ORDNANCE SURVEY GB

GETTING STARTED WITH GEOPACKAGE

OFFICIAL v1.0 July 2021 Page 1 of 19



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Version history

| Version | Date | Description |
|---------|---------|------------------|
| 1.0 | 07/2021 | Initial release. |

Contact details

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I. Introduction

This guide explains what GeoPackage is, lists the key features and benefits of the format, and details the applications that support GeoPackage features. Section 2 provides step-by-step instructions on how to access GeoPackage data via ArcMap, QGIS, MapInfo Professional, ArcGIS Pro and CadCorp. Section 3 details how to load GeoPackage data into PostgreSQL. Section 4 outlines how to read GeoPackage data into FME.

In response to customer feedback on preferred data formats, a growing number of OS products have been made available in GeoPackage format, including AddressBase Core, Boundary-Line, OS Open Zoomstack and OS Open Roads, to name a few.

I.I What is GeoPackage?

GeoPackage (.gpkg) is an open, non-proprietary, platform-independent and standards-based data format for geographic information systems (GIS), as defined by the Open Geospatial Consortium (OGC). It is designed to be a lightweight format that can contain large amounts of varied and complex data in a single, easy to distribute and ready to use file. GeoPackage is natively supported by numerous software applications.

I.2 Key features and benefits of GeoPackage

GeoPackage offers users the following key features and benefits:

- The single file is easy to transfer and offers the end-user a rich experience.
- Attribute names are not limited in length, making the format user-friendly.
- The file size limit is very large at 140 TB¹, so lots of data can be easily accommodated great for GB national coverage.
- It supports raster, vector and database formats, making it a highly versatile solution.
- It is an OGC standard.
- In most cases, it is a Plug and Play format.
- Data will be supplied in British National Grid (ESPG:27700).

 $^{^{\}rm I}$ A file size limit might be imposed by the file system to which the file is written.

2. Accessing GeoPackage data via GIS software

The following sub-sections provide step-by-step instructions on how to access GeoPackage data via ArcMap, QGIS, MapInfo Professional, ArcGIS Pro and CadCorp.

2.1 Accessing GeoPackage data via ArcMap

Requirements:

- ArcMap (version 10.2.2 or later)
- A GeoPackage dataset

These instructions were created using ArcMap version 10.7, but versions from 10.2.2 onwards will also support GeoPackage features.

- I. Open ArcMap.
- 2. Once ArcMap loads, select the *Add Data* button. The icon is an orange-coloured diamond shape with a black plus symbol on top; it can be found in the ribbon at the top of the workspace.



If the Add Data button is not visible, an alternate method to add data is to select File > Add Data > Add Data. An Add Data dialog box will appear which will be similar to the following screenshot:

| Add Data | | | | | | | × |
|---------------|------------------------|---------|-----|---------|----------|--------|---|
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| 🗊 opgrsp_gb | .gpkg | | | | _ | | |
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| | | | | | | | _ |
| Name: | | | | | | Add | |
| Show of type: | Datasets, Layers and R | Results | | ~ | | Cancel | |

If you have not yet connected to the appropriate folder in which you are storing the GeoPackage data, you can connect to it by selecting the *Add Folder* button:



3. Once you have connected to the appropriate folder, locate the GeoPackage to upload into ArcMap. The .gpkg file will look similar to the one in the following screenshot:

| Add Data | × |
|---------------|---------------------------------------|
| Look in: 🛅 | lata 🔷 🛧 🏠 🗔 🏥 🕇 😂 🗊 🚳 |
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| | |
| Name: | Add |
| Show of type: | Datasets, Layers and Results V Cancel |
| | |

4. Double-click on the GeoPackage file to reveal the layers within it. Select the layers you want to upload into ArcMap.

Note: More than one layer can be selected at any time by holding down shift and clicking on multiple layers.

| Add Data | | | \times |
|------------------------|--|---------------|----------|
| Look in: | opgrsp_gb.gpkg 🗸 👍 🗔 🏥 🗸 🔛 | 60 | 6 |
| inain.Acces | sPoint spaceSite | | |
| Name: Show of type: | main.GreenspaceSite Datasets, Layers and Results | Add Cancel | |

- 5. Add the relevant selected GeoPackage layers into the map by clicking the Add button.
- 6. The GeoPackage layers should now be viewable in the layers list in the Table Of Contents on the lefthand side of the workspace.

2.2 Accessing GeoPackage data via QGIS

Requirements:

- QGIS (version 2.10.1 or later)
- A GeoPackage dataset

These instructions were created using QGIS version 3.14. Other versions of QGIS can be used, from version 2.10.1 onwards.

- I. Open a new or existing QGIS project.
- 2. On the top ribbon of the workspace, add a layer by selecting Layer > Add Layer > Add Vector Layer.

| Q Untitled Project — C | IGIS | | |
|--|---|--|------------------------------|
| Project Edit View | Layer Settings Plugins Vector Baster Databa | se Web Mesh MMQGIS Processing Help | ¥Σ = • 🖓 Q. • |
| 🧠 🏟 Vo 🌈 | Add Layer | Add Vector Layer | Ctrl+Shift+V |
| I 🔣 + 📑 + 🌄 · | Embed Layers and Groups Add from Layer Definition File | Add Raster Layer | Ctrl+Shift+R |
| Browser | Copy Style Paste Style | Po Add Delimited Text Layer Po Add PostGIS Layers | Ctrl+Shift+T Ctrl+Shift+D |
| Favorites Favorites Spatial Bookm Home | Copy Layer | Add SpatiaLite Layer Add MSSQL Spatial Layer | Ctrl+Shift+L |
| C\ D\ E4 | Copen Attribute Table F6 Toggle Editing Save Laver Edits | Add DB2 Spatial Layer Add Oracle Spatial Layer Add/Edit Virtual Layer | Ctrl+Shift+2 Ctrl+Shift+O |
| GeoPackage SpatiaLite | Current Edits Save As Save As Laver Definition File. | Add WMS/WMTS Layer Add XYZ Layer Add Arc <u>G</u> IS Map Service Layer | Ctrl+Shift+W |
| PostGIS MSSQL Oracle | Remove Layer/Group Ctrl Duplicate Layer(s) Set Scale Visibility of Layer(s) | D Add WCS Layer C Add WFS Layer Add ArgGIS Feature Service Layer | |
| → Basemap → OS Maps | Set CRS of Layer(s) Ctrl- Set Project CRS from Layer Layer <u>P</u> roperties | -Shift+C Add Vector Tile Layer | |
| SMaps SMapsA | Filter Ctrl- | + F | |
| trial Vector Tiles XYZ Tiles | Show in Overview Show All in Overview Hide All from Overview | | |
| WCS | | * | |

Alternatively, you can simply select the Add Vector Layer button:



3. A dialog box will appear. Here, it is possible to select the GeoPackage that will be loaded using the *three dots* button located next to the Vector Dataset(s) box. Click the *three dots* button.

| Q Da | ta Source Manager Vector | | × |
|-------------|--|-----------|----------------|
| | Source Type | | |
| V | File Directory Database Protocol: HTTP(S), cloud, etc. | | |
| ο, | Encoding | Automatic | • |
| 20 | Source | | |
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| -1+ | | | Close Add Help |

- 4. Navigate to the GeoPackage. Double-click the file or select it, then click Add.
- 5. A separate dialog box will appear. Here, the layers of the GeoPackage can be selected and added to a map. It is possible to add selected layers, numerous layers or all layers.

| Q Select Ve | ctor Layers to Add opgrsp | _gb.gpkg | | | × |
|--------------|-------------------------------------|-------------|--------------------|---------------|-------|
| C:\Temp\OS C |) pen Greenspace (GPKG) GB\data\ | opgrsp_gb.g | pkg | | |
| Layer ID | Layer name | | Number of features | Geometry type | C |
| 0 | AccessPoint | | 292019 | Point | |
| 1 | GreenspaceSite | | 148263 | MultiPolygon | |
| | | | | | Þ |
| Select All | Deselect All Add layers to | a group | | ОК Са | ancel |

- 6. Once the relevant layers have been selected, click OK.
- 7. The GeoPackage layers should now be viewable in the layers list on the left-hand side of the workspace.

2.3 Accessing GeoPackage data via MapInfo Professional

Requirements:

- MapInfo Professional (version 15.2 or later)
- A GeoPackage dataset

These instructions were completed using MapInfo Professional version 2019; however, any version from 15.2 onwards can be used.

- I. Start MapInfo Professional.
- 2. Select Open > Table in the top ribbon.



3. A dialog box will appear where you can search for the appropriate GeoPackage. Once located, select the GeoPackage and click *Open*.

| 🧲 Open | | | | | | × |
|---|--------------------|----------------------------------|-----------------------------------|-------------------|--------------------|--------|
| Look in: | User Guides | ~ | G 🖸 🗈 🛄 - | | | |
| Tables Directory Remote Tables Directory Import Files Directory Workspaces Directory | Name | pkg | Date modified 30/03/2021 12:00 | Type GPKG File | Size 141,916 KB | |
| | File name: | | | | ~ | Open |
| | Files of type: | GeoPackage (*.gpkg) | | | ~ | Cancel |
| | Preferred View: | Automatic | | | ~ | Help |
| MapInfo Places Standard Places | | Create copy in MapInfo format fo | or read/write | | | 4 |

4. Another dialog box will appear. Here, it is possible to select which layers to import into MapInfo Professional from the GeoPackage.

| Select One or More Tables to Open | - | × |
|---|--------|---|
| GeoPackage: C:\Users\twiseman\Desktop\User Guides\opgrsp_gb.gpkg | | |
| Style Options Select All | | ÷ |
| AccessPoint GreenspaceSite | | |
| 2 tables checked 0 tables customized 2 tables listed | | |
| Common Options | | |
| Read-only 🛅 Folder | | ÷ |
| Preferred View: Automatic Y Folder: C:\Users\twiseman\Desktop\User | Guides | |
| OK Cancel Help | | |
| OK Cancer Help | | |

- 5. Once the layers have been selected, click OK.
- 6. The data should now be available in your workspace.

2.4 Accessing GeoPackage data via ArcGIS Pro

Requirements:

- ArcGIS Pro (version 1.1 or later)
- A GeoPackage dataset

These instructions were created using ArcGIS Pro version 2.5, but versions from 1.1 onwards will support GeoPackage.

1. Start ArcGIS Pro, then open an existing project or create a new one. To create a new project, select *Map* from the Blank Templates section, then enter a *Name* and a *Location* for the project in the Create a New Project section. Click *OK*.

| New | | |
|--------------------------|---|----------|
| Blank Templates | Recent Templates | |
| 🛃 Мар | Your recent templates will appear here. | |
| Catalog | Create a New Project | × |
| Global Scono | Name MyProject1 | |
| Cy diobal scene | Location C:\temp | 2 |
| Local Scene | \checkmark Create a new folder for this project | |
| Start without a template | OK Canc | el |
| (you can save it later) | | |

2. In the ribbon at the top of the project, select Map > Add Data.



3. A dialog box will appear. Navigate to the GeoPackage to be added into ArcGIS Pro. Select the GeoPackage and click *Open*. This will open the GeoPackage to reveal the individual layers.

| Ad | d Data | | | | | х | | |
|-----|---|----------------|------------|---------------------|------------|--------|--|--|
| € | 🔄 🕣 👚 🔣 Komputer 🔸 OSDisk (C:) 🔸 Temp 🔸 OS Open Greenspace (GPKG) GB 🔸 data 🔸 | | | | | | | |
| Or | Organize Vew Item | | | | | | | |
| | Folc | Name | Туре | Date | Size | | | |
| 4 | 🙆 Portal 🗧 | opgrsp_gb.gpkg | Geopackage | 16/03/2021 11:38:36 | 141,916 KB | | | |
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| | | Name | | | Default | | | |
| | | | | | Open | Cancel | | |

4. The layers can be selected either individually or together. Once the relevant layers have been selected, click OK. The selected layers will then be added into ArcGIS Pro.

Note: More than one layer can be selected at any time by holding down shift and clicking on multiple layers.

| Add Data | | | | × |
|--|--|--------------------|---------|-----|
| ⊙ Э ⑦ 💽 → Computer → C:\ → Temp → OS C | pen Greenspace (GPKG) GB ト data ト opgrsp_gb.gpkg | | | • 🖑 |
| Organize 🔻 New Item 👻 | | | | 1 |
| 🔺 📄 Project | Name | Туре | Date | |
| 同 Databases | main.AccessPoint | SQLite Database Fe | | |
| Folders | main.GreenspaceSite | SQLite Database Fe | | |
| 🔺 🙆 Portal | | | | |
| My Content | | | | |
| 🛞 Groups | | | | |
| 🛆 All Portal | | | | |
| Living Atlas | | | | |
| 🔺 🗊 Computer | | | | |
| 🚘 Desktop | | | | |
| Cocuments | | | | |
| Cownloads | | | | |
| 😑 C:\ 🔻 | | | | |
| Name | | Default | | • |
| | | | OK Canc | el |

5. The layers added into ArcGIS Pro will appear in the contents pane on the left-hand side of the project.

2.5 Accessing GeoPackage data via CadCorp

Requirements:

- CadCorp SIS
- A GeoPackage dataset

These instructions were created using CadCorp SIS 9 Desktop Express; however, other versions of CadCorp can support GeoPackage.

- I. Start CadCorp SIS.
- 2. In the upper ribbon, select Add Overlay.



3. A dialog box will appear. Select Files > File.

| Files Databases OGC | File A file-based dataset | -12 |
|-----------------------------|--|-----|
| Ordnance Survey (GB) Web | A dataset created by importing data from a file-based dataset | -P |
| Analysis Miscellaneous | Tiles together multiple file-based datasets in a rectangular grid, to make a continuous map base | -P |
| | An index of all of the the raster files in a folder, or tree of folders | P |
| | | |
| | | |
| | | |

4. From here, another dialog box appears where you can map to where the GeoPackage has been stored locally.

| This F | PC ► OSD | isk (C:) ▶ Users | ▶ twiseman ▶ D | Desktop 🕨 User Guid | es 🕨 | 1000 |
|--------------|--------------|-------------------------|---------------------------|----------------------------------|-------------|------------|
| New Folder | | | | | | D v |
| Name | ~ | Size | Туре | Modified | | |
| opgrsp_g | b.gpkg b | 141,917 KB 51,151 KB | GPKG Hie PowerArchiver | 30/03/2021 12: 07/04/2021 15: | | |
| ile name: op | ogrsp_gb.gpl | ۶g | | All kn | own formats | • |

- 5. Once the correct GeoPackage has been located, click Finish.
- 6. The data should now appear on the map.

3. Loading GeoPackage into a database

The following sub-section provides instructions on how to load GeoPackage datasets into PostgreSQL.

3.1 Loading a GeoPackage into PostgreSQL (via GDAL / Command Prompt)

Requirements:

- A development platform for PostgreSQL (for example, pgAdmin or dBeaver)
- A PostgreSQL database
- PostGIS extension
- GDAL
- Access to a Command Prompt or similar
- A GeoPackage dataset

There are various ways of loading a GeoPackage into PostgreSQL. The following step-by-step instructions run through using GDAL / Command Prompt to do this.

- 1. Open your chosen development platform, for example, dBeaver (this can be found by going to Windows Start Menu > PostGreSQL).
- 2. Either connect to an existing database or create a new database. It is recommended that the encoding is set to UTF-8. We will return to the PostgreSQL development platform later.
- 3. Open the Command Prompt by clicking the *Start* button in the bottom left-hand side of the screen and typing *cmd* into the search bar.



4. The Command Prompt will appear.

- 5. Change the directory of the Command Prompt app if necessary. The directory needs to point to the folder where the GeoPackage is stored. For this example, the GeoPackage to be loaded into PostgreSQL is stored in a C:\Temp folder.
- 6. In the Command Prompt, type *cd* followed by the directory of the location of the GeoPackage. Press *Enter* on the keyboard. This will change the directory.



7. Enter the command:

ogr2ogr -progress -gt 65000 -f PostgreSQL "PG:user=<**username>** password=<**password>** dbname=<**database>**" -a_srs EPSG:<**coordinate_system> <data_name>**.gpkg

username, password, database and host can all be found within the subsequent database.

coordinate_system is the EPSG of the data to be loaded, for example, to load into British National Grid, the EPSG is 27700.

data_name is the name of the GeoPackage to be loaded.

Example:

ogr2ogr -progress -gt 65000 -f PostgreSQL "PG:user=**postgres** password=**PG123** dbname=**osdata** host=**localhost**" -a_srs EPSG:**27700 Greenspace**.gpkg

- 8. Open your chosen development platform (for example, dBeaver) by going to Start > dBeaver.
- 9. Under Database Navigator, move to the database you loaded data into and expand the schema. Using the code above, the GeoPackage should be in your default schema (shown in bold).
- 10. The GeoPackage will now appear as new tables / a new table in the schema nominated as default. Nominate a schema by adding the following text to the command noted in step 7:

active schema=**<schema>**

schema can be found within the subsequent database.

11. Once loaded, you may want to add Primary and Foreign Keys to the data. These can only be added on columns where the data values are unique. Where there are no unique data values, an index may be added, which will aid searching.

4. Reading GeoPackage data via FME

Requirements:

- An FME license
- A GeoPackage dataset

GeoPackages can also be read into and used in FME workbenches.

1. Start up FME. In the top ribbon, click the *Add Reader* button, which will look similar to the following image:



2. A dialog box will appear. Here, the format (GeoPackage in this instance) can be specified using the drop-down list. Select the *three dots* button next to Dataset to specify which GeoPackage you want to read. The Coordinate System should also be set appropriately.

| Format: | OGC GeoPackage | ~ | |
|----------|---|---|--|
| Dataset: | "C:\Temp\OS Open Greenspace (GPKG) GB\data\opgrsp_gb.gpkg" | | |
| Param | neters Coord. System: Read from source | ~ | |
| Norkflow | Options | | |
| | - Contraction - | | |

3. Click Parameters...

4. Another dialog box will appear. Here, specific layers within the GeoPackage can be selected, rather than importing the entire file. Additionally, the Search Envelope can be used to clip the GeoPackage to an extent.

| 😝 OGC GeoPackage Parameters | | × |
|-----------------------------|--|---|
| Database Connection | | |
| GeoPackage File: | "C:\Temp\OS Open Greenspace (GPKG) GB\data\opgrsp_gb.gpkg" | |
| Constraints | | |
| Tables: | | |
| > Advanced | | |
| Schema Attributes | | |
| > Use Search Envelope | | |
| Help 🚱 Presets 🔻 | OK Cance | |

- 5. Click the three dots button next to the Tables drop-down menu.
- 6. The next dialog box to appear allows for the selection of specific layers. Here, it is possible to select which themes / layers should be added into the workbench.

| 🔒 Select Tables | | × |
|-----------------|--------|------------|
| AccessPoint | | |
| GreenspaceSite | | |
| | | |
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| | | |
| O Filtor | Select | all Sorted |
| - Filler | | |
| | ОК | Cancel |
| | | |

- 7. Click OK.
- 8. An orange reader will appear which will display the name of the GeoPackage table that has been 'read in'.



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