

Gavin McGough : Assignment 2 : Introducing Mapping, Spatial Data & GIS

Purpose and Audience

The purpose of my map is to illustrate which UK shipping ports are not connected to the railway network, and how busy those ports are relative to each other. The reason for investigating this is to provoke thought and discussion around how the railway network could take on a larger share of freight transport, which is currently dominated by road haulage¹.

Why should there be more freight transported by rail? Rail is a greener form of transport than road. By shifting the balance from road to rail the carbon footprint of the UK freight transport system will be reduced. This is beneficial for Net Zero goals in the short term and climate change in general in the long term.

My map would be intended for a combination of government departments and related organisations. Potential candidates I've identified from a list of [Departments, agencies and public bodies](https://www.gov.uk) on <https://www.gov.uk> include:

- [Department for Transport](#)
- [Network Rail](#)
- [Office of Rail and Road](#)
- [Rail Safety and Standards Board](#)

Data Layers

Dataset	Date	CRS	Spatial Resolution	Source
Basemap	2022	EPSG:3857 WGS 84 Pseudo-Mercator	"at best 2 meters"	CartoDB Positron (https://basemaps.cartocdn.com/)
Railway Network	2022-05-03	EPSG:4326 WGS 84	"at best 2 meters"	OpenStreetMap (via https://overpass-turbo.eu)
Shipping Ports (locations)	2022-06-02	EPSG:4326 WGS 84	"at best 2 meters"	UK Ports (https://uk-ports.org/)
Shipping Ports (annual tonnage)	2022-06-02	N/A	N/A	UK Ports (https://uk-ports.org/)
Shipping Ports (rail connection)	2022-06-14	N/A	N/A	UK Ports (https://uk-ports.org/), OpenRailwayMap (https://openrailwaymap.org/)
Cities	2022-05-13 (version 5.1.2)	EPSG:4326 WGS 84	"at best 2 meters"	Natural Earth (https://www.naturalearthdata.com/)
Terrain Elevation	2013-03-28	EPSG:27700	"Vertical interval of 10m"	Ordnance Survey (https://www.ordnancesurvey.co.uk)

I will now focus on a few of these layers and consider what uncertainty may be lurking within, and some potential improvements that could be made to the data.

Basemap

A possible improvement that could be made to the basemap layer is to use one without labels on it. Given the scale of the map on the A4 page the spatial resolution is a little too fine – too many *too-small-to-read* labels for cities are visible.

Railway Network

The data for the Railway Network came from OpenStreetMap. An aspect of this data source is that it has many contributors. A consequence of this is inconsistency, or thematic uncertainty. Different stretches of railway have been digitised and categorised by different people with different interpretations of the world. As such, different rail segments have varying levels of detail, and the same type of rail segment may be categorised differently.

Specifically, I found inconsistency in the categorisation of rail segments within shipping ports. Sometimes it is "freight" and sometimes it is "industrial" instead. For example, Newport in Wales has "industrial" rail, whereas Leith in Scotland has "freight" – yet they both appear to be shipping ports that handle a variety of cargo via their rail network connection. Other times, rail segments are classified as neither, such as those for Felixstowe in England.

¹ Government Office for Science, Understanding the UK freight transport system, 2019 <<https://www.gov.uk/government/publications/future-of-mobility-the-uk-freight-transport-system>> (Accessed 3 May 2022)

Shipping Ports (locations)

Looking at the Shipping Ports location data, I encountered geographic uncertainty, some cases more apparent than others.

Some examples that were apparent earlier on (while writing a web scraper during the data collection phase) were formatting errors that led to the exclusion of that data in some instances:

- both coordinates suffixed with "N"
- only 1 coordinate; longitude missing
- "M" instead of "N"
- using the letter "o" for a degree symbol

Other examples were only apparent once I had plotted the points in QGIS and examined them:

- correct coordinates for a location out at sea
- correct coordinates for the wrong location on land
- a Scottish port having the exact same coordinates as a Welsh one

There were several ports where the location data was a descriptive sentence rather than a pair of coordinates. I didn't include these locations, but if I had I would have had to place the points myself, which leads to another more subtle bit of uncertainty I noticed: whether the point was placed on land or within the waters of the port. Depending on what you want to do with the location data, a point placed within the waters of a large port may affect the accuracy of some spatial analysis down the line. In other words, the way the data is represented will prescribe the way in which it can be analysed².

One way this data could be improved is by considering the data entry stage. The website could implement input validation on the port details form, which would lead to:

- coordinates always being provided (which are technically valid, at least, if not geographically valid)
- consistency in how coordinates are displayed on port details pages

Shipping Ports (annual tonnage)

There was an element of temporal uncertainty in the Shipping Ports annual tonnage data. Most entries simply stated a number, but some entries quoted a year from which the data was drawn. This drew my attention to the fact the year was unknown for most entries.

Shipping Ports (rail connection)

The Shipping Port data on whether or not it had a rail connection was an attribute I added. It was based on a mixture of:

- inspecting my Railway Network layer and Basemap layer
- reviewing UK Ports data on Transport Connections
- reviewing the OpenRailwayMap website

Ideally this would have been the product of a combination of spatial analysis tools, but once I applied a buffer around the shipping ports and did a little manual analysis, I realised I was going to end up with a series of false negatives and false positives.

Some of the false negatives would be rail-connected ports where the shipping port point was just far enough away from the rail lines that were nearby in my Railway Network layer. If I increased my buffer size to combat that, I would introduce false positives where a non-rail-connected shipping port's buffer would overlap with nearby passenger rail lines. If I tried to narrow my Railway Network layer to show only freight lines, I would bump up against the issue outlined earlier (Felixstowe freight rail lines not being classified as such).

Ultimately I decided manually analysing each port would produce a better dataset in this case.

² Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2015) *Geographic Information Science and Systems*, p.100.

Map Production

CRS selection

I expect the intended viewers of my map to be most familiar with seeing the UK mapped using its local coordinate reference system – OSGB 36 British National Grid EPSG:27700 – so I have selected this CRS for my map, as it includes a full map of the UK.

I believe the audience wouldn't be particularly interested in the coordinate grid and latitude-longitude coordinates (unless they particularly like maps, then they might enjoy the aesthetic it adds) so I have made this map element very faint so it doesn't draw attention to itself.

Feature selection

My Railway Network layer included a little chunk of France in it, due to the bounding box download method from Overpass-Turbo. However, there was no appropriate field to use to filter that out. The design for my map evolved to no longer including the Railway Network on the full UK map, which eliminated this concern.

Map design

I spent some time considering the overall look of my map and decided I wanted to keep the colours I used to a minimum. I initially had graduated point symbology for the shipping ports, going from light red to dark red to represent annual tonnage figures. I also had the terrain elevation contour lines graduated using light red to dark red. Once I started designing the legend for the map layout, it became apparent there could be some confusion as to what the number ranges next to the gradients of red on the legend were referring to on the map. After stubbornly deciding to not introduce another colour, I found graduated point symbology based on size to be effective, and went with solid black points of varying size for the shipping ports.

One further adjustment after this was changing the two overview bounding box borders to red instead of black, which helped them to stand out better when viewing the map from a distance.