

# Method and tools to create Reference Map

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**Abstract:**

This abstract aims to summarize the procedure implemented by ITHACA S.R.L. for creating Reference Maps (Figure 1). The team, thanks to its strong competences in the field of management and processing of geographic and cartographic data and its GIS, Mapping and Data Analysis skills, is able to produce maps in different size and orientation and to satisfy the specific customers' requests.



Figure 1. Activities for creating Reference Cartographic Map

The process consists of automation phases combined with manual work by means of the operator. The starting point was an in-depth investigation of different free available and official datasets (e.g. Natural Earth, Geonames, vMap0) containing the main reference topographic geospatial data (e.g. boundaries, physiography, settlements, transportation, hydrography) used to create Reference Maps [1]. A preliminary analysis on the level of detail and accuracy of the data, as well as the completeness, the timeliness, the temporal coverage, the data policy was performed. Moreover, it is important to have a bulk of geospatial information that can be used in different scales and formats of maps. For this reason, a proper Geodatabase with a particular scheme, that maintains the same structure for any types of product, was realized to store and to uniform the data belonging from different sources (Figure 2). The checked and modified data can also be reused easily in future requests [2].

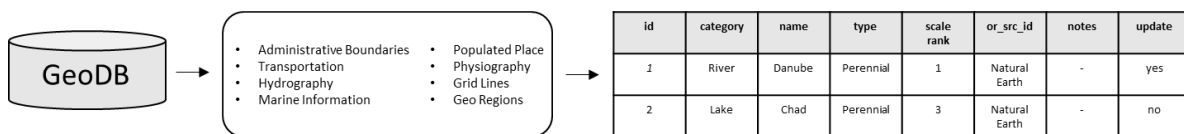


Figure 2. The Geodatabase structure

If the map scale requires it, Open Street Map (OSM) reference data can be used. There are different ways to manage and get data from there but all of them only allow the download of small size dataset. To overcome this annoying limitation, a QGIS tool was developed internally. This automatic tool allows the download of data from OSM from an Area of Interest (AOI) with big size and it exploits the “Quick OSM” tool of QGIS that allows the download of OSM data with the Overpass API. Since the limit in size of the downloadable data, the tool subdivides the AOI in smaller sub-areas from which Quick OSM performs the download of the only selected data, decided by means of a list of key and value that are easily chosen by the operator using the tool interface. After each sub-area is downloaded, the different datasets are merged in a unique shapefile for

each feature class. Then, the tool allows to keep the final data as shapefile for a first manual refinement or to upload it automatically in the Geodatabase.

ITHACA S.R.L. has also developed a set of map template prototypes in ArcGIS Pro environment, that ensure an homogeneous look-and-feel and a company branding while allowing to manage product specific requirements [3].

Regarding the Map Production (Figure 3), firstly, the team analyses in more detail the request of the customer, in order to achieve a complete understanding of the context and to identify the geospatial data necessary to correctly manage the related production activities. Subsequently, the appropriate map template prototype, in terms of format and orientation, is chosen. In the map template, there are three sections that correspond to three steps:

- The first mainframe permits to focus on the Area Of Interest, to manage the extent, to set and fix the required scale and to select the appropriate map projection.
- The second mainframe permits to see all the features contained in the GDB and to clip the data using a clip tool created ad-hoc.
- The third mainframe includes the Table of Contents (TOC) with all the layers that can be visualized in the map.

After that, the data are uploaded in a shared GDB and linked to the TOC of the template. Obviously, data from different sources to produce a map at a definite scale have to be checked by the operator. The first check concerns the geometry of the original data, that must adapt to the production scale of the map and, as consequence, an editing operation is required to generalize or to integrate the data. Another check concerns the data truthfulness and updating; for example, it happens to update the administrative boundaries (Regions or Municipalities) or to re-classify the types of roads (Highways, Primary Roads and so on).

The particular scheme of the Dataset and the use of a shared GDB speed up the editing phase, also ensuring consistency and uniqueness of the topological content and standardizing the cartographic representation of different areas of the world. In order to produce a Reference Map of high level, the operator must verify carefully each element of the template which may require minor changes in order to better fit the type of product or rearrangements to improve visualization and readability. Finally, dedicated quality check tasks, led by a team of quality experts, are foreseen. The use of quality assurance protocols, automatic checklist procedures supported by official cartographic material and combined with technical guidelines will ensure the products' best quality.



Figure 3. Workflow for the Production of Reference Maps

## References

- [1] Types of Maps, <https://geology.com/>  
 [2] Types of geodatabases, <https://desktop.arcgis.com/>  
 [3] Layouts in ArcGIS Pro, <https://pro.arcgis.com/>