

DELIVERABLE

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Generalisation

References

Ref.	Title/Version/Publication Date/Author
[1]	ELF Glossary http://www.elfproject.eu/documentation/glossary
[2]	D2.4 ELF Basemap specification http://www.elfproject.eu/documentation/specification/elf-basemap
[3]	D2.3 Data Maintenance and Processing specification http://www.elfproject.eu/documentation/specification/data-maintenance-and-processing
[4]	D2.9 Data Specification Regional/Global
[5]	D2.10 Data Specification Master

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I Introduction

I.1 Scope

The primary purpose of this document is to specify the requirements of the generalisation process within the context of the ELF project. This document does not specify the detailed implementation as a geotool.

The ELF Generalisation task will provide tools for the national data producers to generalise their topographic ELF data from Master LoD1 to Master LoD2 and from ELF Regional to ELF Global. Additionally these tools will be used by the Coordination Body or the Production Management Team of EuroGeographics for their task of generalising ELF Regional to ELF Global.

The five LoD defined in ELF are: Master LoD0 (scale range larger than 1:5.000), Master LoD1 (scale range 1:5.000 to 1: 25.000), Master LoD2 (scale range 1:25.000 to 1: 100.000), Regional LoD (scale range 1:100.000 to 1:500.000) and Global LoD (scale range smaller than 1:500.000)

The generalisation for BaseMap is considered in deliverable D2.4 [2] and is out of scope of this document.

The generalisation process installed in ELF focuses on automatic procedures and does not include manual work.

The Generalisation Specification gives the principles and methods of the needed generalisation procedures. It defines rules (in natural language) and mapping tables between the different Data specifications defined in ELF (Master LoD1/Master LoD2, Regional/Global). The generalisation from Master LoD1 or 2 to Regional is out of scope for the generalisation tools. Tools are developed for the generalisation from Master LoD1 to Master LoD2, and from Regional to Global.

The tools are available for all themes included in the data specifications of the output LoD (Master LoD2 and Global LoD) of the generalisation process. The tools are for the use by national data providers and the Product Management Team of EuroGeographics.

This document will evolve as the tools are developed.

I.2 Terminology

The ELF Glossary **Feil! Fant ikke referansekilden.** defines basic terms relevant for the ELF project. Beside this generic glossary, the following terms are used in this document:

Acronym	Term	Definition
LoD	Level of Detail	
ERM	EuroRegionalMap	EuroGeographics topographic data set at 1:250.000 scale
EGM	EuroGlobalMap	EuroGeographics topographic data set at 1:1.000.000 scale
PMT	Production Management Team	Group managing and coordinating the production of the different EuroGeographics products

2 Generalisation in the ELF framework

2.1 ELF organisational framework

Generalisation is one component of the organisational framework needed for the maintenance of the European Location Framework. The general data supply chain, from national data to the ELF platform, is described in the deliverable D2.3 Data Maintenance and Processing specification **Feil! Fant ikke referansekilden..**

The generalisation process is applied to ELF data following the ELF data specifications, see D2.9 Data Specification Regional/Global **Feil! Fant ikke referansekilden.** and D2.10 Data Specification Master **Feil! Fant ikke referansekilden..**

2.2 Generalisation at different Levels of Detail

2.2.1 Vision

One idea in ELF is to make the production of pan-European data sets easier for the data producers (NMCAs). The biggest advantage could be achieved if the NMCAs only provide their data at the highest LoD and all lower LoD would be derived automatically by generalisation.

This approach also ensures that the data is consistent between LoD, data is edge-matched and data quality has been checked.

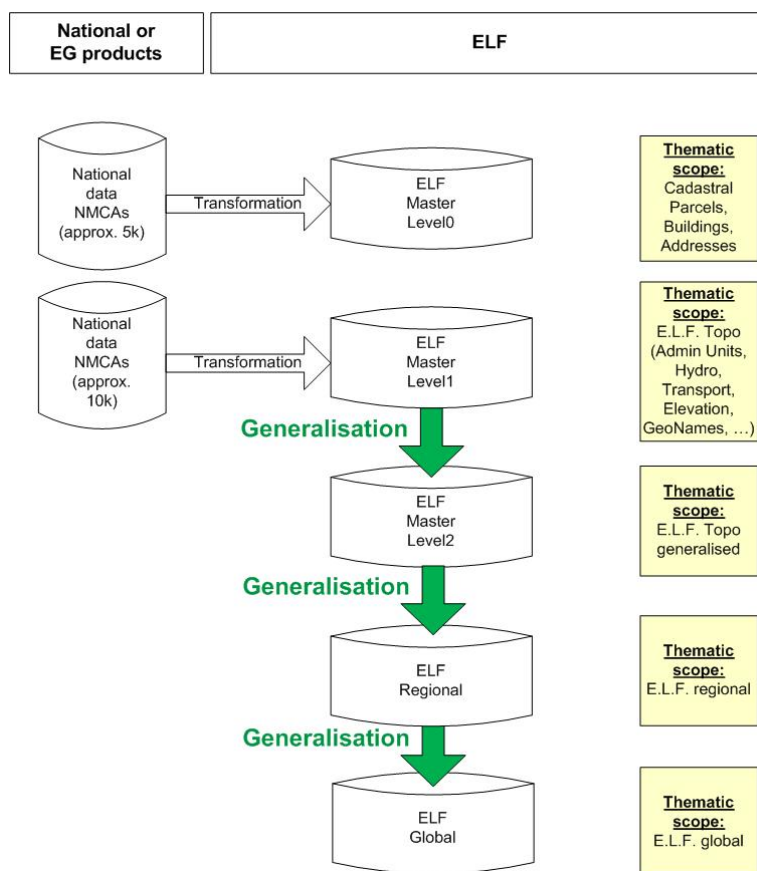


Figure 1 Generalisation vision

This generalisation process is only achievable if some preconditions are met:

- All information needed at lower LoD have to be included in the data at higher LoD

- Good generalisation procedures have to be available

2.2.2 In the scope of ELF project

In the timeframe of ELF project this vision of generalising from Master to Global LoD was not achievable.

Several reasons make a more pragmatic approach necessary:

- Especially the precondition “All information needed at lower LoD have to be included in the data at higher LoD” could not be met. For ELF this would mean that all information included in ELF Regional would have to be present in the Master LoD1 data. But in reality NMCAs can provide some information only for lower LoD. Some information is collected especially for ERM at Regional LoD but is not included in national Master data sets. Additionally ERM contains some attributes and features that are only introduced and maintained at European level and are therefore included in ELF Regional.

For the future production of ERM it is necessary that ERM can be derived from the ELF Regional LoD.

- Some countries have own national generalisation process in place and may want to include their own generalised data at Master LoD2.
- The participating NMCAs do not have much experience in generalisation from 10k/50k to 250k and no ready to use tools were available.
- A generalisation process is being put into place already for the generalisation from ERM to EGM. This work should be utilised for ELF.

For these reasons the ELF project concentrates on the generalisation process from Master LoD1 to Master LoD2 and from Regional to Global.

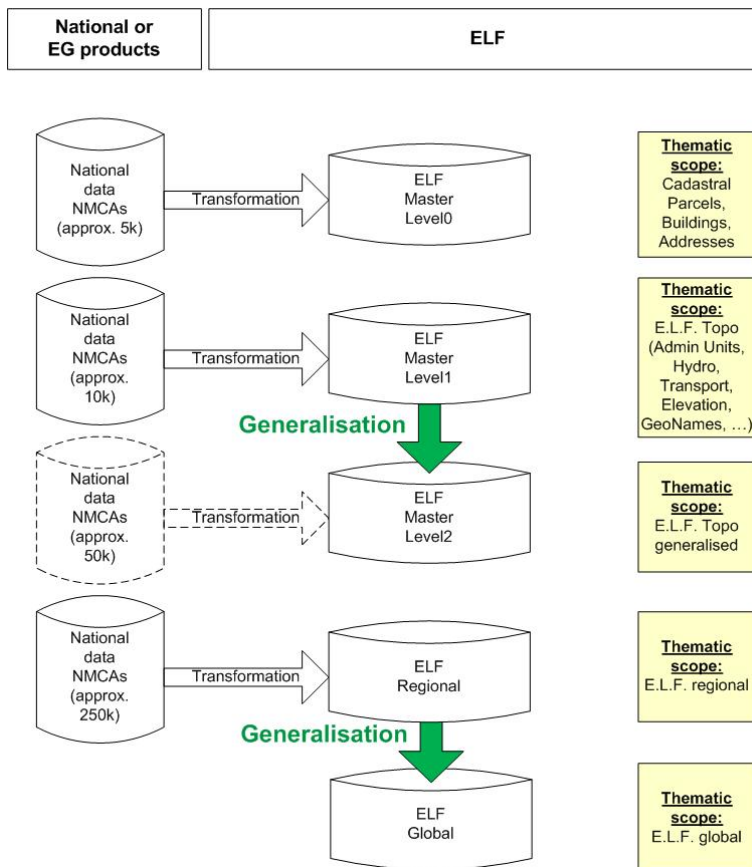


Figure 2 Generalisation pragmatic approach

3 Generalisation process

3.1 Model generalisation and cartographic generalisation

The generalisation process can be divided in two steps: Model generalisation and cartographic generalisation.

In Annex A the selection criteria for Master LoD2, Regional LoD and Global LoD are described as stated in the corresponding data specifications.

3.2 Generalisation process at different LoD

3.2.1 Generalisation Master LoD1 to Master LoD2

In the first step features and properties needed for Master LoD2 are selected automatically from the Master LoD1 data set. The data model states which feature types and properties are included in Master LoD2. Additionally the data capture rules (minimum area, minimum length ...) are stated in the data specifications and in Annex A of this document. They are based on a survey of the data capture rules used by NMCAs. From this survey average values were selected for the generalisation in ELF. Adjoining features with similar property values are combined to bigger features and area features that are too narrow can be collapsed to a line or a point. Features that are smaller than the stated minimum area or length (after combining with neighbouring features) are dropped. The geometries are simplified and smoothing is applied if necessary. Topology is preserved. The created digital landscape model (DLM) is suitable for analysis and should be the base for future generalisation

from Master LoD2 to Regional LoD. It will be stored internally by the NMCAs and will not be provided to the ELF platform.

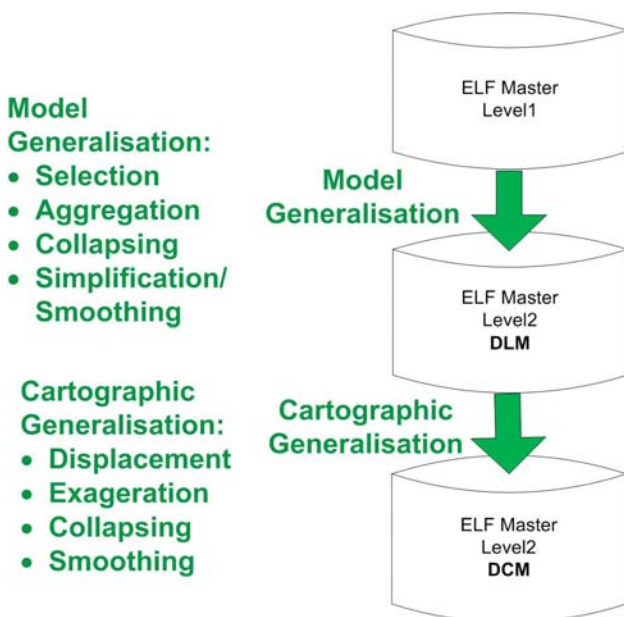


Figure 3 Generalisation steps Master LoD1 to LoD2

In the second step the DLM is generalised cartographically for better quality for visualisation and mapping purposes. In this automatic step displacement and exaggeration of features is used to make the data more suitable for visualisation. Displacement is used to separate features that would otherwise overlap and exaggeration enlarges features that would otherwise be too small to be visible. Smoothing is used to make the geometries look better. This digital cartographic model (DCM) contains all properties of the DLM and can be used for different visualisation use cases. The focus is more on having a data set enabling the easy derivation of a 50k map that shows all necessary information without having to zoom in. Because of displacement and exaggeration, this DCM is not suitable as base for further generalisation.

The detailed requirements for the generalisation process from Master LoD1 to Master LoD2 are described in Annex B.

3.2.2 Generalisation Master LoD to Regional LoD

Generalisation from Master LoD to Regional LoD is out of scope for ELF project. But as this generalisation step is part of the ELF vision for the future a Best Practice Report will be created showing the way forward. The Best Practice Report will be the starting point for providing first generalisation rules for ELF Master LoD to Regional and for a draft generalisation concept.

3.2.3 Generalisation Regional LoD to Global LoD

For Regional LoD to Global LoD, there is no cartographic generalisation: only model generalisation is applied.

The first step of the model generalisation consists in selecting the Regional data which should be kept at Global LoD. This selection is based on the data model and data capture rules of the ELF Global specifications. It is also needed to:

- ensure a harmonised density level in the whole dataset. Some areas or countries, depending on the themes, can need to be densified. Or, on the contrary, some objects may need to be unselected where the selection result is too dense for Global LoD. This means that the selection process needs to be adapted to the national situation.
- preserve the edge-matching across international boundaries: for instance, if a cross-border road is selected in one country, the selection needs to be continued in the neighbouring one. The data is also adapted to the Global international boundaries' geometry.

In the next step, the selected data needs to be simplified to fit the geometrical criteria of the Global LoD. This includes simplifying objects' geometries by removing vertices.

The following picture summarizes the Regional LoD to Global LoD generalisation steps:

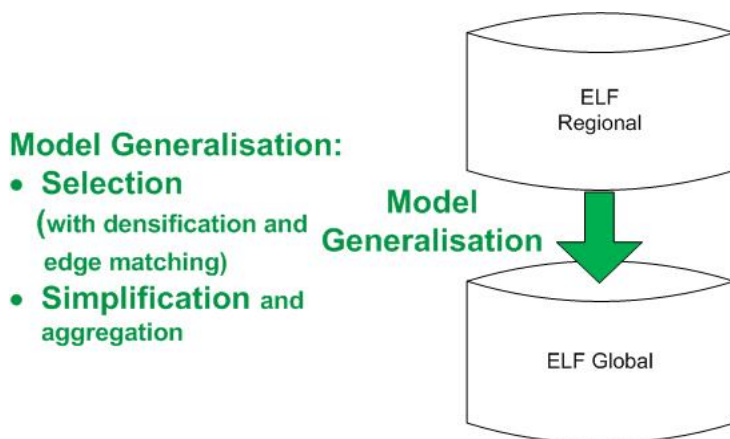


Figure 4 Generalisation steps Regional to Global LoD

3.3 Decentralised vs. centralised Generalisation

3.3.1 Generalisation Master LoD1 to Master LoD2

The generalisation process from Master LoD1 to Master LoD2 will be run by the NMCAs for their national data.

3.3.2 Generalisation Regional LoD to Global LoD

The generalisation process from Regional LoD to Global LoD can either be run by the NMCAs on their national data or by the Coordination Body or the Production Management Team (PMT) on national data sets or the aggregated European data set.

Installing a decentralised generalisation process would mean:

- NMCAs generalise their ELF Regional data to ELF Global
- National specifics can be respected more easily
- No extra work for the Coordination Body for generalising
- Pan-European ELF Global data set has to be aggregated by the Coordination Body

Installing a centralised generalisation process would mean:

- Coordination Body / PMT generalises the national ELF Regional data sets or generalises the pan-European ELF Regional if available
- Better harmonised result from the generalisation process (not so many national specifics can be respected)
- No extra work for NMCAs for generalising
- If the pan-European ELF Regional data set was used for generalisation the ELF Global data set will also be pan-European without extra work.

In order to keep the workload for the Coordination Body / PMT manageable it is recommended to install a decentralised generalisation process where all generalisation steps are run by the NMCAs. The generalisation process should be applied to edge matched data to avoid double work.

3.4 Identifier and life cycle information

For generalisation only valid features are used, i.e. features that have a void value for EndLifespanVersion or whose value for EndLifespanVersion is in the future. Historic features are excluded.

After generalisation the change detection tool has to be run to transfer inspireId and life cycle information for unchanged features and create new inspireId and life cycle information for changed or new features. BeginLifespanVersion is set to the date of the generalisation for changed or new features.

4 Generalisation tools

4.1 Input for tools

4.1.1 Master LoD1 to Master LoD2

The generalisation tools will use the national ELF data at Master LoD1 as input to the generalisation process.

The tools will be used by the NMCAs and work on individual countries.

4.1.2 Regional LoD to Global LoD

The generalisation tools will use the national ELF data at Regional LoD or the pan-European ELF Regional data set as input to the generalisation process.

The tools will work on individual countries. Additionally a list of countries can be processed.

4.2 Output of tools

The generalisation tools will create a new ELF dataset.

Additionally the tools will output a statistic table. The table should state:

- Processed country (Two-character country code according to ISO3166-2char)
- Processing date
- Processing time
- Number of input features per theme and feature type
- Number of output features per theme and feature type
- List of errors that occurred during processing

4.2.1 Master LoD1 to Master LoD2

The generalisation tools will create a dataset at Master LoD2 applying the ELF data model for Master LoD2 and conformant to the ELF data specification for Master LoD2.

4.2.2 Regional LoD to Global LoD

The generalisation tools will create a dataset at Global LoD applying the ELF data model for Global LoD and conformant to the ELF data specification for Global LoD.

4.3 NMCA Profile

The tools provide the possibility for the NMCAs to modify parameter values. The tools are delivered with default parameter values that can be adapted easily by the NMCAs to their national specificities. The acceptable parameter value range is stated in the data specifications.

The default values present an average value for Europe and were defined based on a survey among NMCAs. These average values may not be appropriate for all themes or features in all NMCAs. In order to allow for national specifics the default parameter values can be modified inside a given value range.

The default parameter values should be modified as little as possible in order to maintain the homogeneity of the output data and the function of the generalisation tools. This option should only be used if features of high importance nationally would otherwise be deleted in the generalisation process (small lakes are more important in southern Europe than in Scandinavia) or features of low national importance would otherwise be included (minor roads in densely populated areas should be dropped).

Annex A

Table Model generalisation (generalisation table): D2.3.5_Generalisation_AnnexA.xls