applications

OS MasterMap Highways Network is designed to be used as a single source of highway asset management by private and public sectors alike. The following table describes some of the key product applications:

Table 1. Key applications for OS MasterMap Highways Network products.

Product name	Suggested application
OS MasterMap Highways Network – Roads	<ul style="list-style-type: none"> • Source for legal road identifications • Costings or benefits of road policies • Calculating funding allocations • For evidence-based policy making • Journey and transport planning • Emergency service planning • Enforcement regulation • Traffic statistics • School allocation • Smart cities
OS MasterMap Highways Network – Routing and Asset Management Information (RAMI)	<ul style="list-style-type: none"> • Source for legal road identifications • Costings or benefits of road policies • Calculating funding allocations • Policy making • Asset management • Journey planning, routing, and navigation • Emergency service planning • Transport planning • Enforcement regulation • Traffic statistics • Delivery • Waste management • Planned works • Projects on the resilience of infrastructure • Lane rental schemes • Smart cities
OS MasterMap Highways Network – Paths	<ul style="list-style-type: none"> • To estimate costs or benefits of road and paths policies • Calculating funding allocations • Policy making • Asset management • Journey planning, routing, and navigation • Emergency service planning • Transport planning • Delivery • Enforcement regulation • School allocation • Sustainable travel • Planned works • Projects on the resilience of infrastructure • Smart cities

2. What do I need to use this data?

2.1 System requirements

OS MasterMap Highways Network is designed for use in a geographical information system (GIS). For details of Ordnance Survey's Licensed Partners who can assist you with incorporating the product in their systems, please see the ['Software for Mapping' page on the OS website](http://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/software-for-our-products.html) (<http://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/software-for-our-products.html>).

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, the existing and planned information technology infrastructure and last but by no means least, the applications that the data will be used for.

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

- A means of reading the data, either in its native format, or by translating it 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
- A way of visualising and / or querying the data, typically a GIS

2.2 Backup provision of the product

You are advised to copy the supplied data to a backup medium before following the steps in this guide.

2.3 Typical data volumes

For reading purposes, it is recommended that users store the data on a single hard disc. This will speed up the ability of your computer to read the data.

Uncompressed file sizes for the Full Supply of England, Scotland and Wales are as follows:

Geography Markup Language (GML)

- OS MasterMap Highways Network – Roads: 29GB
- OS MasterMap Highways Network – RAMI: 43GB
- OS MasterMap Highways Network – Paths: 11GB

GeoPackage (GPKG)

- OS MasterMap Highways Network – Roads: 8.5GB
- OS MasterMap Highways Network – RAMI: 3GB
- OS MasterMap Highways Network – Paths: 5GB

Vector tiles (MBTiles)

- OS MasterMap Highways Network – Roads: 1.5GB
- OS MasterMap Highways Network – Paths: 0.4GB

2.4 OS MasterMap Highways Network schema files

Schema files are used to interpret the GML and translate it into a suitable data format by your chosen software. However, we are aware that some firewalls will block access to these. In these instances, it is suggested that you download the schemas from the [OS MasterMap Highways Network GitHub repository \(https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-ALL-Schemas\)](https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-ALL-Schemas).

3. Structure of the supplied data

3.1 Supply format

OS MasterMap Highways Network – Roads and OS MasterMap Highways Network – Paths are supplied in three formats: Geography Markup Language (GML 3.2.1), GeoPackage and vector tiles. All three formats are compressed into a regular zip file (.ZIP).

OS MasterMap Highways Network – RAMI is supplied in two formats: GML 3.2.1 and GeoPackage. Both formats are compressed into a regular zip file (.ZIP).

3.2 Supply media

OS MasterMap Highways Network core products (Roads, RAMI, and Paths) are available to Public Sector Geospatial Agreement (PSGA) Members, commercial customers and OS Partners through the [OS Data Hub](https://osdatahub.os.uk/) (<https://osdatahub.os.uk/>). The products are available as both Full Supply and change-only update (COU) and customers can order an area of interest (AOI) or a Managed Great Britain Set (MGBS). The products are available as a download for all customers, and as a DVD for customers ordering a MGBS.

3.3 Coverage

The products cover Great Britain. Information from the National Street Gazetteer will only be provided for England and Wales. Information from the Scottish Street Gazetteer will only be provided for Scotland.

3.4 Non-geographic chunks

OS MasterMap Highways Network products will only be supplied as non-geographic chunks. Non-geographic chunking is a way of dividing up data into chunks that are supplied in separate volumes that have a feature count, as opposed to a given geographic National Grid area. For this reason, it is possible for features from various geographic locations to appear in one volume and for adjacent features to appear in different volumes.

Non-geographic chunk volumes are designed to be loaded into spatial databases but can be used in a file format, provided all chunks are translated or imported into the system at the same time. For information on the volume feature counts for each feature type in OS MasterMap Highways Network, please see Annex A in the *OS MasterMap Highways Network Product Guide*.

3.5 Product packaging

When a customer receives an order, the product will be packaged as follows:

- Data folder: Contains the GML, GeoPackage or vector tiles files which make up the ordered product.
- Doc folder: Contains a summary.gml file which will contain specific information about the customer order, including the order number, extent and order type information ('Full Supply' or 'COU').
- The GeoPackage and vector tiles formats will be available for GB coverage only, so will not contain COU files.
- Resources folder: Contains the product's Feature Validation Data Set (FVDS). For further information on these resources, please refer to the *OS MasterMap Highways Network Product Guide*

3.6 File naming

3.6.1 GML file names

The file naming for the OS MasterMap Highways Network GML will be constructed as:
Highways_ProductName_FeatureType_SupplyType_NullorDelete_volumenumber.gml.gz.

The name is composed of the following elements:

- *Highways*: Identifies that the GML is from the OS MasterMap Highways Network product family
- *ProductName*: Is the name of the product that is being supplied, for example, Roads
- *FeatureType*: Is the name of the feature type that is being supplied in the GML file, for example, RoadLink
- *SupplyType*: Is the type of supply the GML is, for example, Full Supply or COU
- *NullorDelete*: This will not be present in any GML file names if the GML forms part of a Full Supply. If the GML forms part of a COU supply, then 'Delete' will identify if the file contains all the features which need removing from the customer holding as a part of the COU application.
- *Volumenumber*: Will be the volume number for the file which will be three digits and the first volume will be 001

Examples of the GML file names:

- Highways_Roads_RoadLink_Full_001.gml.gz
- Highways_Rrami_AccessRestriction_Full_001.gml.gz
- Highways_Paths_Maintenance_Full_001.gml.gz

3.6.2 GeoPackage file names

The file naming for the OS MasterMap Highways Network GeoPackage will be constructed as *OSMasterMapHighwaysNetworkProductName_gb.gpkg*.

Examples of GeoPackage file names:

- *OSMasterMapHighwaysNetworkRoad_gb.gpkg*
- *OSMasterMapHighwaysNetworkPath_gb.gpkg*
- *OSMasterMapHighwaysNetworkRAMI_gb.gpkg*

3.6.3 Vector tiles file names

The file naming for the OS MasterMap Highways Network vector tiles will be constructed as *OSMasterMapHighwaysNetworkProductName_gb.mbtiles*

Examples of the vector tiles file names:

- *OSMasterMapHighwaysNetworkRoad_gb.mbtiles*
- *OSMasterMapHighwaysNetworkPath_gb.mbtiles*

3.7 How do I unzip the GML files?

The Highways GML data is supplied in a compressed form (gzip). Some software can access these files directly; others will require it to be uncompressed. To uncompress the zipped data files (.gz extension), use an unzipping utility found on most PCs, for example, WinZip. Open-source zipping / unzipping software can be downloaded from the Internet, for example, 7-Zip.

3.8 How do I unzip the GeoPackage and vector tiles files?

Before loading the data, you will need to unzip it by using any of the regular zip programs available or via the facility within the Windows 10 operating system.

4. How do I load the OS MasterMap Highways Network products into a GIS?

This getting started guide focusses solely on loading the product in GML format. For guidance on using the products in GeoPackage or vector tiles formats, please see the following two format-specific getting started guides, which are available from the ['OS MasterMap Highways Network Product Support' page of the OS website](https://www.ordnancesurvey.co.uk/business-government/tools-support/mastermap-highways-support) (<https://www.ordnancesurvey.co.uk/business-government/tools-support/mastermap-highways-support>):

- *Getting Started with GeoPackage guide*
- *Getting Started with Vector Tiles guide*

GML is an XML dialect, which can be used to model geographic features. It was designed by the Open Geospatial Consortium (OGC) as a means for people to share information regardless of the applications or technology that they use. In the first instance, GML was used to overcome the differences between different GIS applications by providing an open standards file format as an alternative to proprietary formats.

The data can be loaded into several GIS. This section describes how to translate the GML and load it into some commonly used GIS. However, as the data is based on a relational data model, not all GIS formats will support this and storing the data in a relational database is recommended. For more information about other GIS that OS MasterMap Highways Network is compatible with, please speak to your OS Relationship Manager.

The common GIS software applications covered in this section are:

- QGIS
- ArcMap
- MapInfo Professional
- Cadcorp SIS Desktop

Software for loading into a database:

- Go Loader – PostgreSQL

Warning: Some software will successfully read the GML, including both geometry and textual information. However, where a data field contains multiplicity, these elements will be ignored.

4.1 QGIS

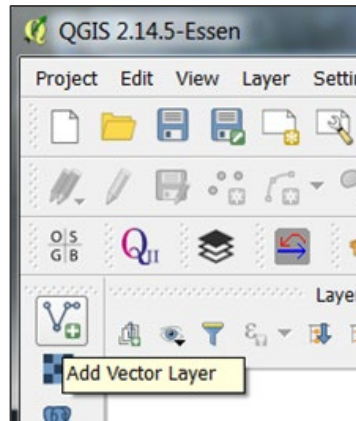
These instructions outline how to load OS MasterMap Highways Network into QGIS using the GML file you have received. They have been prepared using version 2.14.5 of QGIS Desktop – an open-source GIS in which you can create, edit and visualise and publish geographic information.

You can [download QGIS from the QGIS website \(http://www.qgis.org/en/site/forusers/download.html\)](http://www.qgis.org/en/site/forusers/download.html).

4.1.1 Loading and displaying the GML supply

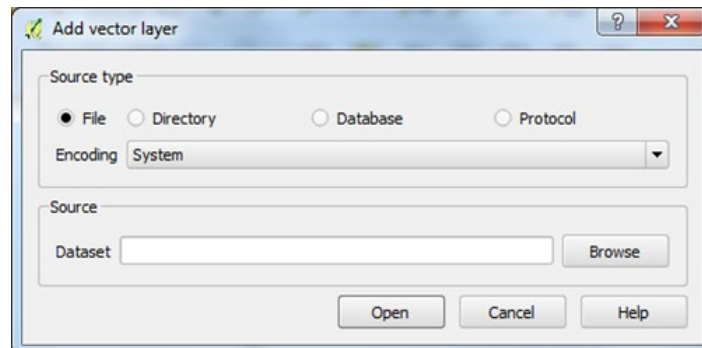
To load and display GML data in QGIS:

1. Open an existing project in QGIS or create a new one.
2. The OS MasterMap Highways Network data can be loaded into QGIS either zipped or unzipped. To load the data, select the Add Vector Layer icon (points and lines in the shape of the letter 'V' beside a white cross symbol on a green square background).

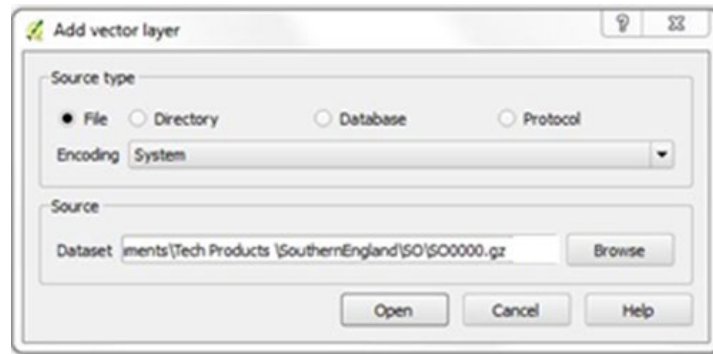


3. In the Add Vector Layer dialog, in the Source section, click *Browse* and navigate to the GZ / GML file you wish to import.

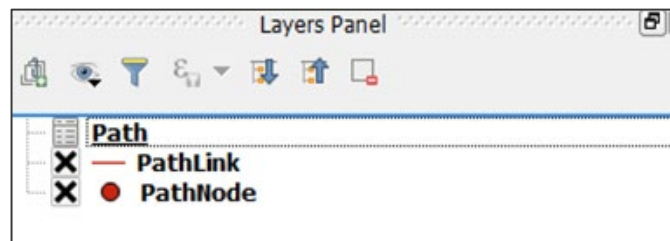
Note: If the files do not appear in the browser window, change the file type in the dropdown to Geography Markup Language [GML].



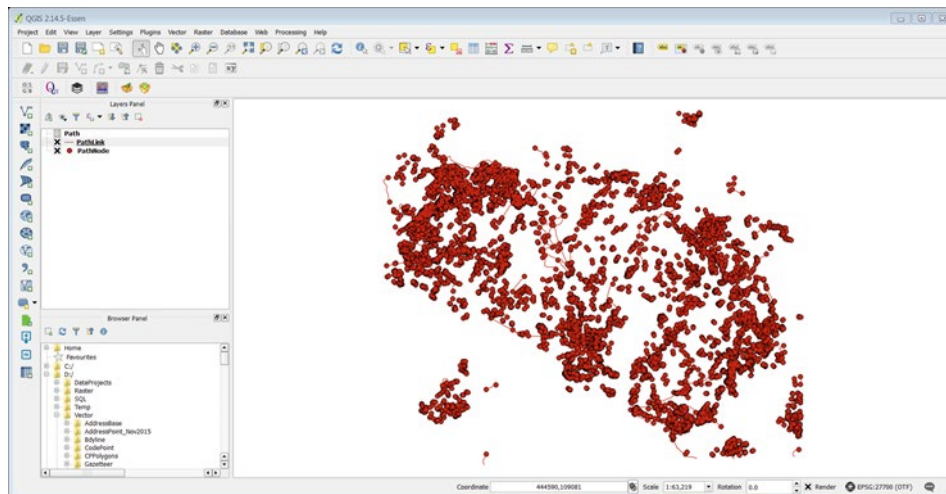
4. After selecting the file, click **Open**.



Note: Alternatively, you can load the file by dragging and dropping the GZ or GML file into a blank canvas. This will open the GML as both vector layers and tables in QGIS, displayed in the Layers Panel.



It also draws the layers in the canvas:



You can add additional layers of OS MasterMap products (for example, OS MasterMap Topography Layer) to give context to the data.

4.1.2 Translating GML using QGIS

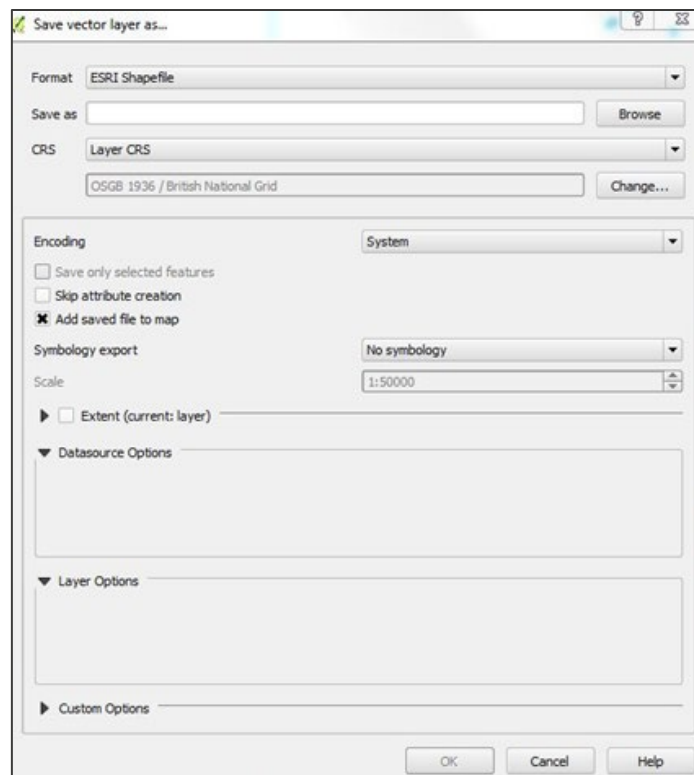
You can also use QGIS to export OS MasterMap Highways Network data in many different common GIS formats. This will allow you to open the files in numerous other GIS applications.

To translate GML using QGIS:

1. Right-click on the layer you want to translate and select *Save as*.

Note: If you are trying to save layers for more tiles or a national dataset, please bear in mind that you will have to save them separately as there is no option for grouping layers.

2. In the Save Vector Layer as... dialog:
 - a. Format: Select your chosen format from the dropdown for further analysis, for example, MapInfo TAB or ESRI Shapefile. Tables can also be saved as either a DBF or CSV file.
 - b. Format: Select *Browse* to save your file to a location of your choice.
 - c. Click *OK* to save the data in your chosen format.



3. Repeat steps 1 and 2 for each layer that you want to translate.

4.2 ArcMap

These instructions outline how to load OS MasterMap Highways Network into ArcMap using the GML file you have received. They have been prepared using version 10.2 of ArcMap.

GML data can be now imported as zipped GML (GZ) directly into ArcMap using the Data Interoperability tool called 'Quick Import'. The Interoperability extension is now available at no cost as a part of ArcMap from version 10.2. You require internet access when using 'Quick Import' tool so the data can access the schema attached to the file.

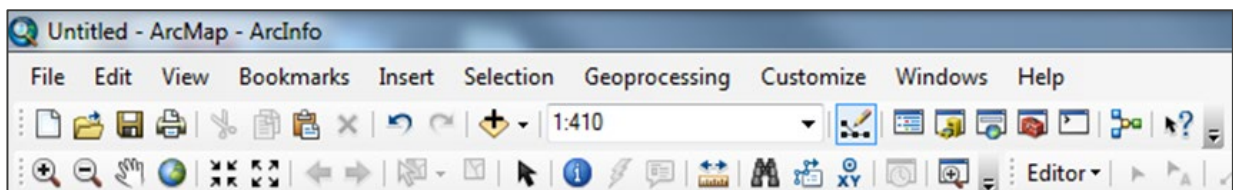
NOTE: If your version of ArcMap is older than 10.2 and you do not have a licence for Data Interoperability, you will have to use translation tools available in QGIS (explained in the previous sub-section) to first translate the GML data into ESRI shapefiles, before you can load them in ArcMap.

You can find [more information about the Quick Import tool on the ESRI website](http://www.esri.com/software/arcgis/extensions/datainteroperability) (<http://www.esri.com/software/arcgis/extensions/datainteroperability>).

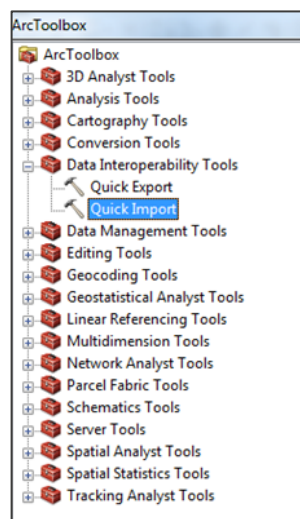
4.2.1 Loading and displaying the GML supply using the 'Quick Import' tool

To import GML data into ArcMap using the 'Quick Import' tool:

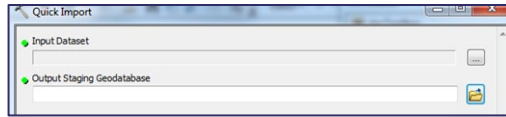
1. Open ArcMap.
2. In the top bar, click the ArcToolbox icon (red toolbox).



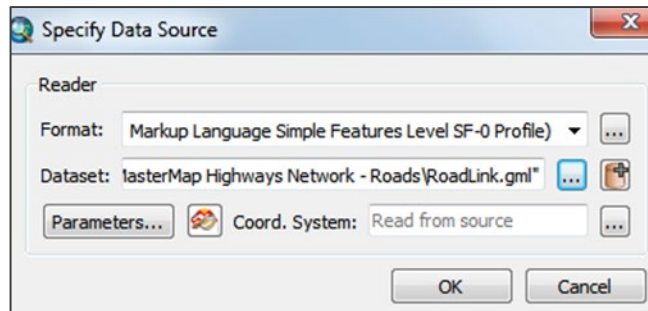
3. In the ArcToolbox menu, expand *Data Interoperability Tools* and double-click on *Quick Import*.



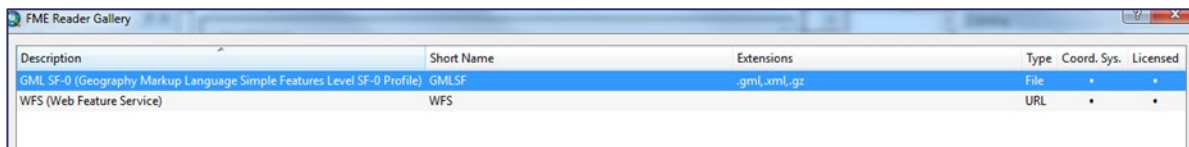
- In the Quick Import dialog, select the *ellipsis* button to the right of the Input Dataset section.



- In the Specify Data Source dialog, select the *ellipsis* button to the right of the Format section.

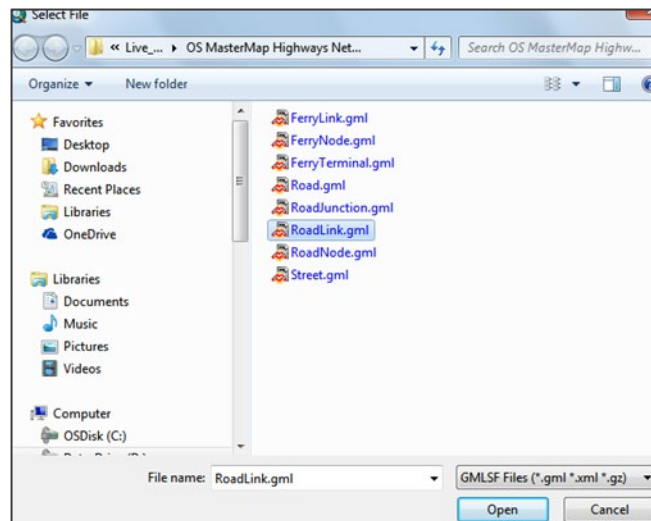


- In the FME Reader Gallery dialog, select *GML SF-0 (Geography Markup Language Simple Features Level SF-0 Profile)*, then click *OK*.

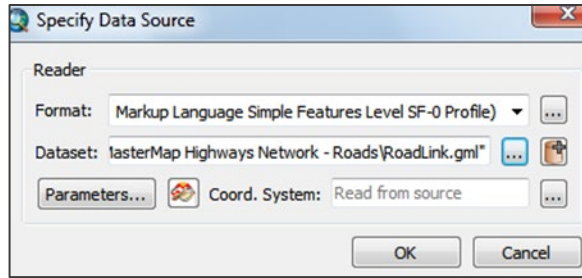


- Back in the Specify Data Source dialog, in the Dataset section, you should use the *ellipsis* button to navigate to the folder where you saved your GML/GZ file.

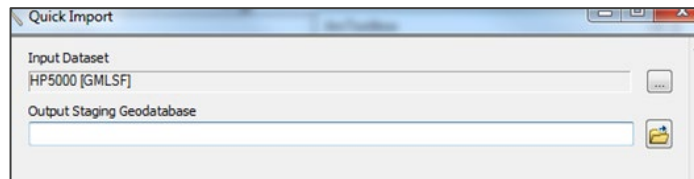
- In the Select File dialog, select the GML/GZ file and click *Open*. Make sure that the extensions available to load are *.gz or *.gml.



9. Leave the rest of the settings as the defaults and click *OK* in the Specify Data Source dialog.

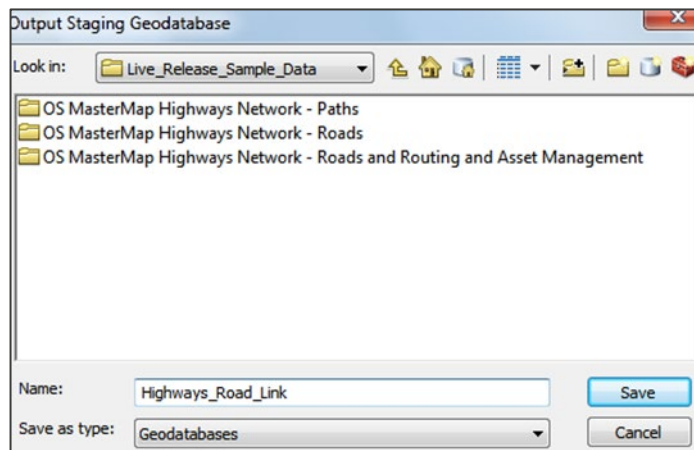


10. In the Quick Import dialog, select the *folder icon* to the right of the Output Staging Geodatabase section.

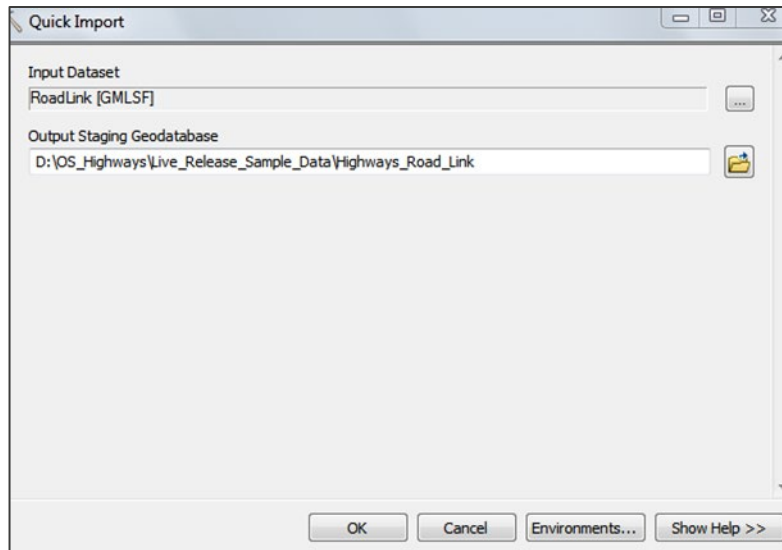


11. In the Output Staging Geodatabase dialog:

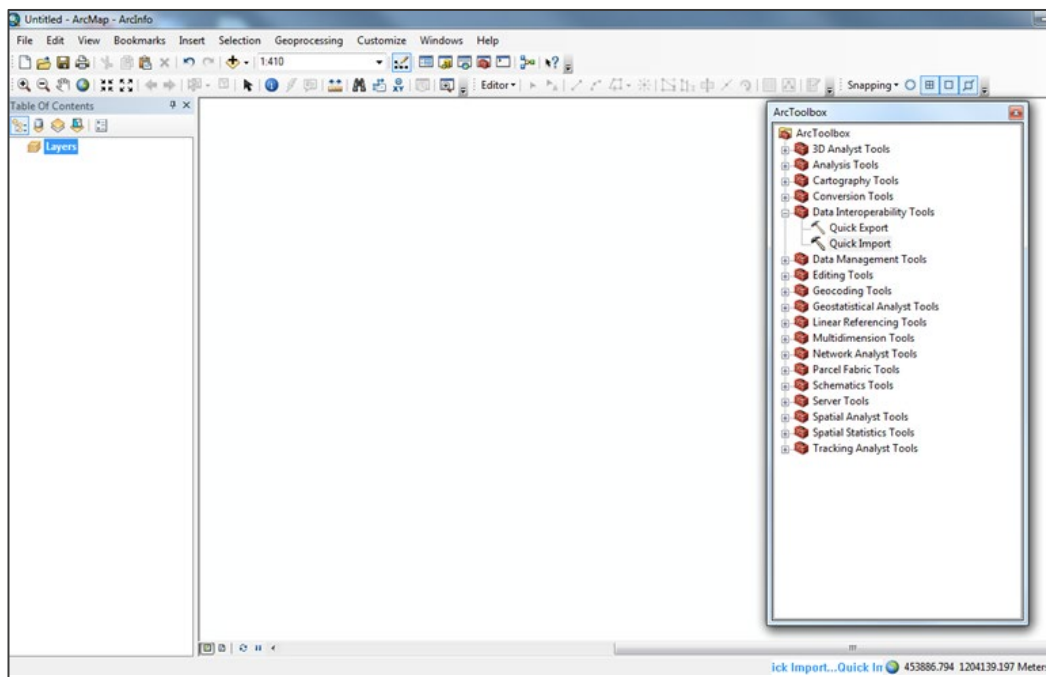
- a. Navigate to the folder and select the output *Personal Geodatabase* for the feature classes to be stored in.
- b. Select *Geodatabases* from the Save as type dropdown.
- c. Click *Save*.



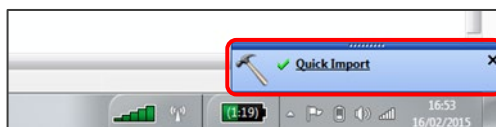
12. Next, select **OK** in the **Quick Import** dialog.



The process starts and you will see the process running notification at the bottom of the screen.



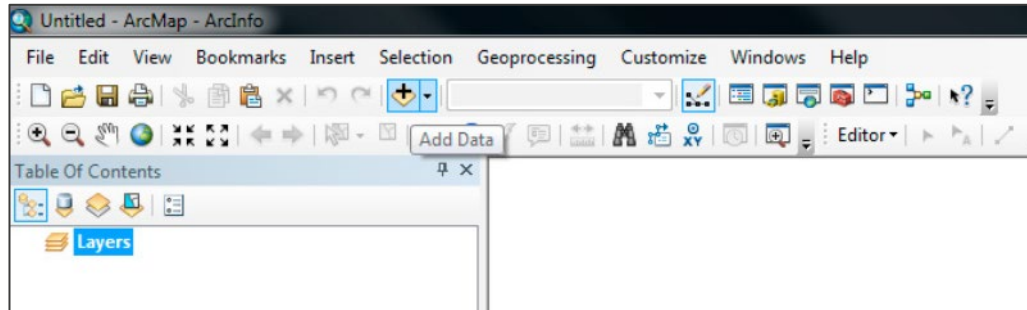
When the process is complete, a popup window will appear at the bottom right corner of the screen:




13. Close the ArcToolbox menu.

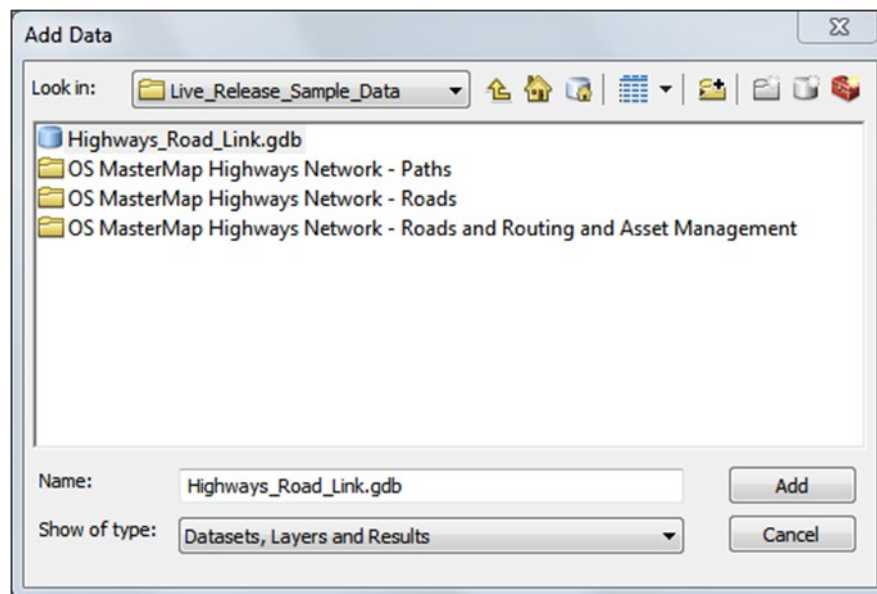
To add data into ArcMap:

1. Select the *Add Data* button  (black cross on a yellow diamond) from the top ribbon.



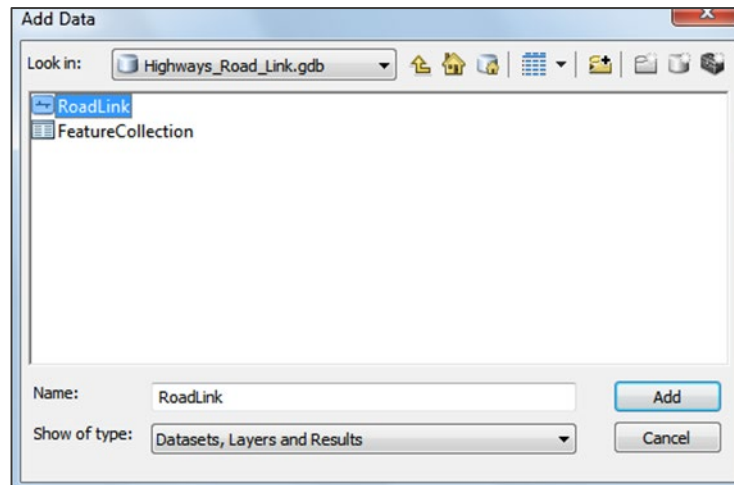
2. In the Add Data dialog, connect to the folder where you saved the Geodatabase by selecting the *Connect to Folder* button  (yellow rectangular folder with a black cross on top of it).

Note: If you stored the file geodatabase in a folder to which you are already connected, you will not need to connect to the folder again.

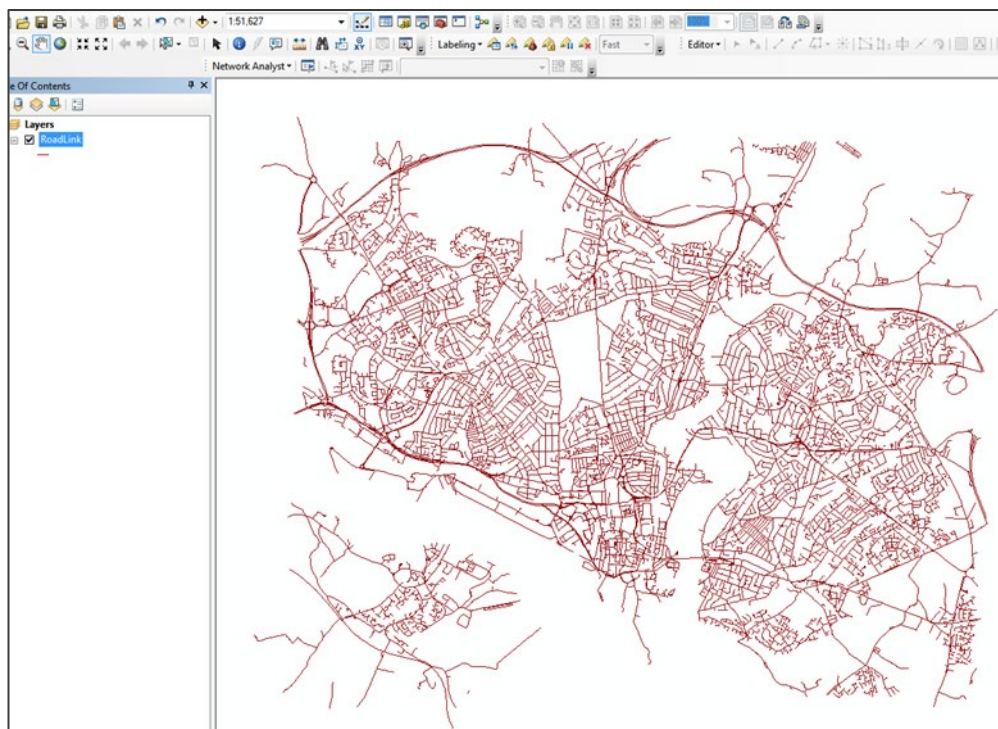


3. In the Connect to Folder dialog, navigate to the folder and click *OK*. Select the Highways geodatabase that you have created and click *Add*.

- The component feature classes within the file geodatabase will appear in the Add Data dialog. In this example, we only have the RoadLink feature class. Select the OS MasterMap Highways Network RoadLink feature class within the file geodatabase, then click *Add*.



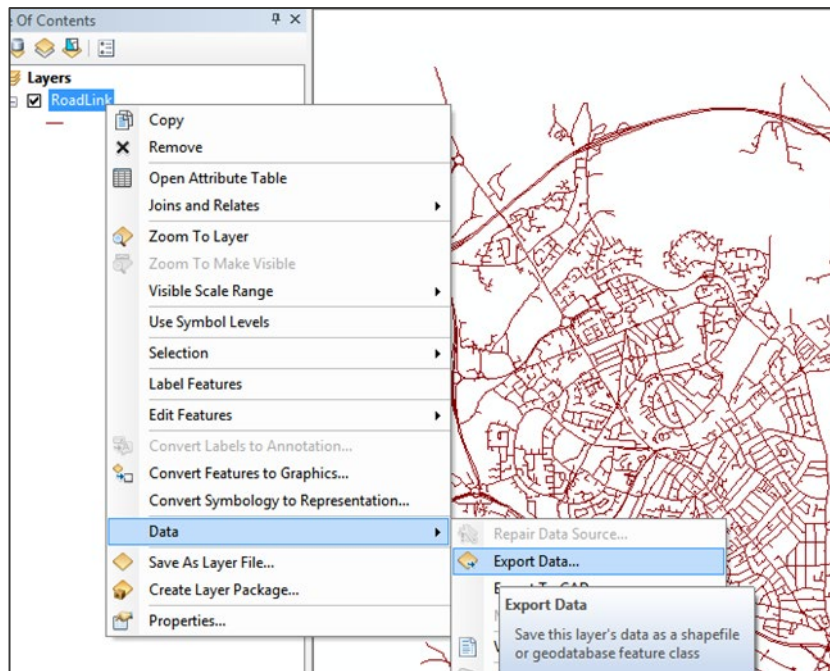
The data appears in the map window in ArcMap un-styled, as shown in the example below:



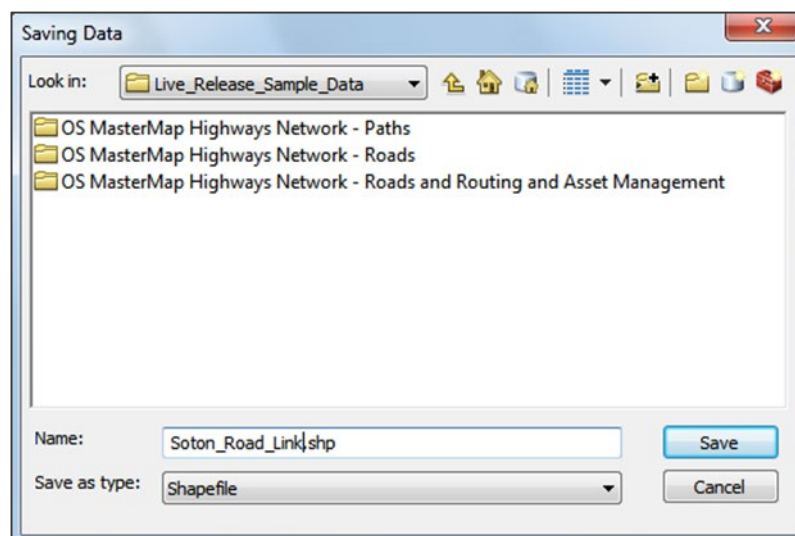
You can view and analyse the features, as they are, directly from the Geodatabase. You can also save the OS MasterMap Highways Network data as ESRI shapefiles or GeoDatabase feature classes.

To save the OS MasterMap Highways Network data as ESRI shapefiles or Geodatabase feature classes:

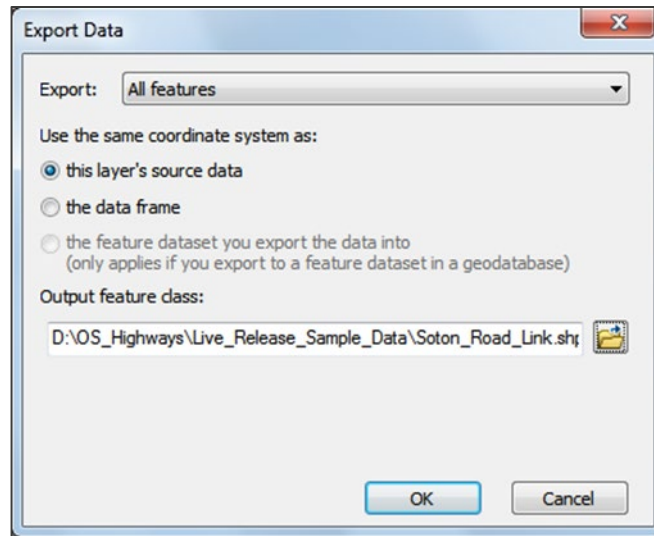
1. Right-click on the feature on the Table of Contents, then select *Data > Export Data...* from the menu.



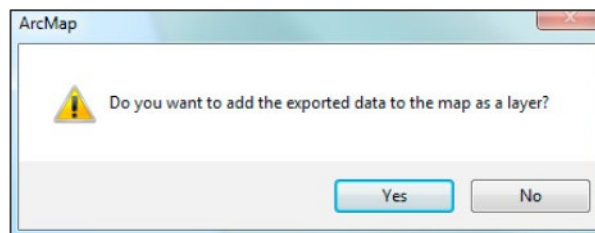
2. In the Export Data dialog, select the folder icon.
3. In the Saving Data dialog:
 - a. Navigate to the folder where you wish to save your data.
 - b. Name: Rename your data accordingly, for example, Soton_Road_Link.shp.
 - c. Save as type: Select *Shapefile* or *Geodatabases* from the dropdown.
 - d. Click *Save*.



4. Leave the rest of the settings in the Export Data dialog as they are and click OK.




5. An ArcMap warning popup window will appear asking if you want to add the exported data to the map as a layer; there is no need to do that, so click No.



4.2.2 Loading untranslated GML into ArcMap

If you are using a more recent version of ArcMap (version 10 onwards), you can open GML files directly in ArcMap and view the geometry.

To load untranslated GML files into ArcMap:

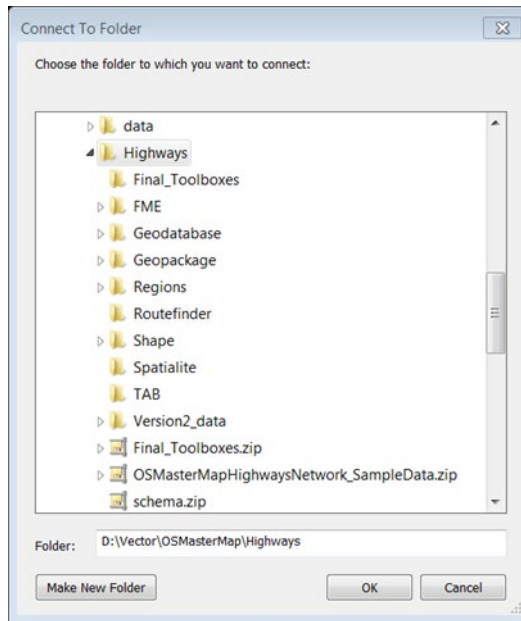
1. Open ArcMap.
2. Click the *Add Data* button  (black cross on top of a yellow diamond) in the top ribbon.



3. In the Add Data dialog, connect to the folder where you saved your translated OS MasterMap

Highways Network data by clicking the *Connect to Folder* button  (black cross on top of a yellow rectangle).

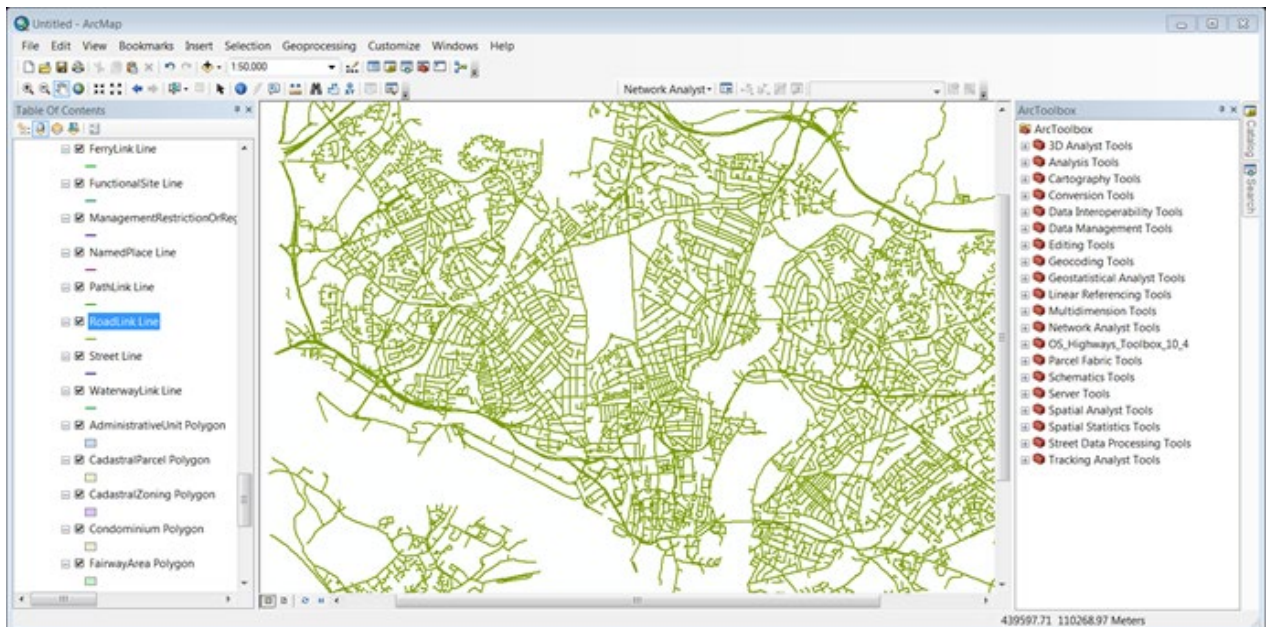
4. In the Connect to Folder dialog, navigate to your folder and click OK.



5. The Add Data dialog will remain open, so you can navigate to your GML files, choose a file to open and click Add.

This will load the geometry into ArcMap for you to inspect.


6. You can export the geometry to either a shapefile or a geodatabase by right-clicking on a layer in the Table of Contents and selecting *Data > Export Data...* from the menu.

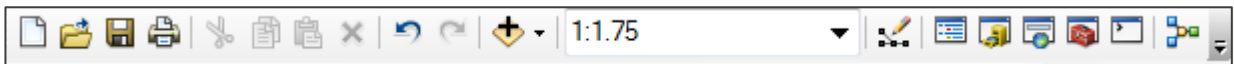



4.2.3 Loading translated GML into ArcMap

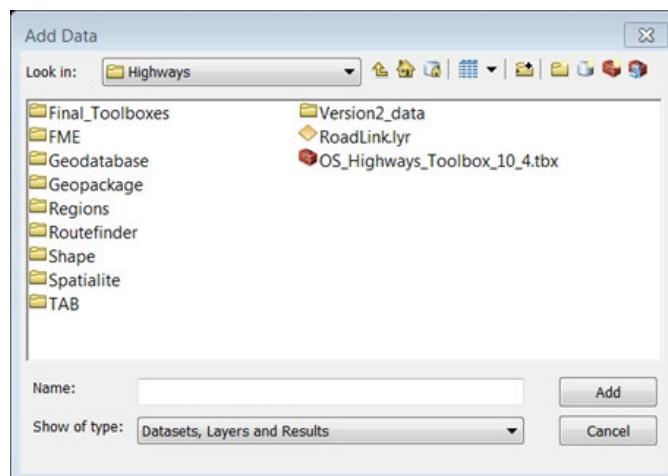
If your version of ArcMap is older than version 10 or if you do not have access to the Quick Import (Data Interoperability) extension, you can use other translation tools such as QGIS (explained in an earlier subsection in this guide). This will enable you to first translate the GML for OS MasterMap Highways Network data into either a File Geodatabase or ESRI shapefiles before you can load them into ArcMap. However, it is recommended to use a File Geodatabase, as a shapefile can only store geometry and not the related tables.

To load translated GML into ArcMap:

1. Open ArcMap.
2. To load a geodatabase or shapefile into ArcMap, select the *Add Data* button  (black cross on top of a yellow diamond) in the top ribbon.

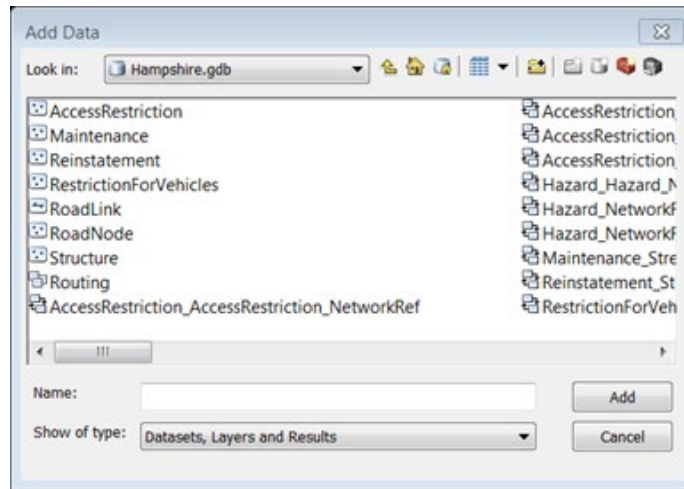


3. In the *Add Data* dialog, connect to the folder where you saved your translated OS MasterMap Highways Network data by clicking the *Connect to Folder* button  (black cross on top of a yellow rectangle).



4. In the *Connect to Folder* dialog, navigate to your folder and click *OK*.

5. The *Add Data* dialog will remain open, so you can navigate to the folder containing your data, select the elements of the data you wish to open in the map window and click *Add*.




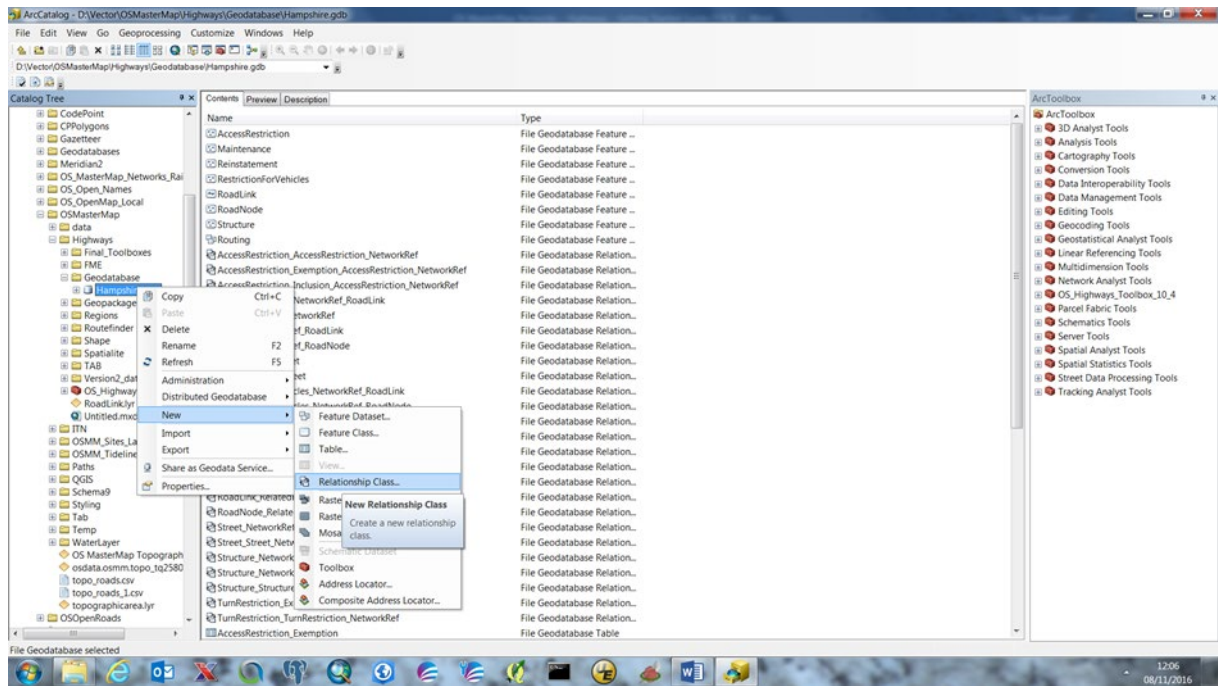
The OS MasterMap Highways Network features will be added to the ArcMap.

4.2.4 Creating relationships in an ESRI File Geodatabase

The OS MasterMap Highways dataset has been created using a relational data model. If you are using a File Geodatabase, you can create relationship classes within the Geodatabase.

Note: Appendix A lists all the relationships between the tables.

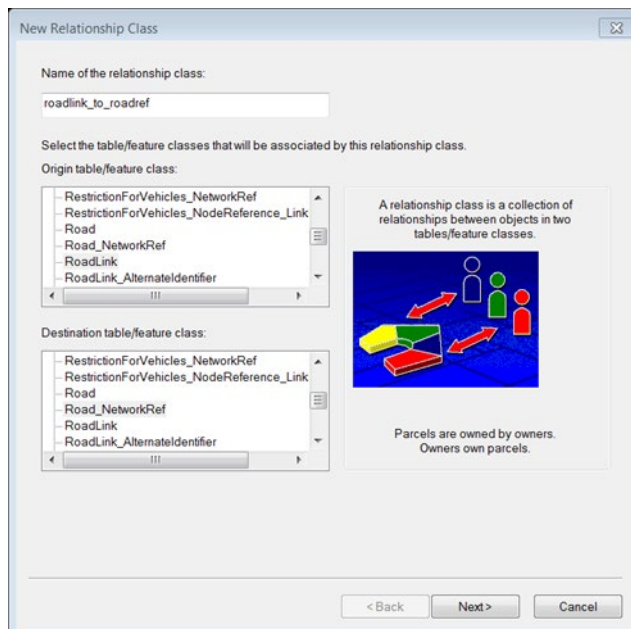
1. Open ArcCatalog.
2. If you don't have a connection to the folder containing data, add one now by clicking the *Connect to Folder* button  (black cross on top of a yellow rectangle) from the top ribbon.
3. In the Catalog Tree:
 - a. Navigate to the folder containing your geodatabase.
 - b. Right-click on the geodatabase and select *New > Relationship Class* from the menu.



4. In the New Relationship Class dialog:

- a. Give the new relationship class a meaningful name, click on the tables the relationship is between, then click Next>.

In this example, we are creating a relationship between the RoadLink and Road_NetworkRef, which is reflected in the name selected for the Name of the relationship class section.

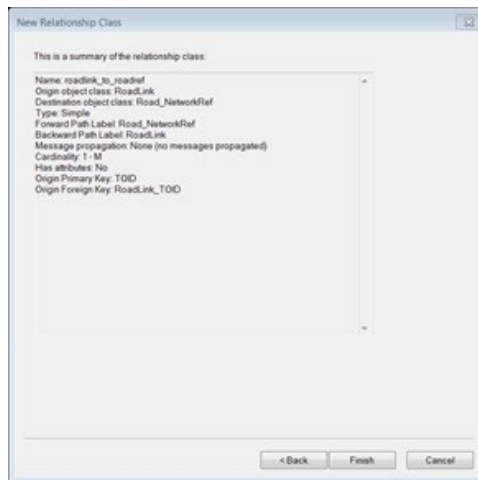


- b. Leave the default as Simple (Peer to Peer) Relationship and click Next>.
- c. Leave the default names and select None (no messages propagated), then click Next>.

- d. As there is more than one reference to the RoadLink, you will need to create a one-to-many relationship by selecting *1-M* and then click *Next>*.
- e. You do not need to add attributes, so select *No*, then click *Next>*.

Note: The next step is important as it defines the fields that will be used to link the data together. These relationships are described in Appendix A.

- f. For this example, we are using the Primary field in the RoadLink table: TOID; select this from the dropdown list.
- g. The Foreign Key in the Road Network Reference table will be RoadLink TOID. Select this from the dropdown list, then click *Next>*.
- h. Click *Finish* to create the new relationship class.



When you open the data in ArcMap and use the Identify Tool, it will now return all data that forms part of the created relationship.

4.3 MapInfo Professional

These instructions outline how to load OS MasterMap Highways Network into MapInfo Professional using the GML you have received. They have been prepared using version 15.2.2 of MapInfo. This version of MapInfo allows you to convert GML data using the Universal Translator Tool (older versions of MapInfo Professional may not have this functionality).

However, using this tool will only convert the files that contain geometry. If you wish to use the full data set, it is recommended that you store the data in either a relational database or a Spatialite or GeoPackage data structure, supported from version 12.5 of MapInfo Pro.

Note: These instructions refer to the 64Bit version. The Universal Translator Tool is the same in the 32Bit version; however, the MapInfo menus are slightly different.

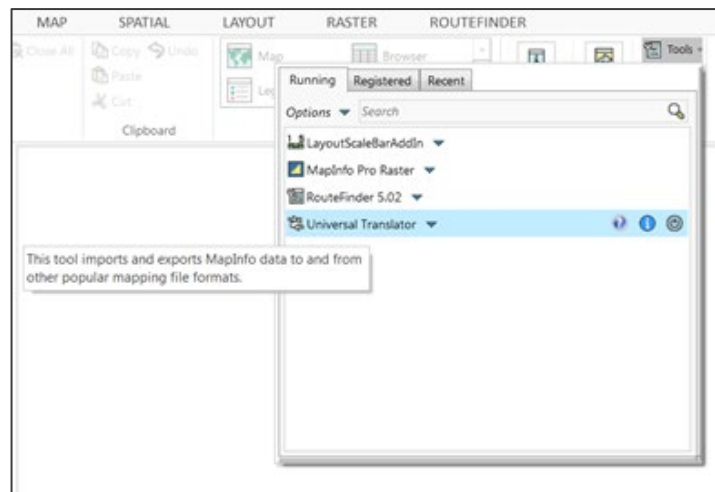
If your version of MapInfo is 12.0.2 or older, you will have to use translation tools available in QGIS (explained in an earlier sub-section) to first translate the OS MasterMap Highways Network GML data into MapInfo TAB files, before you can load these files into MapInfo.

If you are bringing in already translated TAB files, start following the instructions from [Section 4.3.2](#).

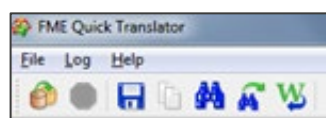
4.3.1 Using the Universal Translator Tool to translate GML data to TAB files

1. Open MapInfo Professional.
2. On the main Tools tab, select *Universal Translator*.

Note: If this is not under the list of 'Running' tools in the 'Running' tab, go to the 'Registered' tab and scroll down the list of available tools until you find it.

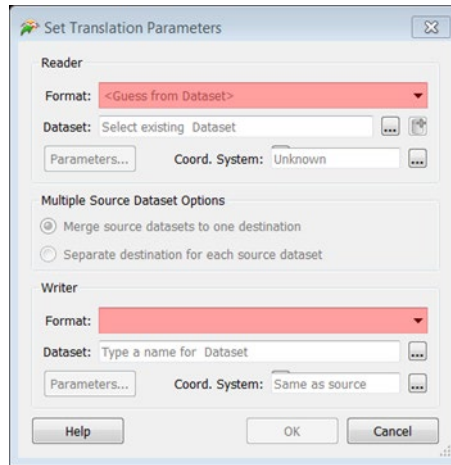


3. In the FME Quick Translator dialog, either select *File > Translate* or click the *Translate Data* button (side-by-side opened brown and orange cylinders connected by a green arrow).

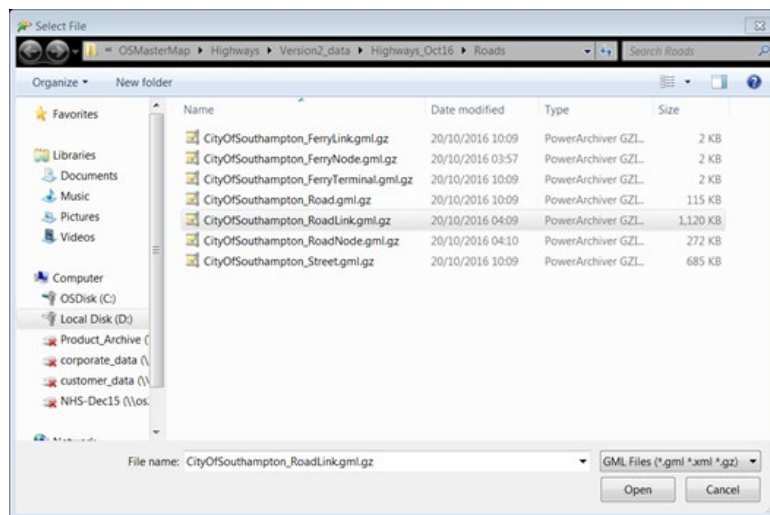


4. In the Set Translation Parameters dialog:

- a. Reader: Select *GML (Geography Markup Language)* from the Format dropdown menu.

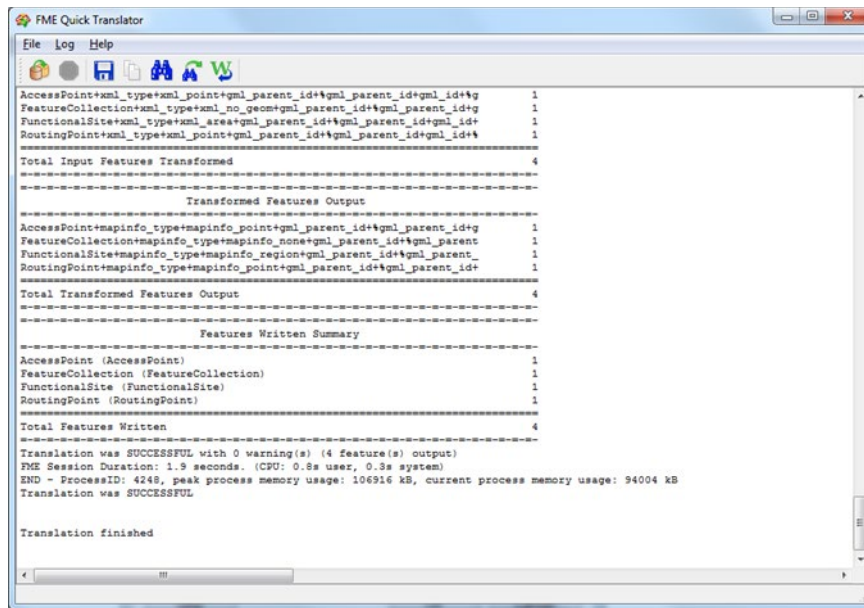


- b. Reader: In Dataset, use the ellipsis button to navigate to the folder where you saved your GML files.



- c. Writer: Select *MapInfo TAB* from the Format dropdown menu.
- d. Writer: In Dataset, use the ellipsis button to navigate to the folder where you want your TAB file to be saved.
- e. Leave the rest of the settings as the defaults.
- f. Click OK.

The translation starts. You will notice comments appearing in FME Quick Translator dialog. When complete, you will see a notification saying the 'Translation was SUCCESSFUL'.



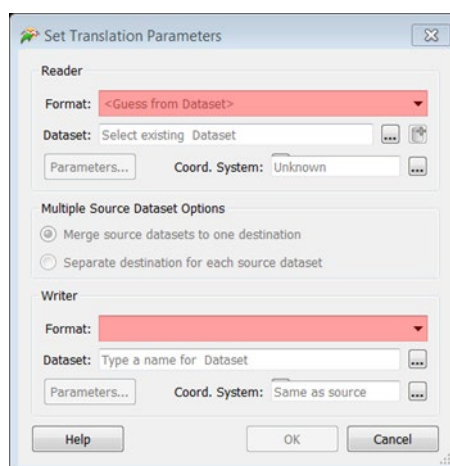
5. After you receive a successful translation notification, close the FME Quick Translator dialog.

4.3.2 Setting the application schema

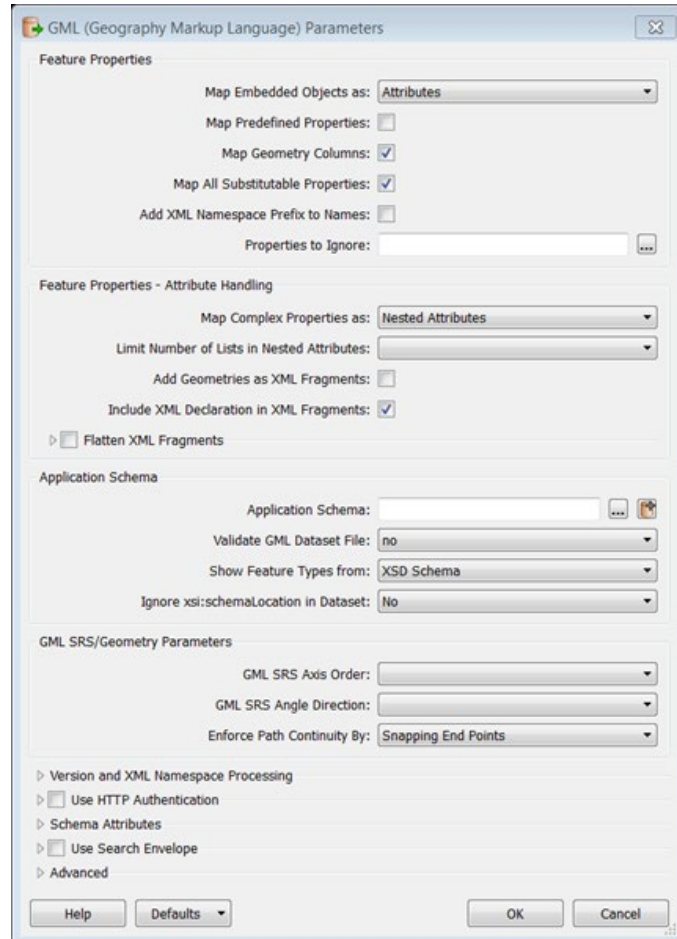
One common reason for the translation to fail is that the Universal Translator Tool cannot find the schema file used to interpret the GML. If this is the case, the schema file can be added manually.

To manually add the schema file used to interpret the GML:

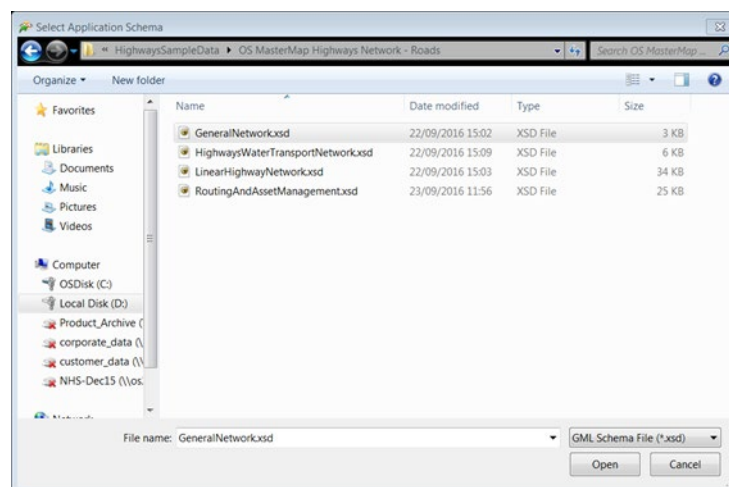
1. Follow Steps 1 to 3 in the sub-section above to open the Universal Translator Tool in MapInfo Professional.
2. In the Set Translation Parameters dialog, click the *Parameters...* button in the Reader section.



- Halfway down the GML (Geography Markup Language) Parameters dialog, click the *ellipsis* button to the right of the Application Schema box, then navigate to the schema location and select *GeneralNetwork.xsd*. (The schemas can be downloaded from the [OS MasterMap Highways Network GitHub repository \(https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-ALL-Schemas\)](https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-ALL-Schemas)).



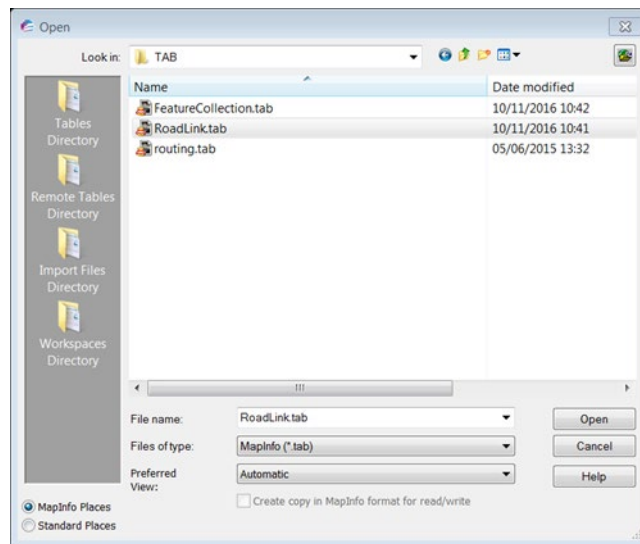
- In the Select Application Schema dialog, click *Open* and then *OK* and re-run the translation.



4.3.3 Opening the translated files in MapInfo Professional

To open translated TAB files in MapInfo Professional:

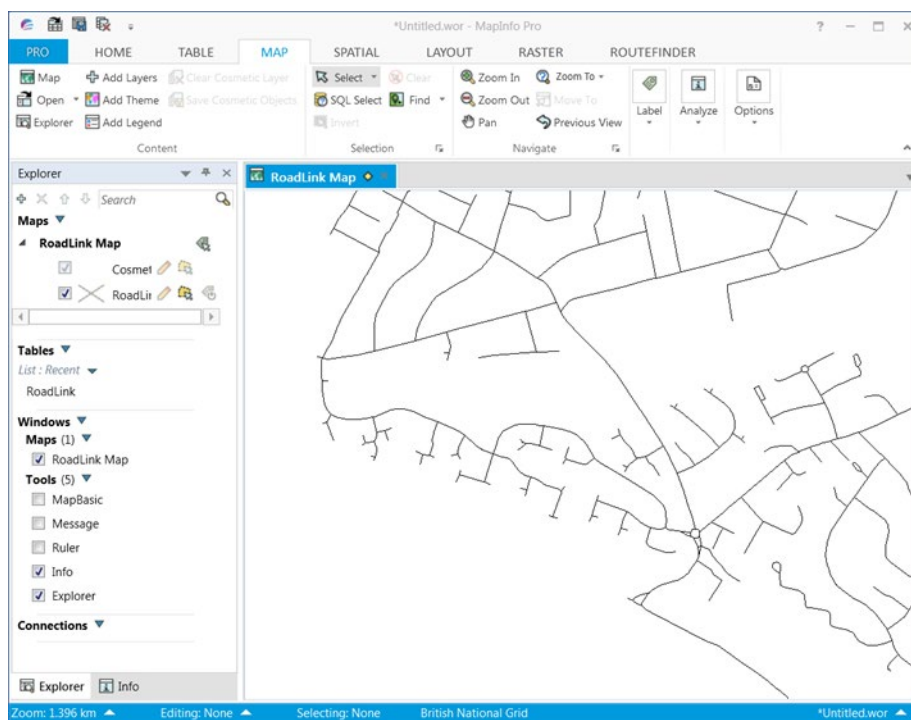
1. In the top ribbon, select the *Home* tab > *Open* > *Table*.
2. In the Open dialog, use the dropdown menu against 'Look in' to navigate to the folder where you saved your TAB files.



Note: If you cannot see your files, select MapInfo (.tab) from the 'Files of type' dropdown menu.*

3. Select your translated TAB file, then click *Open*.

The data will now load into MapInfo Professional without styling:



4.3.4 Creating and using OGC GeoPackage in MapInfo Professional

From version 11.5.2 of MapInfo Professional, the SQLite data format has been supported. This is a light-weight portable data type that allows users to store both geometry and tabular data within the same structure. OGC GeoPackage is an extension of this and is supported from MapInfo Professional version 15.2.2 (version 15.2.2 supports tables with geometry and version 21 supports all GeoPackage content). Both formats can be created using FME workbenches.

To open a GeoPackage for use in MapInfo Professional:

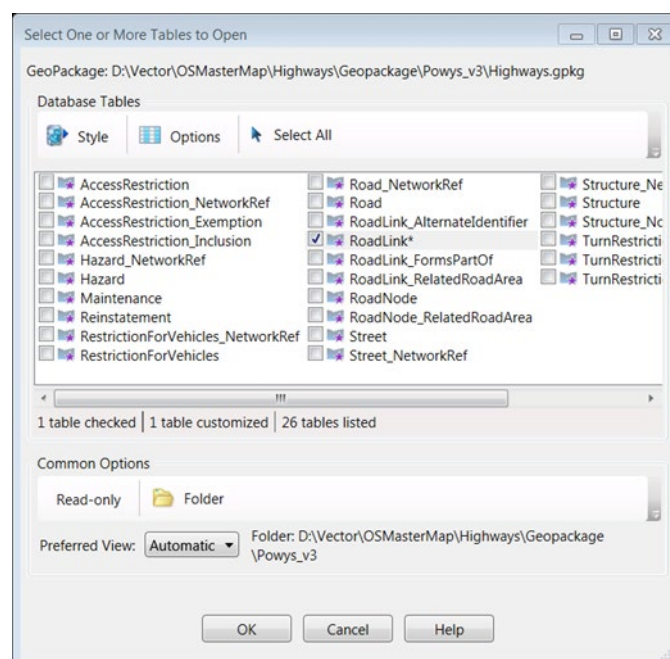
1. In the top ribbon, select the *Home* tab > *Open* > *Table*.
2. In the Open dialog:
 - a. Change the Files of type dropdown to *GeoPackage (.gpkg)*.

Note: You will also see an option in the 'Files of type' dropdown for SQLite, which can be opened in a similar way.

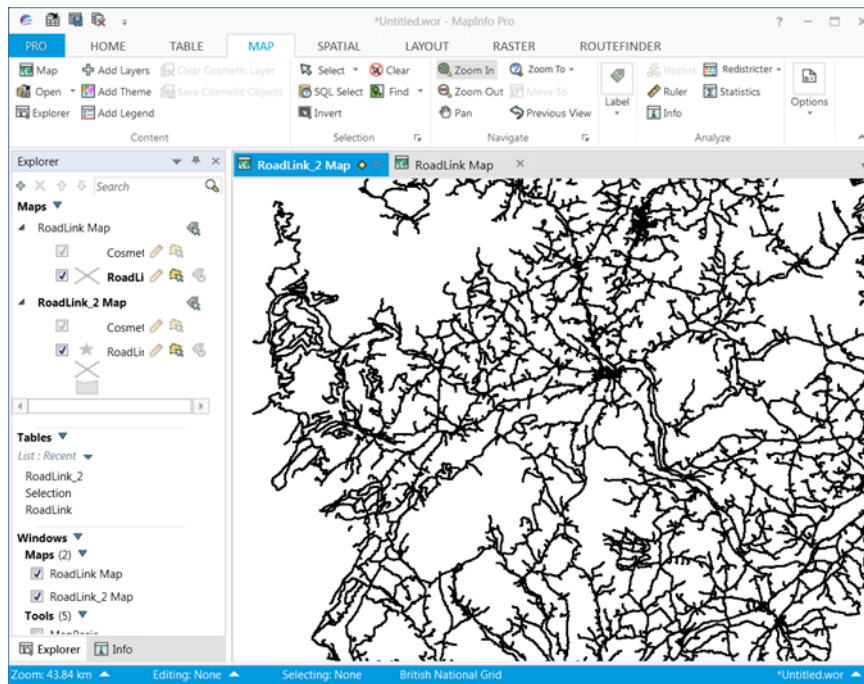
- b. Use the dropdown menu against 'Look in' to navigate to the folder where you saved your GeoPackage file.
- c. Click *Open*.

A list of available tables appears in the Select One or More Tables to Open dialog.

3. In the Select One or More Tables to Open dialog:
 - a. Select the tables you wish to open.
 - b. If your table contains geometry, you can set the default style by selecting the *Style* tab.
 - c. Chose the geometry type (Point, Line or Area) and select a style.
 - d. Click *OK* to open the tables in MapInfo Professional.



MapInfo Professional will create a TAB file for the data you have selected. The file will open within the Explorer panel and the map window and will be ready for you to work with.



4.4 Cadcorp SIS Desktop

The following instructions explain how to display and build a structured topological dataset using OS MasterMap Highways Network data in Cadcorp SIS Desktop. For the purposes of this guide, the version of Cadcorp SIS Desktop used is 9.1.1610.

There are several ways to load OS MasterMap Highways Network data into Cadcorp SIS Desktop:

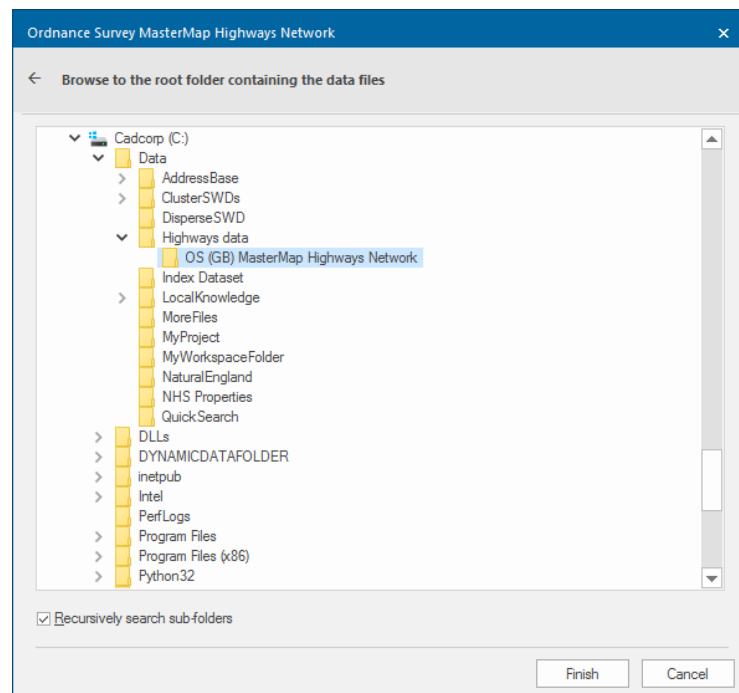
- Using OS MasterMap Highways Network utility. This allows you to visualize the highways data, and carry out network analysis using the SIS Desktop Routing Tools.
- Using Drag & Drop to visualize the highways data, which does not create a routable network.
- Using the OS (GB) Networks Manager to load the highways data and create a fully routable network dataset.
- Optionally, add OS Paths data to that dataset.

Each method is dealt with in turn, in the following sections.

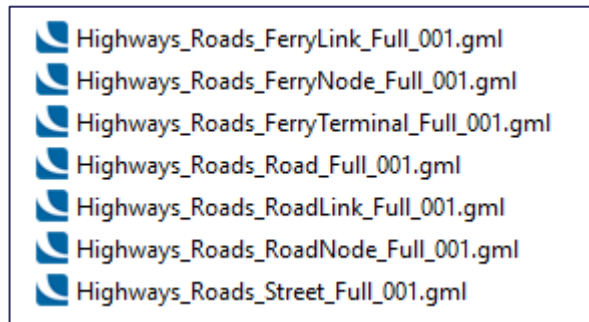
4.4.1 Loading Highways Data with OS MasterMap Highways Network

OS MasterMap Highways Network allows Highways data supplied directly from Ordnance Survey to be loaded into SIS. This option should be used for the initial visualization of the Highways data.

1. On the main Cadcorp SIS Desktop screen, select *Add Overlay > Ordnance Survey (GB) > OS (GB) Transport Network*.
2. Click *Next* to display the Ordnance Survey MasterMap Highways Network dialog.
3. Browse to the root folder containing the OS (GB) MasterMap Highways Network files.

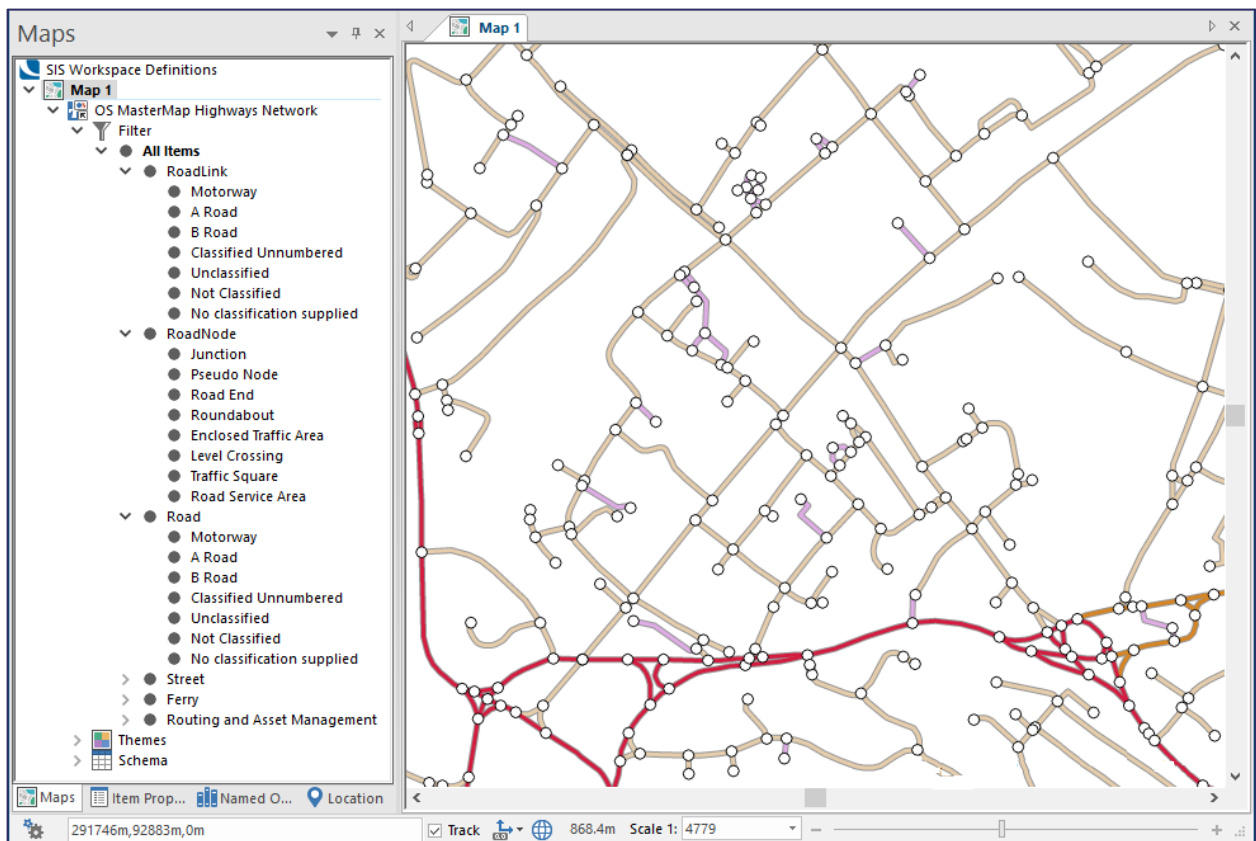


The example below shows the OS (GB) MasterMap Highways Network folder that contains the following .gml files:



4. Select the folder and click *Finish*.

The following map will be displayed:

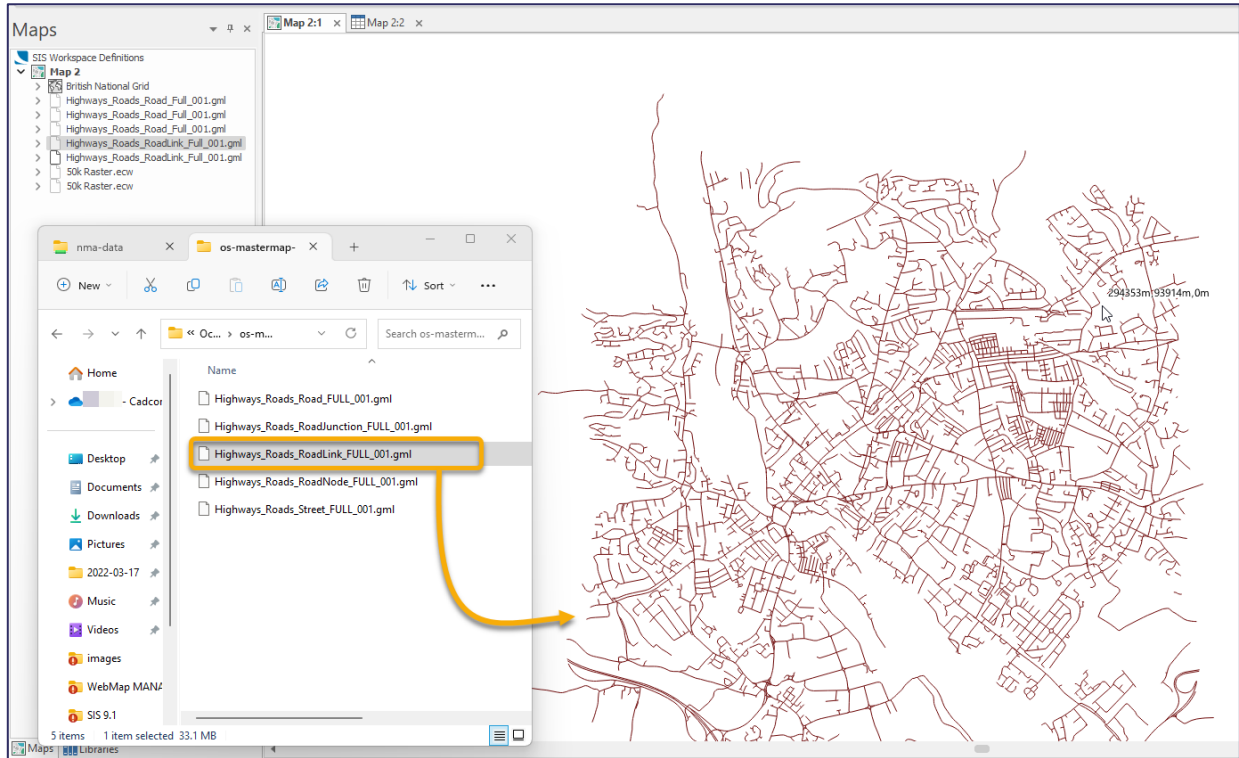


This layer is topologically structured and can be used with the SIS Desktop Routing Tools, for network analysis, including Point to Point routing based on road classification, as well as the underlying topology.

To avoid loading the .gml files every time this network is required, we recommended you use the Ordnance Survey MasterMap Highways Network Manager to load Highways data into a single topologically structured file, as described below.

4.4.2 Loading Highways Data using Drag & Drop

You can also load Highways data into SIS Desktop by simply dragging and dropping a Highways .gz or .gml file as supplied by Ordnance Survey into the SIS Desktop window.



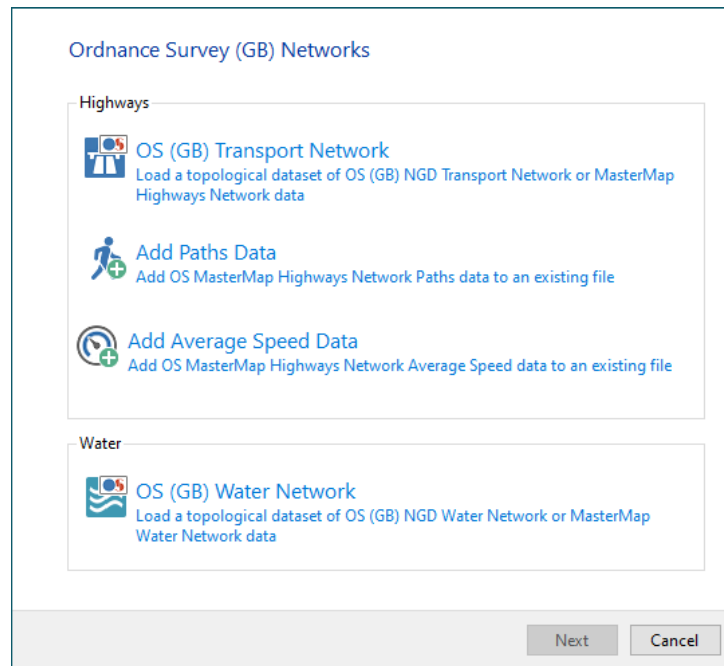
Note: This method will not create a routable network in SIS Desktop and will not apply any of the routing information or U-turn restrictions. It is a method to simply display the data in SIS Desktop. To obtain a routable network, you must use the method described in the next section.

4.4.3 Loading Highways Data using Ordnance Survey (GB) Networks Manager

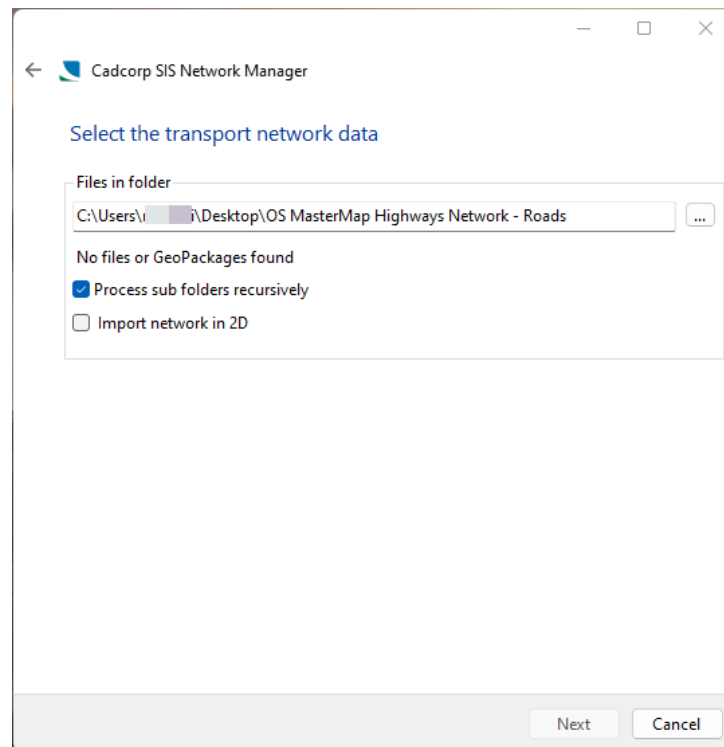
To build the Highways data into a single, topological structured .bds file, the data should be processed using the Ordnance Survey (GB) Networks Manager.

1. Click **File > Utilities > Ordnance Survey (GB)** and select **Cadcorp SIS Network Manager**.

The Cadcorp SIS Network Manager dialog opens.



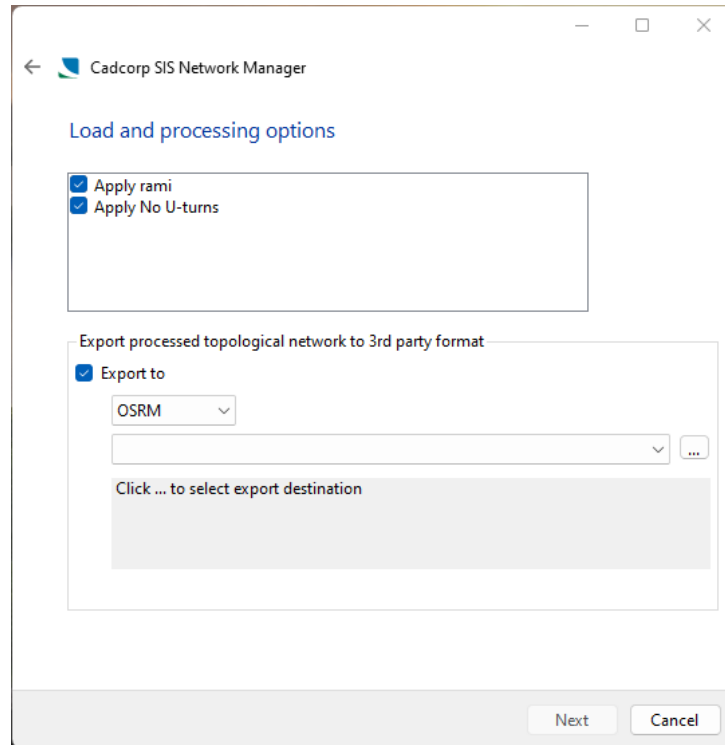
2. Select OS (GB) Transport Network.
3. Use the file browser to navigate to the location of the source files and click *Next*.



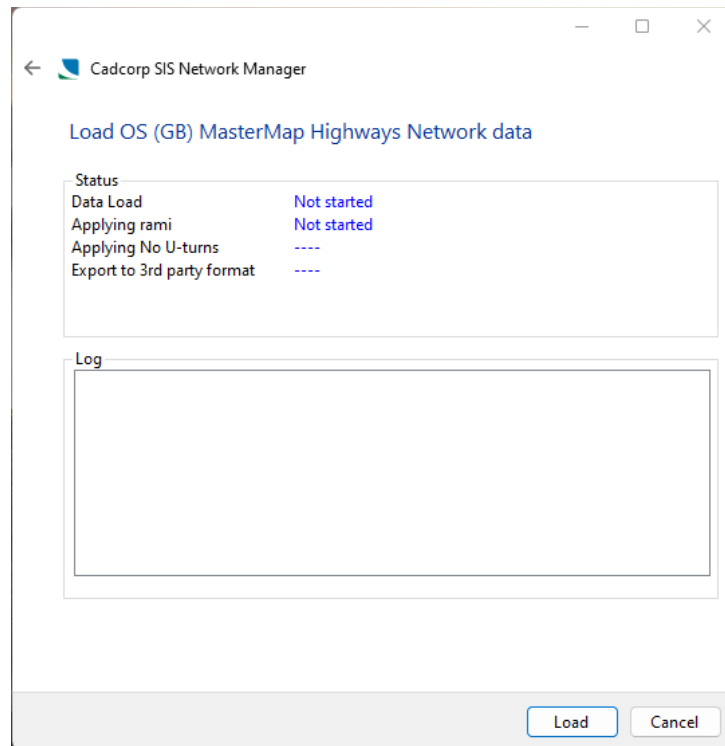
The number of .gzl.gml files selected for loading will be shown in the dialog above.

4. If required, check the *Import network in 2D* option. This will disregard the z value in the Highways data which can sometimes distort snapping.
5. Click *Next*.

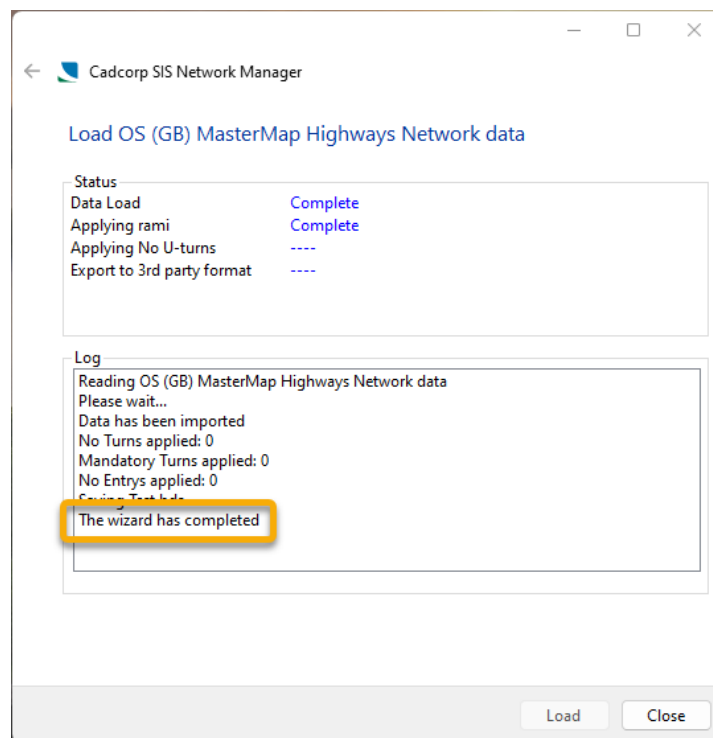
- To create a new .bds file to hold the topological data from the .gml files, navigate to an appropriate location where you want to create the .bds file, then enter a filename and click Save.
- In the next window, check the tickbox(es) for the required processing options. For network analysis, it is recommended that both options are applied to prevent routing behaving illogically.



- In the preceding dialog, you also have the option of saving and exporting the network to an OSRM (Open Source Routing Machine) database which can be used for exceptionally fast routing in SIS Desktop.
- Click *Next > Load* to begin loading the data.



10. When loading is complete (shown by the confirmation message in the log), click *Close*.

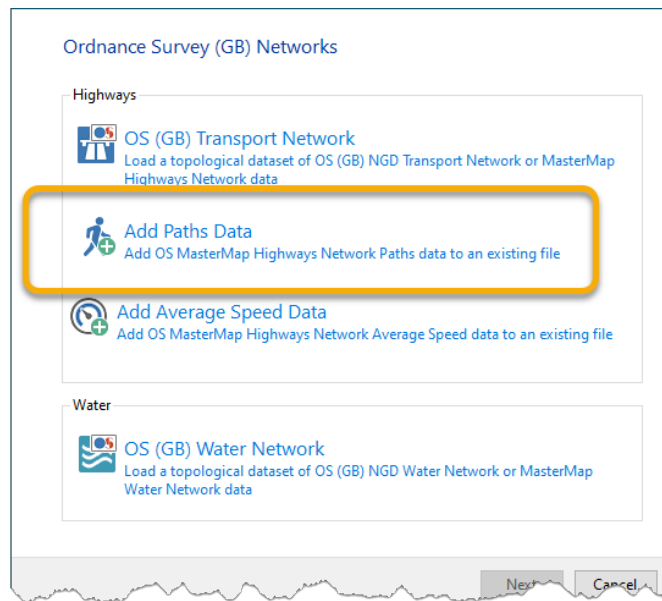


The *.bds* file is created in the chosen location.

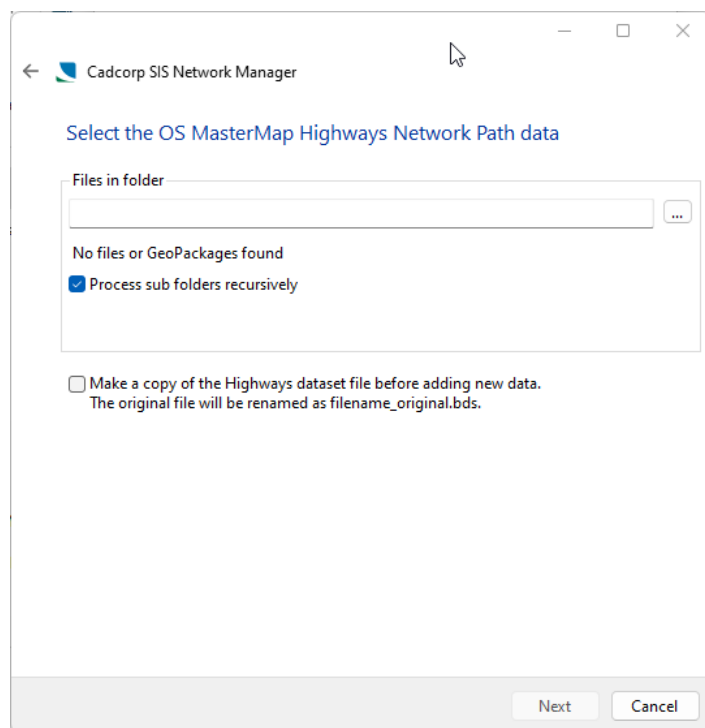
4.4.4 Adding OS MasterMap Highways Network Paths Data

If required, you can also add OS MasterMap Highways Network Paths data to the OS MasterMap Highways Network data file you created in the previous section.

1. On the Cadcorp SIS Network Manager dialog, select *Add Paths Data*.
2. Use the file browser to navigate to the Highways data file (usually a .bds file) and click *Next*.

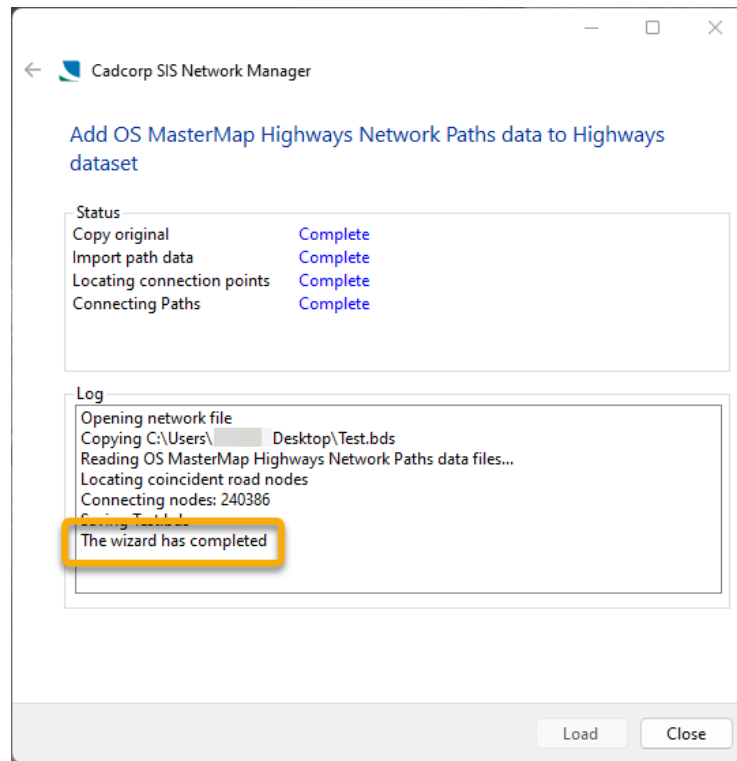


3. Select the OS MasterMap Highways Network Path data you would like to add to the .bds file. (Click on the three dots to open the file browser).



You can also choose to maintain a separate copy of the .bds file by the option in the preceding dialog.

4. Click *Next > Load* to begin loading the OS MasterMap Highways Network Paths data.



A message is displayed in the preceding dialog to confirm that the Paths data has finished loading.

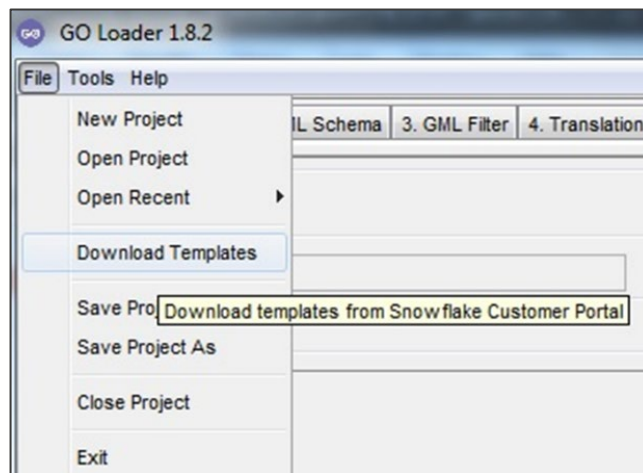
5. Using Snowflake to load the data into a database

Snowflake Software provide standard project templates for various OS products, so that users can load the data to a standard data model with a minimum of effort to a data model that meets the needs of most end-users.

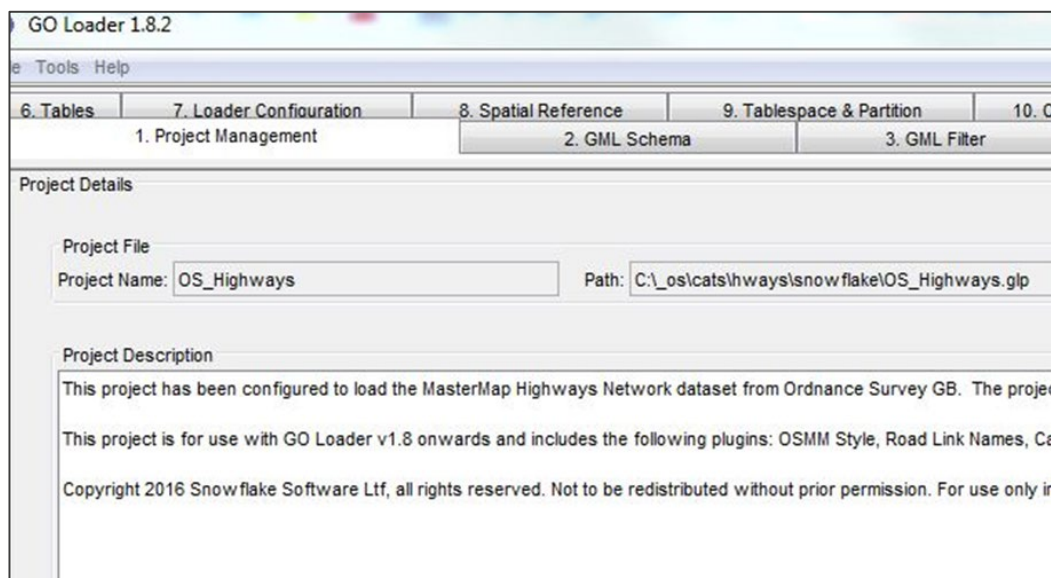
Snowflake have created a new standard project to support the new OS MasterMap Highways Network dataset. This can be downloaded from the Snowflake support portal.

The project also includes columns to help support styling / MapInfo styling if needed.

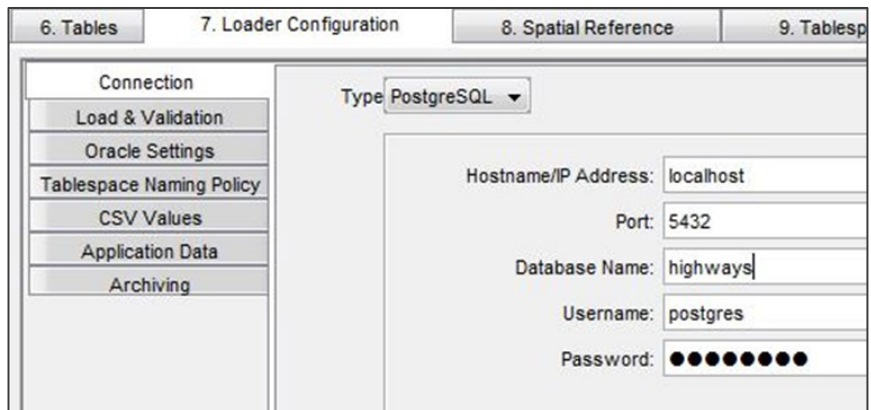
1. Open GO Loader, File/Download Templates, and download the new standard GO Loader project for Highways, from the Customer portal (Products/GO Loader/Resources/Project Templates).
2. Save the file to your drive and unzip it.



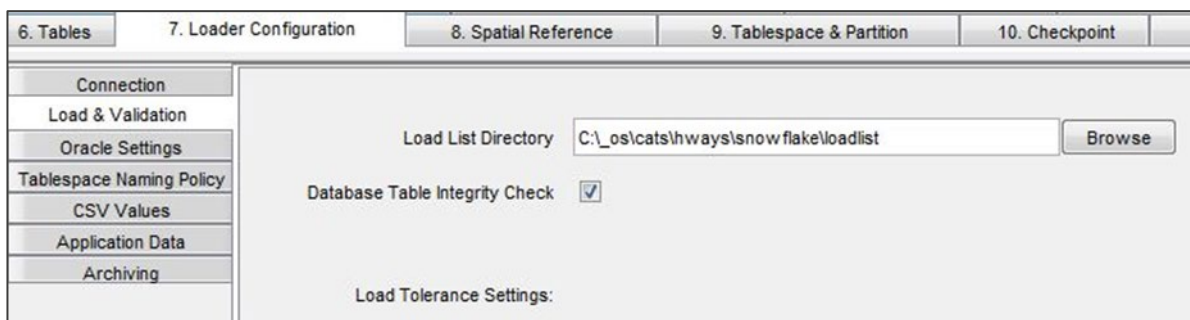
3. In GO Loader, open the new extracted OS_Highways.glp GO Loader Standard project (or drag it into the Project File area of the screen).



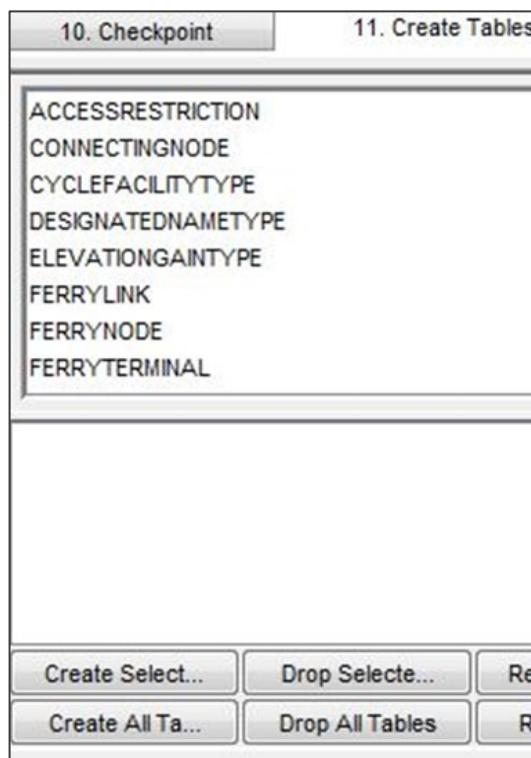
4. Select the *Loader Configuration* tab to set your target database details.



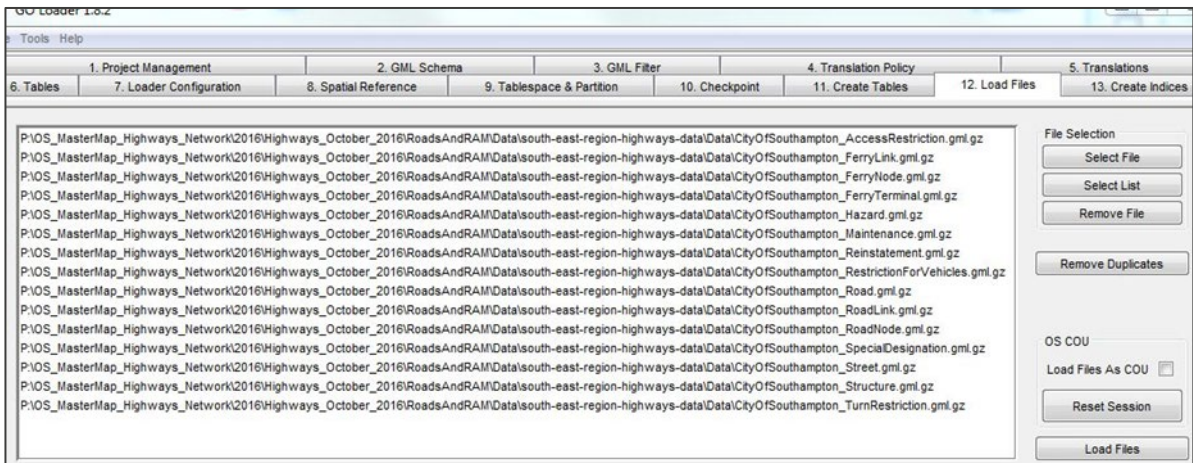
5. Set a directory location on your hard drive for 'load lists' (choose any valid local location).



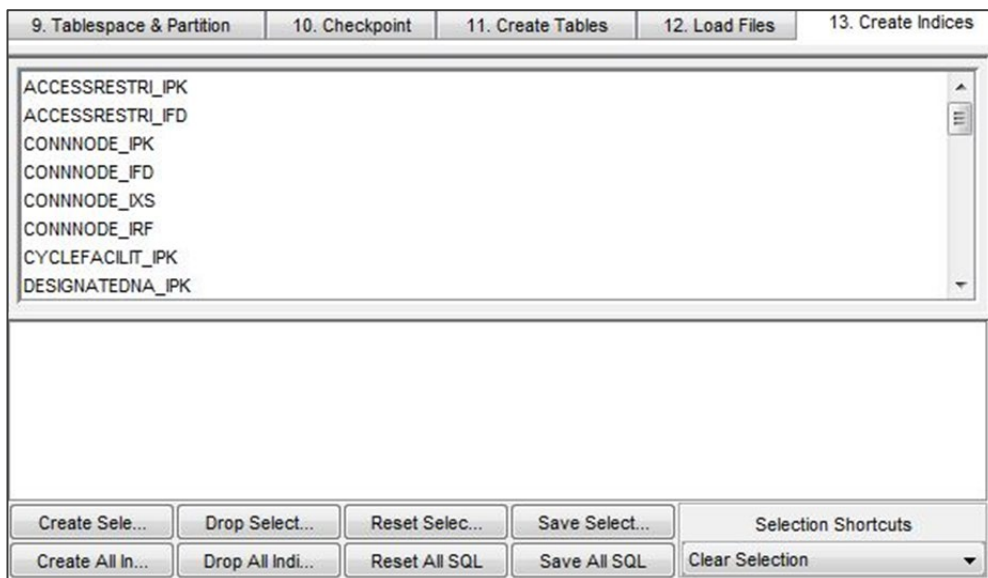
6. Create all the tables defined in the GO Loader Highways project (ideally choose a new database or schema without other existing tables).



7. Load all your Highways data files.



8. Create the Spatial Indexes and other indexes.



Annex A: Relationships between Highways tables

The following table is intended for use with the procedures described in [Section , Creating relationships in an ESRI File Geodatabase](#), of this guide:

Table 2. Relationships between Highways tables.

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
RoadLink	Linear Network	RoadLink	Y	TOID	N/A	N/A
RoadLinkAlternativeIdentifier	Linear Network	RoadLink	N	TOID (id in GML/technical spec)	RoadLink	TOID
RoadLinkFormsPartOf	Linear Network	RoadLink	N	TOID	Road or Street	formsPartOf - Will be either Road TOID or Street USRN
RoadLink_TopoTOIDRef	Linear Network	RoadLink	N	TOID	Topo Area	RelatedRoadAreaTOID - Will be the TOID of the Topo area(s) that represent the RoadLink.
AccessRestriction_NetworkRef	Routing and Asset Management Information	AccessRestriction	N	TOID	RoadLink	RoadLink_TOID - The TOID in the RoadLink table
AccessRestriction	Routing and Asset Management Information	AccessRestriction	N	TOID	AccessRestriction_NetworkRef, AccessRestriction_Inclusion, AccessRestriction_Exemption	TOID
AccessRestriction_Inclusion	Routing and Asset	AccessRestriction	N	TOID	AccessRestriction	TOID

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
	Management Information					
AccessRestriction_Exemption	Routing and Asset Management Information	AccessRestriction	N	TOID	AccessRestriction	TOID
Hazard_NetworkRef	Routing and Asset Management Information	Hazard	Y	TOID	RoadLink and RoadNode	RoadLink_TOID and RoadNode_TOID - The TOID in the respective tables
Hazard	Routing and Asset Management Information	Hazard	Y	TOID	Hazard_NetworkRef	TOID
Hazard_NodeReference_LinkReference	Routing and Asset Management Information	Hazard	N	TOID	RoadLink	RoadLink_TOID
RestrictionForVehicles_NetworkRef	Routing and Asset Management Information	VehicleRestriction, RestrictionForVehicles	N	TOID	RoadLink and RoadNode	RoadLink_TOID and RoadNode_TOID - The TOID in the respective tables
RestrictionForVehicles	Routing and Asset Management Information	VehicleRestriction, RestrictionForVehicles	Y	TOID	RestrictionForVehicles_NetworkRef	TOID

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
RestrictionForVehicles_NodeReference_LinkReference	Routing and Asset Management Information	VehicleRestriction, RestrictionForVehicles	N	TOID	RoadLink	RoadLinkTOID
Road	Linear Network	Road	N	TOID	Road_NetworkRef	TOID
Road_NetworkRef	Linear Network	Road	N	TOID	RoadLink	RoadLink_TOID - Is the TOID of the RoadLink table.
RoadNode	Linear Network	RoadNode	Y	TOID	N/A	N/A
RoadNode_RelatedRoadArea	Linear Network	RoadNode	N	TOID	Topo Area	RelatedRoadAreaTOID - Will be the TOID of the Topo area(s) that represent the RoadNode.
Street_NetworkRef	Linear Network	Street	N	USRN	RoadLink	RoadLink_TOID - Will be the TOID of the RoadLink table.
Street	Linear Network	Street	N	USRN	Street_NetworkRef	USRN
Structure_NetworkRef	Routing and Asset Management Information	Structure	N	TOID	RoadLink and RoadNode	RoadLink_TOID and RoadNode_TOID - The TOID in the respective tables
Structure	Routing and Asset Management Information	Structure	Y	TOID	Structure_NetworkRef	TOID
Structure_NodeReference_LinkReference	Routing and Asset Management Information	Structure	N	TOID	RoadLink	RoadLink_TOID

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
TurnRestriction_NetworkRef	Routing and Asset Management Information	TurnRestriction	N	TOID	RoadLink	RoadLink_TOID - The TOID in the RoadLink table
TurnRestriction	Routing and Asset Management Information	TurnRestriction	N	TOID	TurnRestriction_NetworkRef, TurnRestriction_Exemption, TurnRestriction_Inclusion	TOID
TurnRestriction_Exemption	Routing and Asset Management Information	TurnRestriction	N	TOID	TurnRestriction	TOID
TurnRestriction_Inclusion	Routing and Asset Management Information	TurnRestriction	N	TOID	TurnRestriction	TOID
Maintenance Point	Routing and Asset Management Information	Maintenance	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Maintenance Line	Routing and Asset Management Information	Maintenance	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Maintenance Area	Routing and Asset	Maintenance	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
	Management Information					
Maintenance No Geometry	Routing and Asset Management Information	Maintenance	N	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Reinstatement Point	Routing and Asset Management Information	Reinstatement	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Reinstatement Line	Routing and Asset Management Information	Reinstatement	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Reinstatement Area	Routing and Asset Management Information	Reinstatement	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Reinstatement No Geometry	Routing and Asset Management Information	Reinstatement	Y	ID	Street	Reference_To_StreetUSRN - The USRN in the Street table
Junction	Linear Network	RoadJunction	N	TOID	RoadNode	TOID, RoadNode_TOIDs (the junction can reference back to multiple road nodes)
Highways Dedication	Routing and Asset	Dedication	Y	ID	Road, Street or Path	NetworkRef - TOID in RoadLink and PathLink table and USRN in the Street table

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
	Management Information					
Special Designation Point	Routing and Asset Management Information	SpecialDesignation	Y	networkRef	Street	NetworkRef - USRN in the Street table
Special Designation Line	Routing and Asset Management Information	SpecialDesignation	Y	networkRef	Street	NetworkRef - USRN in the Street table
Special Designation Area	Routing and Asset Management Information	SpecialDesignation	Y	networkRef	Street	NetworkRef - USRN in the Street table
Special Designation No Geometry	Routing and Asset Management Information	SpecialDesignation	N	networkRef	Street	NetworkRef - USRN in the Street table
Ferrylink	Linear Network	FerryLink	Y	TOID	N/A	N/A
Ferrylink	Linear Network	FerryLink	N	TOID	FerryNode	FerryNode_TOID (one for startNode and one for endNode)
FerryNode	Linear Network	FerryNode	Y	TOID	N/A	N/A
FerryTerminal	Linear Network	FerryTerminal	N	refToFunctionalSite,roadNodeRef, pathNodeRef	Road Node, Path Node and Functional Site	TOID

Table	Specification	GML file	Contains geometry	Column ID Primary	Relates to	Column ID Foreign
PathLink	Paths	PathLink	Y	TOID	N/A	N/A
PathLinkAlternativeIdentifier	Paths	PathLink	N	TOID	PathLink	TOID
PathLinkFormsPartOf	Paths	PathLink	N	TOID	Path or Street	formsPartOf - Will be either Path TOID or Street USRN
PathLink_TopoTOIDRef	Paths	PathLink	N	TOID	Topo Area	RelatedPathAreaTOID - Will be the TOID of the Topo area(s) that represent the PathLink.
PathLink	Paths	PathLink	N	TOID	PathNode	PathNode_TOID (one for startNode and one for endNode)
Path	Paths	Path	N	TOID	Path_NetworkRef	TOID
Path_Ref_PathLink	Paths	Path	N	TOID	PathLink	PathLink_TOID - Is the TOID of the PathLink table.
PathNode	Paths	PathNode	Y	TOID	N/A	N/A
PathNode_RelatedRoadArea	Paths	PathNode	N	TOID	Topo Area	RelatedPathAreaTOID - Will be the TOID of the Topo area(s) that represent the PathNode.
ConnectingLink	Paths	ConnectingLink	Y	TOID	PathNode and ConnectingNode	TOID
ConnectingNode	Paths	ConnectingNode	Y	TOID	RoadLink	TOID

Annex B: Product support links

Guides

You can find additional information and documentation about the product on the '[OS MasterMap Highways Network Technical Information](https://www.ordnancesurvey.co.uk/products/os-mastermap-highways-network-roads#technical)' page on the OS website (<https://www.ordnancesurvey.co.uk/products/os-mastermap-highways-network-roads#technical>):

We recommend that you read the following guides:

- *OS MasterMap Highways Network – Product Guide*
- *OS MasterMap Highways Network – Roads – Technical Specification*
- *OS MasterMap Highways Network – Routing and Asset Management Information – Technical Specification*
- *OS MasterMap Highways Network – Paths – Technical Specification*
- *Getting Started with GeoPackage*
- *Getting Started with Vector Tiles*
- *Guide to Routing for the Public Sector*

Stylesheets

- Predefined stylesheets for OS MasterMap Highways Network are available for download from the [Ordnance Survey OS-MasterMap-Highways-Network-stylesheets GitHub repository](https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-stylesheets) (<https://github.com/OrdnanceSurvey/OS-MasterMap-Highways-Network-stylesheets>).
- To download a ZIP containing all stylesheets, navigate to *Code > Download ZIP*.