



Workshop on Volunteered Geographic Information: Enabling VGI creation, management and sharing

POLITECNICO DI MILANO



Digital ecosystem for OpenStreetMap Data

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Politecnico di Milano, DICA – GEOLab

The OpenStreetMap ecosystem

- OpenStreetMap has evolved into a complex ecosystem:
 - datasets, software, services & applications
- How is OpenStreetMap used?
 - map visualization
 - software (editors, routing, etc.)
 - data download
 - humanitarian applications
 - quality assurance/quality control
 - games
 - (enrichment/update of governmental maps)
 - (education and research)

http://wiki.openstreetmap.org/wiki/List_of_OSM-based_services

The OpenStreetMap ecosystem

Map visualization

Map visualization

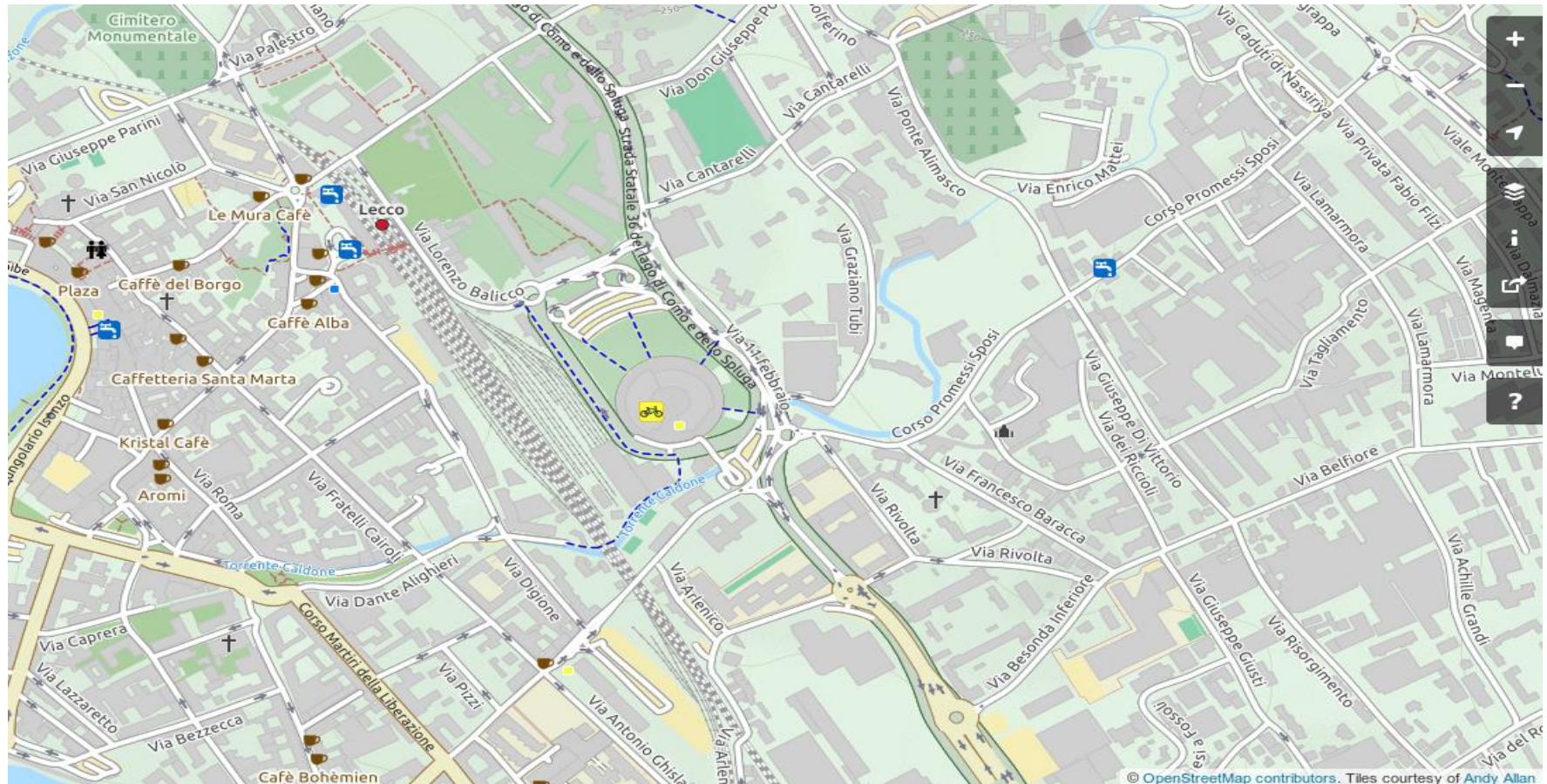
- OSM vector data can be visualized with customized styles:
 - standard visualization



<http://www.openstreetmap.org>

Map visualization

- OSM vector data can be visualized with customized styles:
 - cycle map visualization



<http://www.openstreetmap.org>

Map visualization

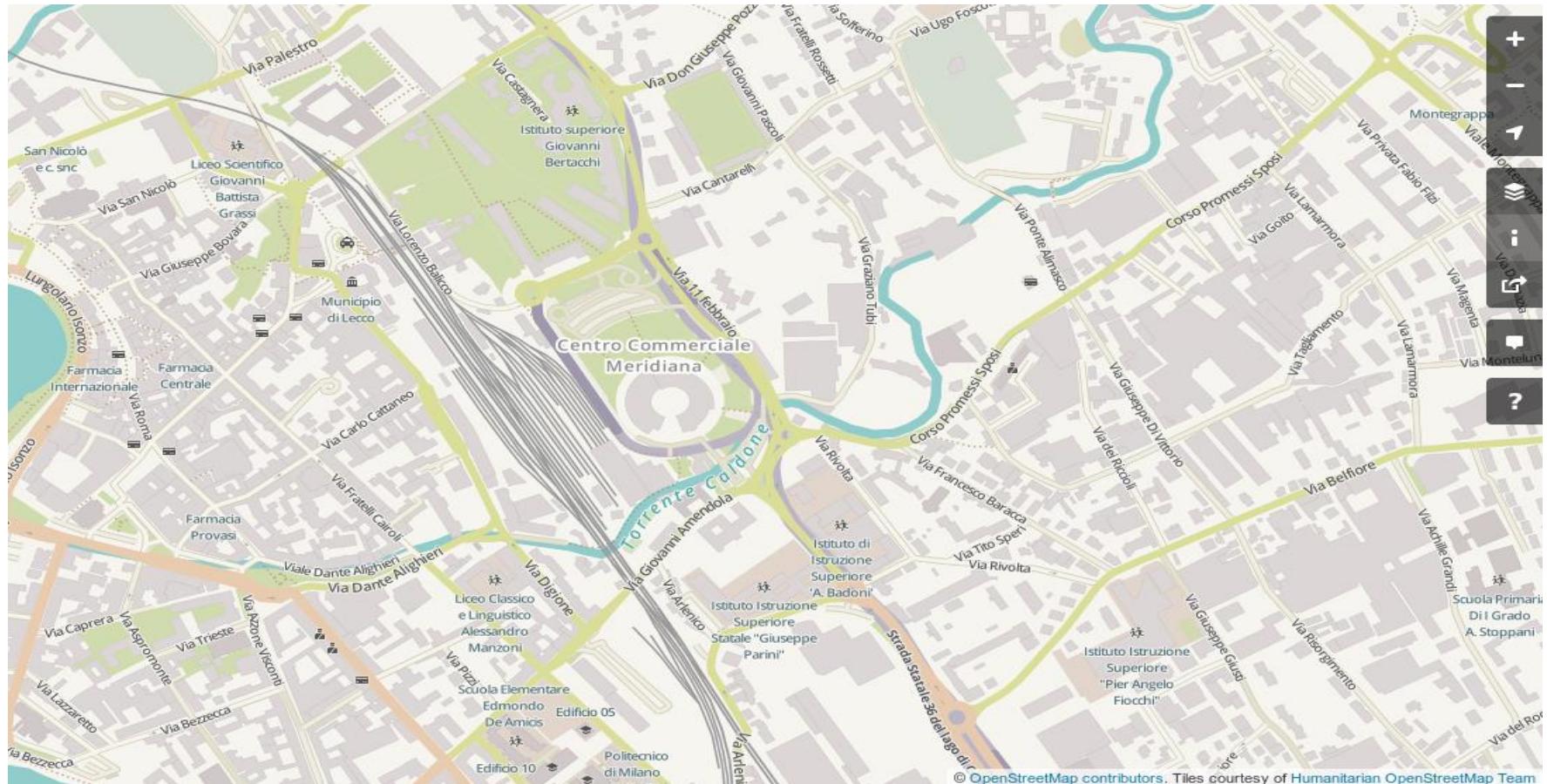
- OSM vector data can be visualized with customized styles:
 - transport map visualization



<http://www.openstreetmap.org>

Map visualization

- OSM vector data can be visualized with customized styles:
 - humanitarian visualization



<http://www.openstreetmap.org>

Map visualization

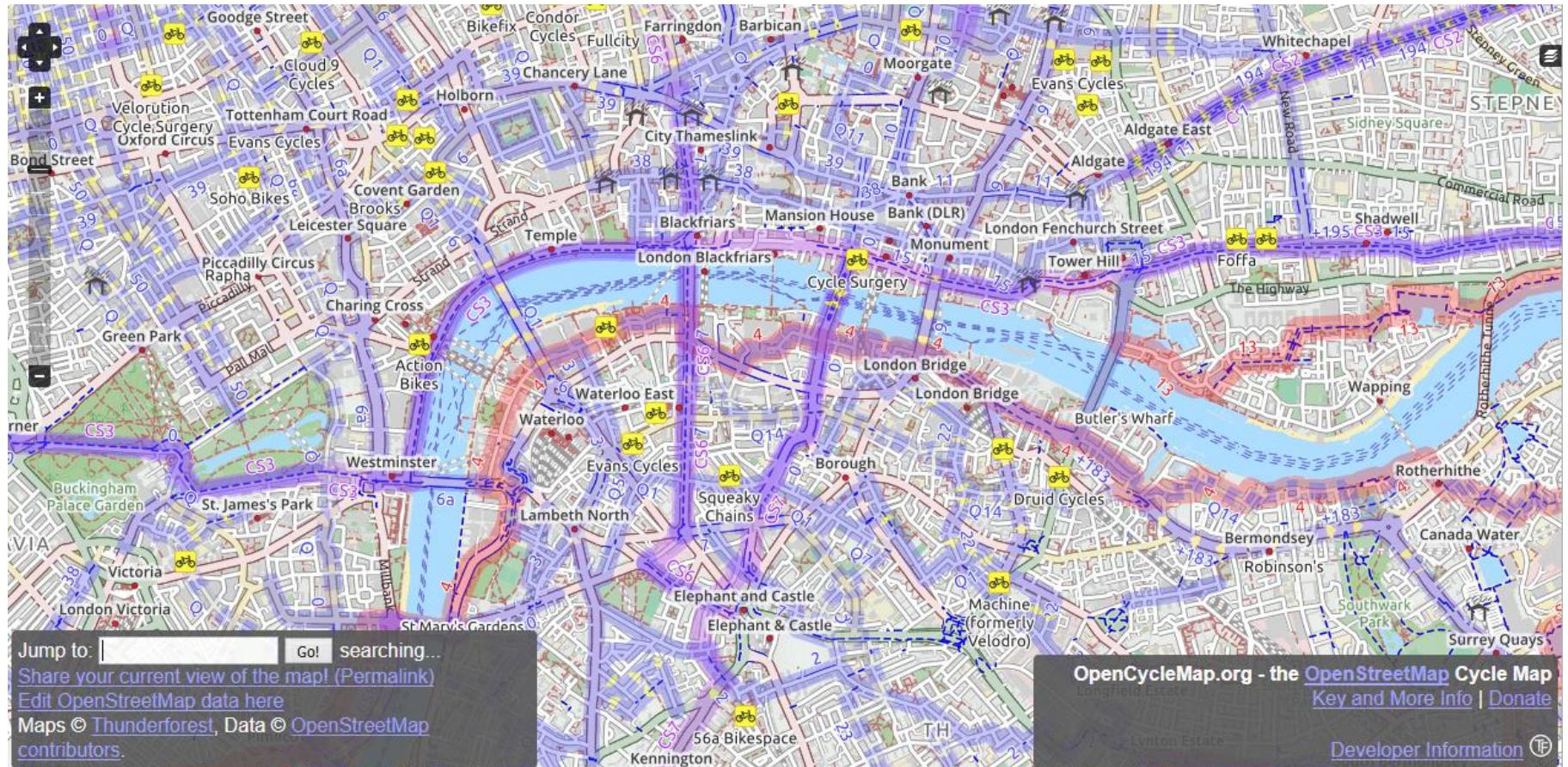
- OSM vector data can be visualized with customized styles:
 - topographic visualization



<https://opentopomap.org>

Map visualization

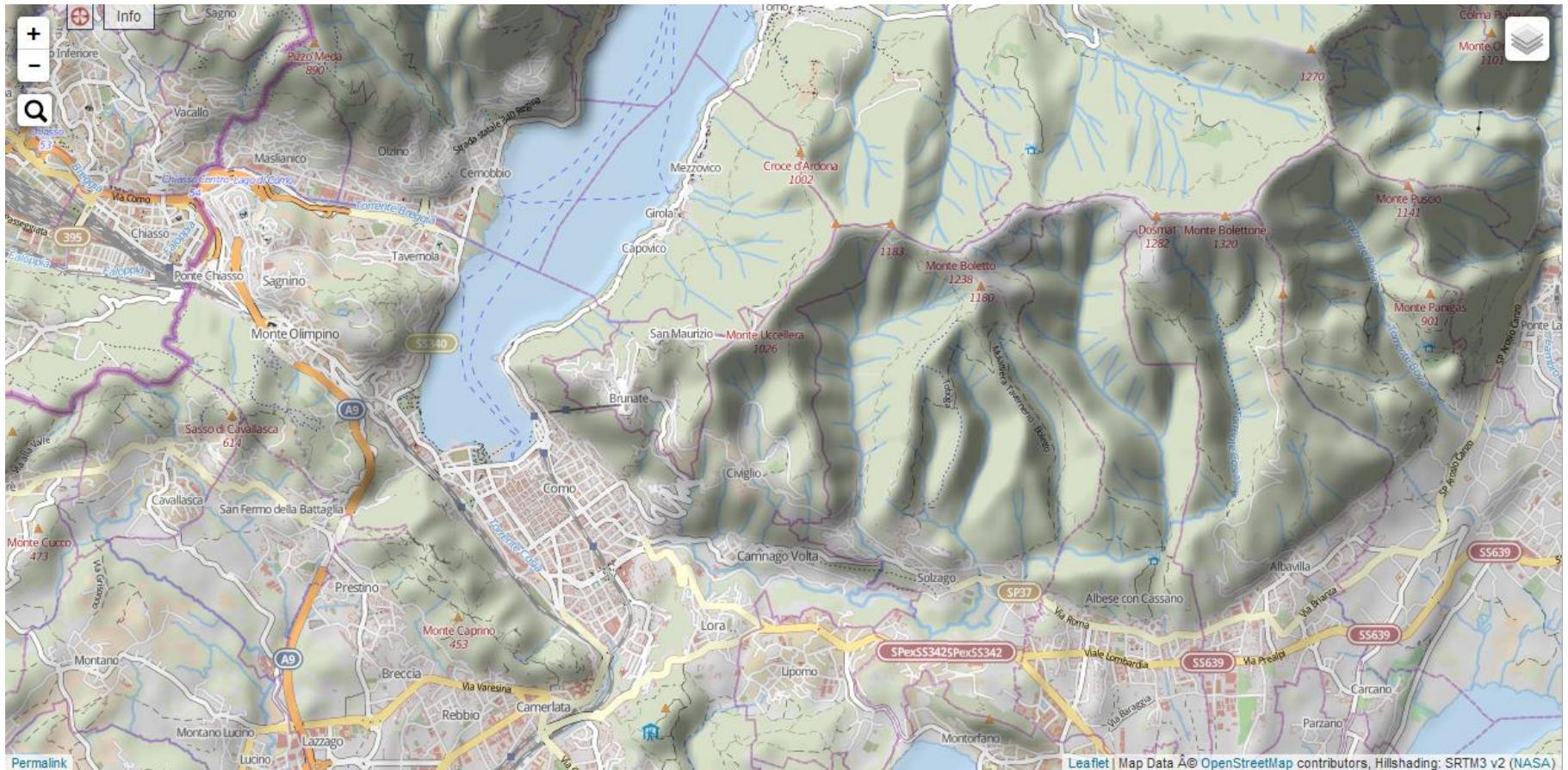
- OSM vector data can be visualized with customized styles:
 - cycle map visualization



<https://www.opencyclemap.org>

Map visualization

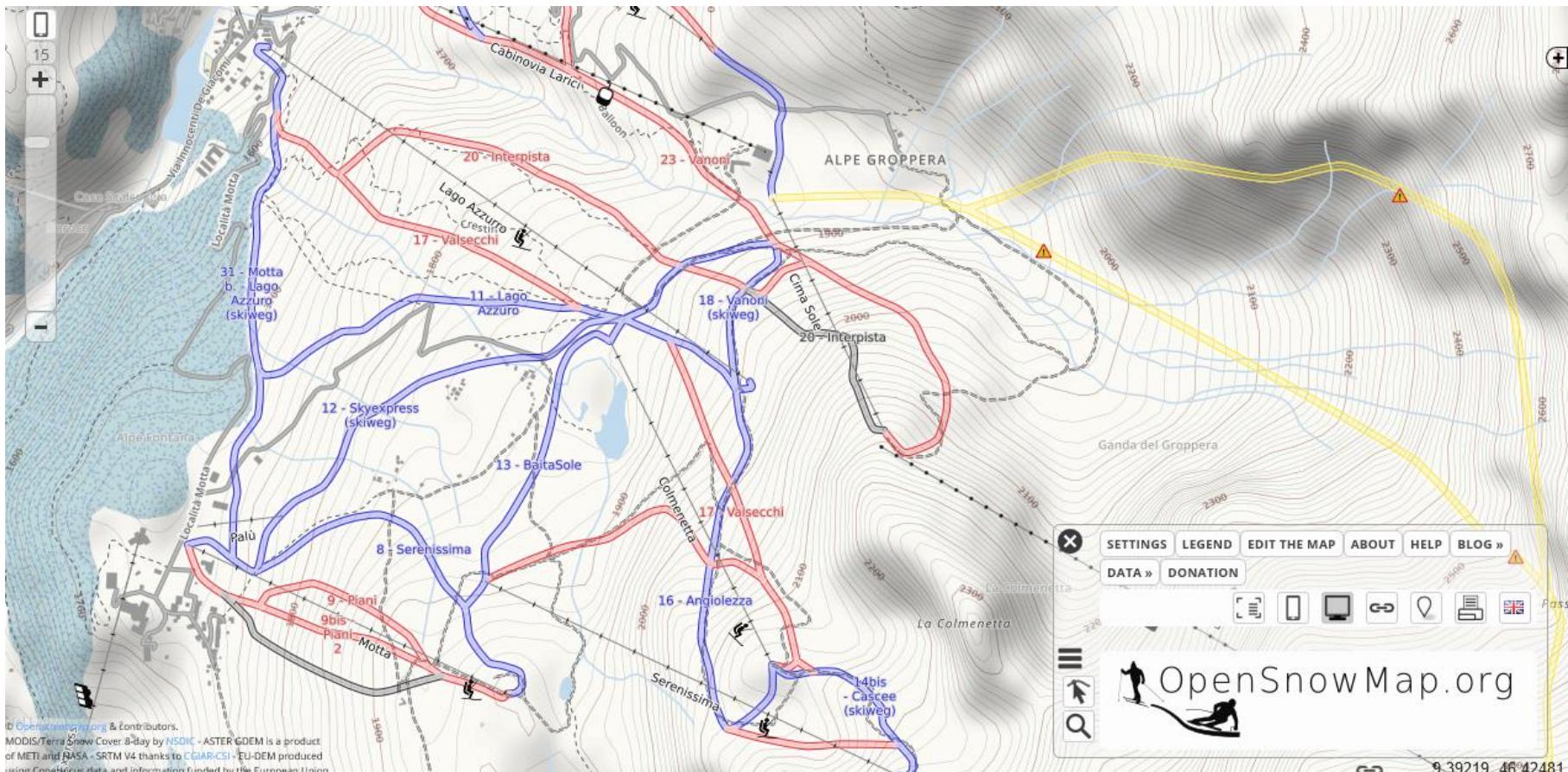
- OSM vector data can be visualized with customized styles:
 - hiking/biking map visualization



<http://hikebikemap.org>

Map visualization

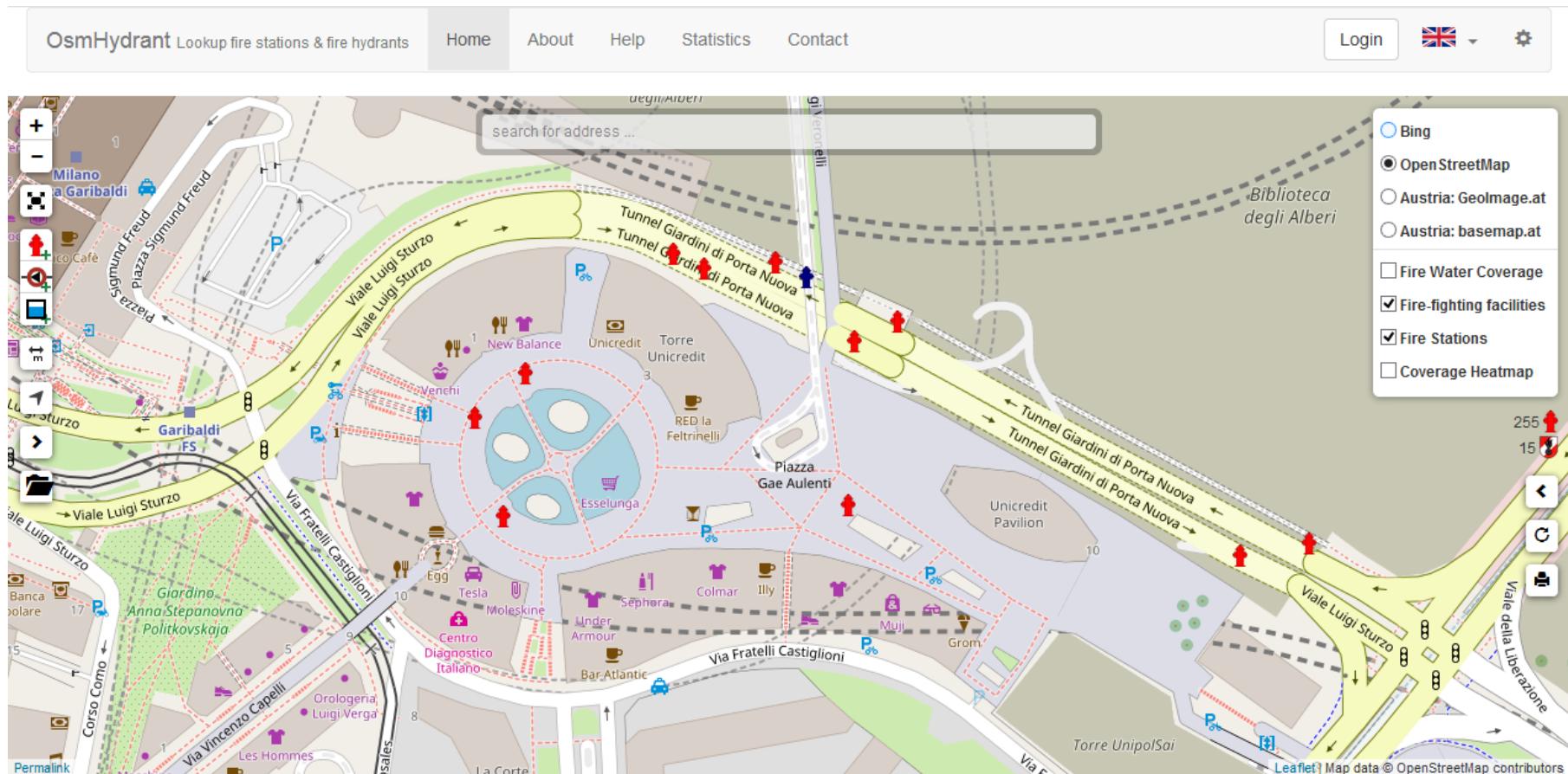
- OSM vector data can be visualized with customized styles:
 - snow map visualization



<http://www.opensnowmap.org>

Map visualization

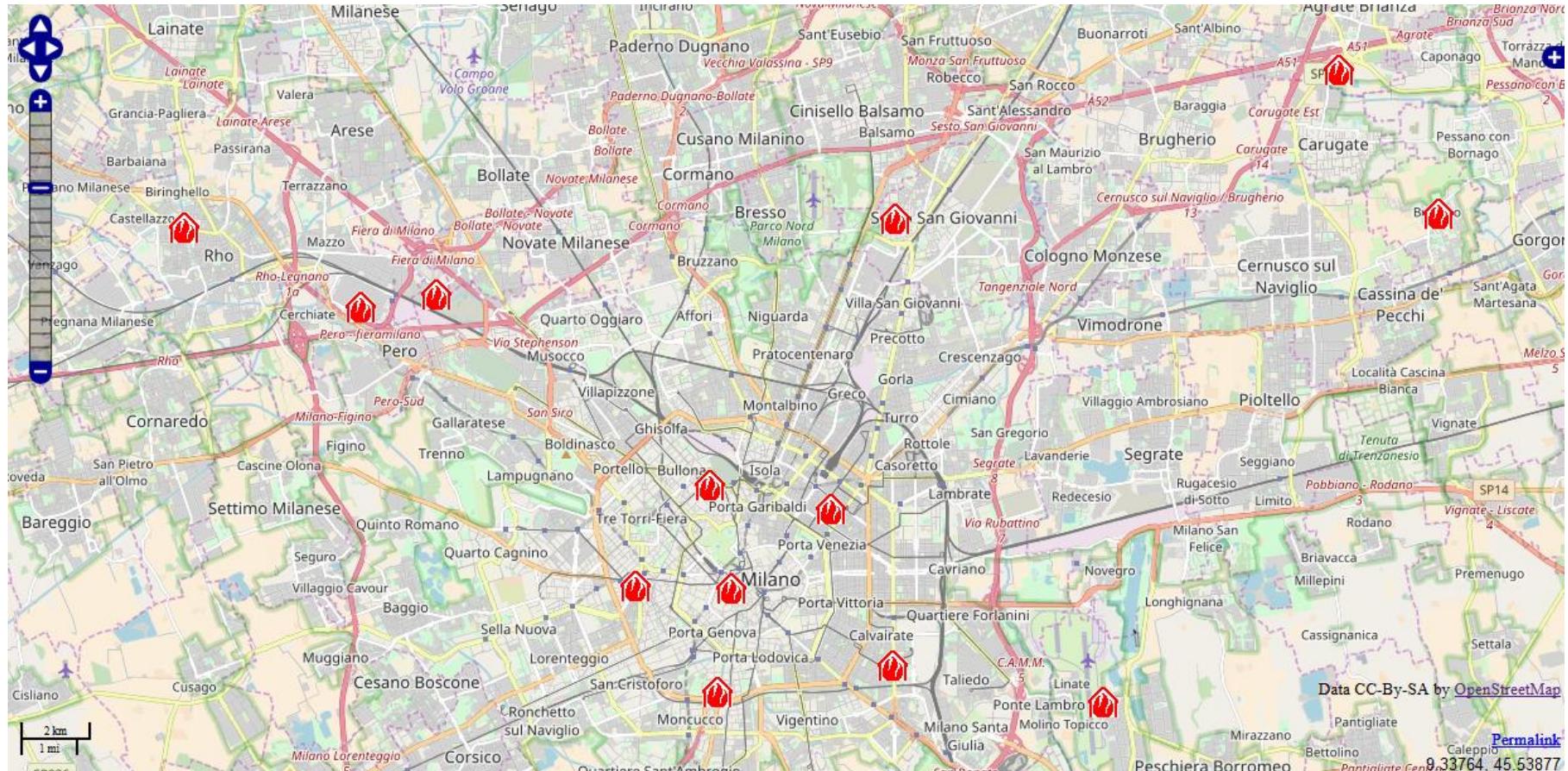
- OSM vector data can be visualized with customized styles:
 - fire fighting facilities visualization



<https://www.osmhydrant.org>

Map visualization

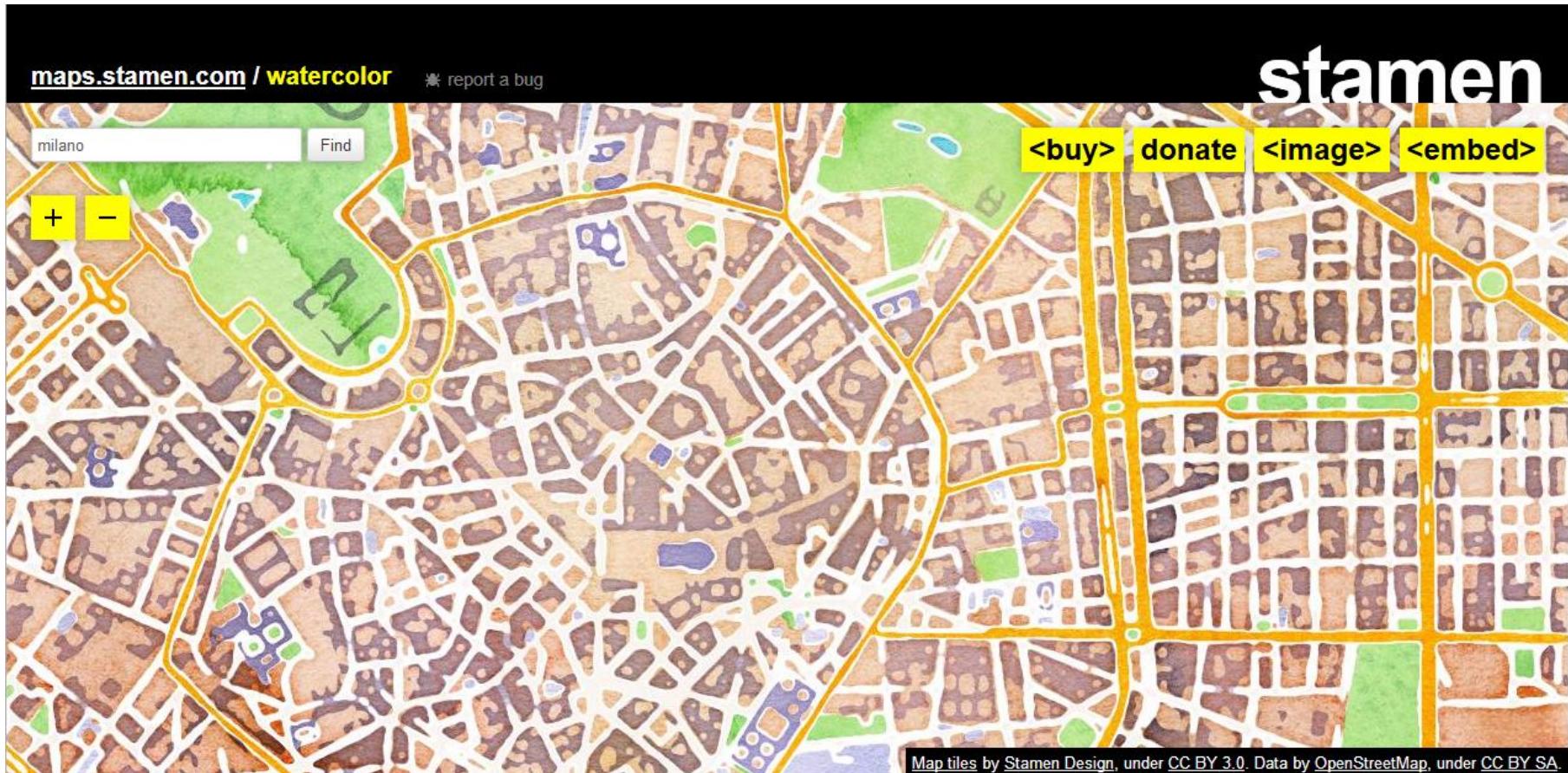
- OSM vector data can be visualized with customized styles:
 - fire stations visualization



<http://openfiremap.org>

Map visualization

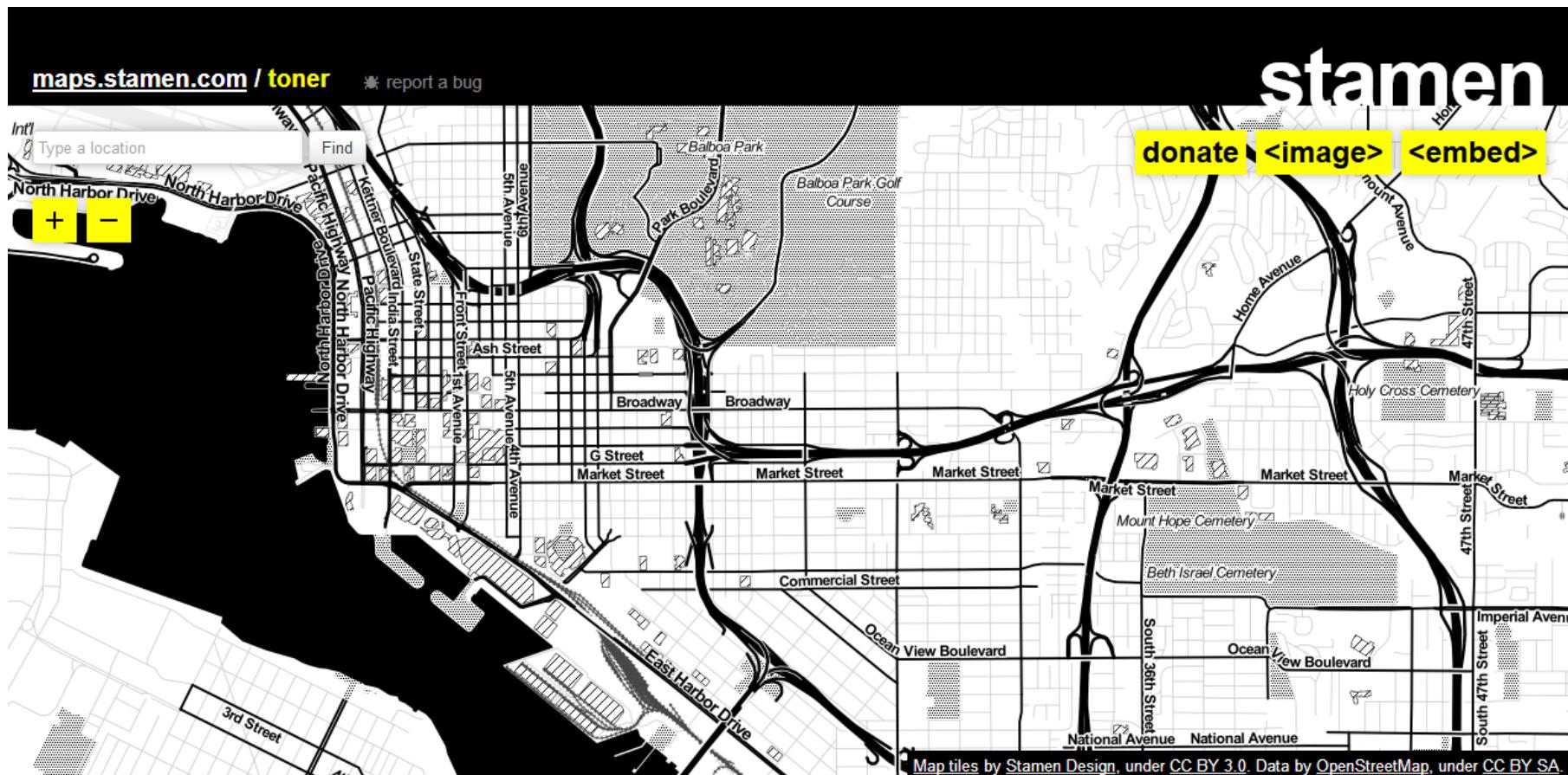
- OSM vector data can be visualized with customized styles:
 - watercolor visualization



<http://maps.stamen.com/watercolor>

Map visualization

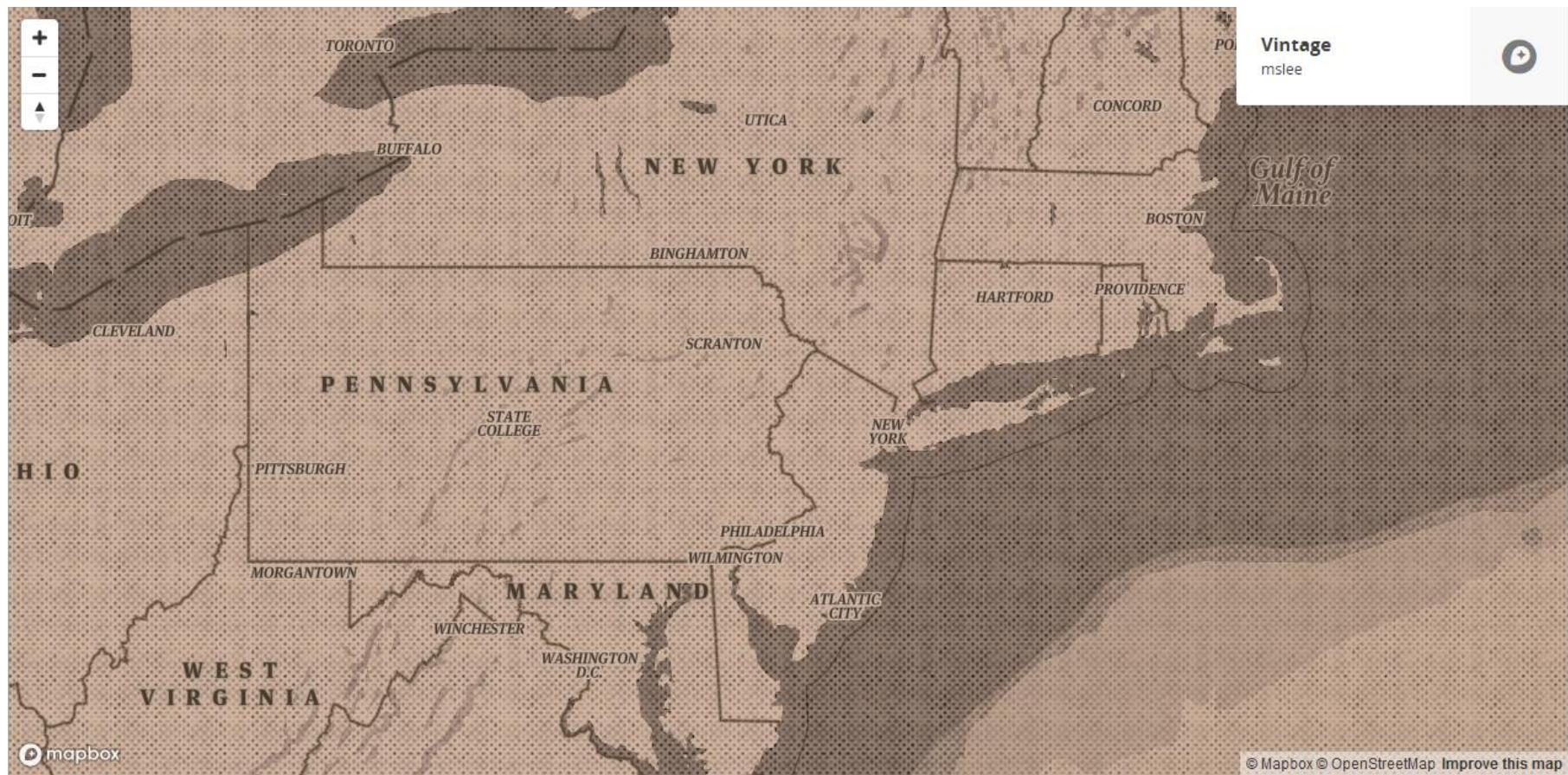
- OSM vector data can be visualized with customized styles:
 - toner visualization



<http://maps.stamen.com/watercolor>

Map visualization

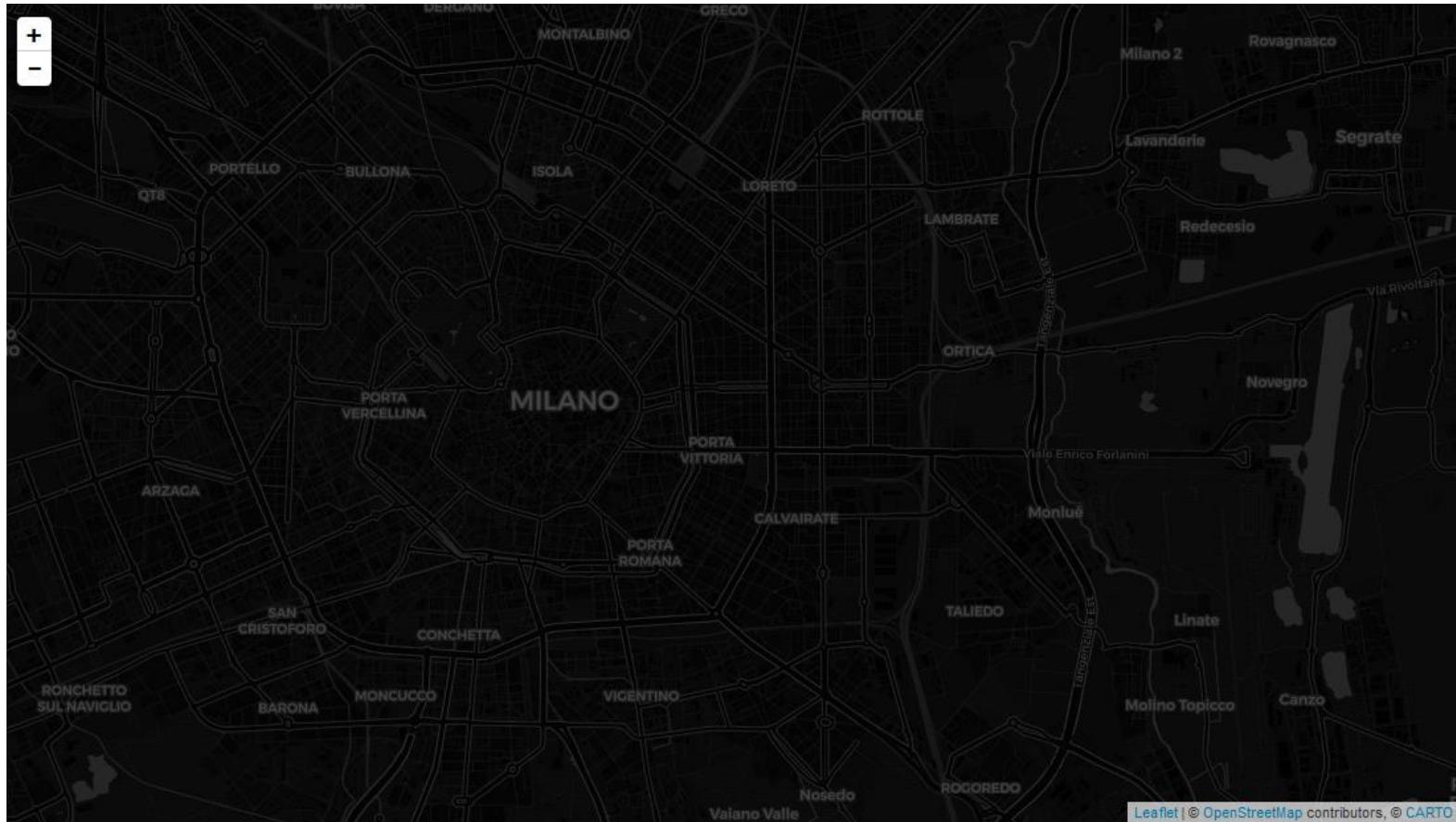
- OSM vector data can be visualized with customized styles:
 - vintage visualization



<https://tinyurl.com/yasqcqp4>

Map visualization

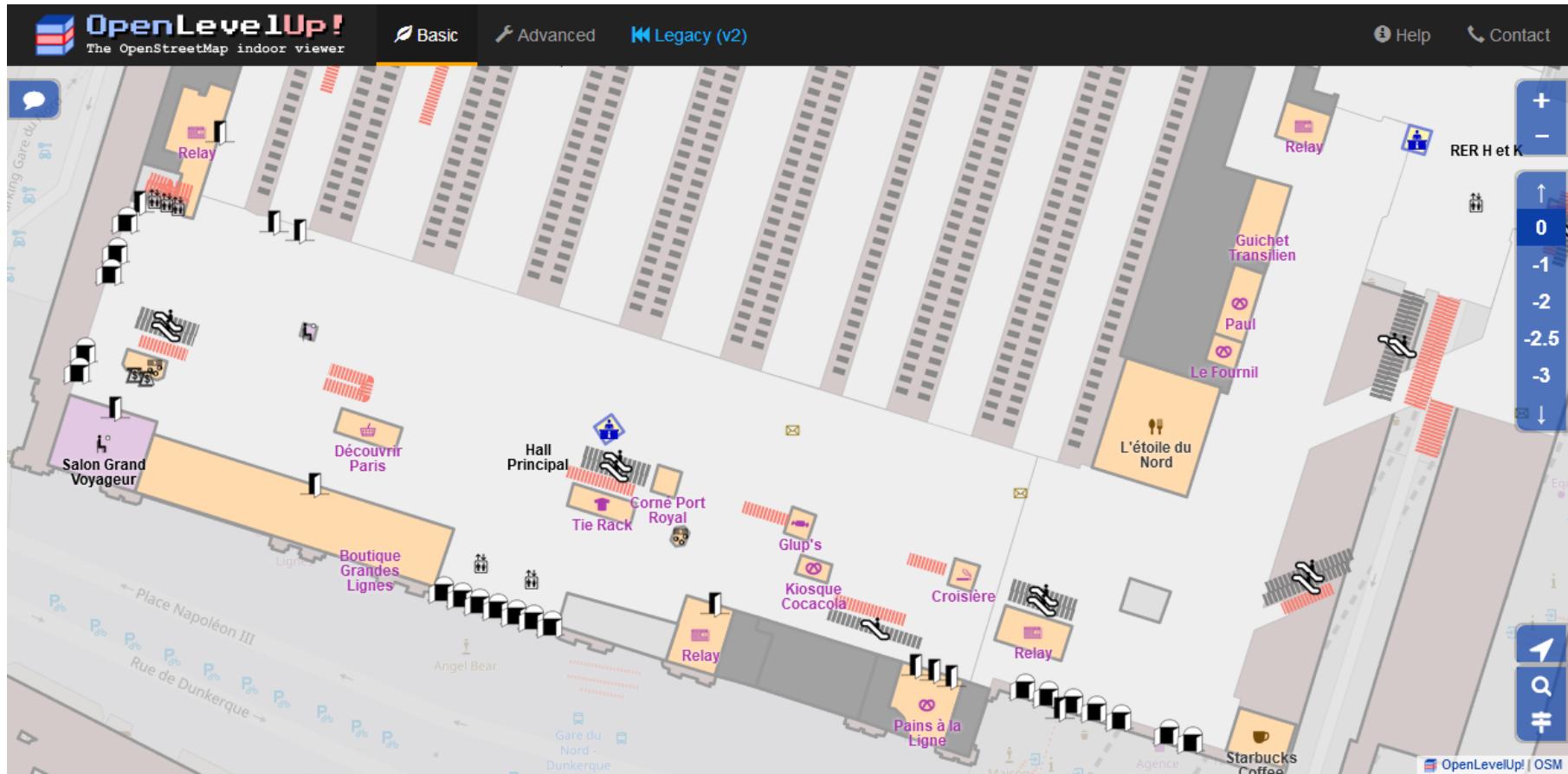
- OSM vector data can be visualized with customized styles:
 - dark visualization



<https://carto.com/location-data-services/basemaps>

Map visualization

- OSM vector data can be visualized with customized styles:
 - Indoor level-based visualization



<https://openlevelup.net>

Map visualization

- OSM vector data can be visualized with customized styles:
 - 3D building visualization

The screenshot shows the OSM Buildings website interface. At the top, there is a navigation bar with links for Solutions, Data, Blog, Developer, and Login. On the left, there is a search bar and a "Looking for our data?" section featuring a map and a table. The main content area displays a detailed 3D rendering of a city block, showing buildings, roads, and green spaces. The map includes labels for various streets and landmarks such as "Kita zum Prenzlauer Berg", "Prenzlauer Berg", "Greifswalder Platz", and "West Thälmann Park". The bottom of the page contains copyright information and links to social media and contact details.

OSM Buildings

Solutions Data Blog Developer Login

Search

Looking for our data?

GIS data for Analysis, properties included
Download samples Get a quote

© Data OpenStreetMap © Map Mapbox © 3D OSM Buildings

© OSM Buildings Twitter Github Terms Contact

<https://osmbuildings.org>

Map visualization

- OSM vector data can be visualized with customized styles:
 - 3D building visualization



<http://osm.eoapps.eu/application>

Map visualization

- OSM vector data can be visualized with customized styles:
 - 3D building visualization



<http://demo.f4map.com>

Software – Editors

How to add/edit OpenStreetMap data?

- There are three main ways to contribute data to OSM:
 - **Outdoor mapping:** it implies to know the area to be mapped through a personal field survey; data is uploaded using specific software.
 - **Armchair mapping:** it consists in digitizing objects (buildings, roads, etc.) in remote areas without a personal field survey. Information is typically derived from openly-licensed aerial/satellite imagery and is uploaded using specific software.
 - **Bulk import:** it consists in the direct upload of datasets available under an open license compatible with ODbL. Bulk import is a delicate operation, which must be discussed and authorized by the OSM community and is reserved for expert users.
- Regardless of the way chosen to map, data upload in OSM requires to use an **editor**.

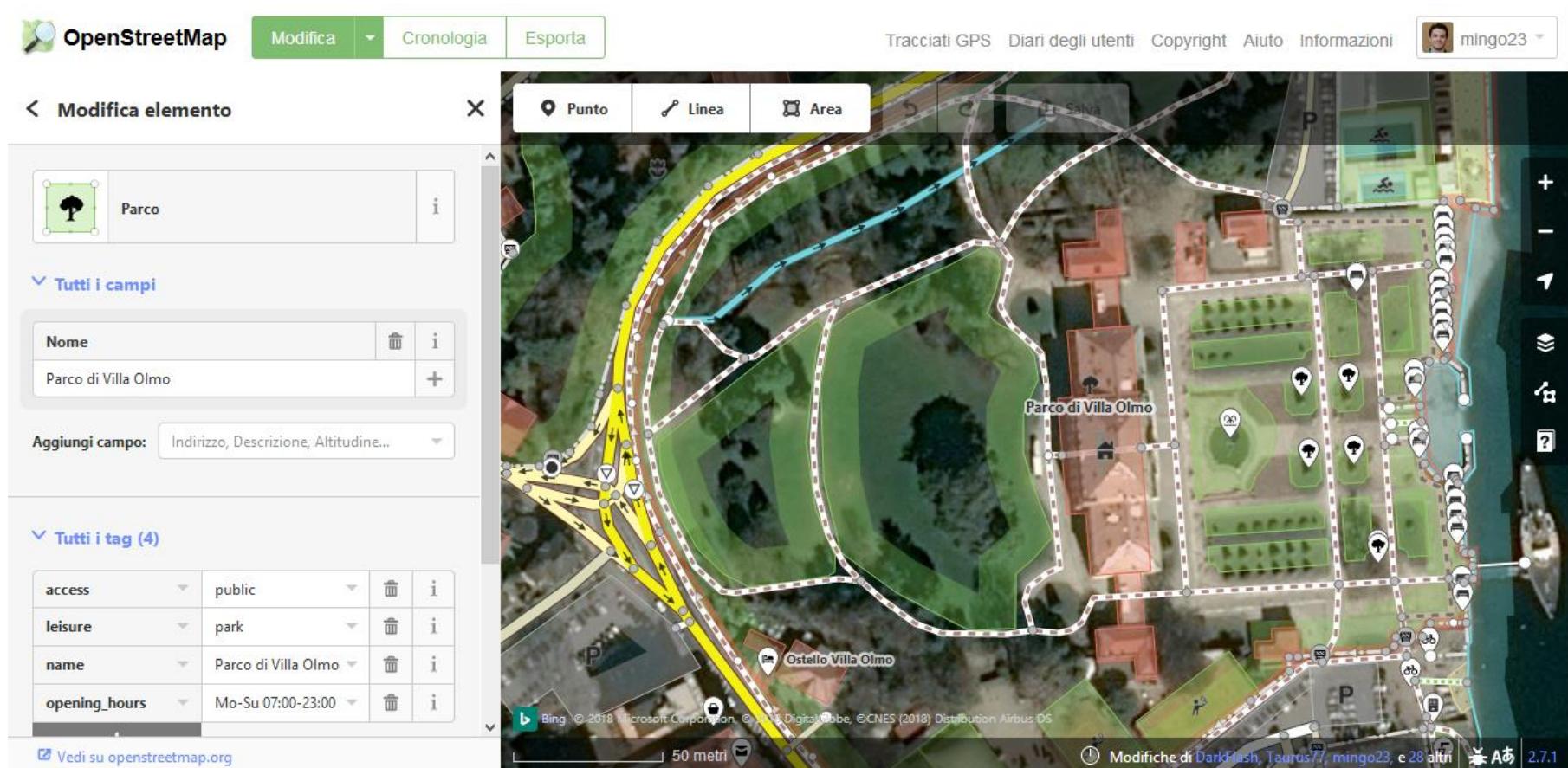
https://wiki.openstreetmap.org/wiki/Mapping_techniques

<http://wiki.openstreetmap.org/wiki/Import/Catalogue>

<http://wiki.openstreetmap.org/wiki/Editors>

How to add/edit OpenStreetMap data?

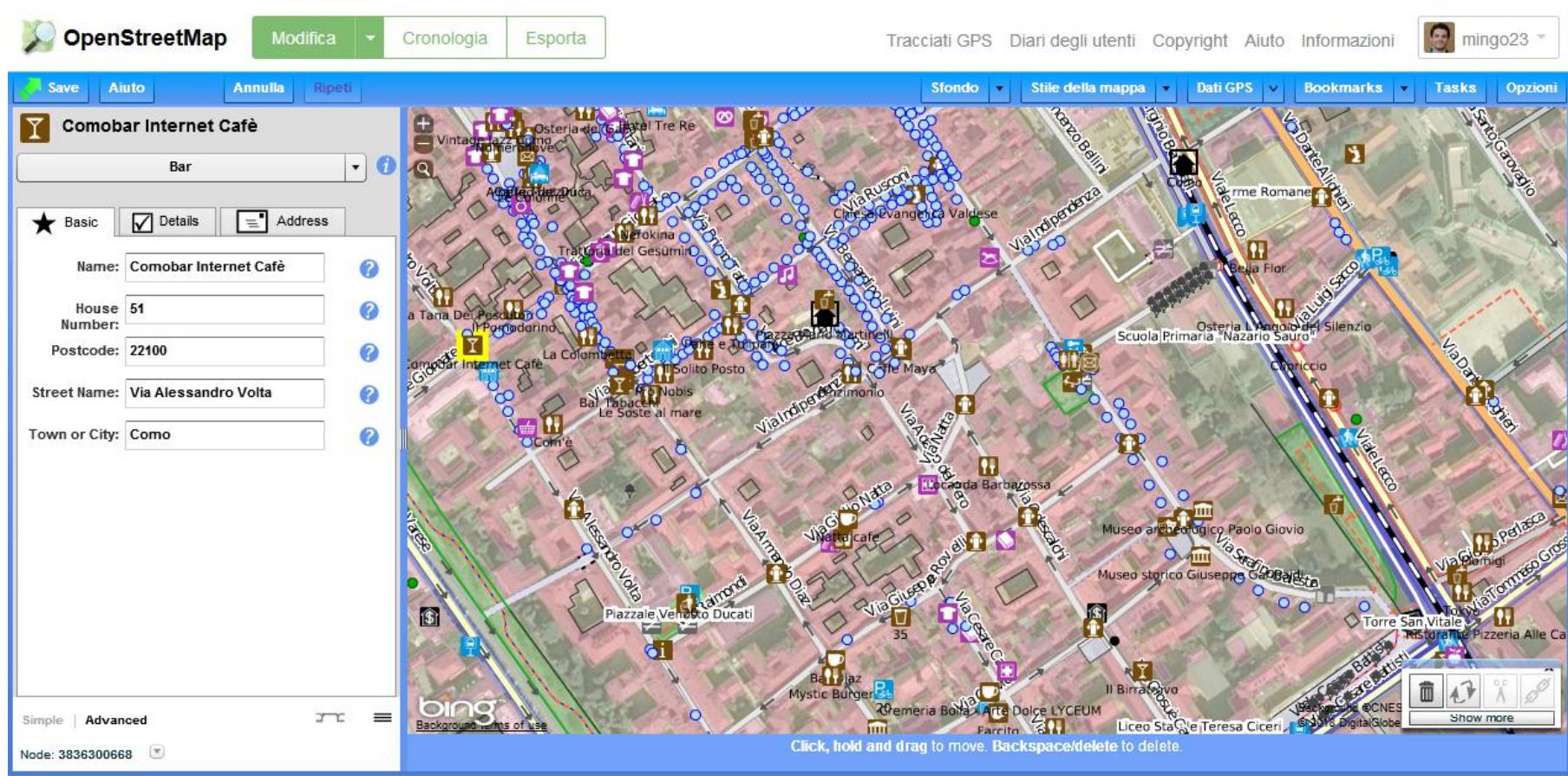
- OSM editors include:
 - iD editor: web-based editor, suitable for beginners



<https://wiki.openstreetmap.org/wiki/ID>

How to add/edit OpenStreetMap data?

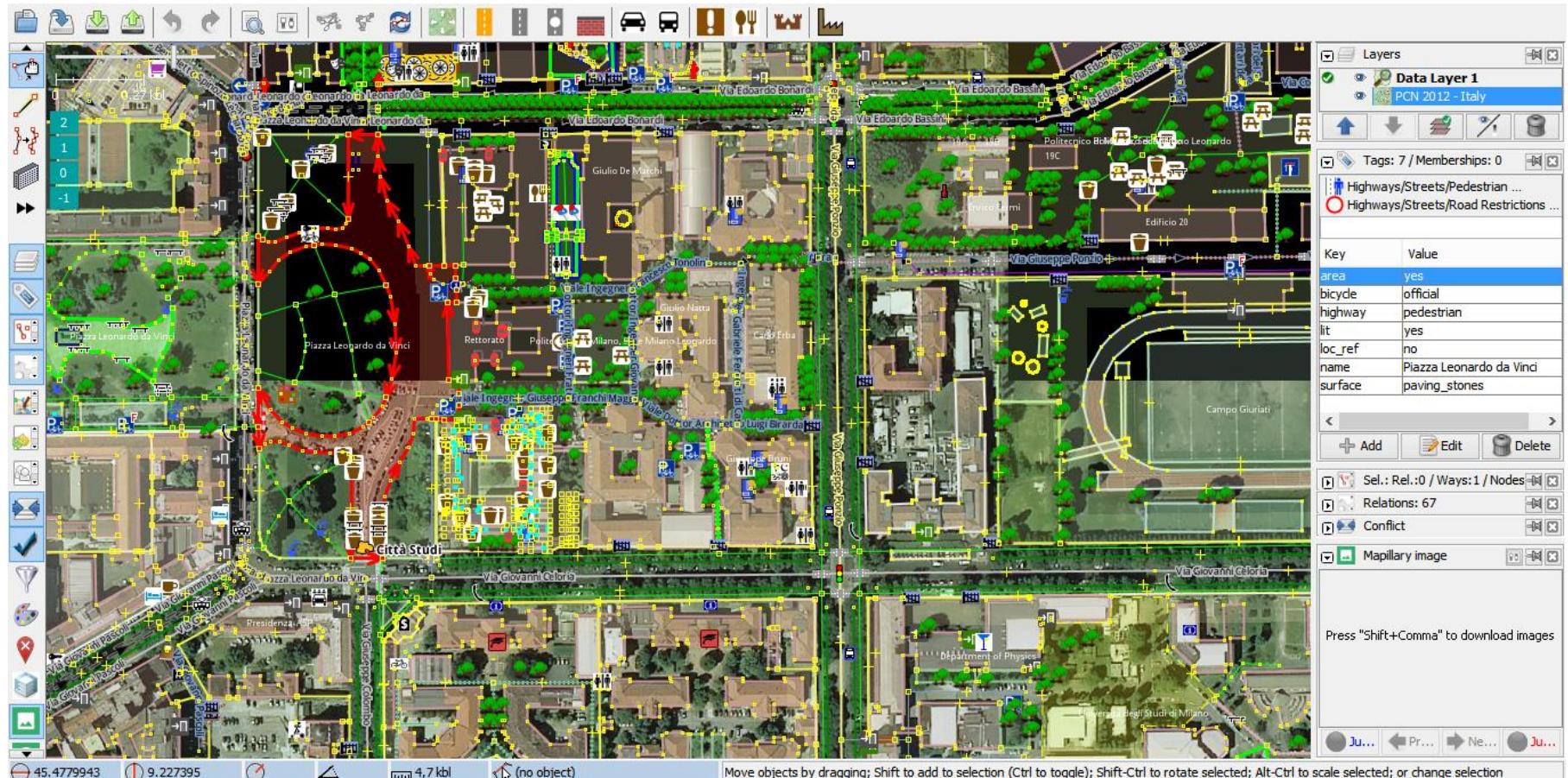
- OSM editors include:
 - Potlatch 2: web-based editor, suitable for more advanced users



https://wiki.openstreetmap.org/wiki/Potlatch_2

How to add/edit OpenStreetMap data?

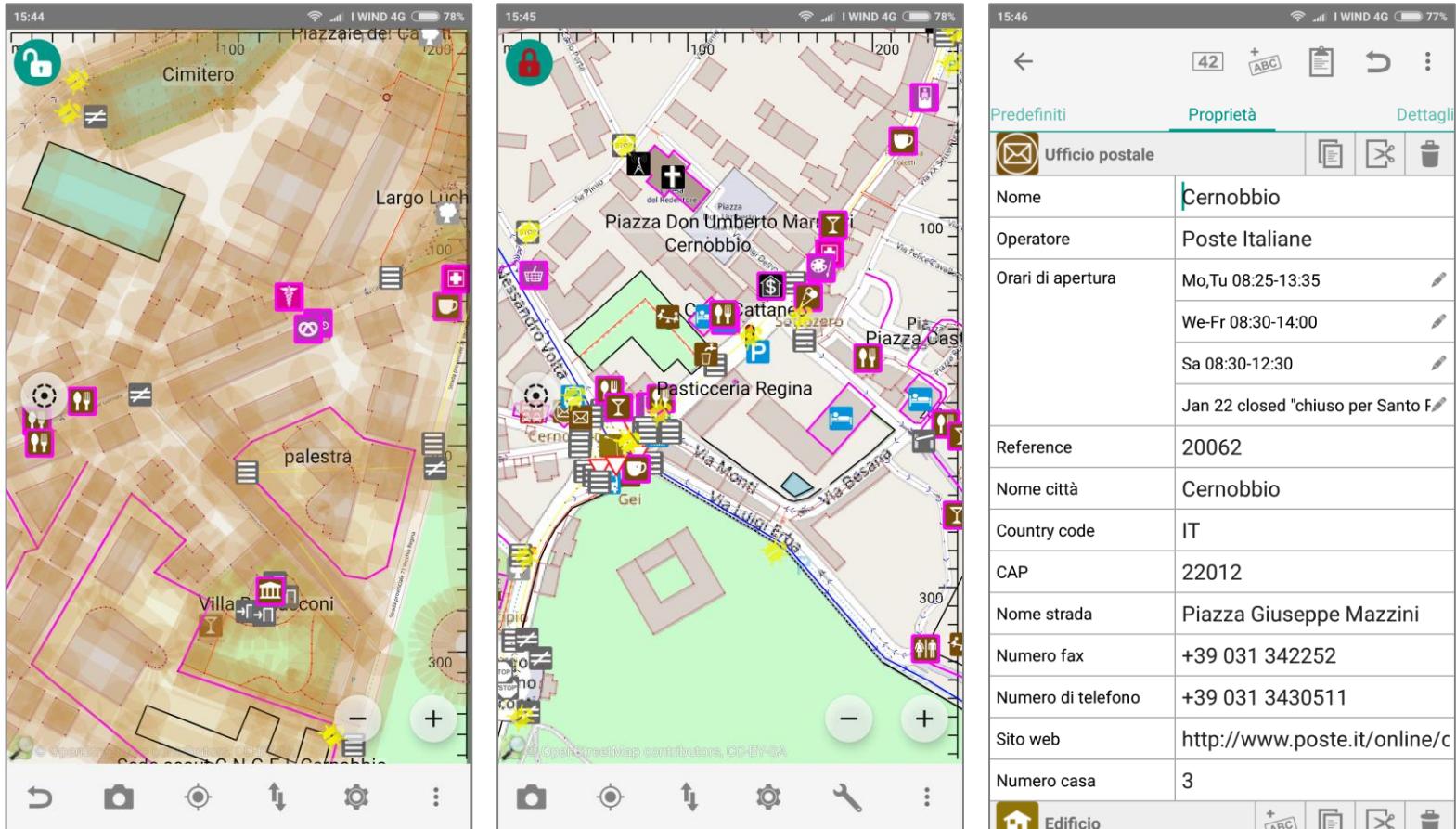
- OSM editors include:
 - JOSM: Java-based desktop editor, suitable for advanced users



<https://josm.openstreetmap.de>

How to add/edit OpenStreetMap data?

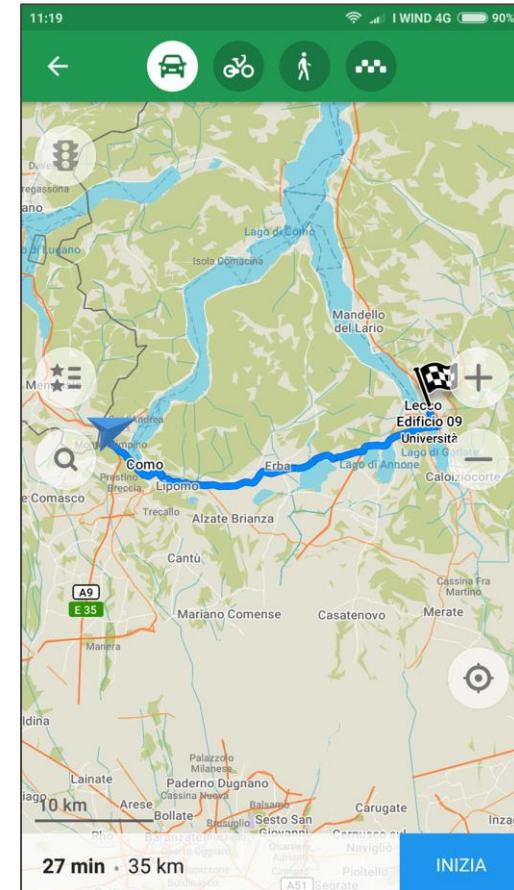
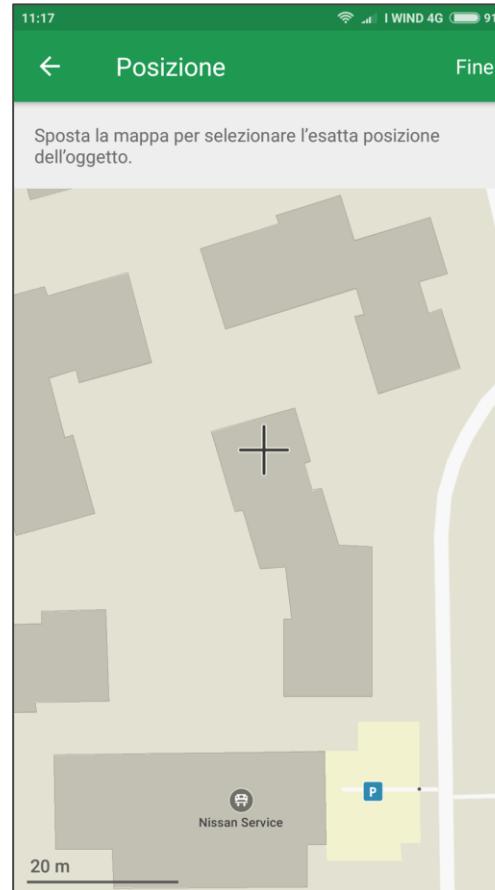
- OSM editors include:
 - Vespucci: Android app to download, edit & upload OSM data



<https://wiki.openstreetmap.org/wiki/Vespucci>

How to add/edit OpenStreetMap data?

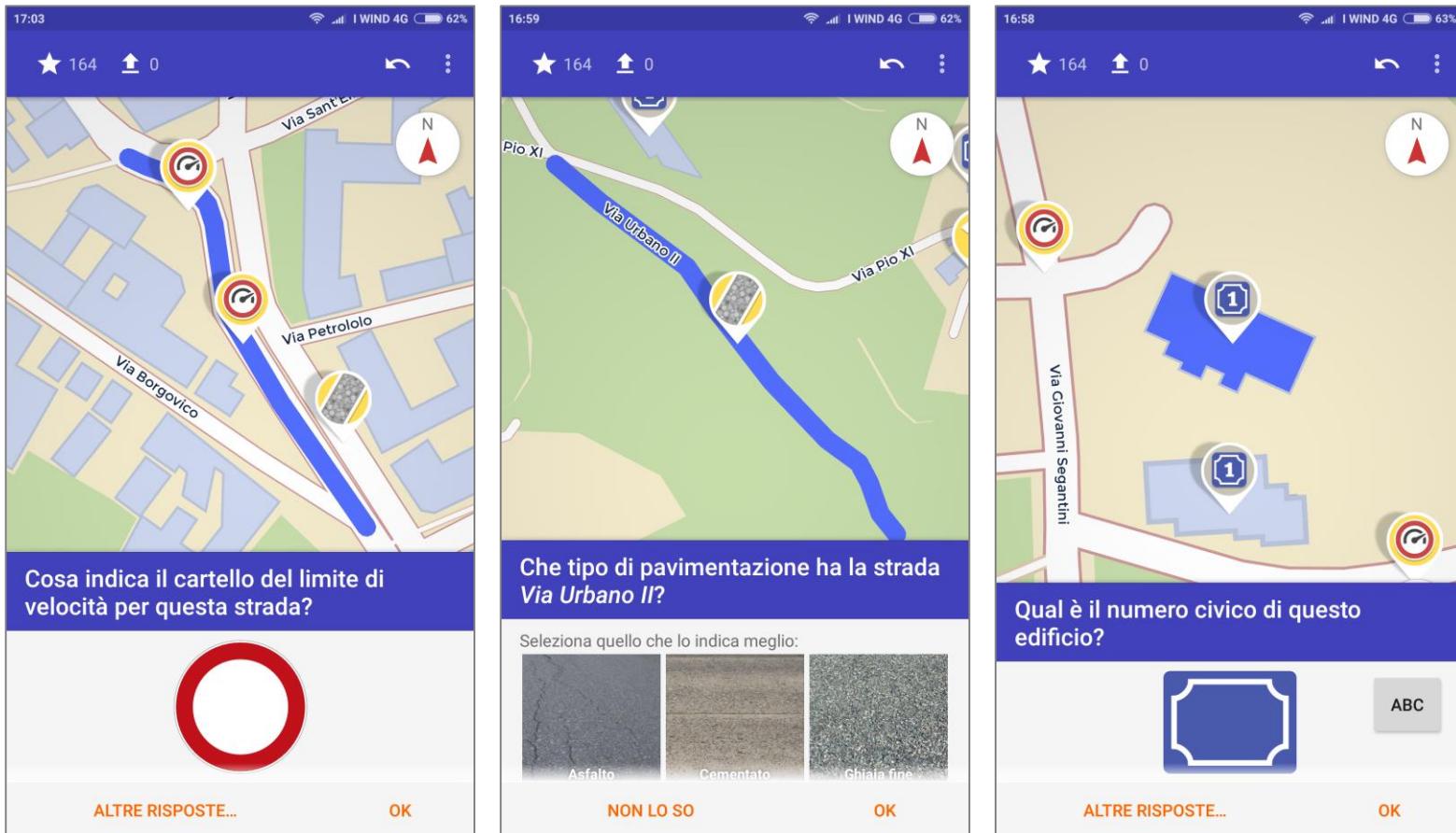
- OSM editors include:
 - MAPS.ME: Android/iOS app to add OSM nodes and navigate



<https://wiki.openstreetmap.org/wiki/MAPS.ME>

How to add/edit OpenStreetMap data?

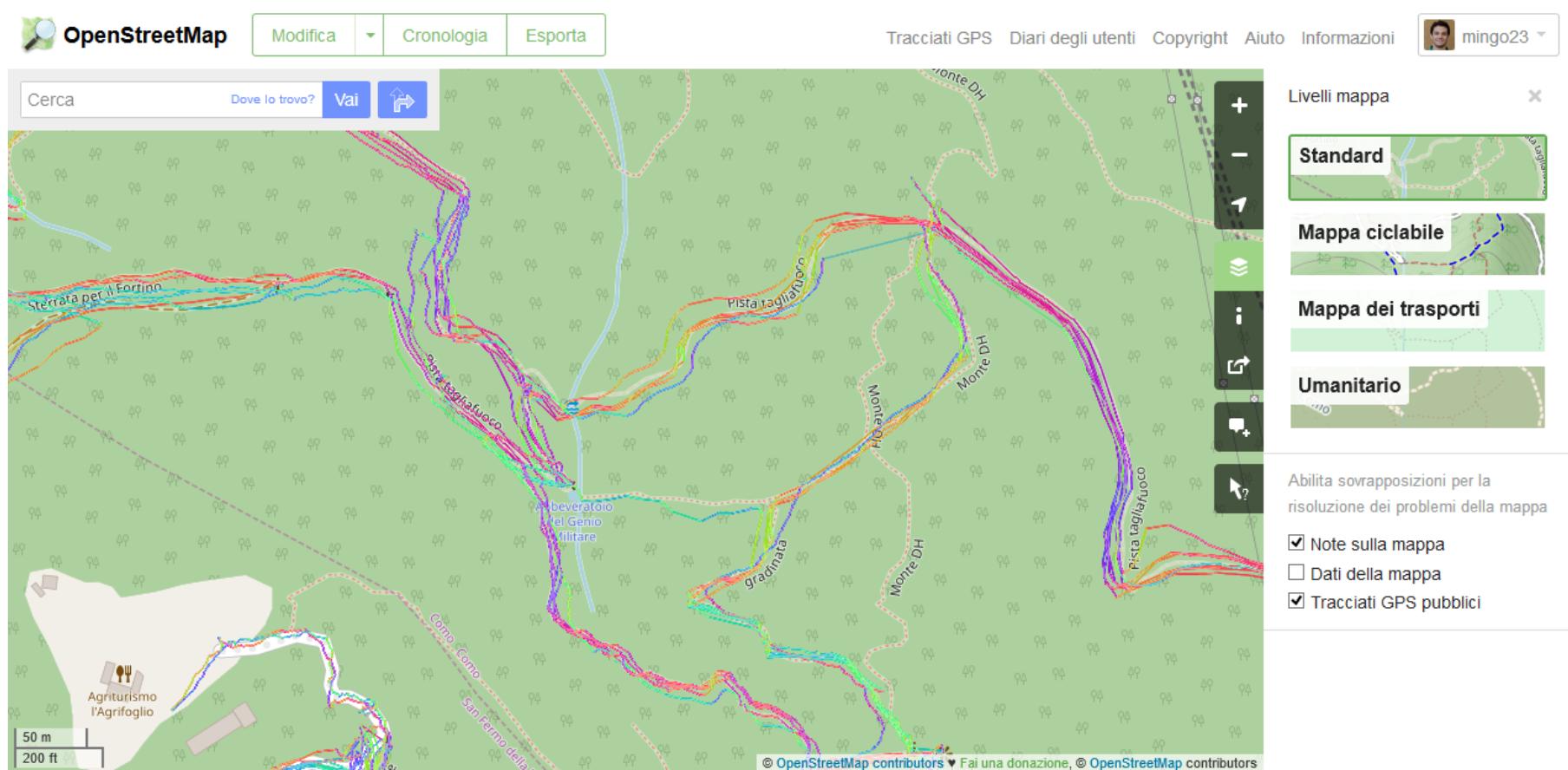
- OSM editors include:
 - StreetComplete: Android app to add street-related tags



<https://wiki.openstreetmap.org/wiki/StreetComplete/Quests>

How to add/edit OpenStreetMap data?

- There are many useful tools to support OSM mapping:
 - GPS receivers: crucial to add map data not visible from imagery



How to add/edit OpenStreetMap data?

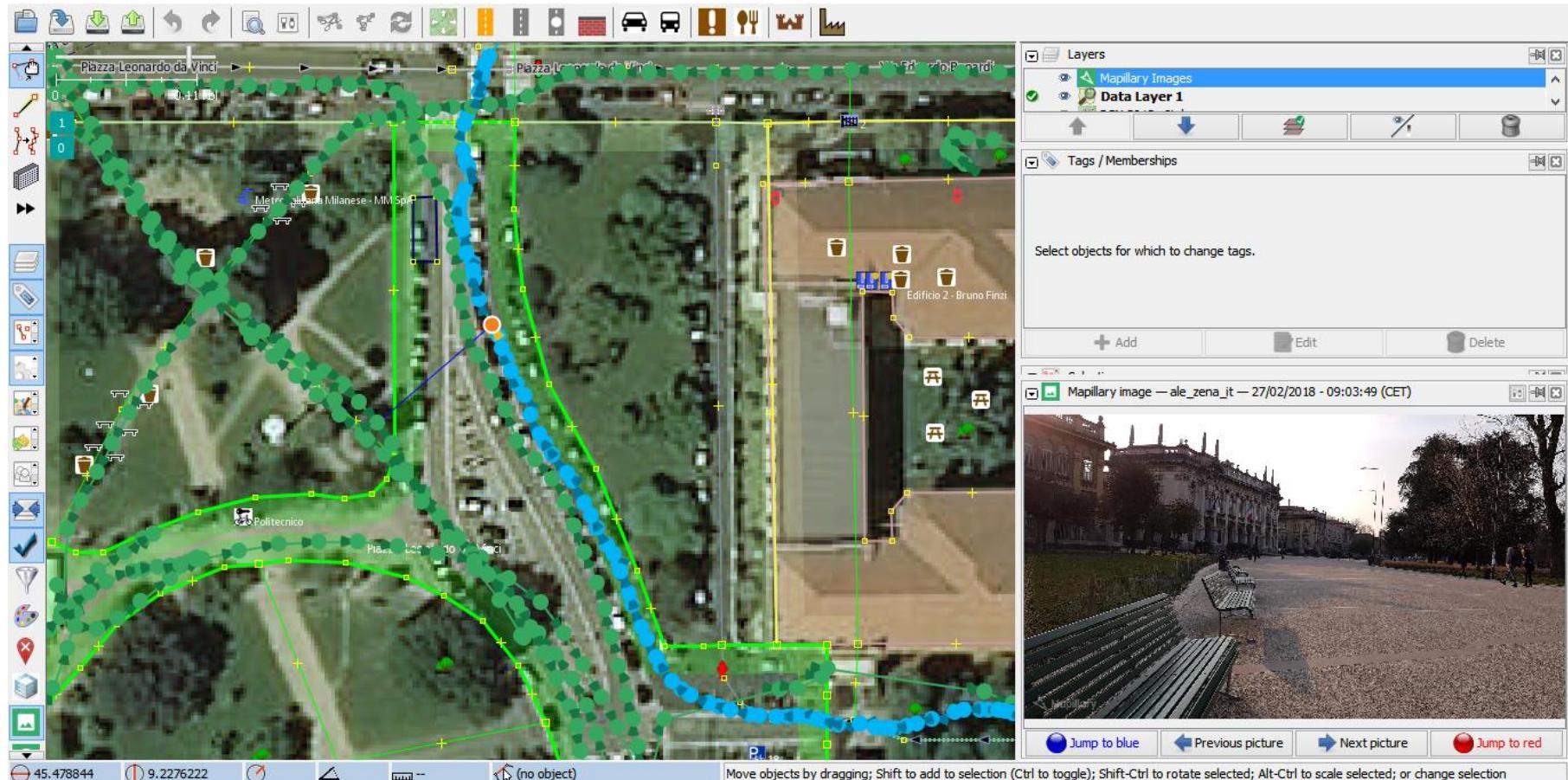
- There are many useful tools to support OSM mapping:
 - **Field Papers**: a service to generate & print the OSM map of any area to be used to take notes during field survey



<http://fieldpapers.org>

How to add/edit OpenStreetMap data?

- There are many useful tools to support OSM mapping:
 - Mapillary: an open collection of street-level imagery

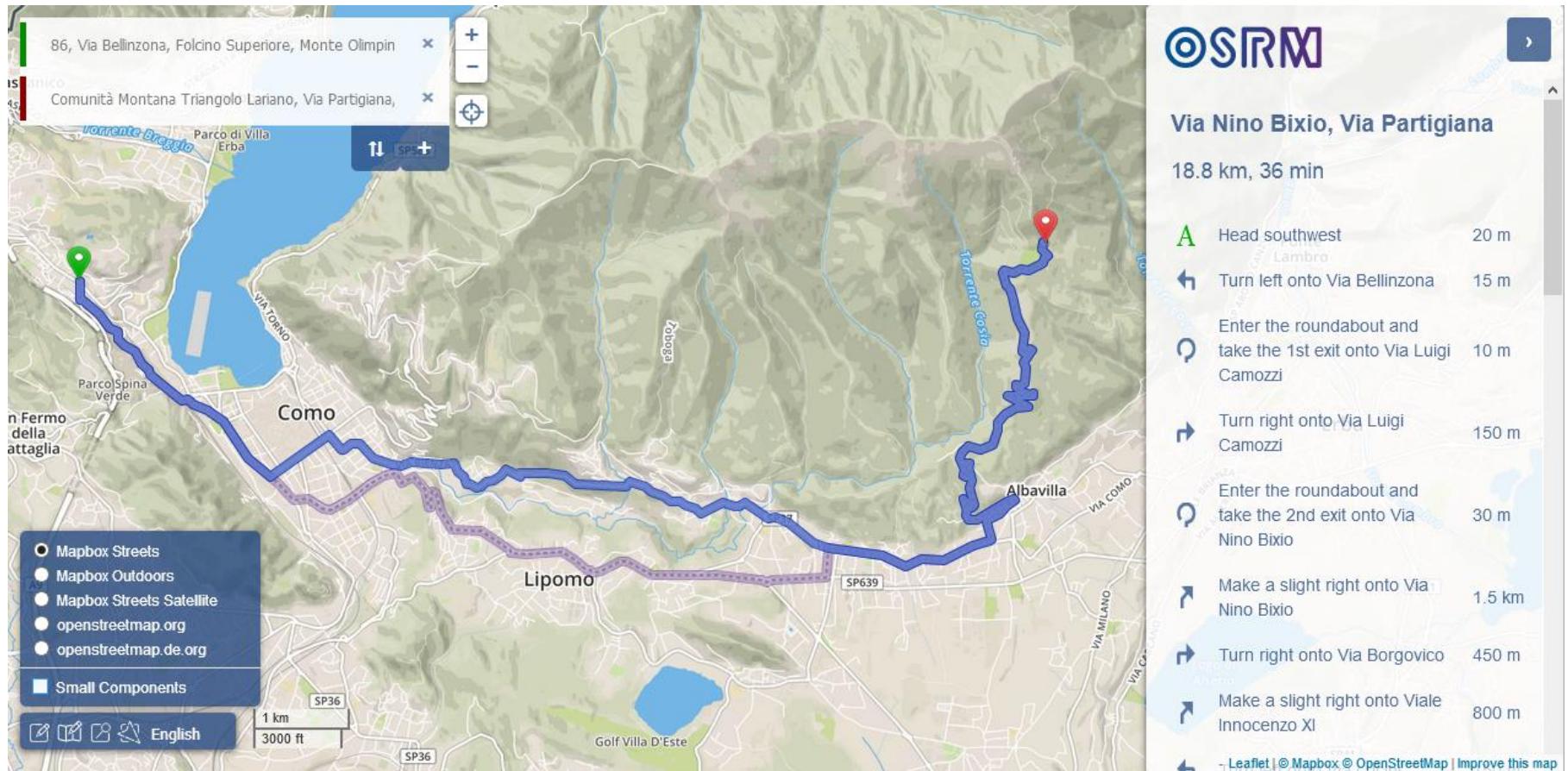


<https://www.mapillary.com>

Software – Routing

How to compute routes using OSM roads?

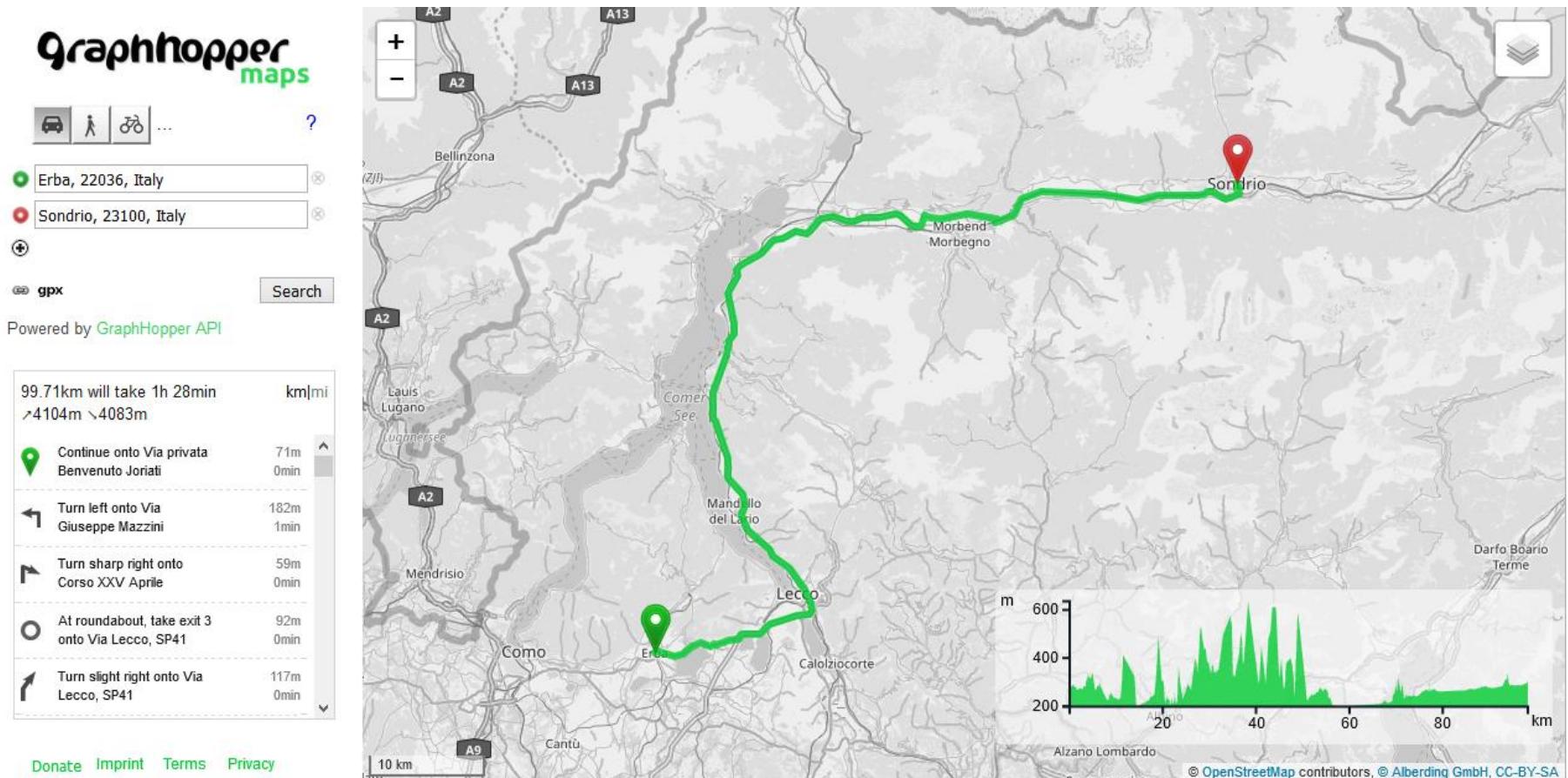
- There are many OSM-based routing services:
 - Open Source Software Machine (OSRM): OSM C++ routing library



<http://project-osrm.org>

How to compute routes using OSM roads?

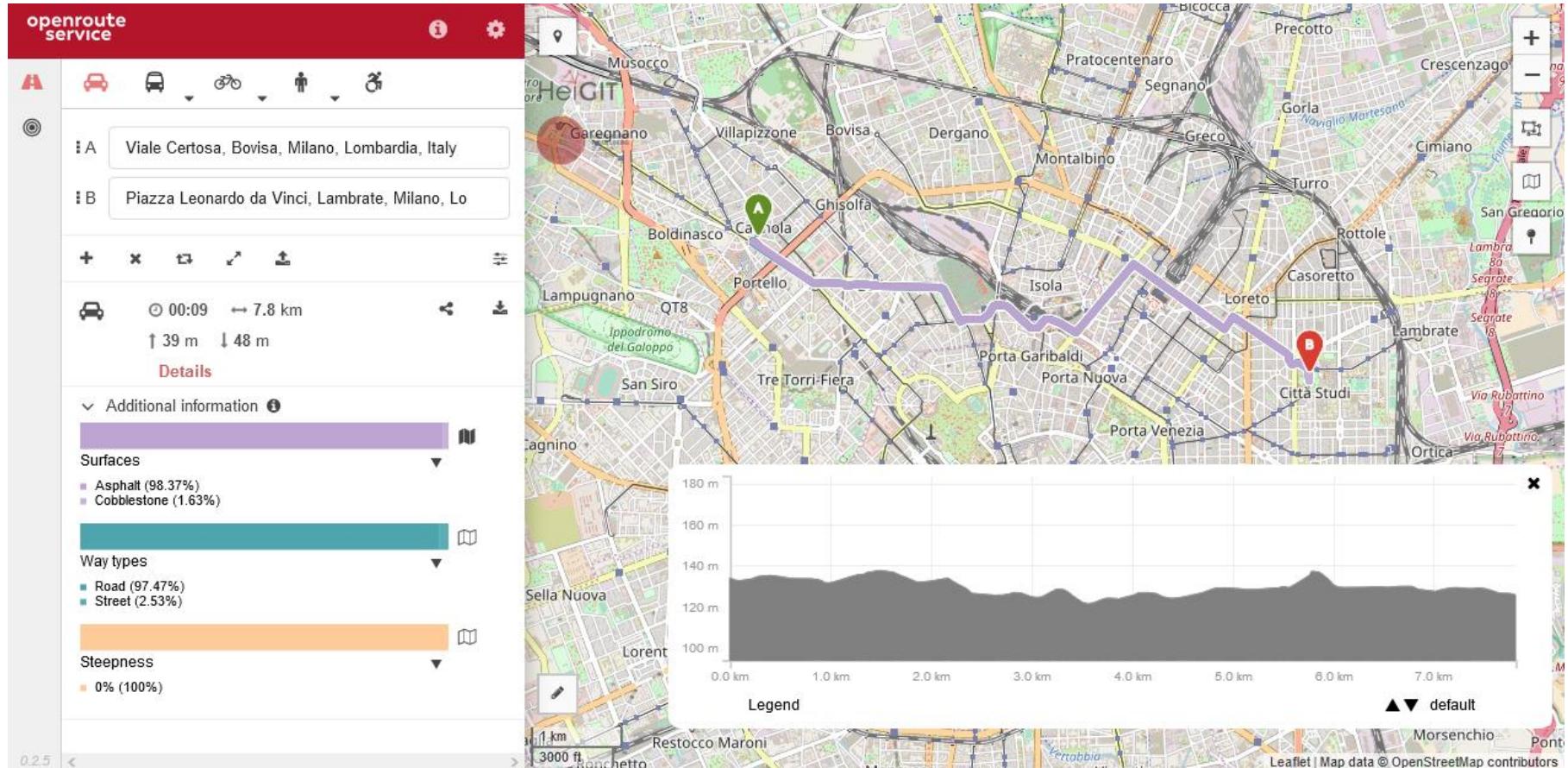
- There are many OSM-based routing services:
 - GraphHopper: OSM-based API for route planning/optimization



<https://www.graphhopper.com>

How to compute routes using OSM roads?

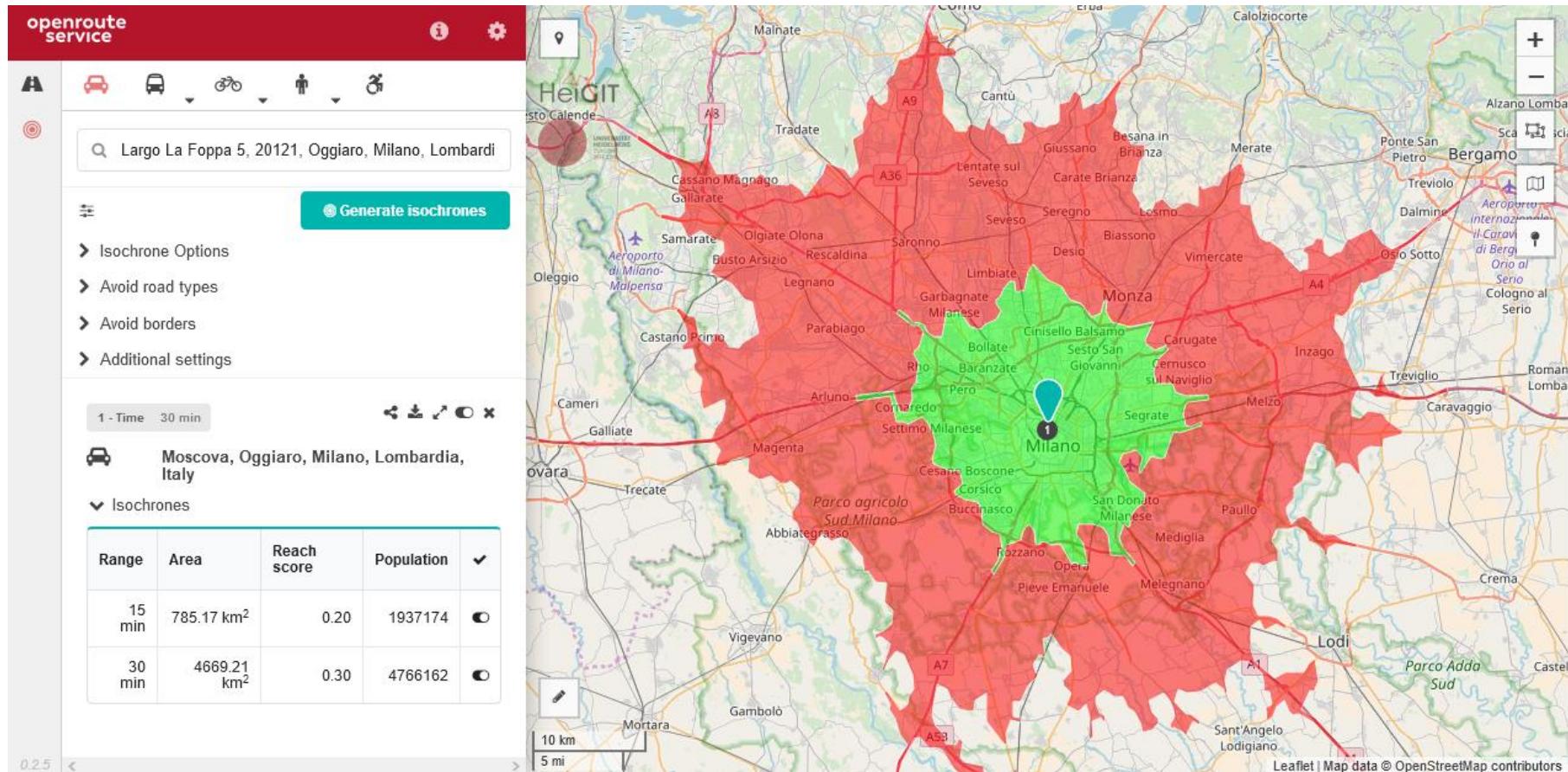
- There are many OSM-based routing services:
 - OpenRouteService: variety and richness of routing settings/outputs



<https://maps.openrouteservice.org>

How to compute routes using OSM roads?

- There are many OSM-based routing services:
 - OpenRouteService: variety and richness of routing settings/outputs



<https://maps.openrouteservice.org>

How to compute routes using OSM roads?

- There are many OSM-based routing services:
 - Kurviger: routing service for motorcyclists

Kurviger.de

Route Planning **Round Trips**

Valmadrera, 23868, Lo Albino, Lombardy, Italy

+ **Search**

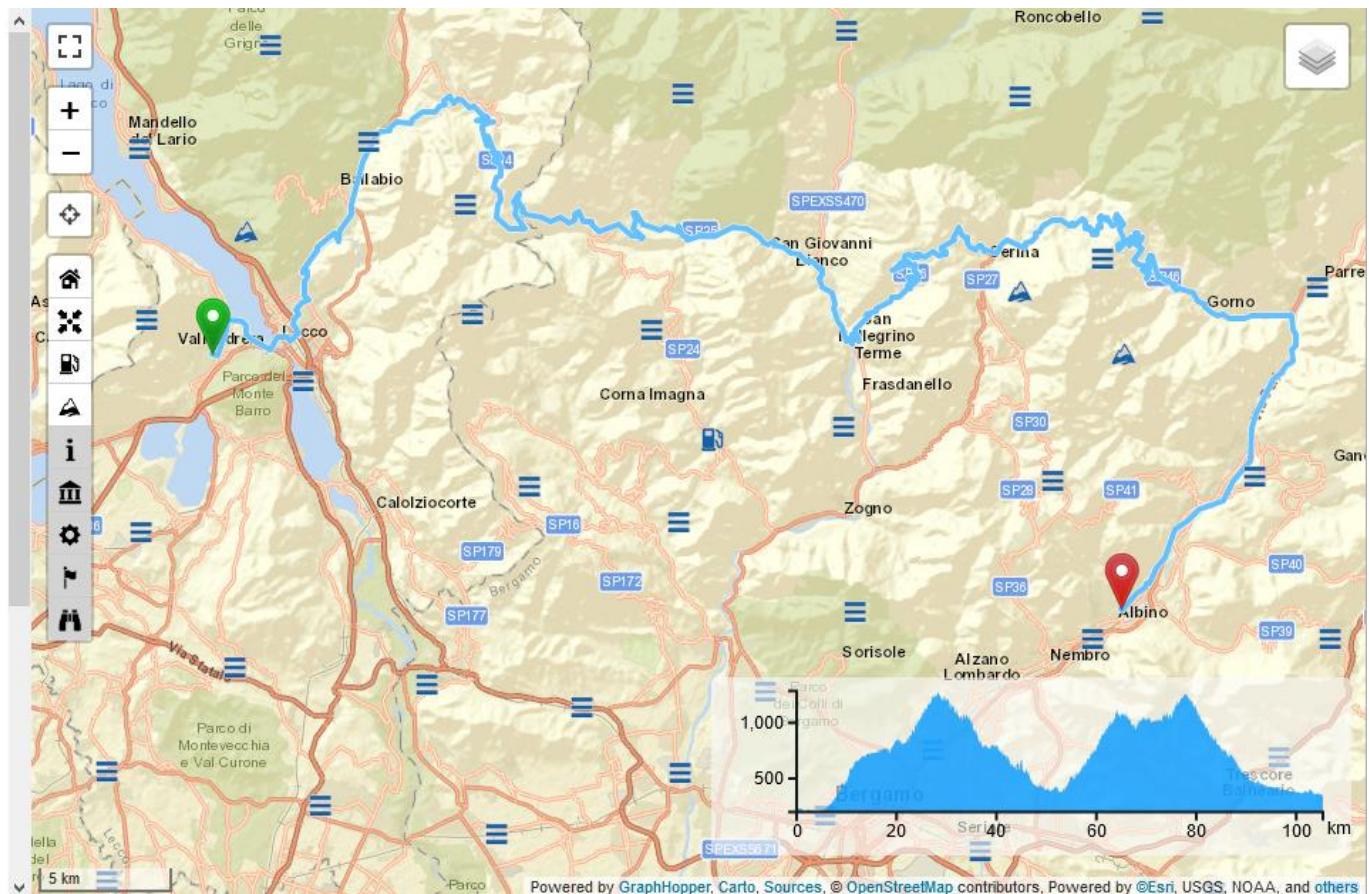
Import Export

Tourcode Turn instructions

Advanced Options

Distance: 112km
Estimated duration: 1h 57min
Altitude: ↗9361m ↘9252m

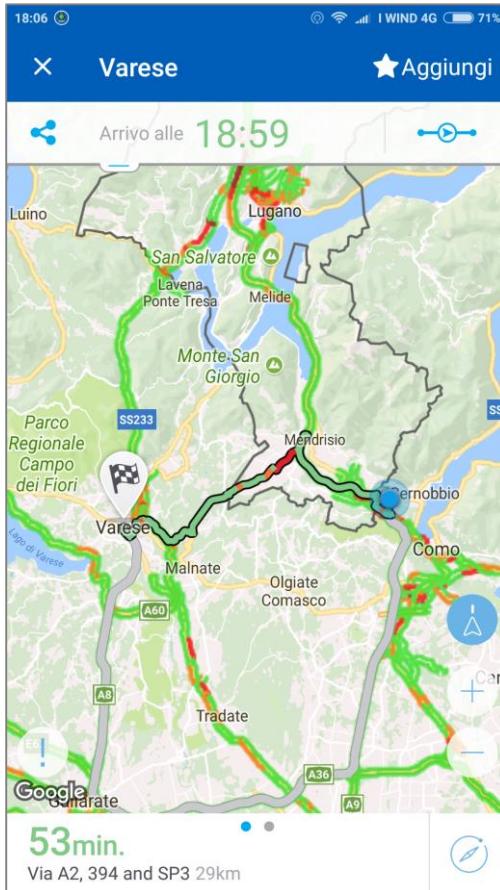
Deutsch Français
Español Nederlands



<https://kurviger.de/en>

How to compute routes using OSM roads?

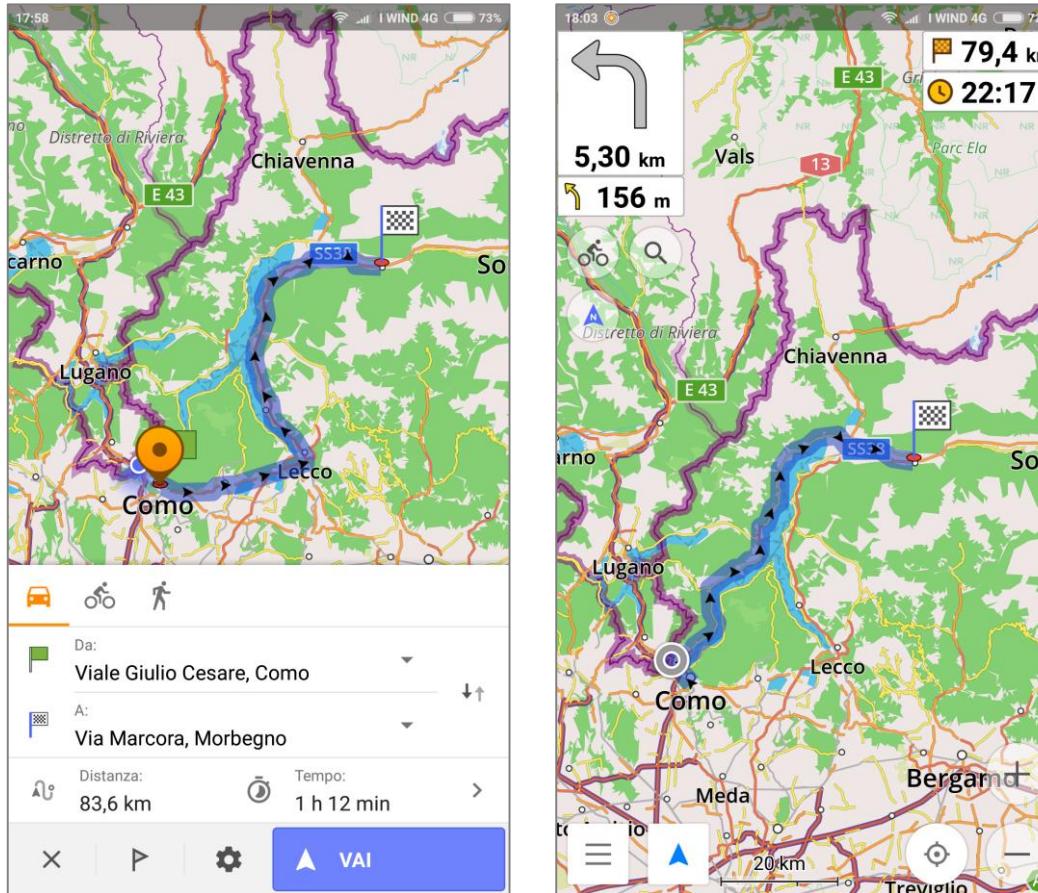
- There are many OSM-based routing services:
 - INRIX Traffic: Android/iOS app for routing, learns user's driving habit



<http://inrix.com/mobile-apps>

How to compute routes using OSM roads?

- There are many OSM-based routing services:
 - INRIX Traffic: Android app for offline maps & routing/navigation



<http://osmand.net>

The OpenStreetMap ecosystem

Data download

How to download OSM data?

- OSM data can be downloaded in many ways:
 - OSM website: download based on a selected area on the map

 OpenStreetMap Modifica Cronologia Esporta Tracciati GPS Diari degli utenti Copyright Aiuto Informazioni mingo23 ▾

Cerca Dove lo trovo? Vai ↗

Esporta

45.81318	9.07955	9.08337
45.81146		

Licenza

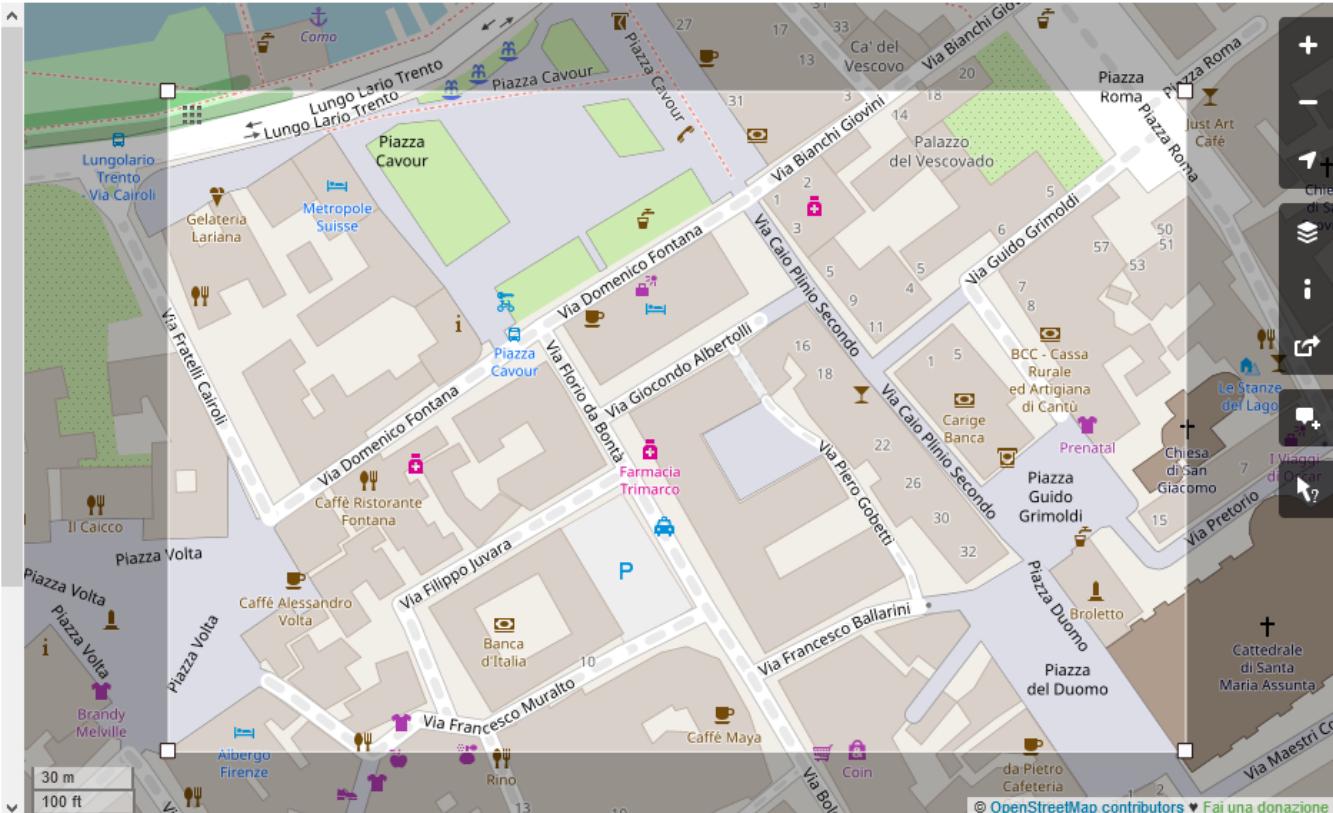
I dati OpenStreetMap sono rilasciati con licenza Open Data Commons Open Database (ODbL).

Esporta

Se le esportazioni riportate sopra non riescono, prova con una delle fonti elencate di seguito:

[Overpass API](#)
Scarica questo riquadro di selezione da un mirror del database di OpenStreetMap

[Pianeta OSM](#)
Copia aggiornate regolarmente del database OpenStreetMap completo



<https://www.openstreetmap.org>

How to download OSM data?

- OSM data can be downloaded in many ways:
 - **Planet OSM**: the complete OSM database (including history)



Planet OSM

The files found here are regularly-updated, complete copies of the OpenStreetMap.org database, and those published before the 12 September 2012 are distributed under a Creative Commons Attribution-ShareAlike 2.0 license, those published after are Open Data Commons Open Database License 1.0 licensed. For more information,

[see the project wiki](#).

Complete OSM Data

[Latest Weekly Planet XML File](#)

65 GB, created 2 days ago.

md5: 174fba36c1ad1be4324cea573de429df.

[Latest Weekly Changesets](#)

2.2 GB, created 2 days ago.

md5: 90f90b5a01416ac88379b6a6216347be.

[Latest Weekly Planet PBF File](#)

40 GB, created 2 days ago.

md5: 80f22f7ad2996f36aebe0be74ed0a2ad.

<https://planet.openstreetmap.org>



Planet OSM

The files found here are complete copies of the OpenStreetMap.org database, including editing history. These are published under an Open Data Commons Open Database License 1.0 licensed. For more information, [see the project wiki](#).

Complete OSM Data History

[Latest Full History Planet XML File](#)

99 GB, created 2 days ago.

md5: c404d82c255d76106441db844c7178bf.

[Latest Full History Planet PBF File](#)

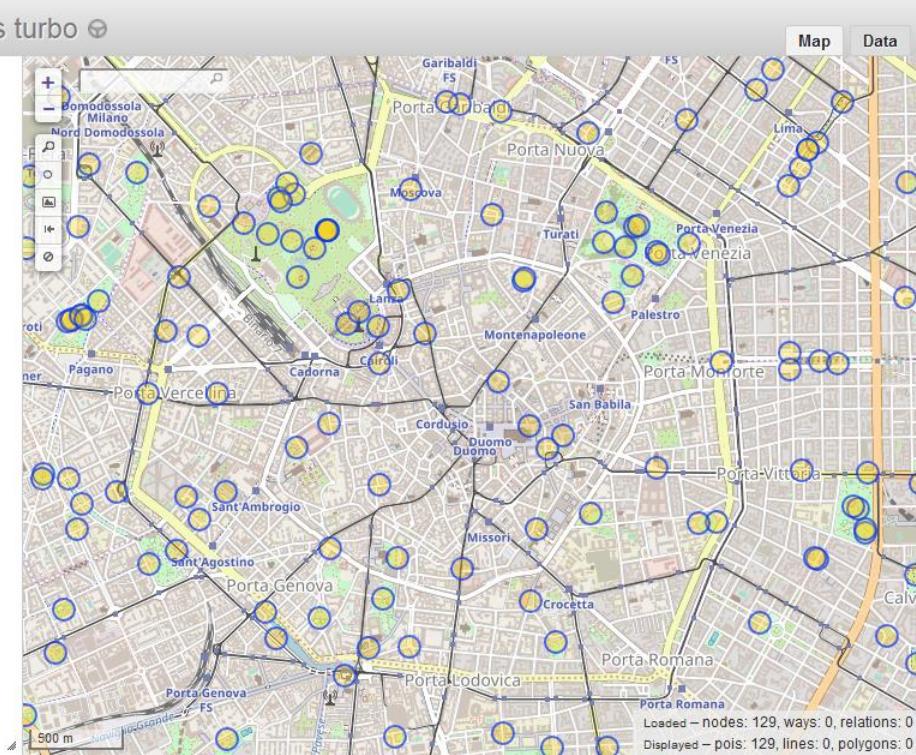
65 GB, created 2 days ago.

md5: 4815ac8b6da2b3a073cd91da79f8a4dd.

<https://planet.openstreetmap.org/planet/full-history>

How to download OSM data?

- OSM data can be downloaded in many ways:
 - OSM API: read/write access to the OSM database
 - Overpass API: read-only API – a powerful frontend is Overpass Turbo



The screenshot shows the Overpass Turbo interface. At the top, there's a toolbar with buttons for Run, Share, Export, Wizard, Save, Load, Settings, and Help. The title bar says "overpass turbo". Below the toolbar is a code editor window containing the following Overpass query:

```

1 /*
2 This has been generated by the overpass-turbo wizard.
3 The original search was:
4 "drinking water"
5 */
6 [out:json][timeout:25];
7 // gather results
8 (
9   // query part for: "drinking water"
10   node["amenity"="drinking_water"]((bbox));
11 );
12 // print results
13 out body;
14 >;
15 out skel qt;

```

To the right of the code editor is a map of Milan, Italy, showing a dense network of streets and various locations marked with yellow circles. These circles represent the locations of drinking water points found by the query. The map includes labels for several neighborhoods and landmarks, such as Garibaldi, FS, Porta Nuova, Porta Venezia, and the Duomo.

<https://wiki.openstreetmap.org/wiki/API>

https://wiki.openstreetmap.org/wiki/Overpass_API | <http://overpass-turbo.eu>

How to download OSM data?

- Some predefined extracts of OSM are also made available:
 - Geofabrik: country-level data extracts

GEOFABRIK downloads

Download OpenStreetMap data for this region:

Europe

[\[one level up\]](#)

Commonly Used Formats

- [europe-latest.osm.pbf](#), suitable for Osmium, Osmosis, imposm, osm2pgsql, mkgmap, and others. This file was last modified 10 hours ago and contains all OSM data up to 2018-04-13T20:43:02Z. File size: 20.4 GB; MD5 sum: [2c819686408d677b16d1b62494c4c544](#).
- [europe-latest-free.shp.zip](#) is not available for this region; try one of the sub-regions.

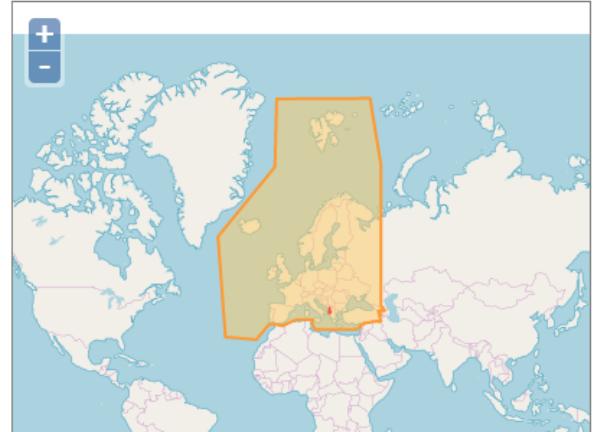
Other Formats and Auxiliary Files

- [europe-latest.osm.bz2](#), yields OSM XML when decompressed; use for programs that cannot process the .pbf format. This file was last modified 1 day ago. File size: 32.2 GB; MD5 sum: [6e06ceb99c8dcf814adb229c661cf66f](#).
- [europe.osh.pbf](#), a file that contains the full OSM history for this region for processing with e.g. osmium. This file was last modified 2 days ago. File size: 33.5 GB; MD5 sum: [26feb46113339304715839206355c0f5](#).
- [.poly file](#) that describes the extent of this region.
- [.osc.gz files](#) that contain all changes in this region, suitable e.g. for Osmosis updates
- [raw directory index](#) allowing you to see and download older files

Sub Regions

Click on the region name to see the overview page for that region, or select one of the file extension links for quick access.

Sub Region	Quick Links		
	.osm.pbf	.shp.zip	.osm.bz2
Albania	[.osm.pbf] (26.5 MB)	[.shp.zip]	[.osm.bz2]
Andorra	[.osm.pbf] (1.5 MB)	[.shp.zip]	[.osm.bz2]



 Not what you were looking for? Geofabrik is a consulting and software development firm based in Karlsruhe, Germany specializing in OpenStreetMap services. We're happy to help you with data preparation, processing, server setup and the like. [Check out our web site](#) and contact us if we can be of service.

<http://download.geofabrik.de>

How to download OSM data?

- Some predefined extracts of OSM are also made available:
 - OSMaxx: predefined and customized data extracts

OSMaxx / Existing excerpt export

To delete your own non-public excerpts go to [excerpt management](#).

Export options

GIS export formats

- Esri File Geodatabase (~7 GB)
- Esri Shapefile (~37 GB)
- GeoPackage (~18 GB)
- SpatiaLite (~17 GB)
- Garmin navigation & map data (~423 MB)
- OSM Protocolbuffer Binary Format (~472 MB)

GIS options (ignored for Garmin and PBF)

Coordinate system: UTM Zone 32, northern hemisphere

Detail level: Full detail

Export (will take around 30 minutes)

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<https://osmaxx.hsr.ch>

How to download OSM data?

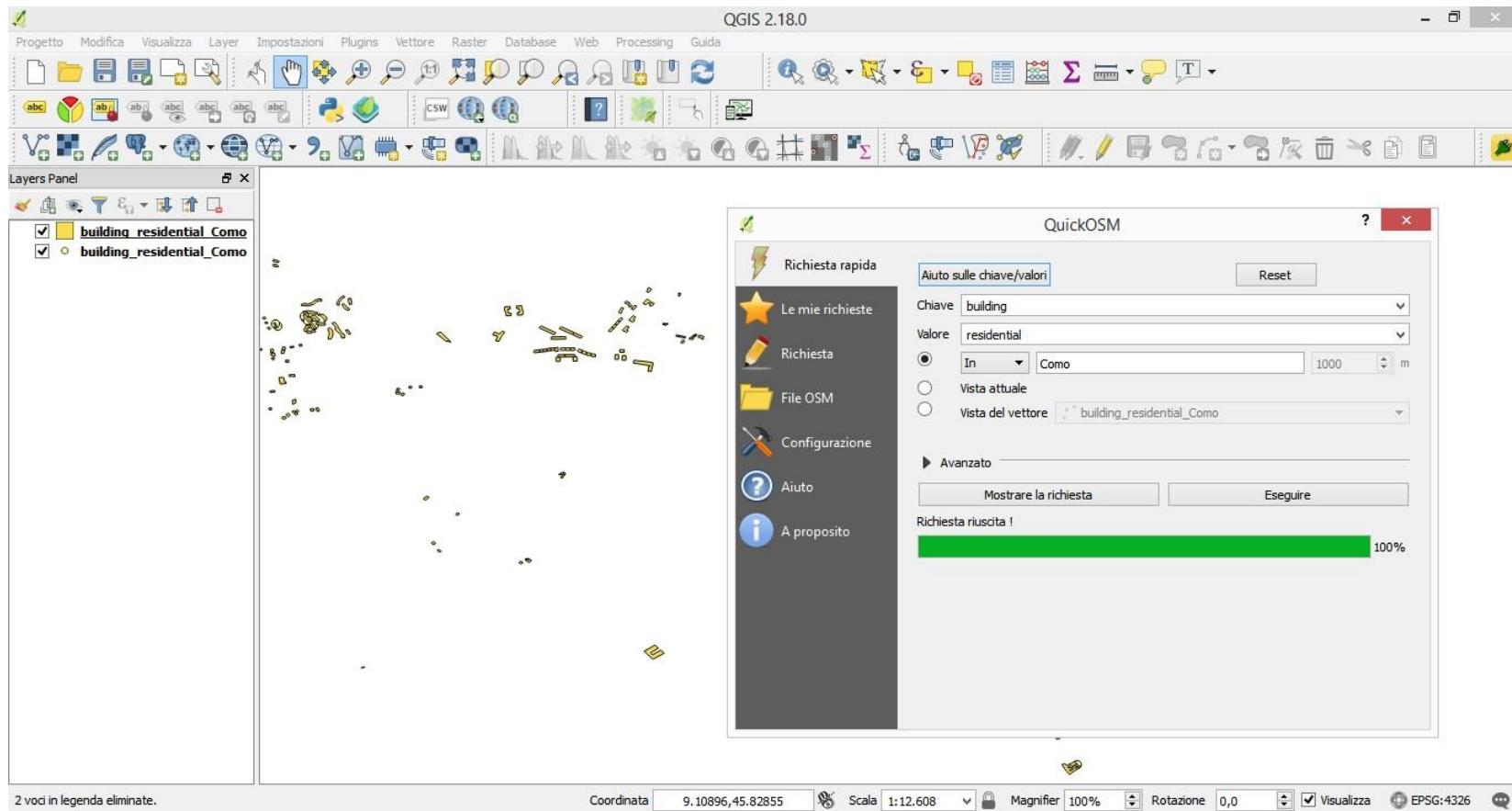
- Some predefined extracts of OSM are also made available:
 - **HOT Export Tool**: customized data extracts created in near real-time

The screenshot shows the HOT Export Tool interface. On the left, there's a sidebar with a red 'HOT' logo and the text 'EXPORT TOOL'. Below it, a navigation bar has tabs: '1 Describe' (selected), '2 Formats', '3 Data', and '4 Summary'. Under 'File Formats', several options are listed with checkboxes: Shapefile (.shp) (checked), GeoPackage (.gpkg) (unchecked), Garmin (.img) (unchecked), Google Earth (.kml) (checked), OSM (.xml) (unchecked), OSM (.pbf) (unchecked), MAPS.ME (.mwm) (unchecked), OsmAnd (.obf) (unchecked), and MBTiles (.mbtiles) (unchecked). A 'Next' button is at the bottom right of this section. At the very bottom left, a message says 'OpenStreetMap database last updated 2 minutes ago'. On the right side, the main area shows a map of Puerto Rico with a blue polygon highlighting the 'Area Of Interest (AOI)'. The map includes labels for San Juan, Arecibo, Moca, Mayagüez, Ponce, Guánica, Caguas, Ceiba, and the Virgin Islands. A search bar at the top right contains 'puerto rico'. To the right of the map is a vertical 'Tools' panel with icons for 'SEARCH', 'BOX', 'DRAW', 'THIS VIEW', and 'IMPORT'. At the bottom right of the main area, there's a 'ZOOM TO SELECTION' button and a copyright notice: '© OpenStreetMap contributors. © Mapbox'.

<https://export.hotosm.org/en/v3/exports>

How to download OSM data?

- Plugins to download OSM data are available for desktop GIS software:
 - Quick OSM: QGIS plugin to extract customized OSM data



<https://plugins.qgis.org/plugins/QuickOSM>

Humanitarian applications

Humanitarian OpenStreetMap Team (HOT)

- Born after the Haiti earthquake in 2010 to coordinate collaborative OSM mapping in areas affected by natural disasters or humanitarian crises



Humanitarian
Open Street Map
Team

<https://www.hotosm.org>

@hotosm



https://www.youtube.com/watch?v=oNZ_ZBCTRqc

Missing Maps

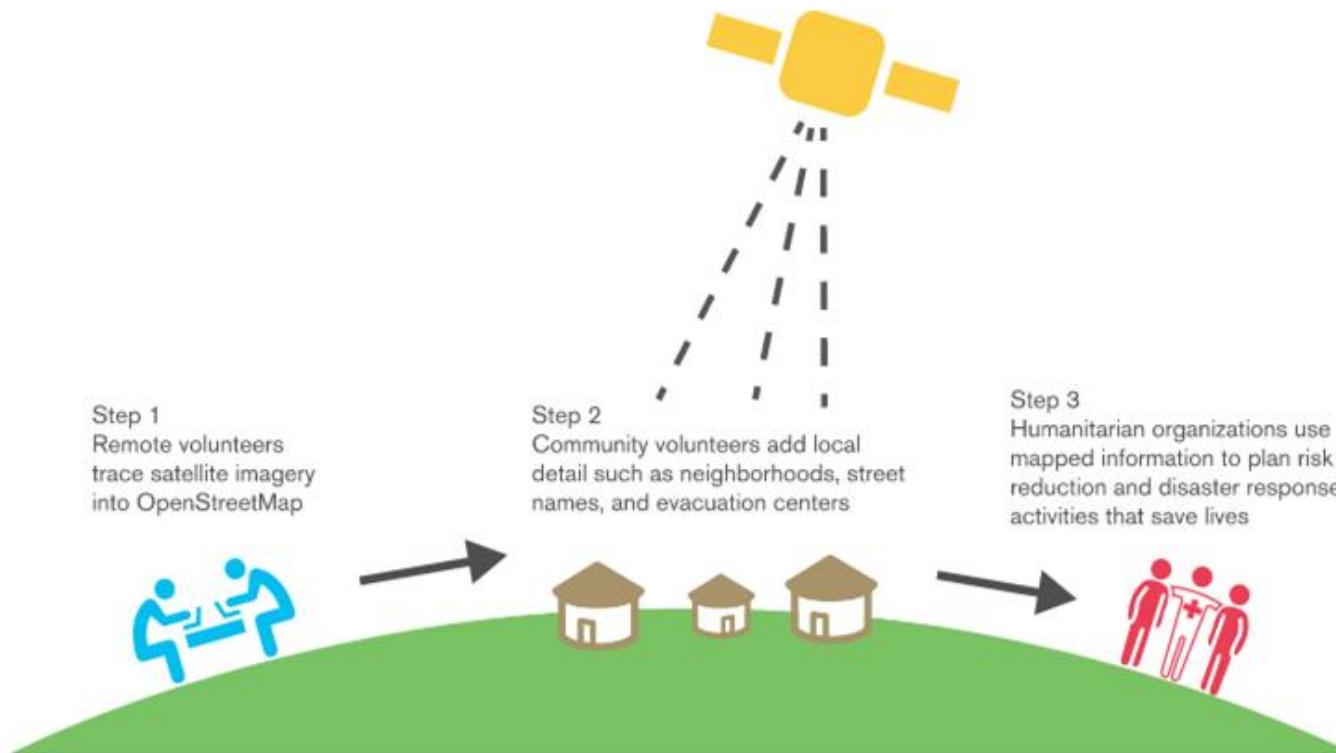
- Focused on anticipating humanitarian crises by identifying and mapping the most vulnerable areas of the world where maps do not exist.



**MISSING
MAPS**

<http://www.missingmaps.org>

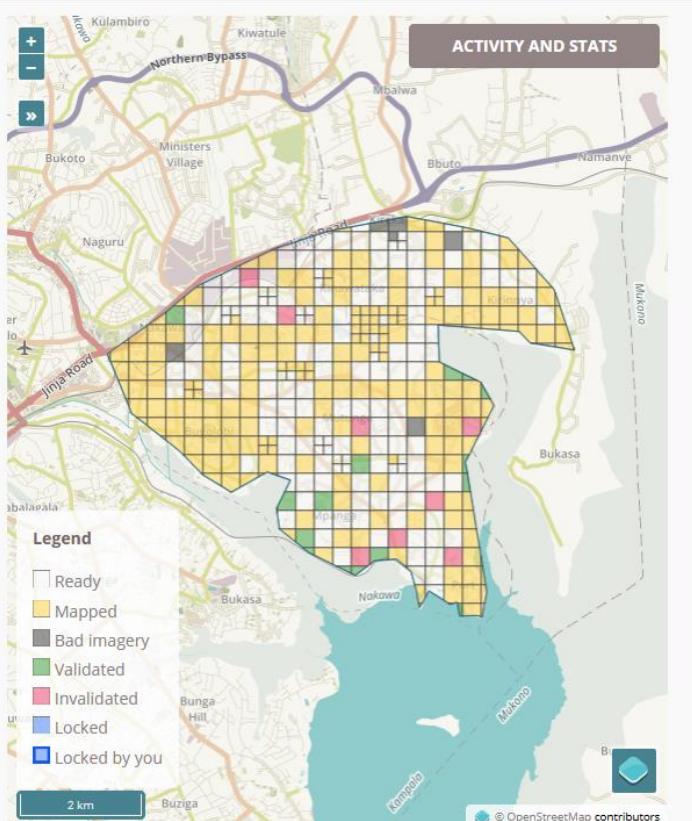
@TheMissingMaps 



How to use OSM for humanitarian applications?

- The main software tools used for humanitarian applications include:
 - HOT Tasking Manager:** coordinated mapping/validation & monitoring


TASKING MANAGER
[Contribute](#)
[Learn](#)
[About](#)
[What is New?](#)
English ▾
mingo23 ▾

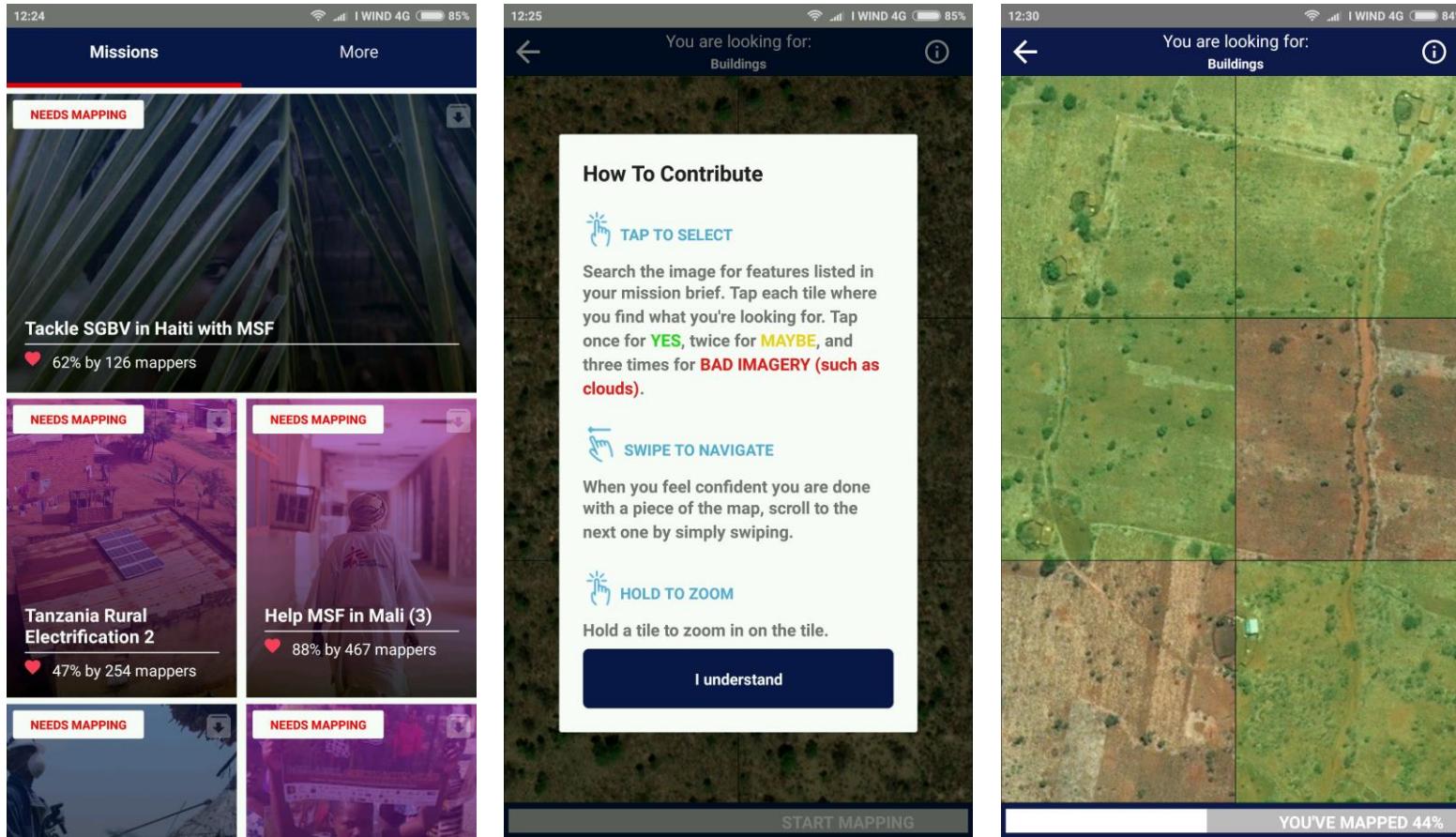


The screenshot shows the HOT Tasking Manager interface. On the left, there's a sidebar with 'Instructions' for mapping buildings only, a 'Changeset Comment' section with the hashtag #hotosm-project-4371, and sections for 'Imagery' (using tms[22] URL) and 'Shelters'. On the right is a map of Kampala, Uganda, with a large yellow grid overlay indicating areas assigned for building mapping. A legend on the map defines colors for different mapping statuses: white for 'Ready', yellow for 'Mapped', dark grey for 'Bad imagery', green for 'Validated', pink for 'Invalidate', blue for 'Locked', and blue with a lock icon for 'Locked by you'. A scale bar indicates 2 km.

<https://tasks.hotosm.org>

How to use OSM for humanitarian applications?

- The main software tools used for humanitarian applications include:
 - MapSwipe: Android/iOS app for image humanitarian classification

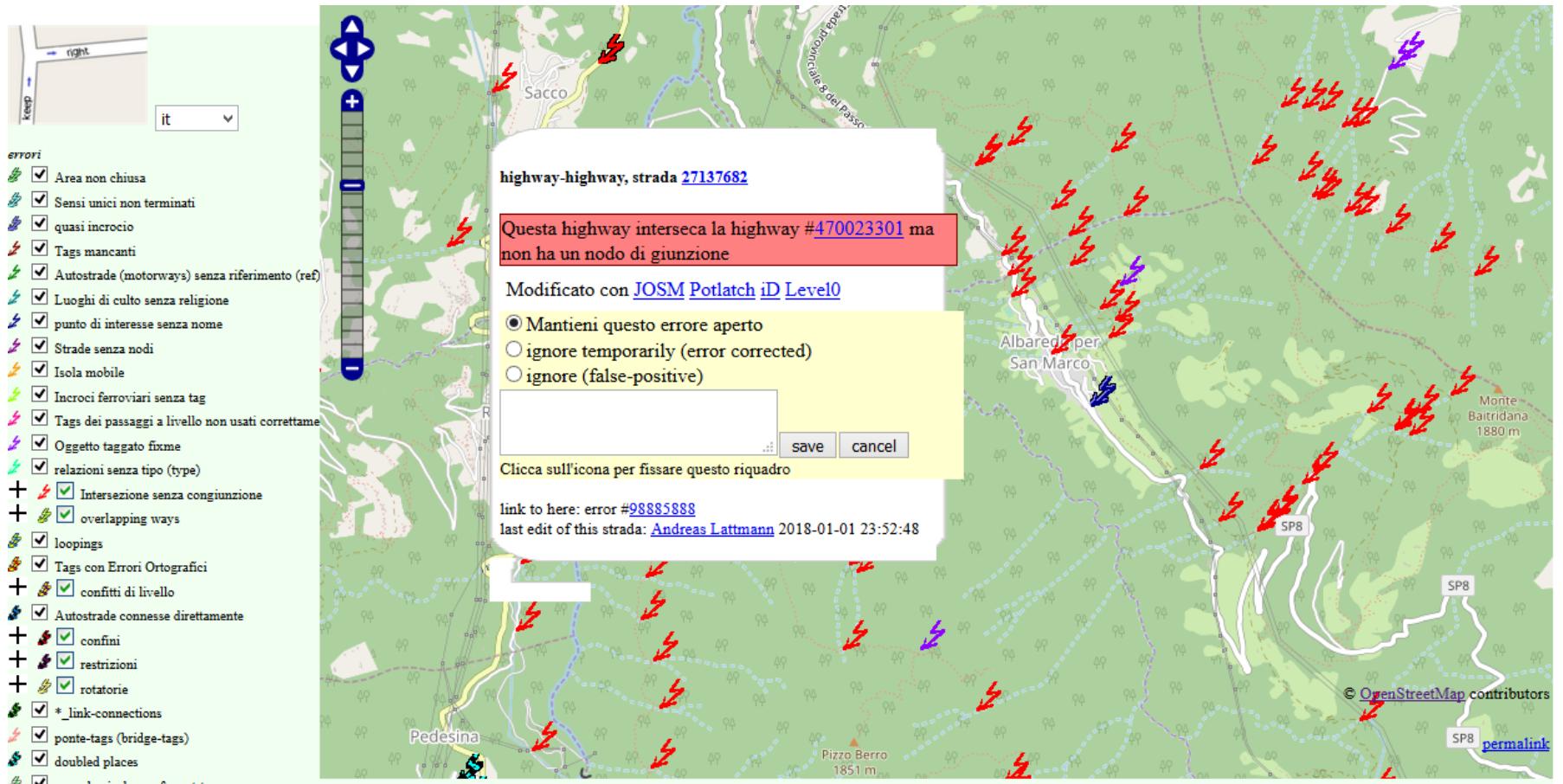


<https://mapswipe.org>

Quality assurance/ Quality control

How to check the quality of OSM data?

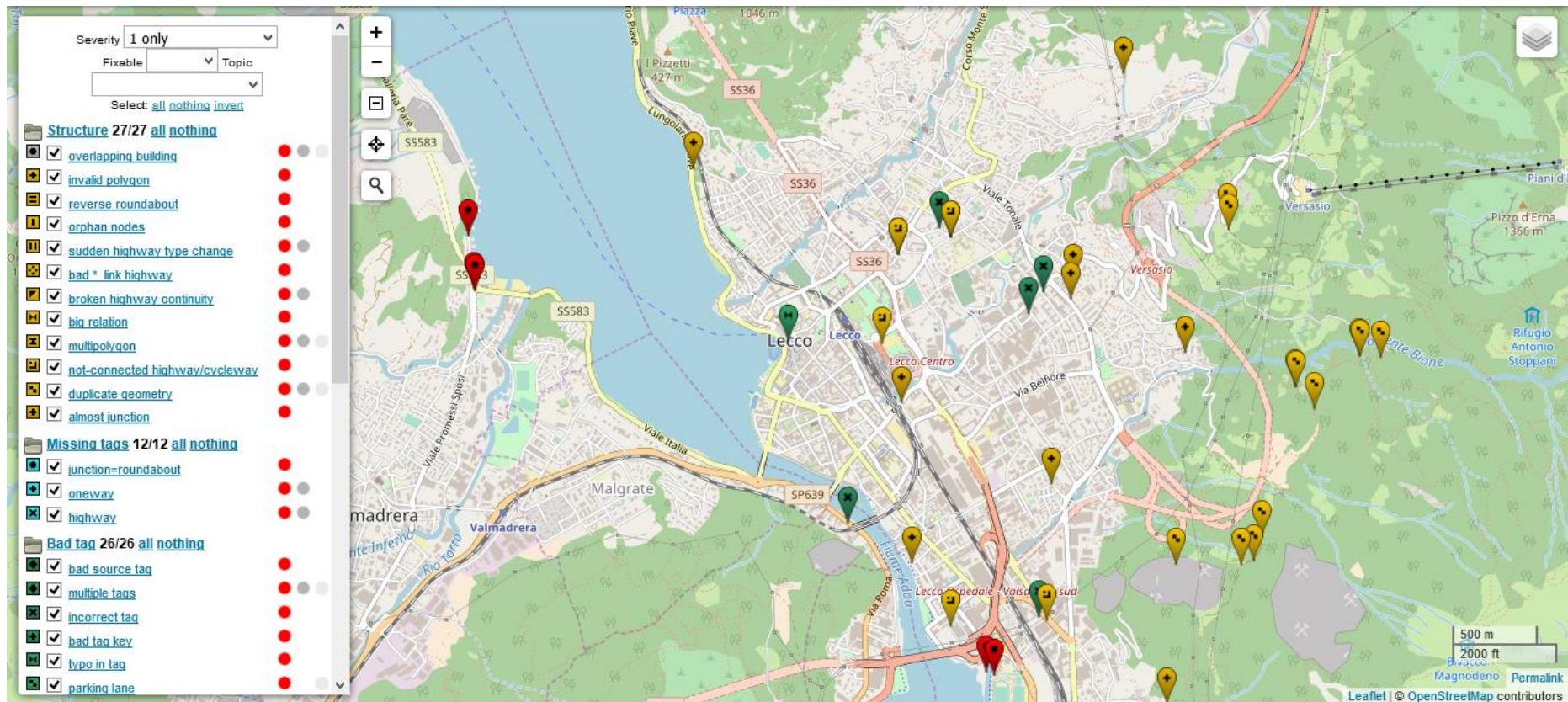
- Many tools are available to check for mistake/inconsistencies in OSM data:
 - KeepRight: highlights errors in tags and geometry/topology



http://keepright.ipax.at/report_map.php

How to check the quality of OSM data?

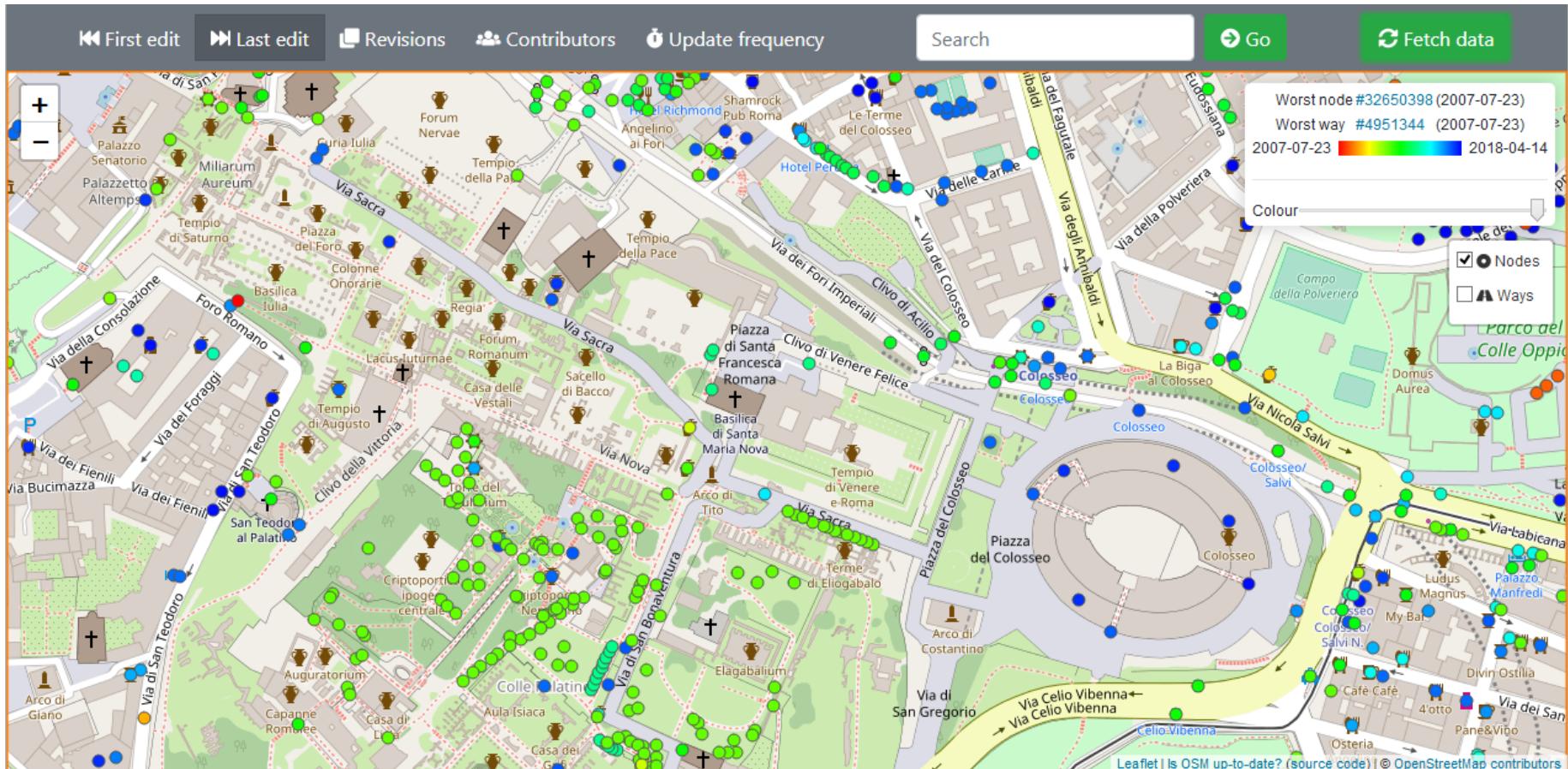
- Many tools are available to check for mistake/inconsistencies in OSM data:
 - Osmose: highlights errors in tags and geometry/topology



<http://osmose.openstreetmap.fr/en/map>

How to check the quality of OSM data?

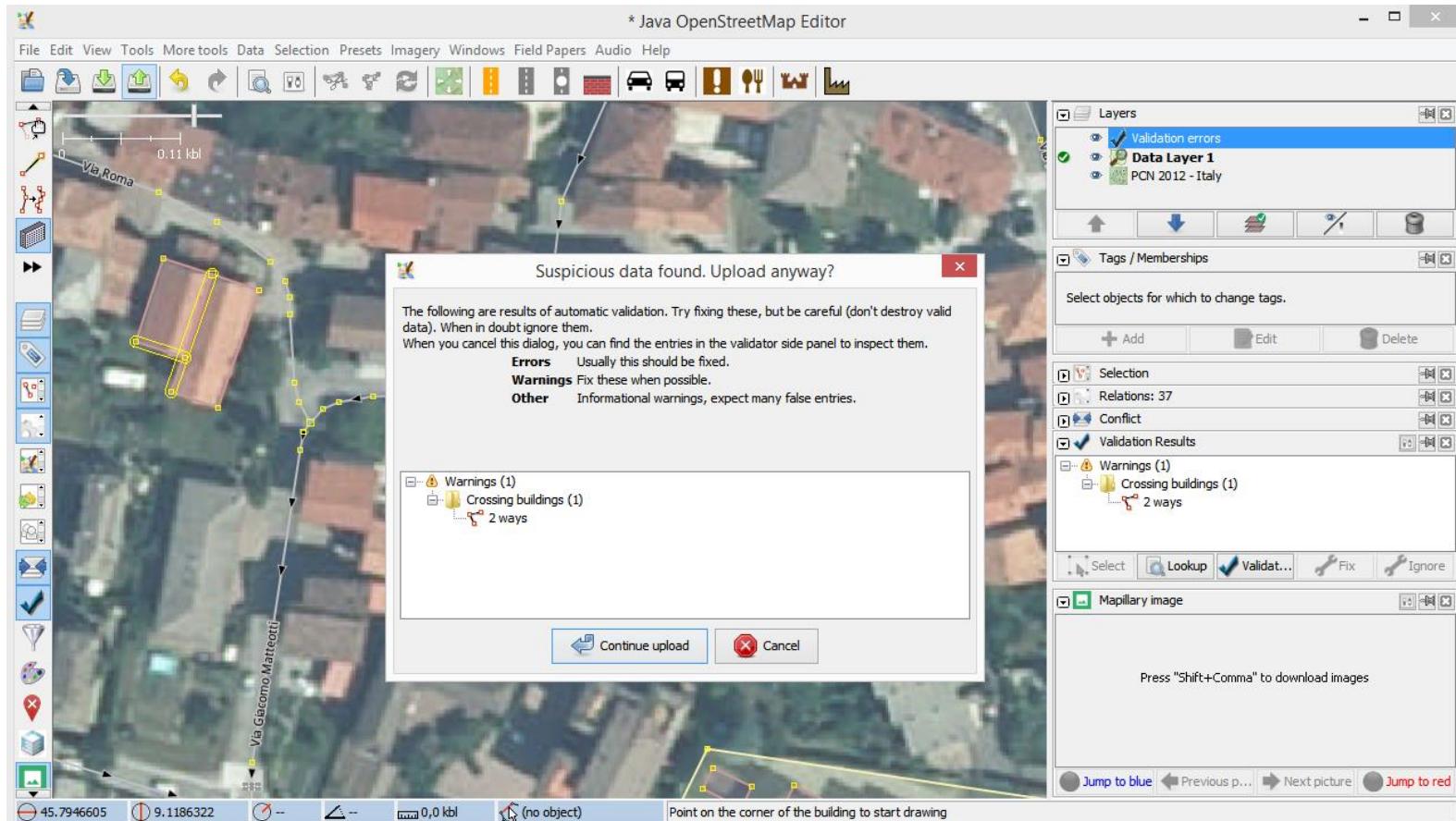
- Many tools are available to check for mistake/inconsistencies in OSM data:
 - is OSM up-to-date: qualitative visualizations of OSM temporal history



<https://is-osm-updated.frafra.eu>

How to check the quality of OSM data?

- Many tools are available to check for mistake/inconsistencies in OSM data:
 - JOSM Validator: highlights errors in JOSM before data upload



<https://wiki.openstreetmap.org/wiki/JOSM/Validator>

How to check the quality of OSM data?

- Many tools are available to check for mistake/inconsistencies in OSM data:
 - TagInfo: information & statistics on the usage of OSM tags

taginfo

KEYS · TAGS · RELATIONS · PROJECTS · REPORTS · ABOUT

Data from: 2018-04-14 00:58 UTC

English ▾

building=church

A building that was built as a church.

Comparison list (0 items) ▾ Filter: No filter ▾

XAPI JOSM Level0 Editor Overpass turbo

Overview Combinations Map Wiki Projects

Overview

Type	Number of objects	
All	228 837	0.00%
Node	10 905	0.01%
Way	215 817	0.04%
Relation	2 115	0.04%



<https://taginfo.openstreetmap.org>

How to check the quality of OSM data?

- Many tools are available to check for mistake/inconsistencies in OSM data:
 - [Italian street directory](#): finds mistakes in the Italian street names

The screenshot shows a web-based application for checking street names in Italy. At the top, there is a search bar labeled "Ricerca per nome del Comune" with the placeholder text "Come". Below the search bar is a search button labeled "Cerca". The main area displays a list of results for "Strade a Como".

Street Name	Type	Count	Action
Piazza Pietro Amato Perretta	ortografia	3	[Icon]
SP ex SS35 Statale dei Giovi	DUG non conosciuta	12	[Icon]
Strada Monte Boleto	ortografia	1	[Icon]
Via Adriano Auguadri	ortografia	2	[Icon]
Via Agliati	ortografia	1	[Icon]
Via Alberina		1	[Icon]

<https://osmit3.wmflabs.org/stradario>

The OpenStreetMap ecosystem

Games

How is OSM used in games?

- Many games use OSM as the base map source:

- X-Plane



<http://www.x-plane.com>

- Tom Clancy's The Division



<https://tomclancy-thedivision.ubisoft.com/game/en-us>

- Collapse



<http://collapse-thedivisiongame.ubi.com>

- Pokemon Go



<https://pokemongolive.com>

Contacts

- A nice reference:
 - Mooney P. & Minghini M. (2017) A review of OpenStreetMap data. In: Foody G., See L., Fritz S., Mooney P., Olteanu-Raimond A.-M., Fonte C.C. and Antoniou V. (Eds) *Mapping and the Citizen Sensor*, 37-59. London: Ubiquity Press.
<https://www.ubiquitypress.com/site/books/10.5334/bbf>
- This presentation is available at <https://tinyurl.com/yden2nea>

Thank you!

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