Challenging Cartography in ArcGIS
with the Carto-Tools from Esri Switzerland

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Zurich, February 2014

esri Suisse

Esri's European Competence Centre for Cartography

+ Background

> The kick-off was a project to restructure the production of the National map series 1:25 000 by the Federal Office of Topography swisstopo.

> Through various customer projects a multitude of tools and concepts to help optimize production, quality check data and produce high quality printed maps have been created.

+ Cartographic Solutions

> ArcGIS for consistent processing within a single system

> Carto-Tools, QA-Framework

> Installation, Configuration and Implementation

> Consulting, Development, Training and Support

Use Cases

Use Cases

High-quality printed maps

Largely automated processing
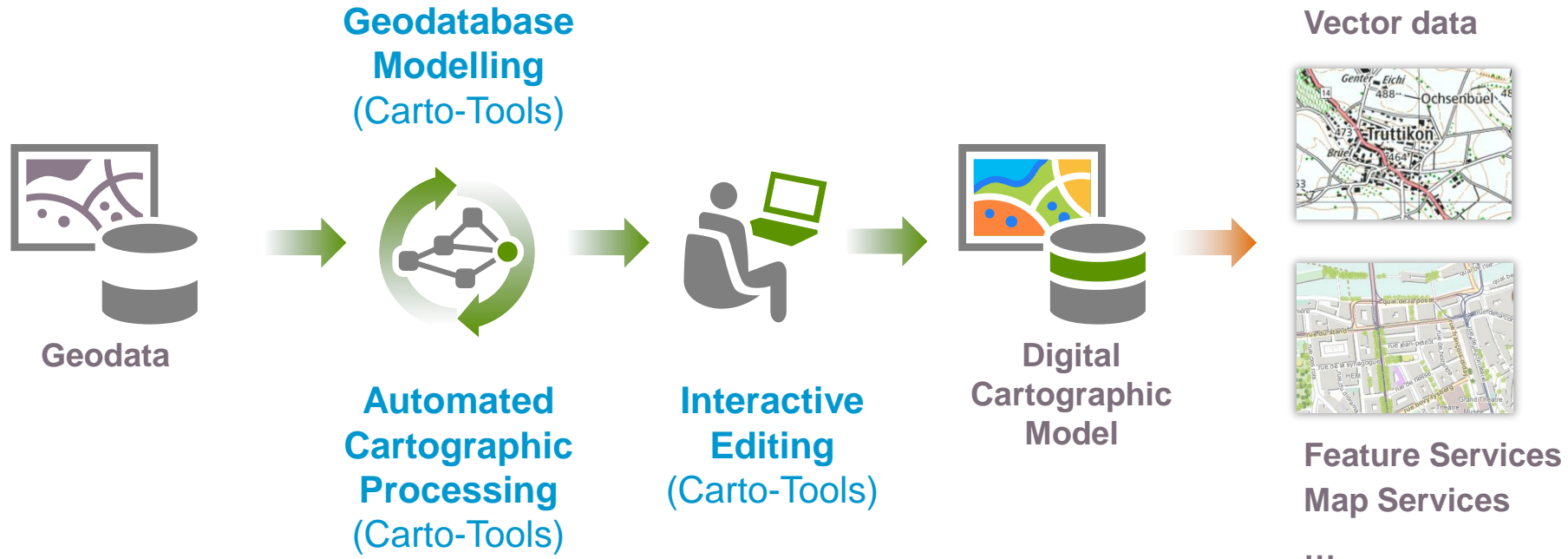
Efficient interactive editing

Base maps for the web

Fully automatic processing

Up-to-date, high quality

# Cartographic processing workflow

Quality Control
(QA-Framework)

**Geodatabase
Modelling**
(Carto-Tools)

Geodata

**Automated
Cartographic
Processing**
(Carto-Tools)

**Interactive
Editing**
(Carto-Tools)

**Digital
Cartographic
Model**

**Printed Maps
Raster files
Vector data**

**Feature Services
Map Services
…**

Quality control with the QA-Framework

+ Before, during and after the cartographic editing

> Clean geodata for the correct starting point

> Precise location of cartographic conflicts

Carto-Tools

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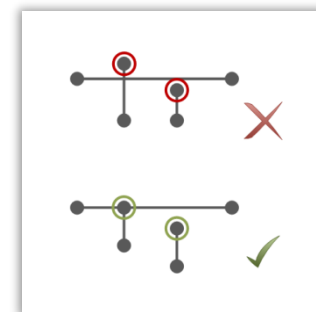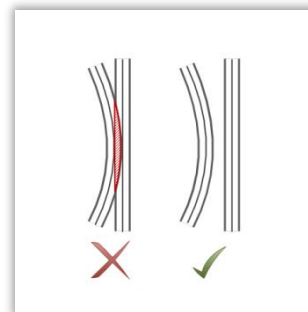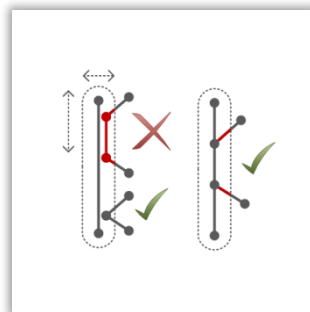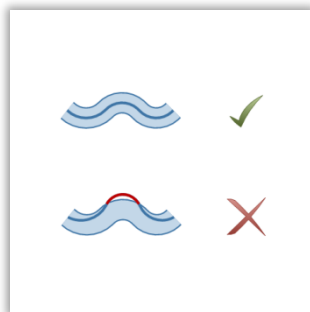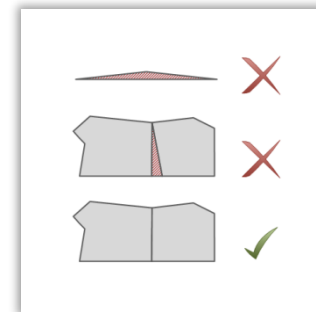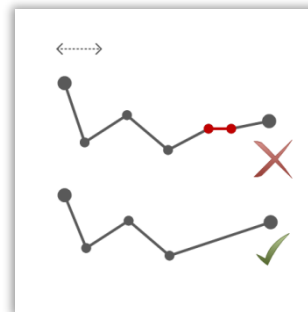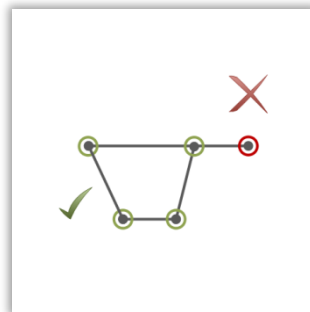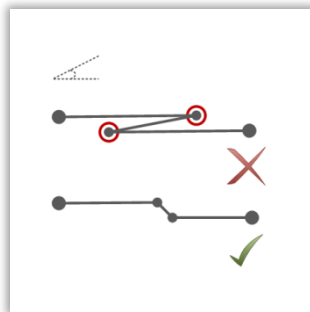
What are the Carto-Tools?

+ Rule-based tools for adding cartography to your geodata

+ Advantages

> Automation of certain editing procedures

> Tools for cartographic modelling (Schema extension)

> Rule-based, configurable cartographic processes

> Respective of previous processing and manual editing

> Efficient interactive processing with the "One-Click" edit tools

> Configuration data saved in simple XML format

+ Extension to ArcGIS

> For ArcGIS for Desktop 10.0, 10.1 or 10.2/10.2.1

> Standard level is required to create cartographic representations

Carto-Tools for challenging Cartography
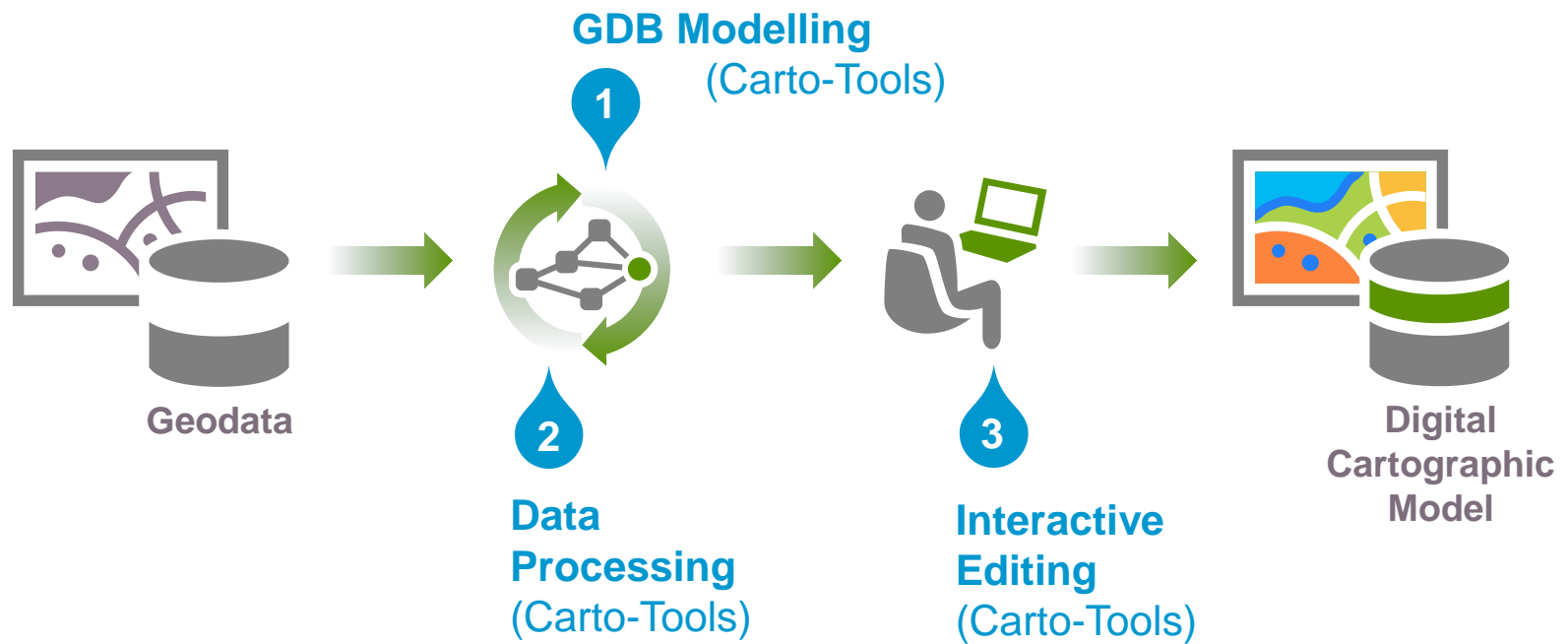
GDB Modelling
(Carto-Tools)
1

Geodata

2
Data Processing
(Carto-Tools)

3
Interactive Editing
(Carto-Tools)

Digital Cartographic Model

Cartographic Preparation with the Carto-Tools

1 **Tools for Geodatabase Modelling**

> Database schema preparation

> Defining Cartographic Representations and Rules

> Assign the Representations to the Geodata

2 Automated cartographic editing

> Using rule-based, configurable CartoProcesses

> Automation of repetitive cartographic processing steps

3 Interactive editing by the cartographer

> Ergonomic "One-Click" tools

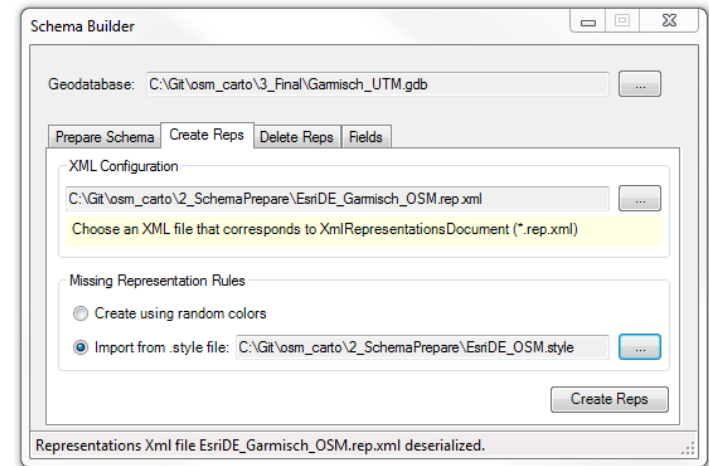> For manual intervention on the automatically generated map image

1 **Geodatabase Modelling**

+ Schema Builder

> Extending the data model

  > New datasets

  > Relationship classes

  > Domains

  > New Attribute fields

> Define text

> Define and create representations and their rules

+ Attribute Dependencies

> Attribute combinations

> Mapping the Geodata to the Representation

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> For manual intervention on the automatically generated map image
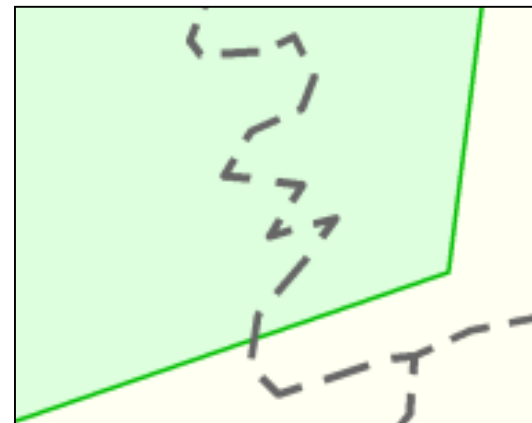
② Data Processing

+ CartoProcesses

> Over 20 Processes for the automated cartographic editing

> Performed on selected features, the visible extend or databases

> Respects previous processing and manual edits

+ Example: CalculateControlPoints

> Adds additional control points when a defined angle has been reached
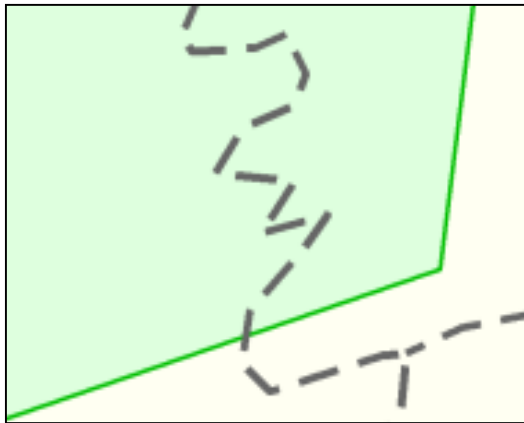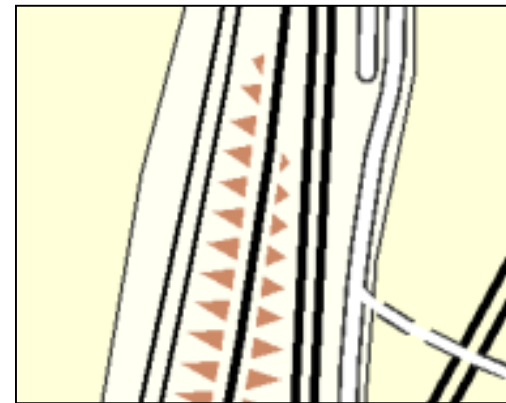

Before

After

2 Data Processing

+ Example: CreateEscarpments

> Generates automatically hachures from line features

> Generated polygons hachures may be edited interactively

> The process can also be used for generating dams, sinkholes etc.

Before

After

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2 **Data Processing**

+ **Example: CreateMarkerPatternInsidePolygon**

  > Replaces an area fill with regularly placed individual marker symbols under the consideration of defined obstacles such a rivers.

  > Marker symbols can be configured to have various sizes

  > The generated point features (marker symbols may be edited interactively.
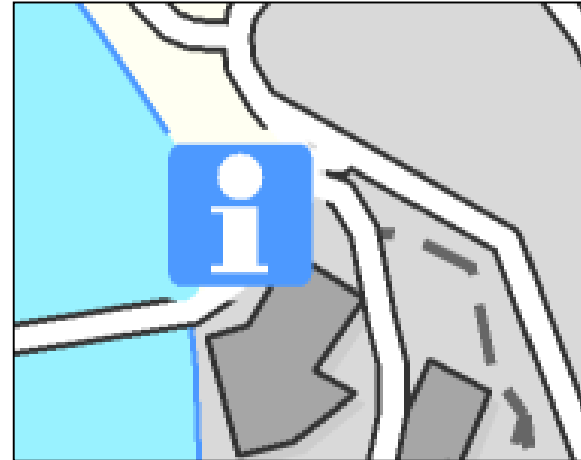

Before

After

2 Data Processing

+ Example: CreateFeatureMasks

> Generates mask polygons for various geometries and their representations

> The new polygons may be configured as a masking layer in the MXD.
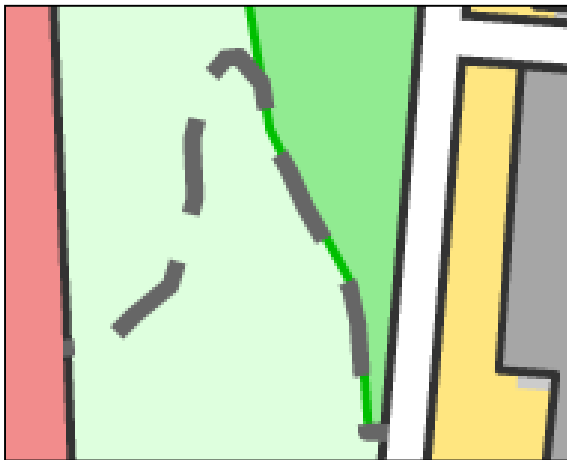
> Supports selective masking

Before

After

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② Data Processing

+ Example: SubstituteLineSymbolOverlaps

> Finds overlapping line symbols

> The representation of a polygon contour is suppressed in the region of overlap („Proxy effect")
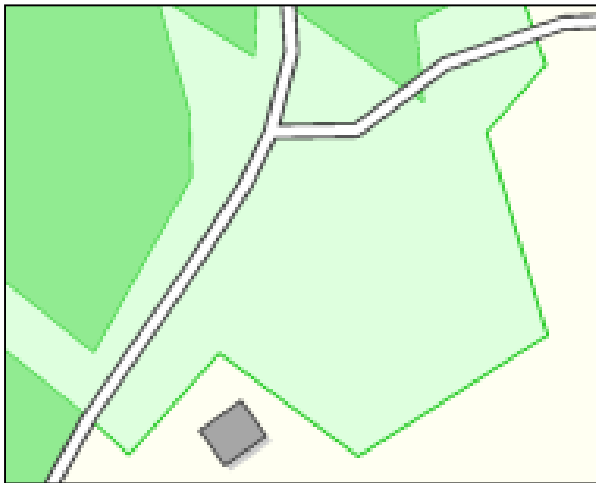

Before

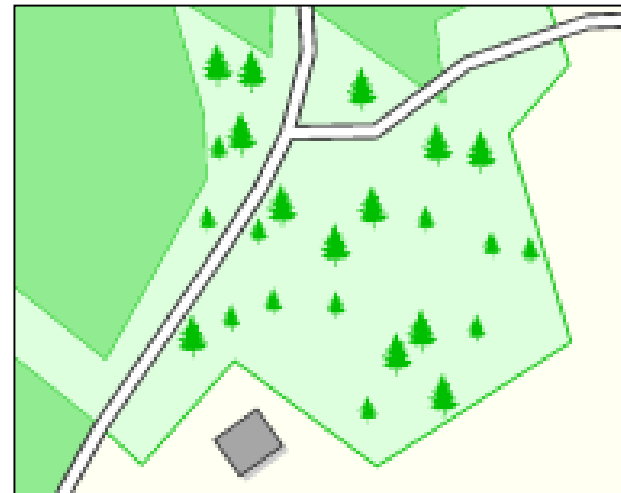**After**

2 **Data Processing**

+ **Example: CreateMarkerPatternRandomInPolygon**

  > Replaces an area fill with randomly placed individual marker symbols whilst considering defined obstacle data sets

  > The Marker symbols may be configured to have various sizes

  > The generated point features (marker symbols) may be individually interactively edited

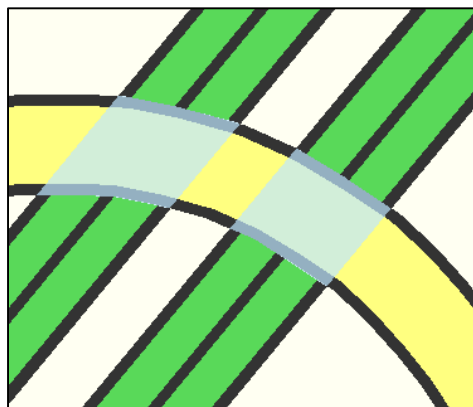
Before

After

2 **Data Processing**

+ **Example: CreateCrossingMasksLevel**

  > Generates Masking polygons for the correct over- and under pass representation
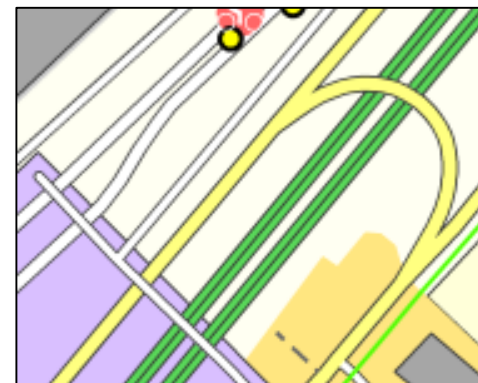
Before

Mask

After

2 **Data Processing**

+ Over 20 different CartoProcesses

> AdjustRoundabouts

> AlignRepresentations

> AttributeDependencySetter

> CalculateControlPoints

> CalculateLineCaps

> CalculateLineExtremity

> CalculateLineTransitions

> ColorBlobSetter

> CreateAnnoMasks

> CreateAnnotations

> CreateControlPointsAtCrossings

> CreateCrossingMasksLevel

> CreateEscarpments

> CreateFeatureMarkers

> CreateFeatureMasks

> CreateLineMasks

> CreateMarkerPatternInsidePolygon

> CreateMarkerPatternRandomInPolygon

> FillPolygonHoles

> HideInnerBoundaries

> OnOverlapAttributeCopier

> OnOverlapAttributeSetter

> SimpleAttributeCopier

> SimpleAttributeSetter

> SubstituteLineSymbolOverlaps

> …

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> Ergonomic "One-Click" tools

> For manual intervention on the automatically generated map image

3 **Interactive Editing**

+ One-Click Editing tools

> About 20 effective tools for cartographic finishing

> Optimized feature editing by minimizing the number of mouse clicks

> The standard tools repackaged

> Specialised tools for complex processes (e.g. to align geometries parallel)
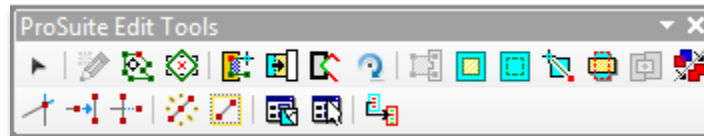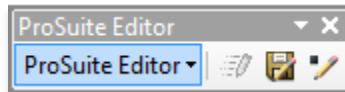
+ Specifically useful where

> a lot of time and money is invested in cartographic editing

> topological integrity must be maintained

> specific editing tools might need to be developed

3 **Interactive Editing**

+ **One-Click Editing tools**

| Create Representation Tool	Tool zur Erzeugung neuer Representation Features
Reshape Feature Tool	Tool für „Reshape Feature"-Task
Reshape Along Features Tool	Tool für Reshape entlang ausgewählter Abschnitte von Features
Destroy and Rebuild Tool	Tool für vollständige Neudefinition der Geometrie eines Features
Make Parallel Tool	Tool zum parallelen Ausrichten von Features
Selection Tool	Erweitertes Selektionstool (mit Picker-Unterstützung)
Convert Line to Bezier Tool	Tool zur Umwandlung von geraden Segmenten in Bezierkurven
Convert Bezier to Line Tool	Tool zur Umwandlung von Bezierkurven in gerade Segmenten
Densify Tool	Tool zur Verdichtung von Stützpunkten
Generalize Tool	Tool zur Generalisierung von Features (Douglas Peucker Algorithmus)
Cut Polygon Tool	Tool zum Zerschneiden von einem oder mehreren Polygonen
Cut Hole Tool	Tool zum Schneiden von Löchern in eines oder mehrere Polygone
Remove Hole Tool	Tool zum Entfernen von Löchern in einem ausgewählten Polygon
Merge Polygons Tool	Tool zum Verschmelzen von jeweils zwei Polygon-Features
Adjust Tool	Tool um ein Feature an ein oder mehrere andere Features anzugleichen
Fill Hole Tool	Tool um ein Loch innerhalb/zwischen ausgewählten Polygonen zu füllen
Attributeditor-Tool	Tool zum Öffnen des Attributeditors für auszuwählende Features
Attributeditor-Command	Command zum Öffnen des Attributeditors für die aktuelle Selektion

References

Challenging Cartography from a single system

Swisstopo 1:25 000 – Federal Office of Topography, Switzerland
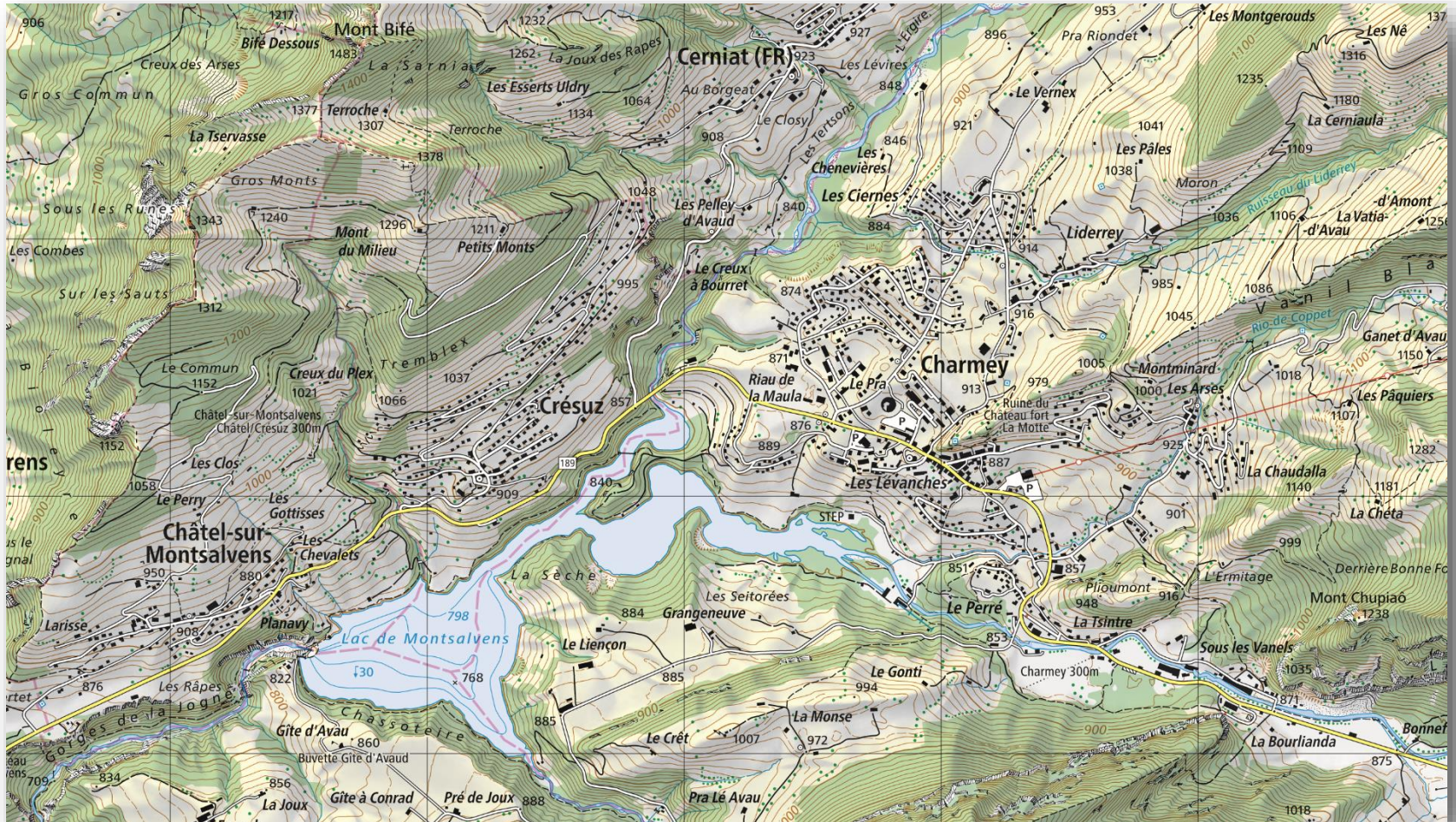
Map sample 1:25'000, Stand 2011 © 2014 Federal Office of Topography swisstopo

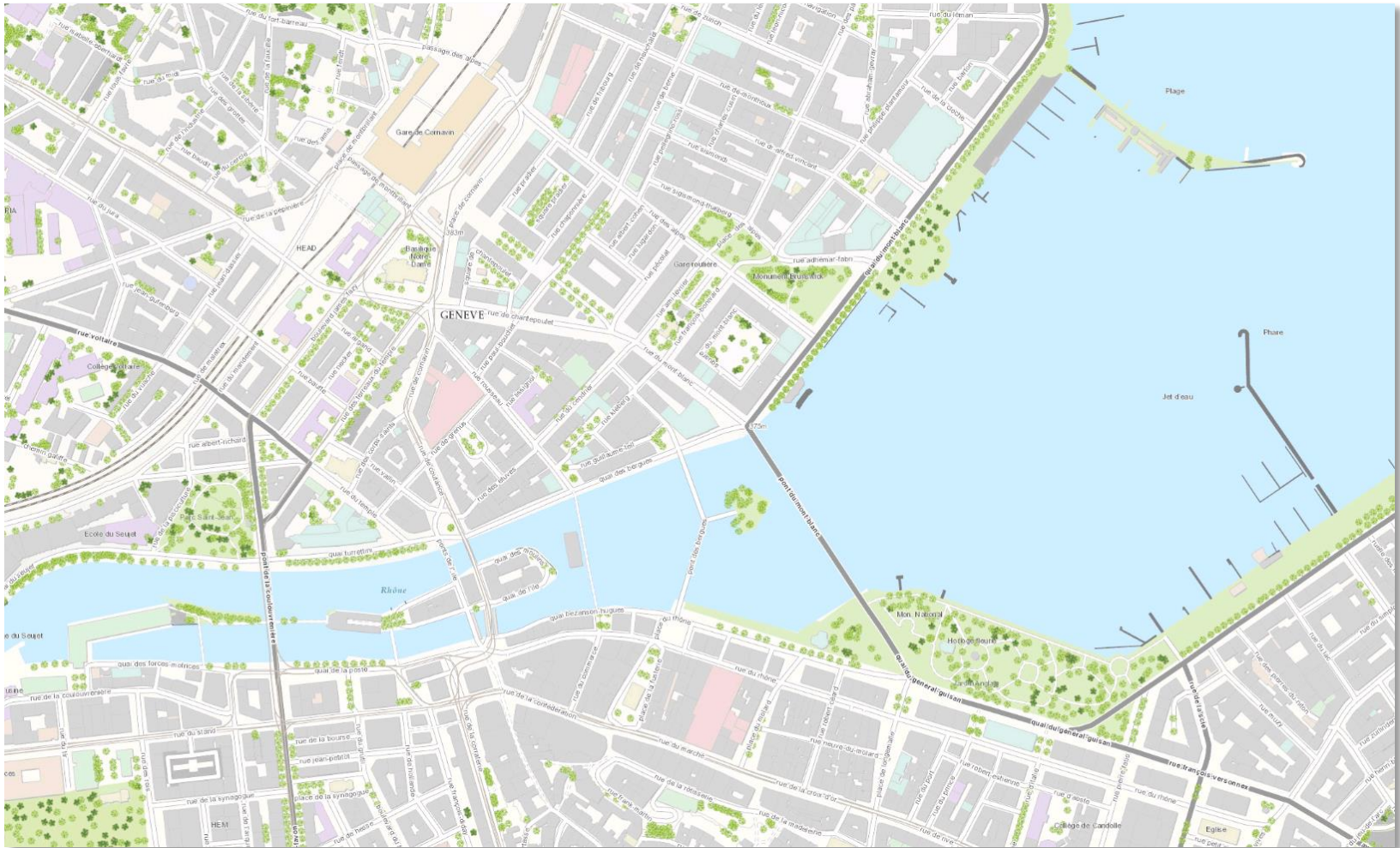# Swisstopo 1:1 Million – Federal Office of Topography, Switzerland

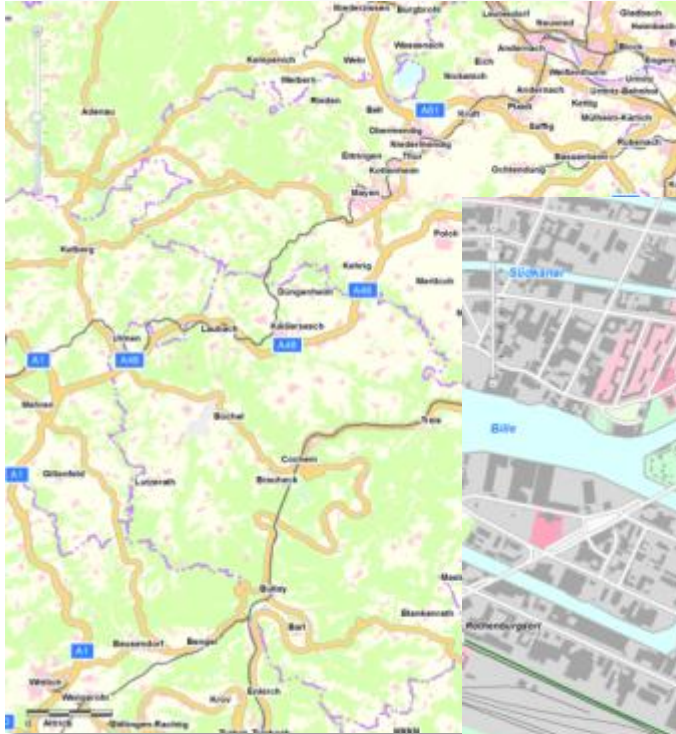# BEV 1:250 000 – Federal Office of Metrology and Surveying, Austria

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World Topographic Map from ArcGIS Online

http://www.arcgis.com/home/webmap/viewer.html?webmap=a72b0766aea04b48bf7a0e8c27ccc007
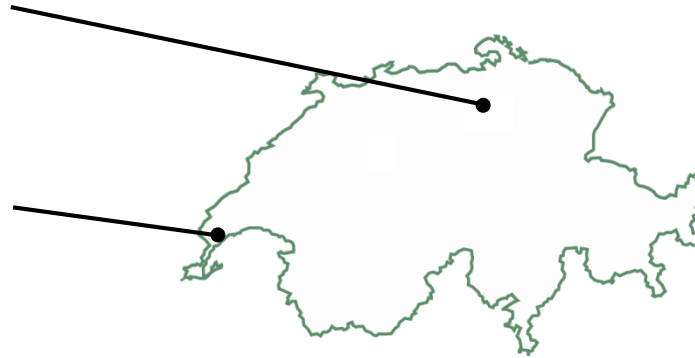
WebAtlasDE base map

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Take Away's

Thank you for listening and remember….

"It's Ok to be a Cartographer!"

Georg Gartner, ICC 2013