Automated generalisation of 1:10k topographic data from municipal data

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- ‘Key- Registers’of topography in the Netherlands
- Case: automatic generalisation
  - Reclassification and selection
  - Geometric generalisation
  - Spatial relationship
  - Quality assessment
- Concluding remarks and summary

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Key-Registers of topography in the Netherlands

Current situation:

- **Key-register large scale topography at scale 1:1k(BGT)**
  - **Provided by municipalities**
  - **Object oriented at scale 1:500/1:1k**
  - **Covering the whole of the Netherlands from 2015**

- **Key-register topography(BRT)**
  - **Provided by Kadaster (National Mapping Agency)**
  - **Separate object oriented vector datasets at scale 1:10k, 1:100k 1:250k, 1:500k and 1:1000k**
  - **Covering the whole of the Netherlands**

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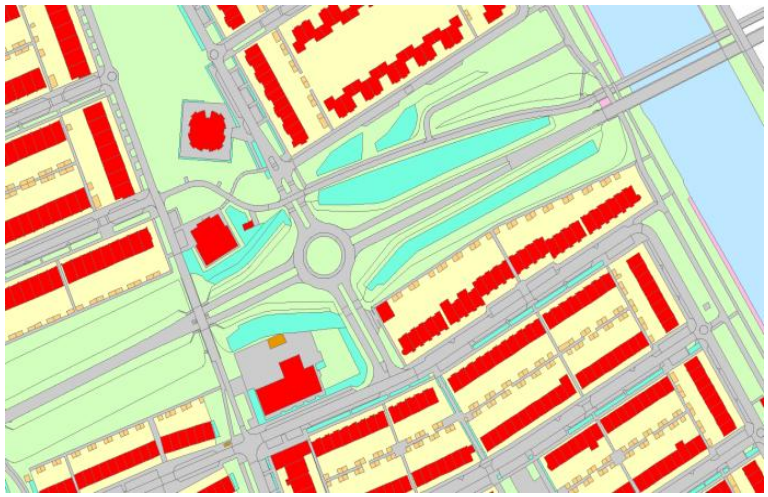
Key-Registers of topography in the Netherlands

- **BGT:**
  - Large scale data for maintaining public areas
  - Municipalities are main users and producers
- **TOP10NL:**
  - Medium scale topographic data for visualization and GIS analyses
  - Produced by Kadaster



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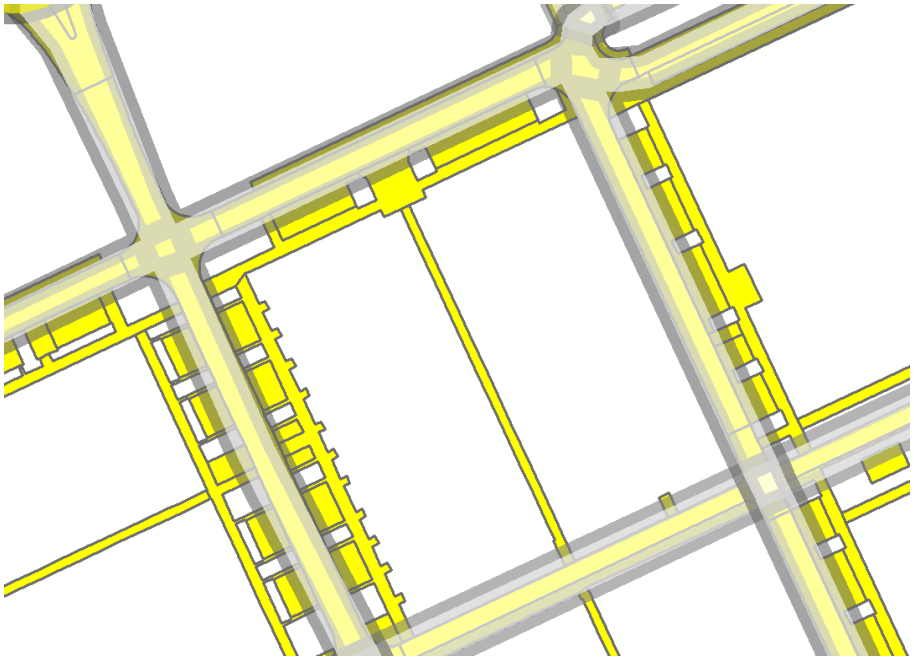
Key-Registers of topography in the Netherlands

- ***Example: Comparison of roads***



TOP10NL roads shown transparently on top of BGT roads

Differences in the definition of road width

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Key-registers of topography in the Netherlands

Motivation:

- ***'... Collect data once and use it many times'***

- **Can BRT 1:10k dataset (not per se TOP10NL) be automatically derived from BGT data?**

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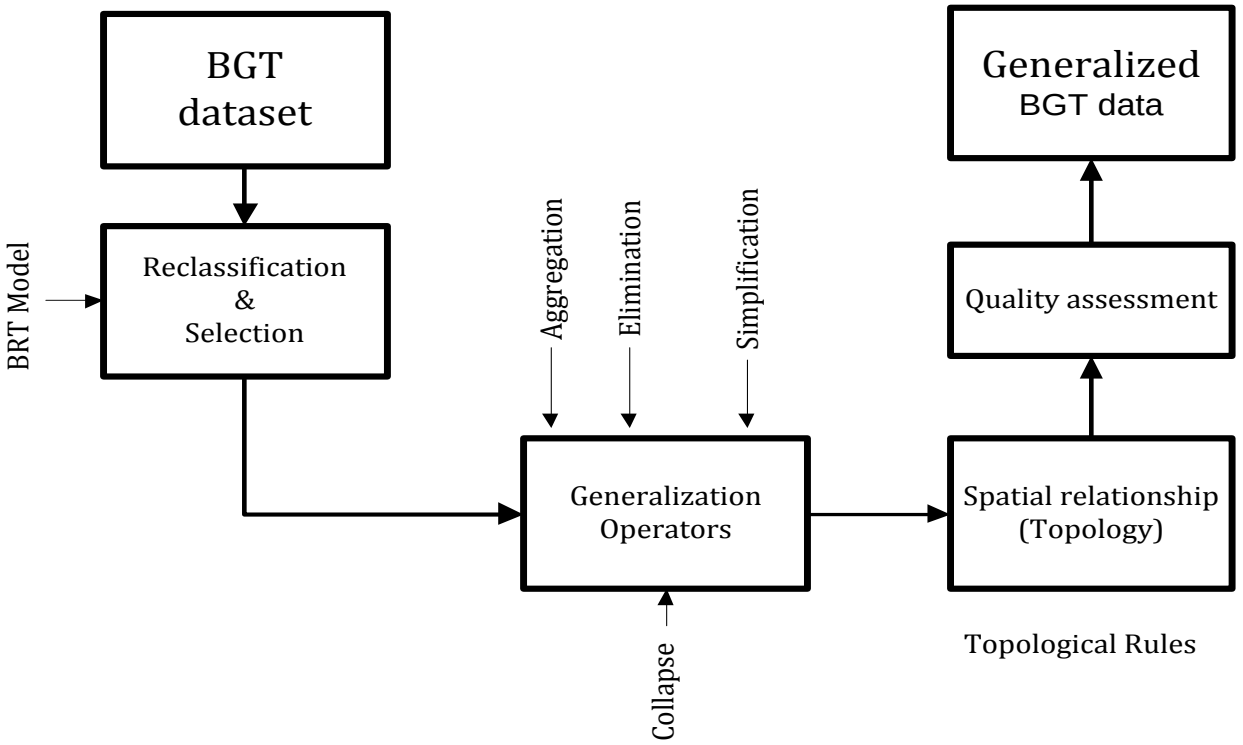
Automatic Generalisation Procedure



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Automatic Generalisation Procedure

- **Reclassification and Selection**

Class	BGT	TOP10NL
(PartOfRoad (*Wegdeel*)	Yes	Yes
Terrain (*Terrein)*	Yes	Yes
(part of)Water (*Waterdeel*)	Yes	Yes
(PartOf)Railway (*Spoorbaandeel*)	Yes	Yes
Layout Element (*Inrichtingselement)*	Yes	Yes
Registration Area (*Registratief Gebied*)	Yes	Yes
Building (*Pand*)	Yes	No
Living Unit (*Verblijfsobject*)	Yes	No
Engineering Structure (*Kunstwerk)*	Yes	No
Building Complex (*Gebouw)*	No	Yes
Geographical Area (*Geografisch gebied*)	No	Yes
Functional Area (*Functioneel gebied)*	No	Yes
Relief (*Reliëf)*	No	Yes

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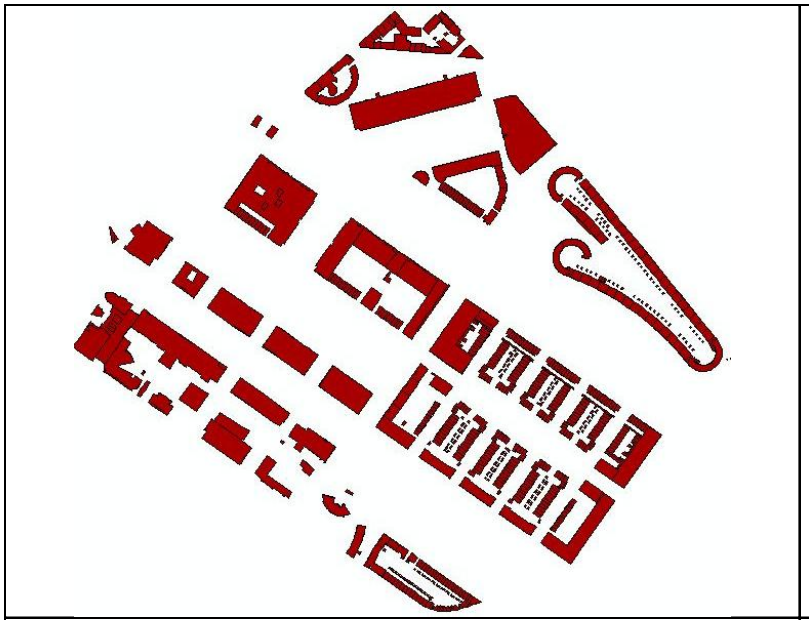
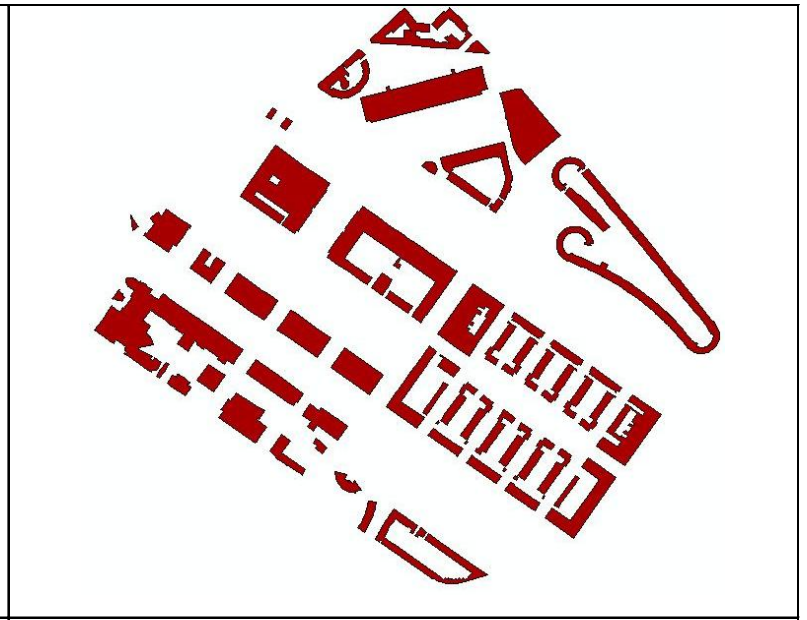
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

  Example: Buildings

	
Before generalization	After generalisation

Conditions: If the distance between two buildings are closer than 3m then **amalgamate** . Keep the orthogonal shape and If the buildings are smaller than 25m2 then **Remove**.

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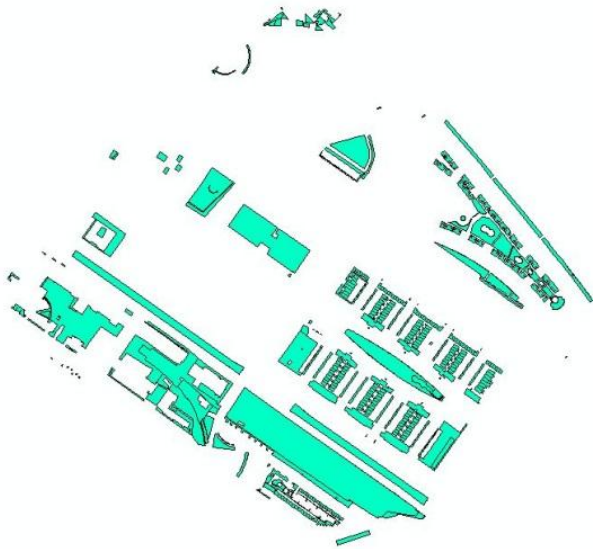
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

Example: Terrain

	
Before generalization	After generalisation

Conditions: Terrain is **aggregated** (if they have the same attributes after reclassification) and **simplified**. Polygons smaller than 100m^2 are **removed**, as well as holes <100m^2. Boundaries are simplified.

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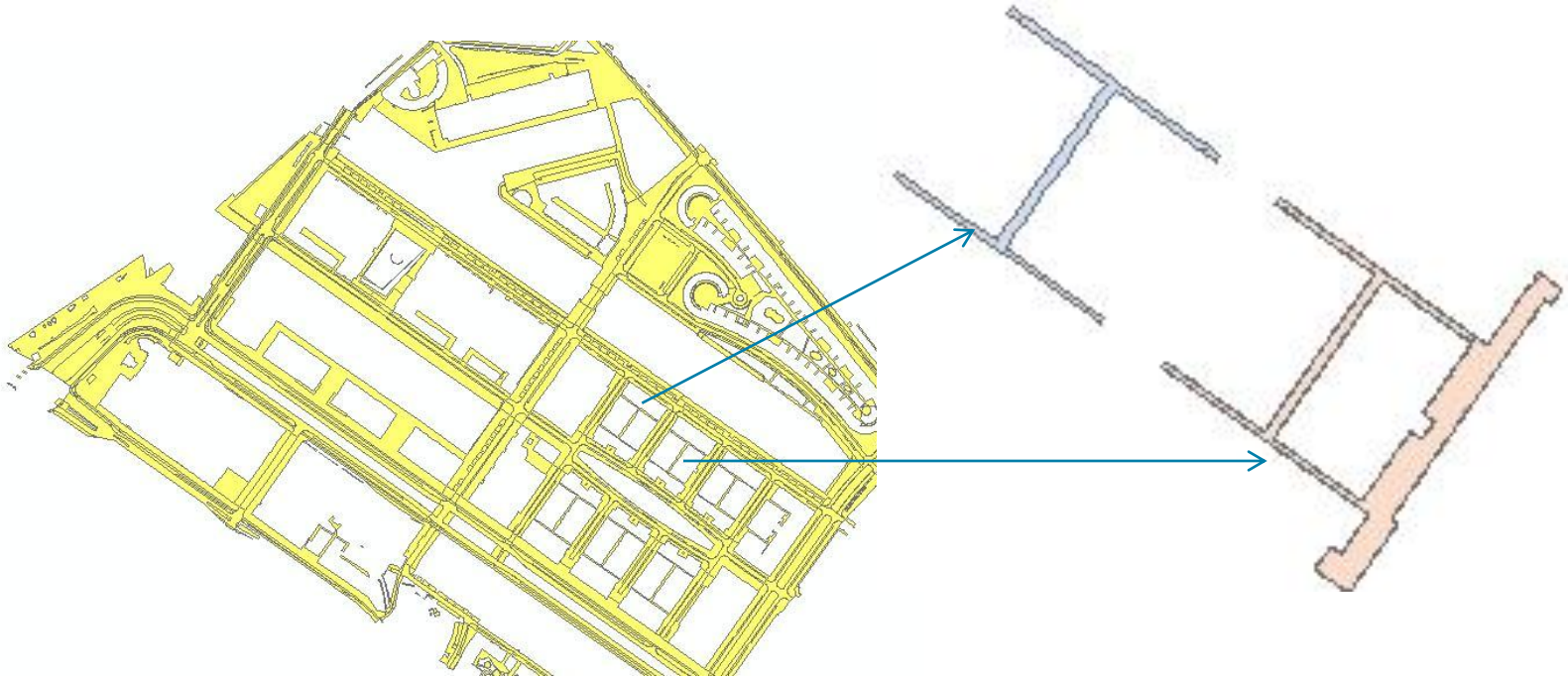
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

  Example: Roads



Eliminate road parts narrower than 2meters?

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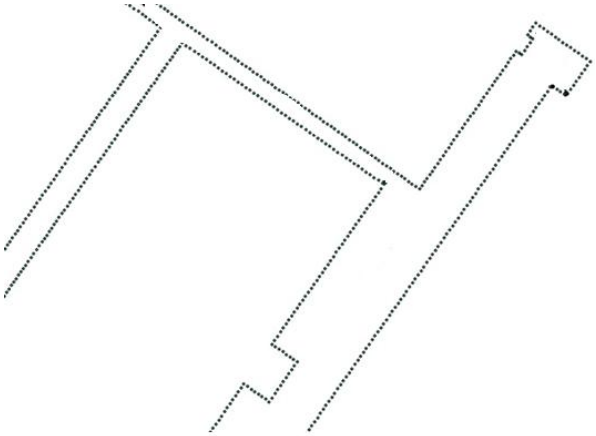
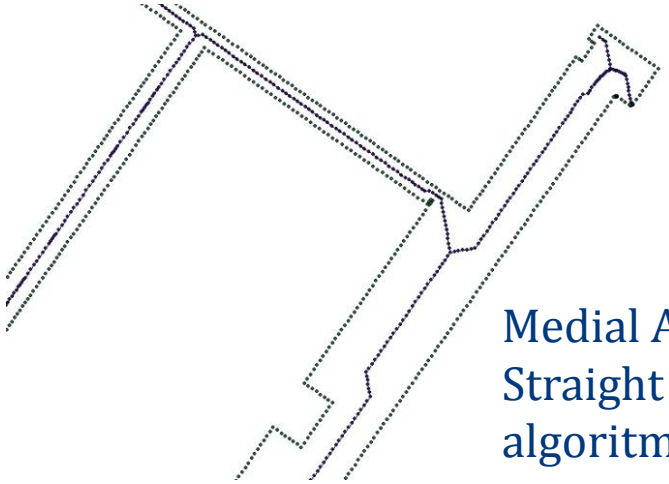
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

  Example: Roads





Medial Axis or Straight Skeleton algoritm

Generalisation of roads based on calculated road widths

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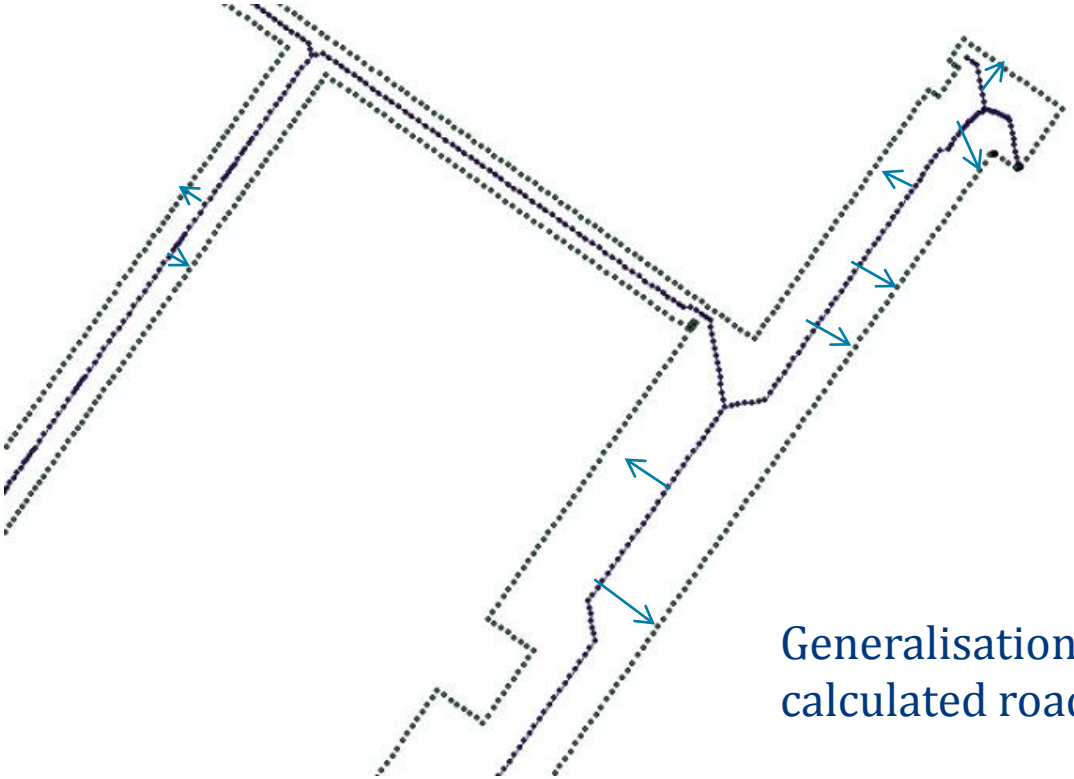
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

  Example: Roads



Generalisation of roads based on calculated road widths

Medial Axis or Straight Skeleton algoritm

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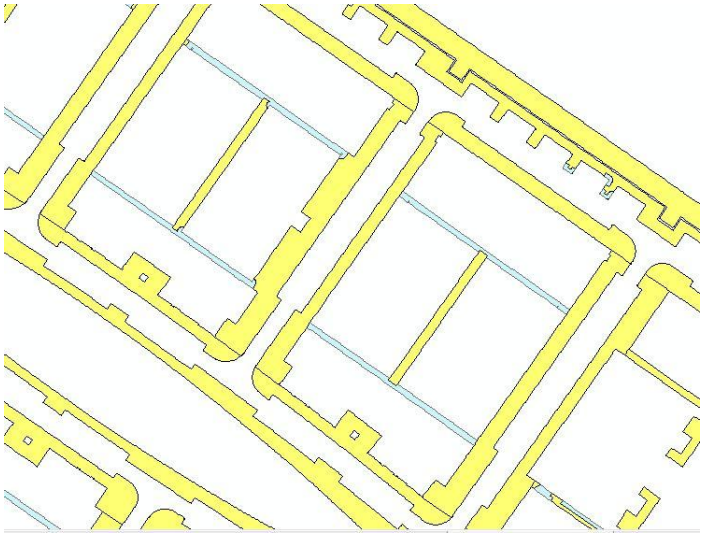
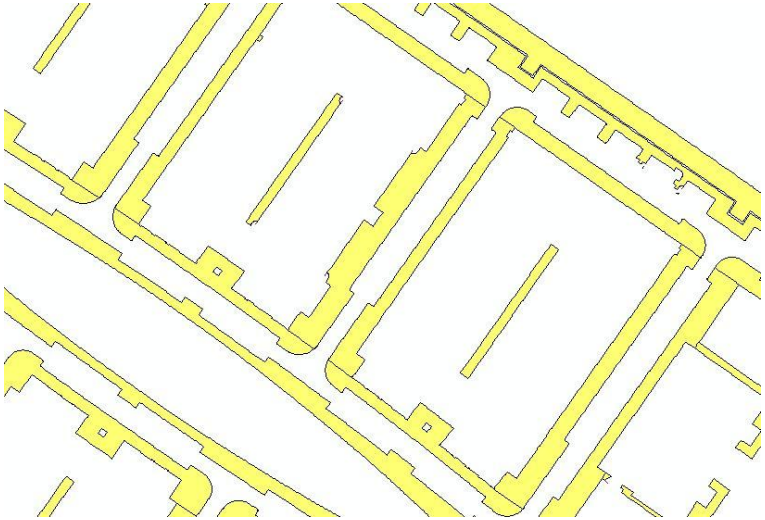
Automatic Generalisation Procedure

- **Geometric generalisation for specific classes**

  Example: Roads



Original road feature, blue colored areas represent the areas under threshold.



Results of applying masking and erasing to the original road feature.

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Automatic Generalisation Procedure

- **Spatial Relationship (Rules)**

Terrain

'Must not overlap with': Building, Water and Road features

Building

'Must not overlap with': Terrain, Water and Road features

Water

'Must not overlap with': Terrain, Building and Road features

***Road** (side walk, highway, cycle path, parking lots)*

'Must not overlap with': each sub-road parts

** for each feature 'must not have gaps' also applied*

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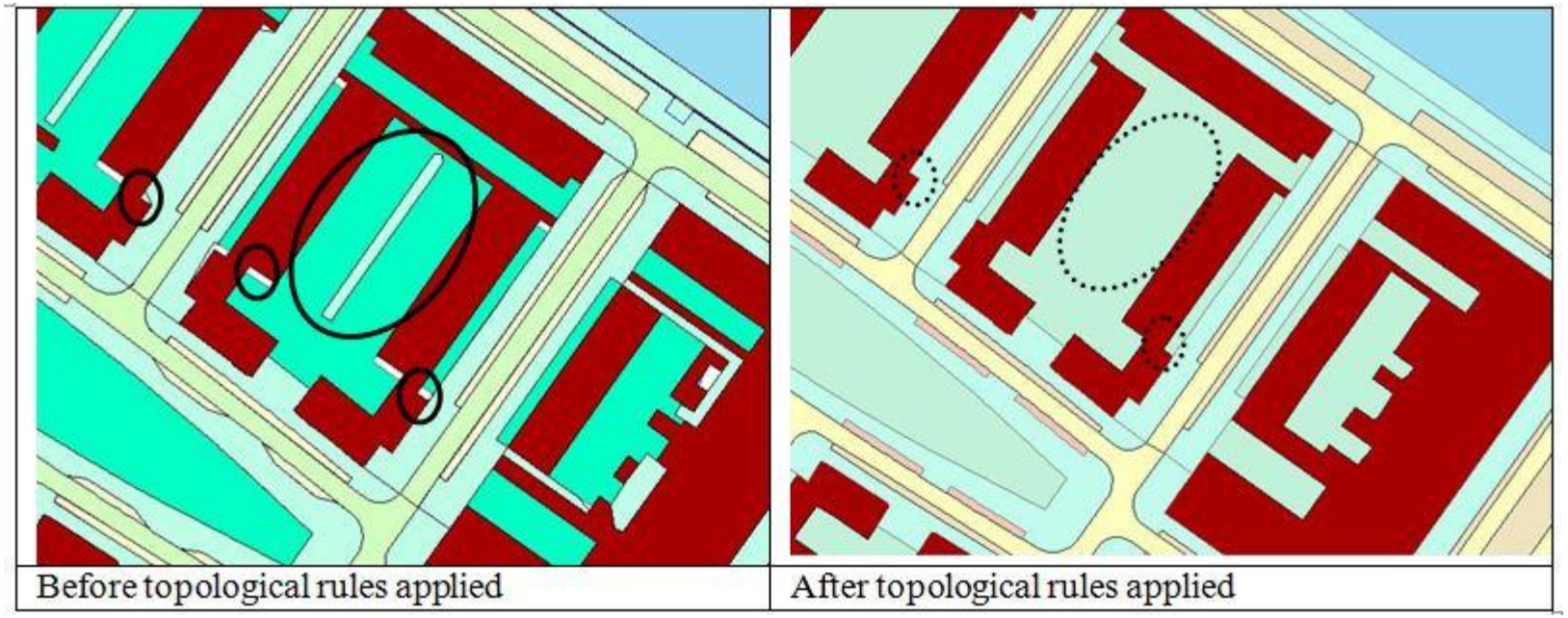
Automatic Generalisation Procedure

- **Spatial Relationship (Results)**



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Automatic Generalisation Procedure

- **Quality assessment**

Difference between the intersected areas:

$$R_{intrusion} = \frac{Area\,(O \cap G)}{Area\,(O)}$$

Difference between the intersected areas:

$$R_{Extrusion} = \frac{Area\,(O \cap G)}{Area\,(G)}$$

Ratio between areas:

$$R_{Area} = \frac{Area\,(G)}{Area\,(O)}$$

Positional deviation from plygon centroids:

$$\overline{X} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

$$\overline{Y} = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i}$$

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Automatic Generalisation Procedure

- **Results : quality assessment**

Characteristic	Intersection rate		Ratio	Average Euclidean distance(m)
Object Class	$R_{Intrusion}$	R_{Ext}	R_{Area}	Centroids deviation
Building	0,98	0,97	1,01	0,42
Terrain	0,98	0,90	1.1	0,90
Sidewalk	0,46	0,49	0,94	0,62
Parking lot	0,91	0,48	6,47	0,77

the average of positional deviation: 0.67m

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Automatic Generalisation Procedure

- **Results :** ***Before generalisation*** ***After generalisation***

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Concluding remarks and summary

- It is possible to automatically derive a data set at 1:10k from BGT data;
- Further research is required to define the optimal situation once BGT becomes practice:
  - Principle: Integration in one key register
  - One database with objects; smaller scales for visualisation; for some objects (road network, others?) also objects at smaller scales, not necessarily as part of topographic database
  - Current TOP10NL users may (or should) move to BGT once BGT data is available (because of the history TOP10NL data has been available from 2006; while BGT data is still not)

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Thank you for your attention!

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