



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

 POLITECNICO DI MILANO



# Digital ecosystem for OpenStreetMap Data

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- 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](http://wiki.openstreetmap.org/wiki/List_of_OSM-based_services)

# Map visualization



# Map visualization

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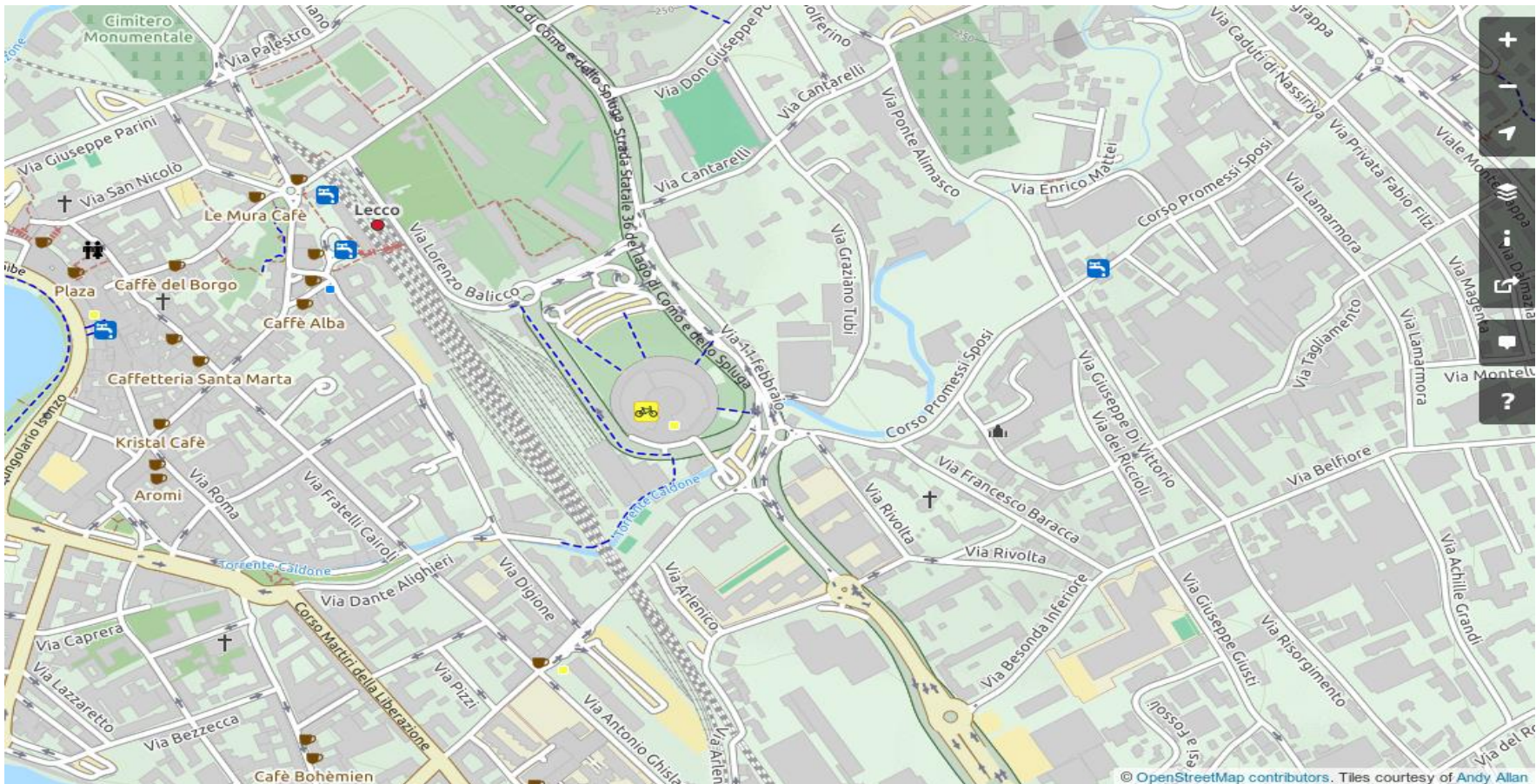
- OSM vector data can be visualized with customized styles:
  - standard visualization



<http://www.openstreetmap.org>



- cycle map visualization



<http://www.openstreetmap.org>





# Map visualization

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



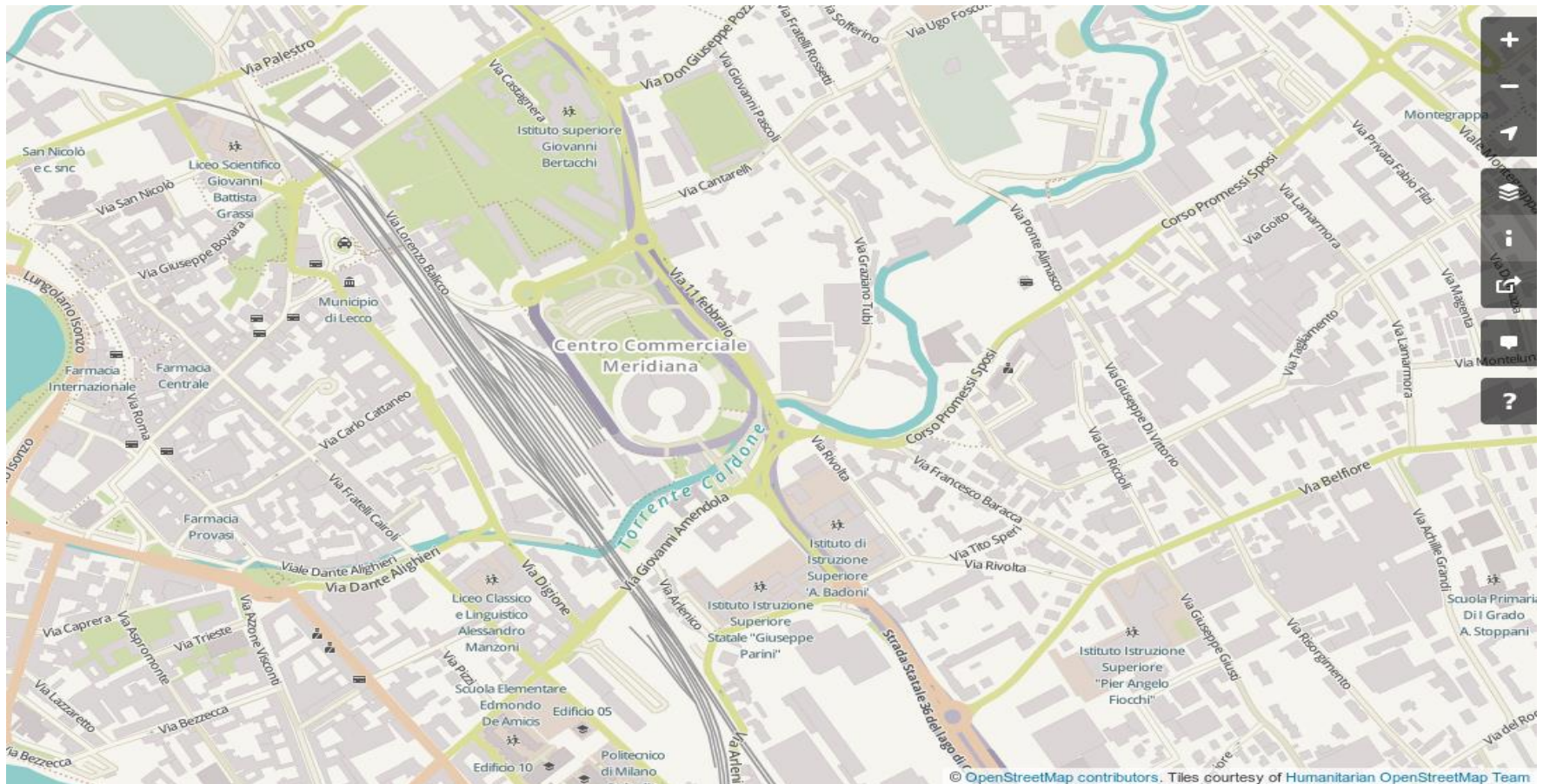
<http://www.openstreetmap.org>



# Map visualization

6

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



<http://www.openstreetmap.org>

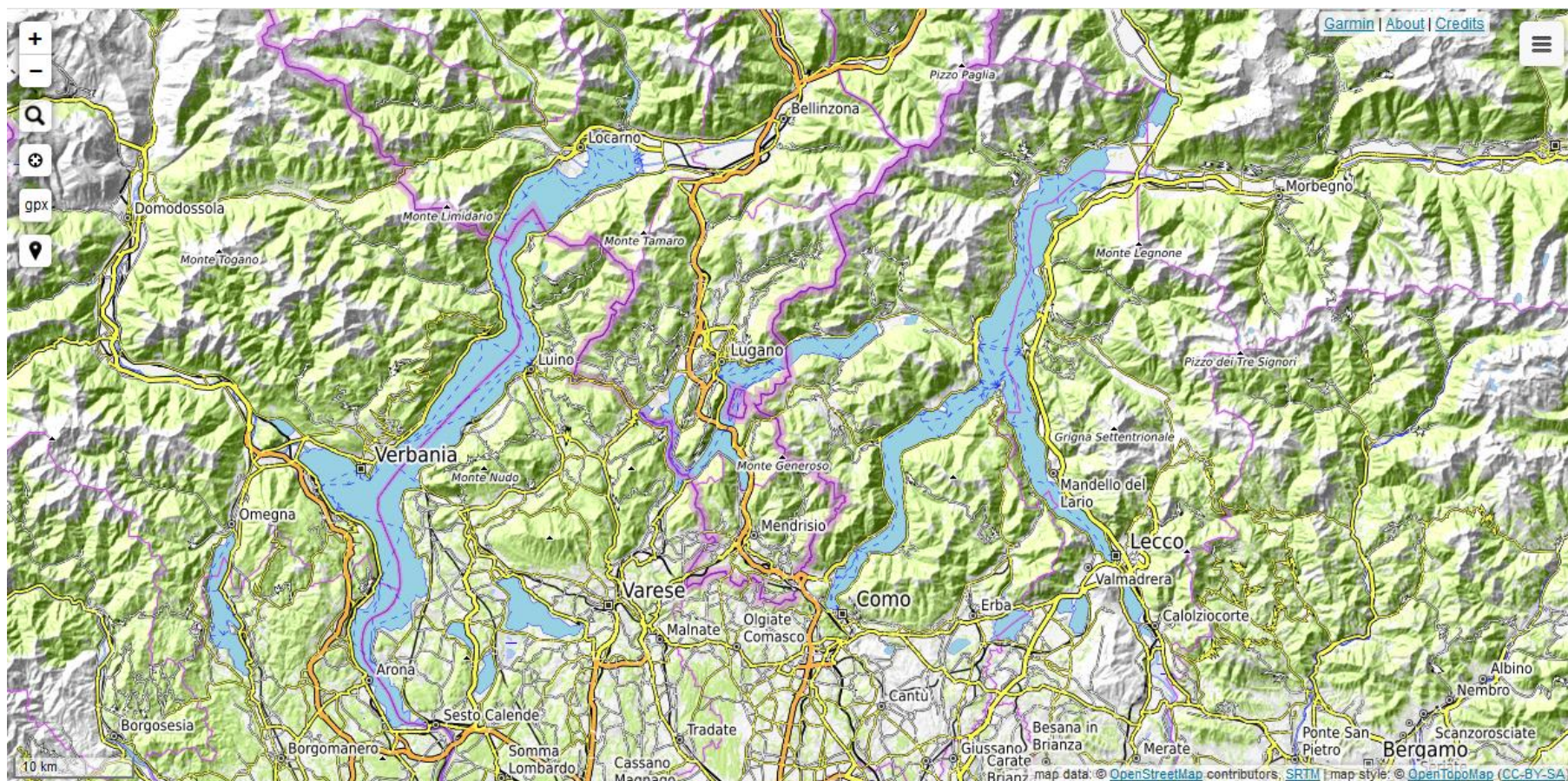




# Map visualization

7

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



<https://opentopomap.org>



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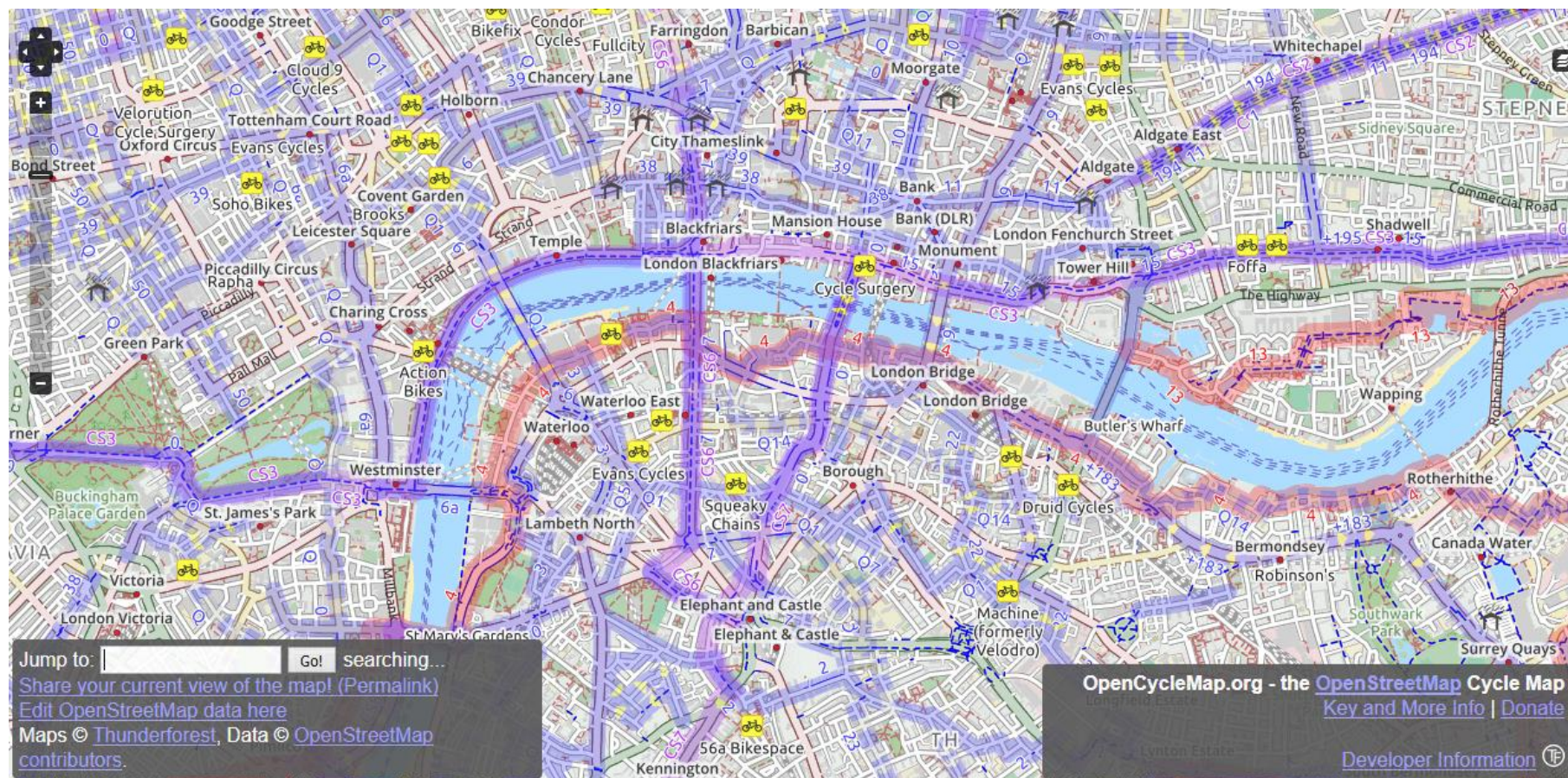




# Map visualization

8

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



<https://www.opencyclemap.org>





# Map visualization

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



<http://hikebikemap.org>

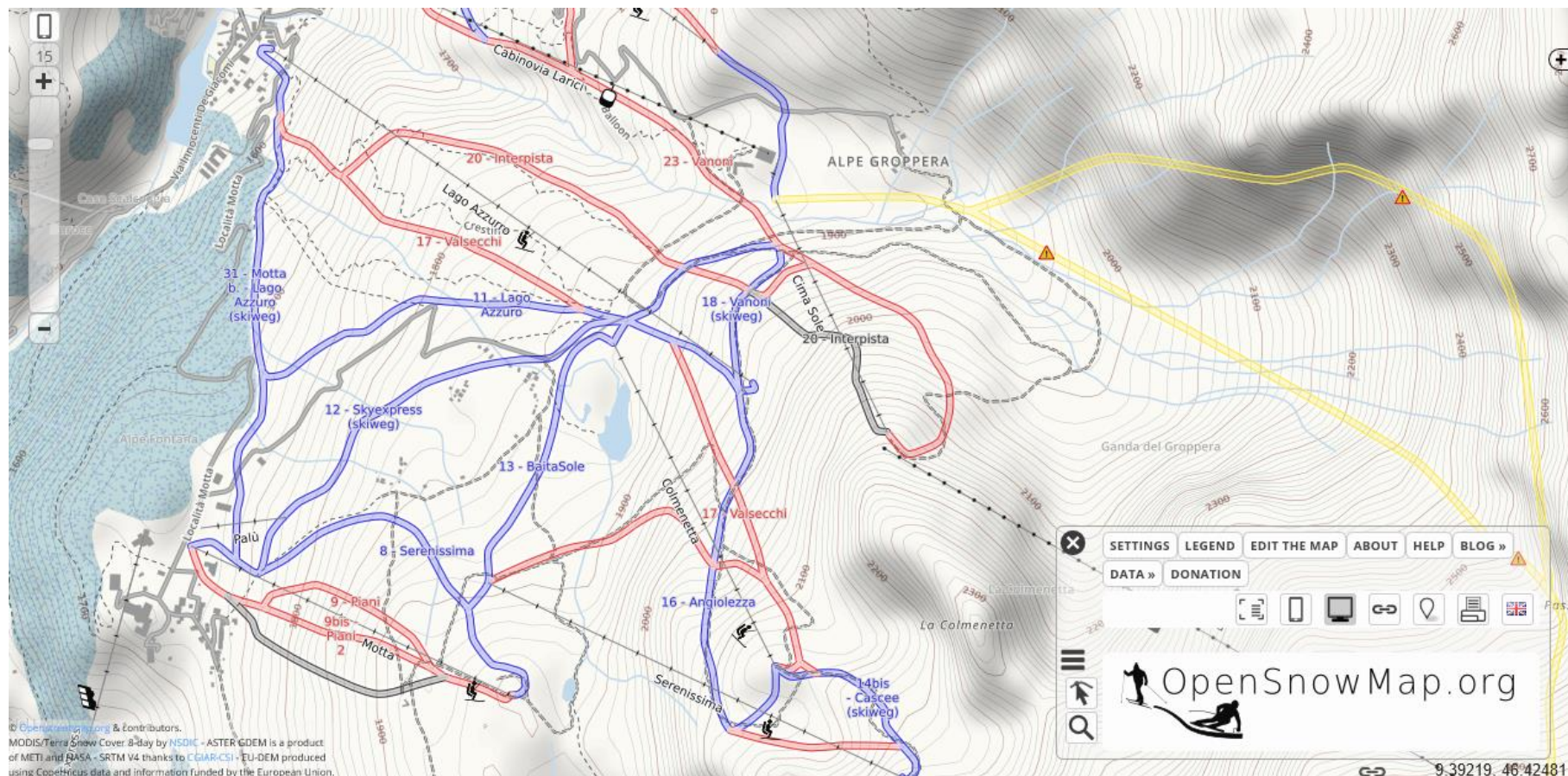




# Map visualization

10

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



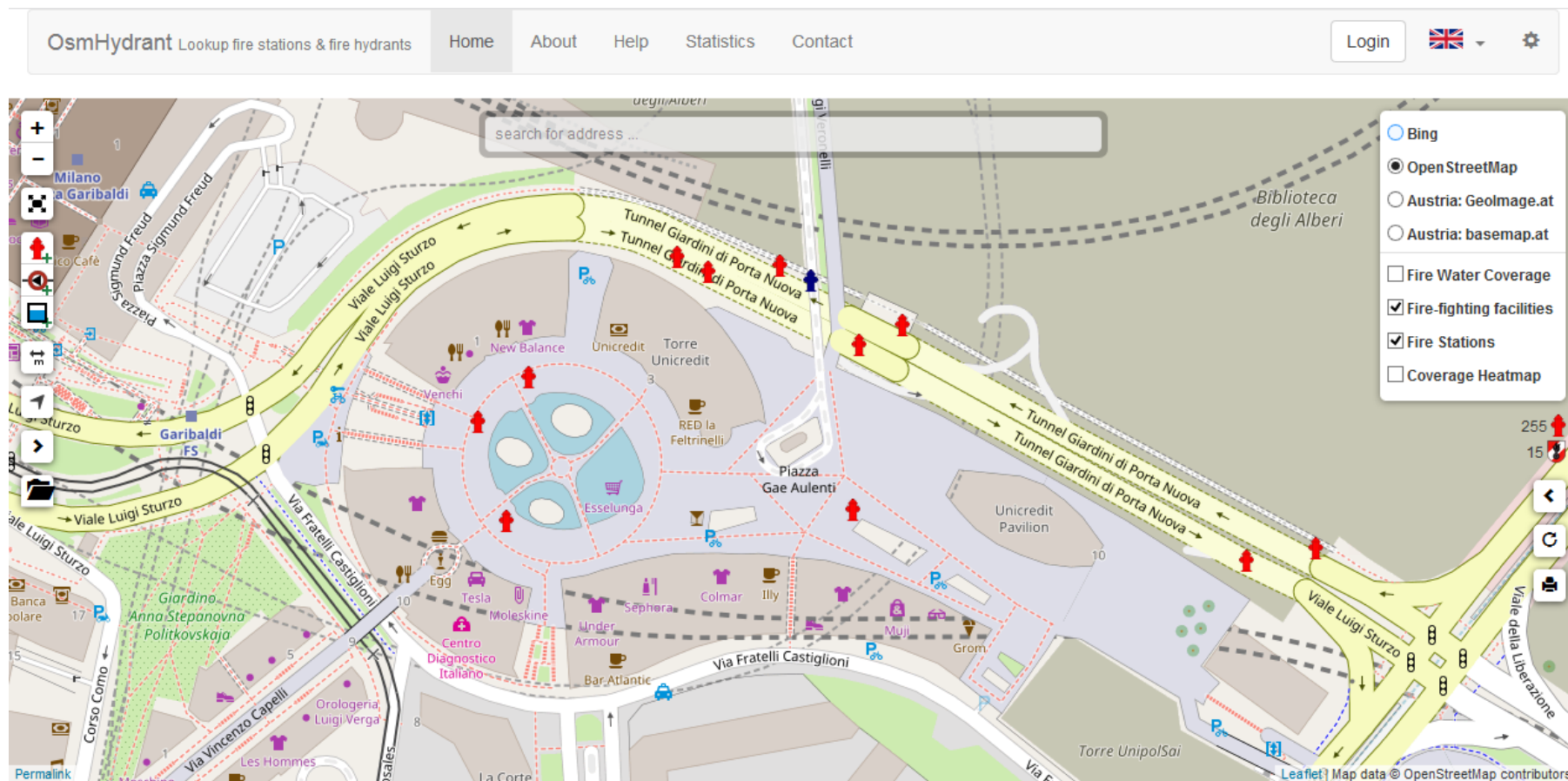
<http://www.opensnowmap.org>



# Map visualization

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

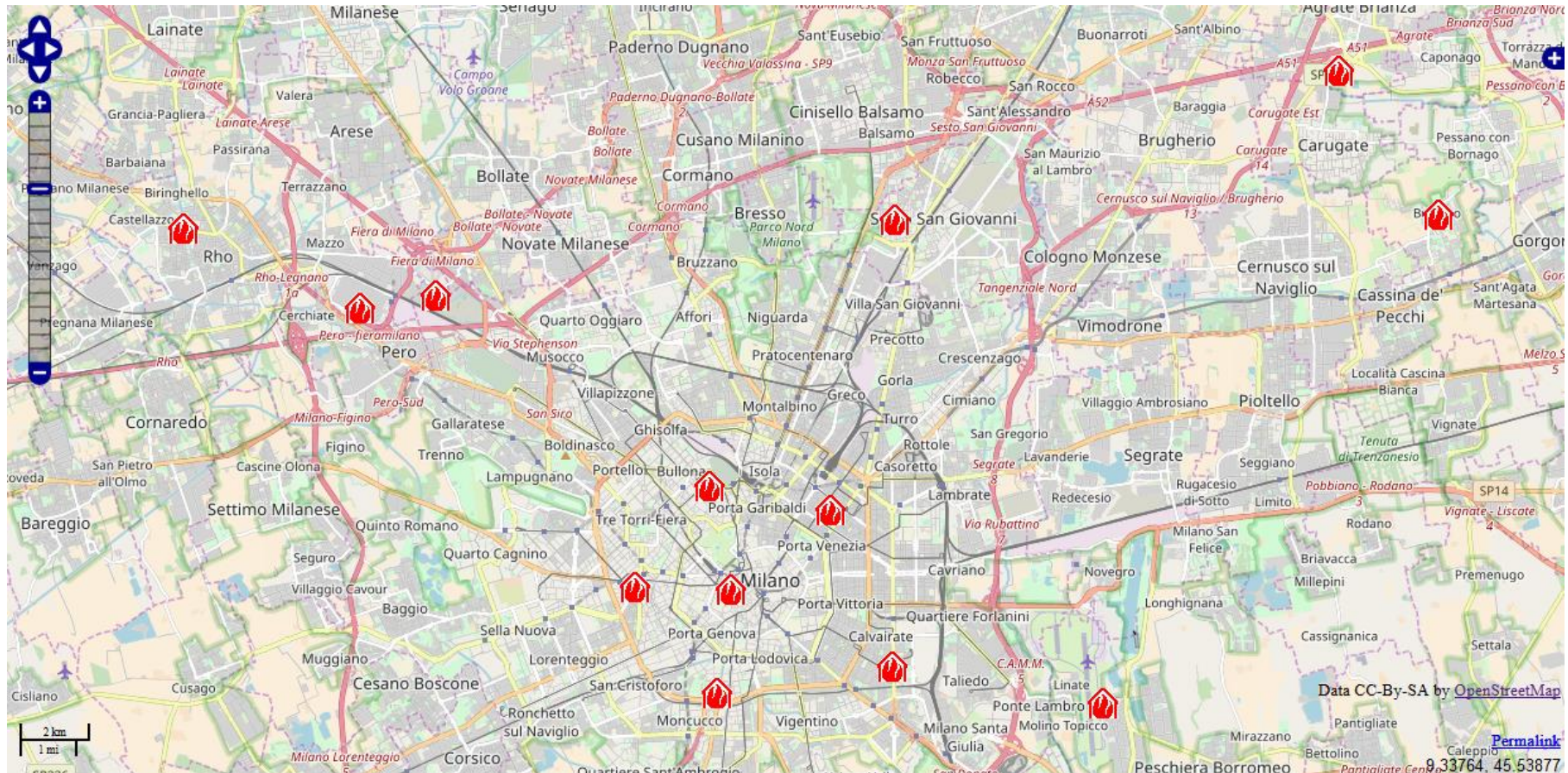


<https://www.osmhydrant.org>





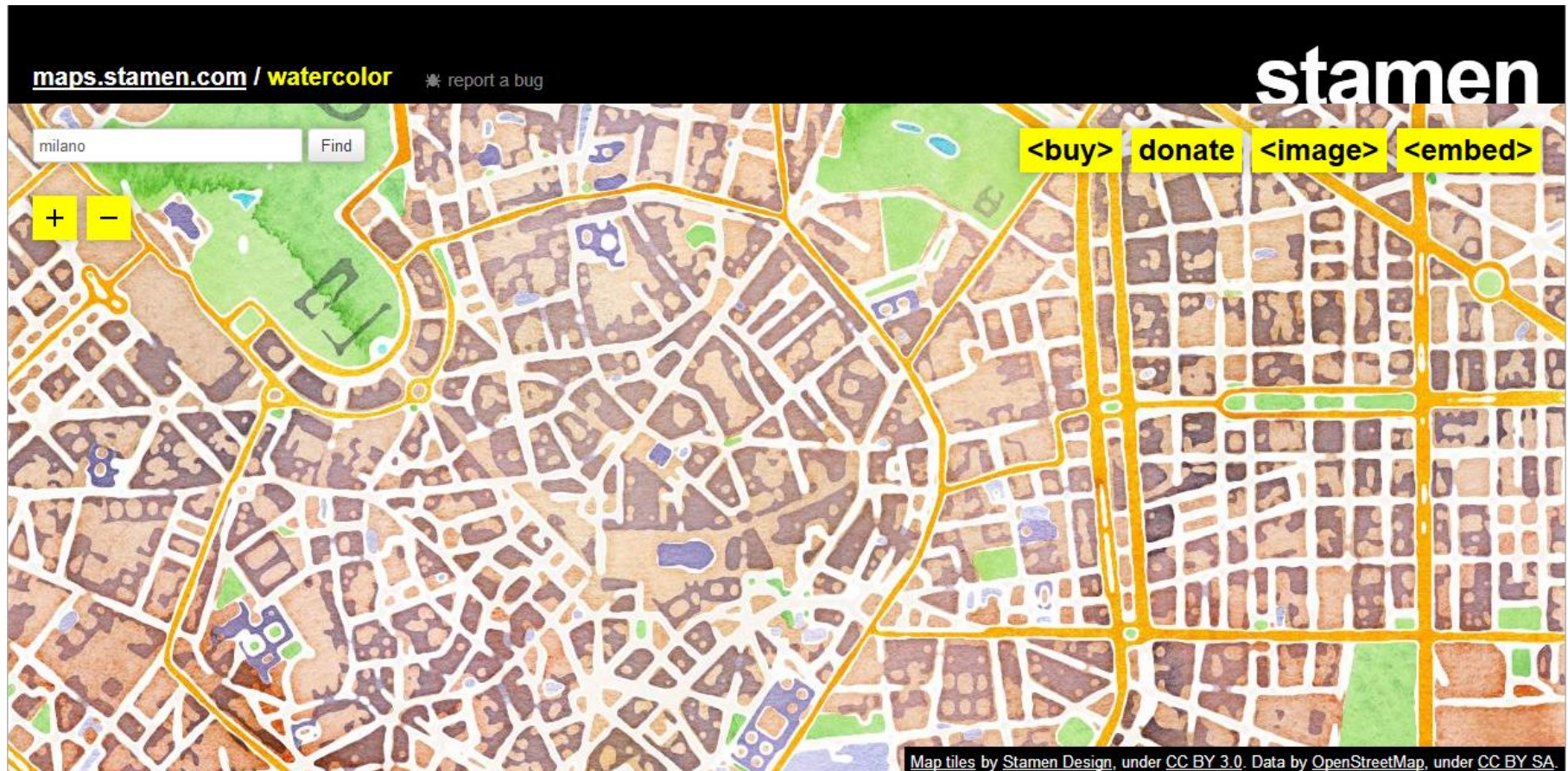
- OSM vector data can be visualized with customized styles:
  - fire stations visualization







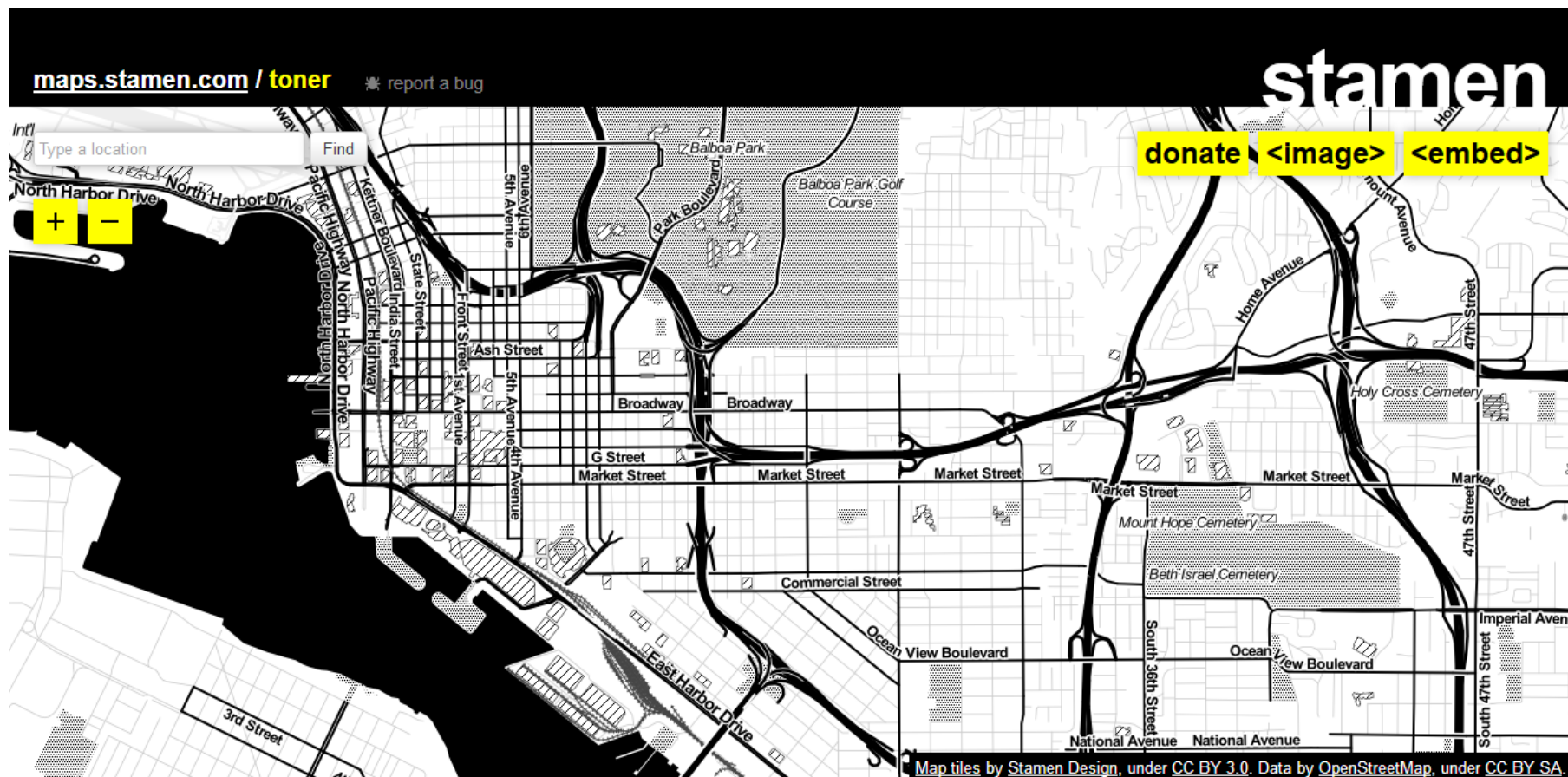
- OSM vector data can be visualized with customized styles:
  - watercolor visualization



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



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

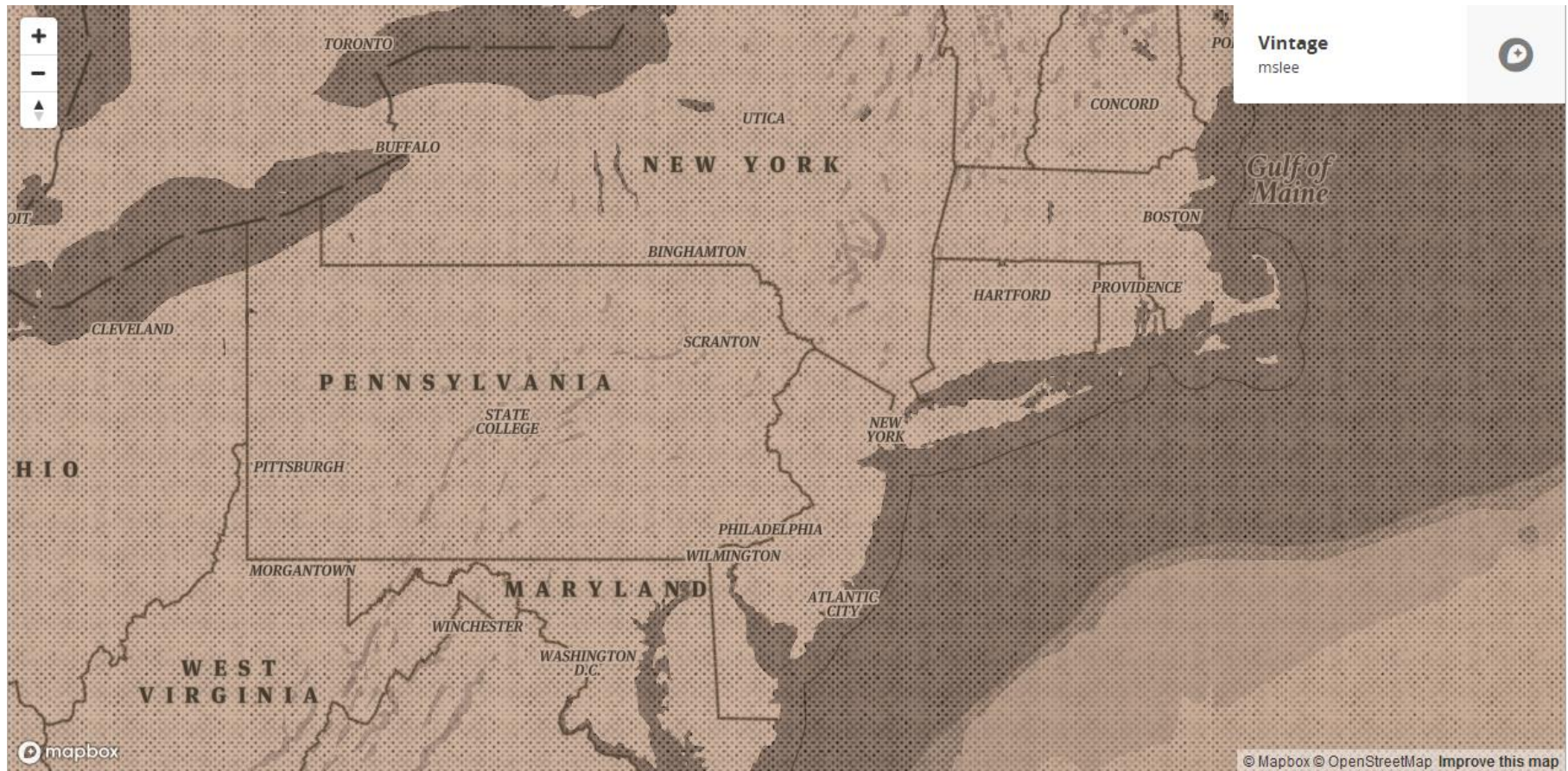


<http://maps.stamen.com/watercolor>





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

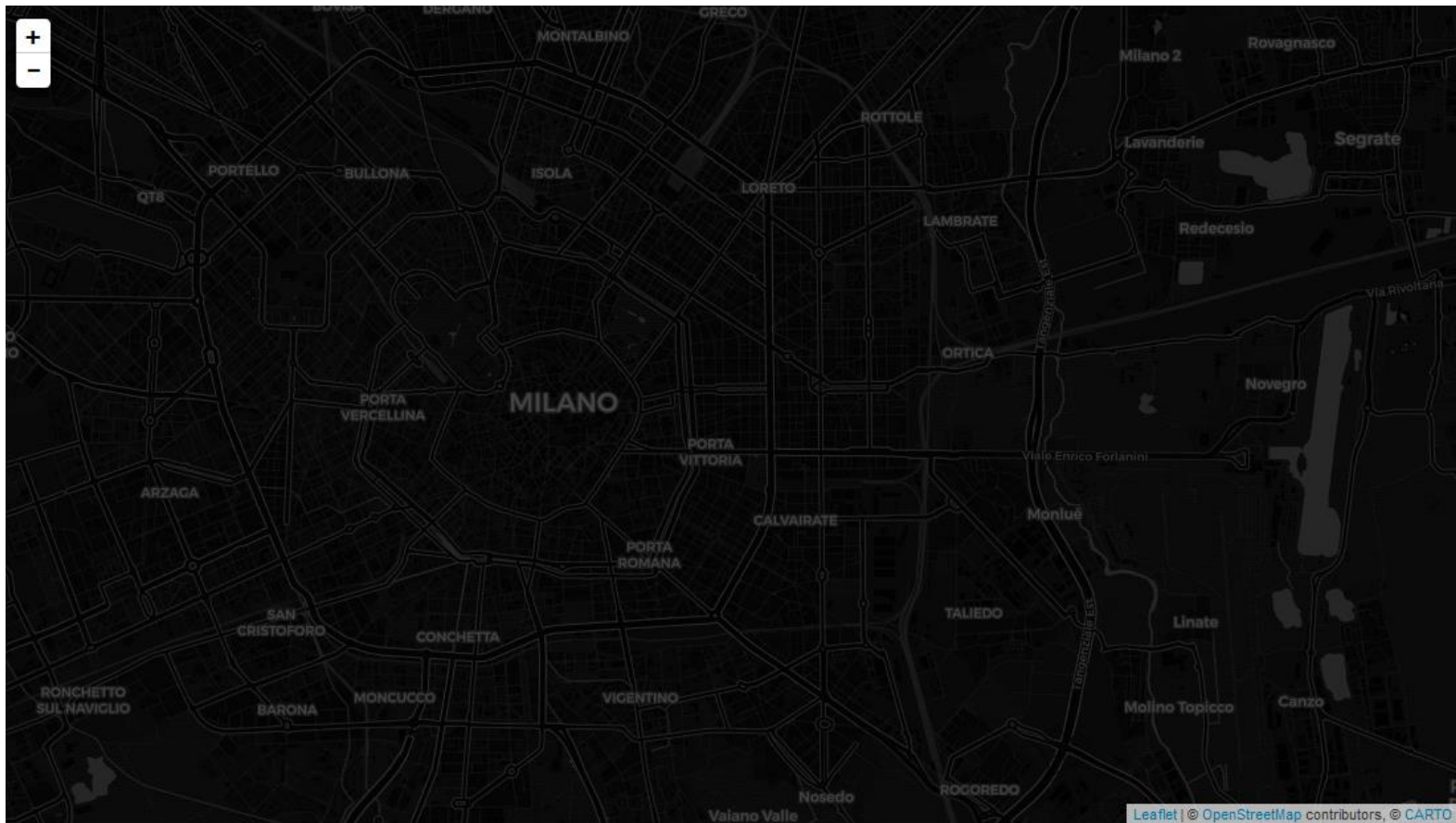


<https://tinyurl.com/yasqcqp4>





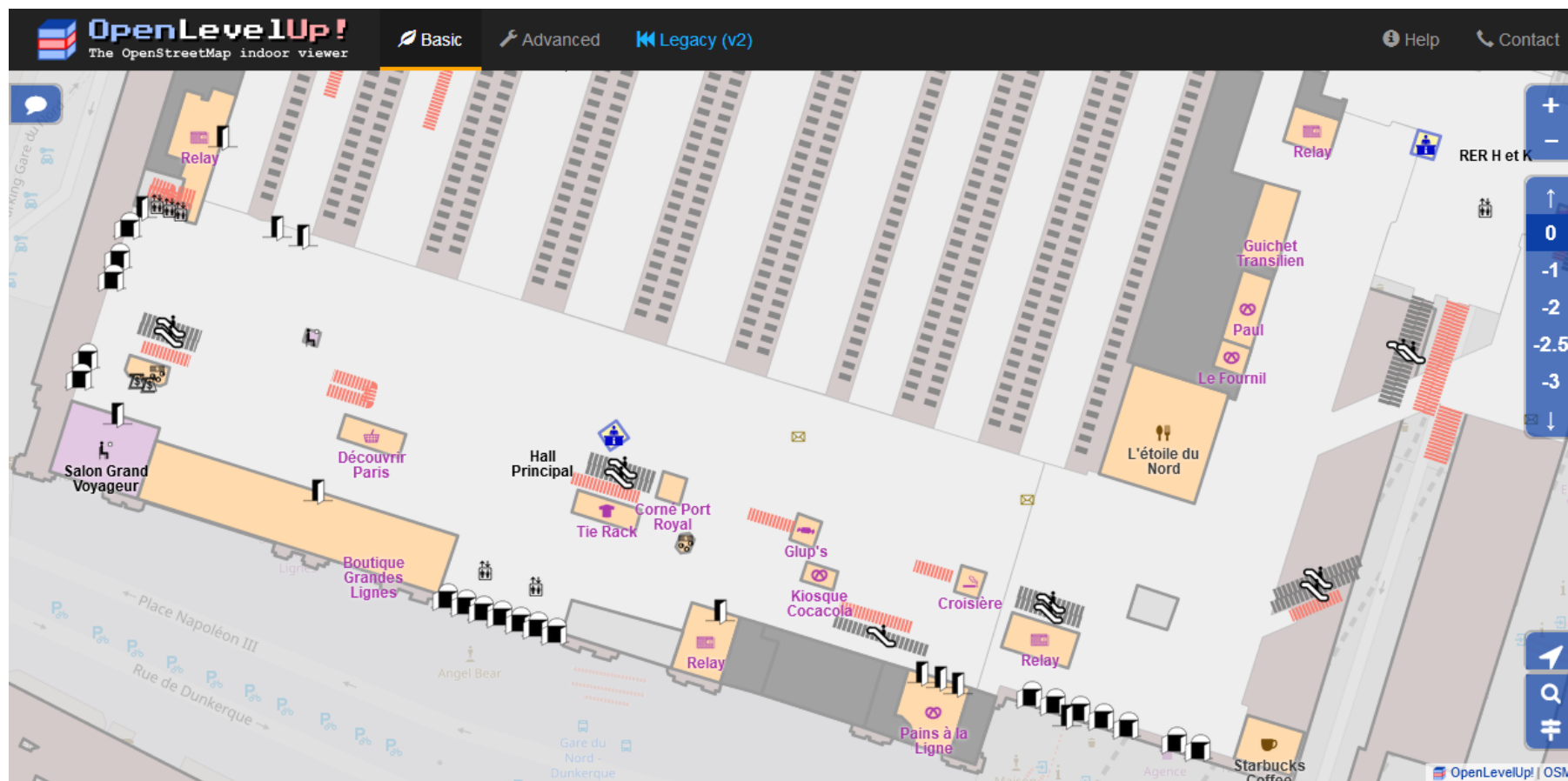
- OSM vector data can be visualized with customized styles:
  - dark visualization



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



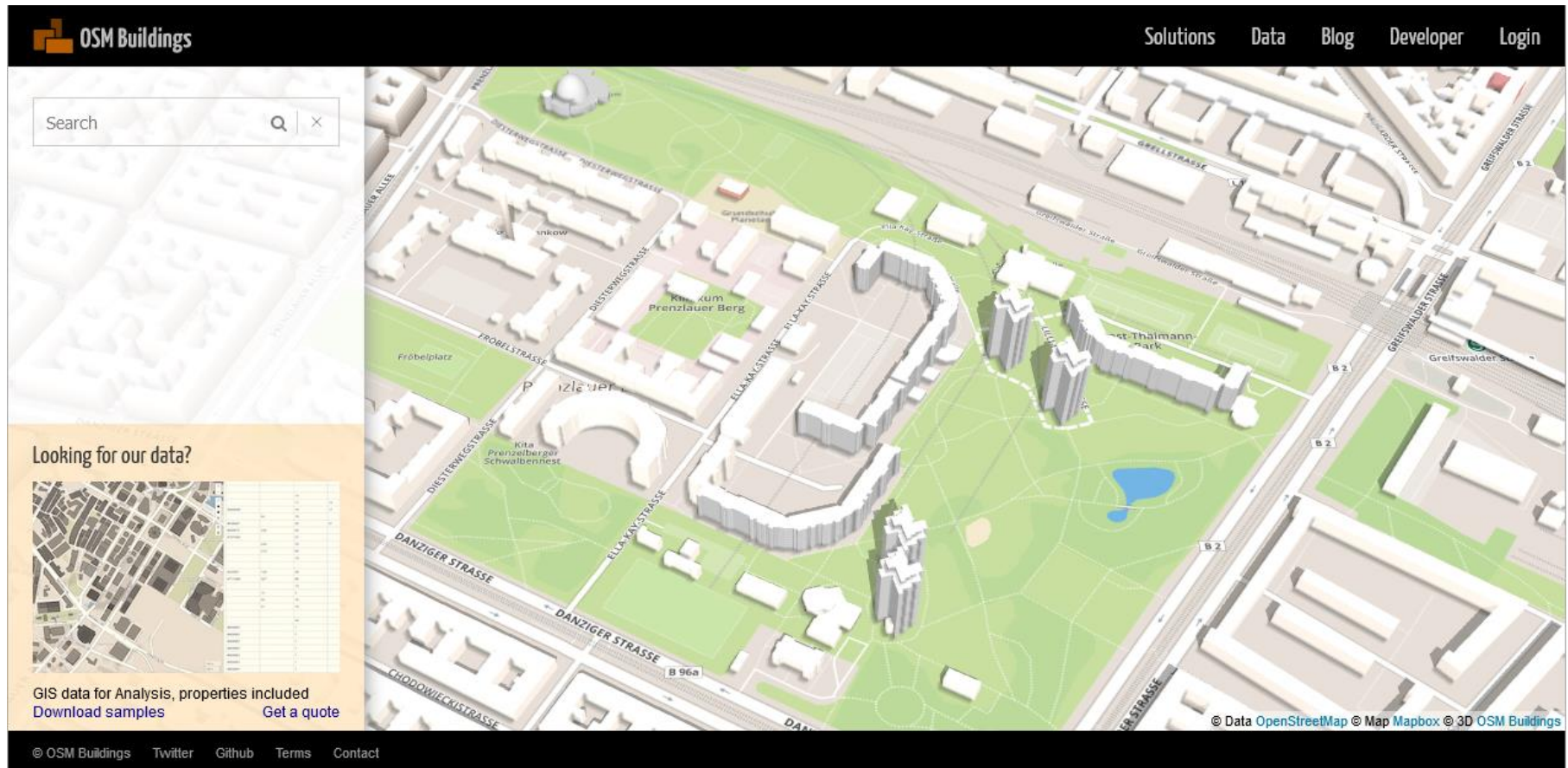
- OSM vector data can be visualized with customized styles:
  - Indoor level-based visualization



<https://openlevelup.net>



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



<https://osmbuildings.org>





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



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





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



<http://demo.f4map.com>

# Software – Editors





- 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](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?

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

The screenshot shows the OpenStreetMap iD editor interface. On the left, the 'Modifica elemento' (Edit element) panel is open, showing the 'Parco' (Park) element type. The 'Nome' (Name) field is filled with 'Parco di Villa Olmo'. Below it, the 'Aggiungi campo' (Add field) dropdown is set to 'Indirizzo, Descrizione, Altitudine...'. The 'Tutti i tag (4)' (All tags) section shows a table of tags:

Tag	Value	Delete	Info
access	public		
leisure	park		
name	Parco di Villa Olmo		
opening_hours	Mo-Su 07:00-23:00		

On the right, the map view shows 'Parco di Villa Olmo' with various map controls and a scale bar. The bottom status bar indicates 'Modifiche di Darklash, Taurus77, mingo23, e 28 altri' and version '2.7.1'.

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

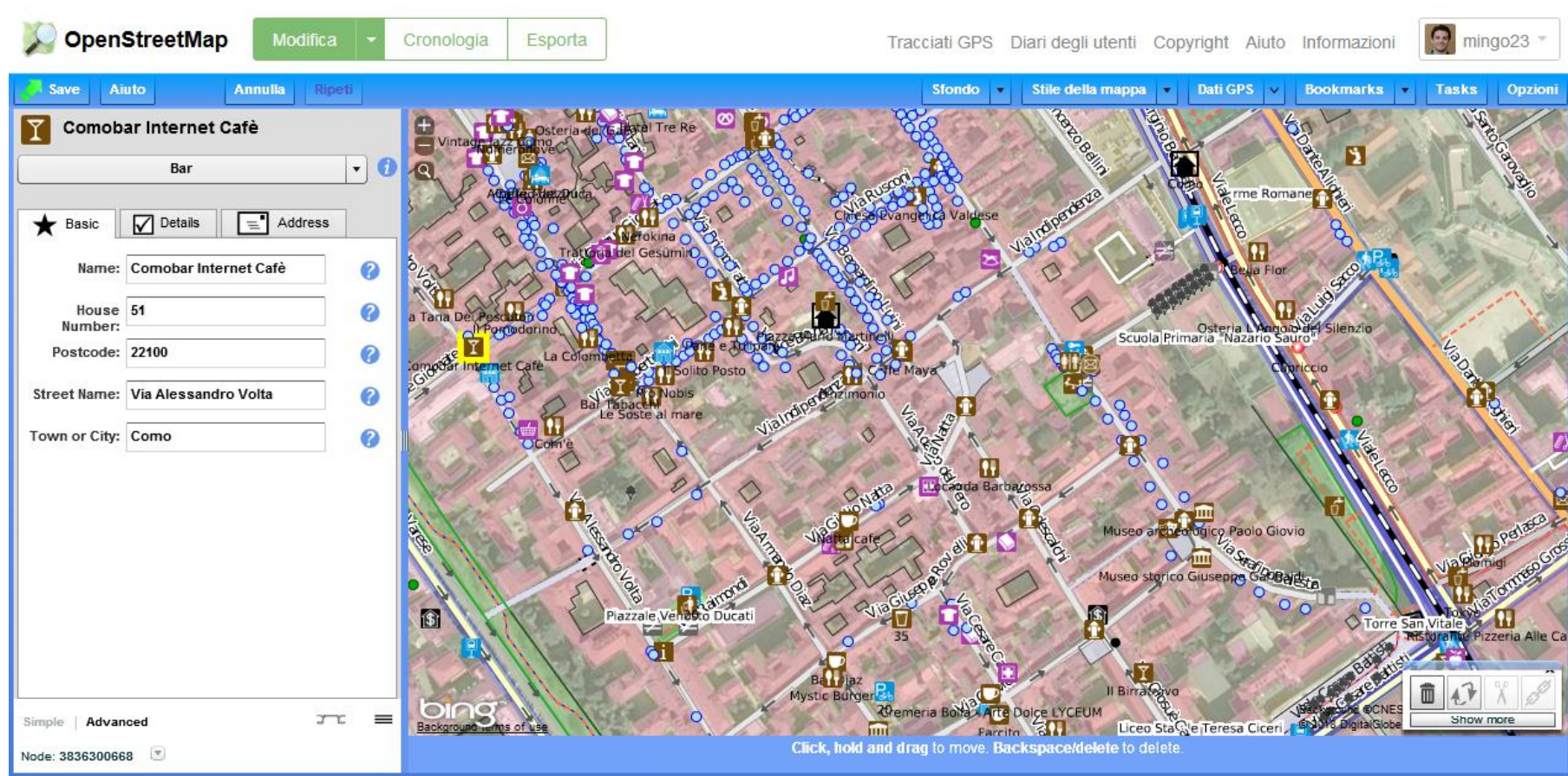




# How to add/edit OpenStreetMap data?

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



[https://wiki.openstreetmap.org/wiki/Potlatch\\_2](https://wiki.openstreetmap.org/wiki/Potlatch_2)

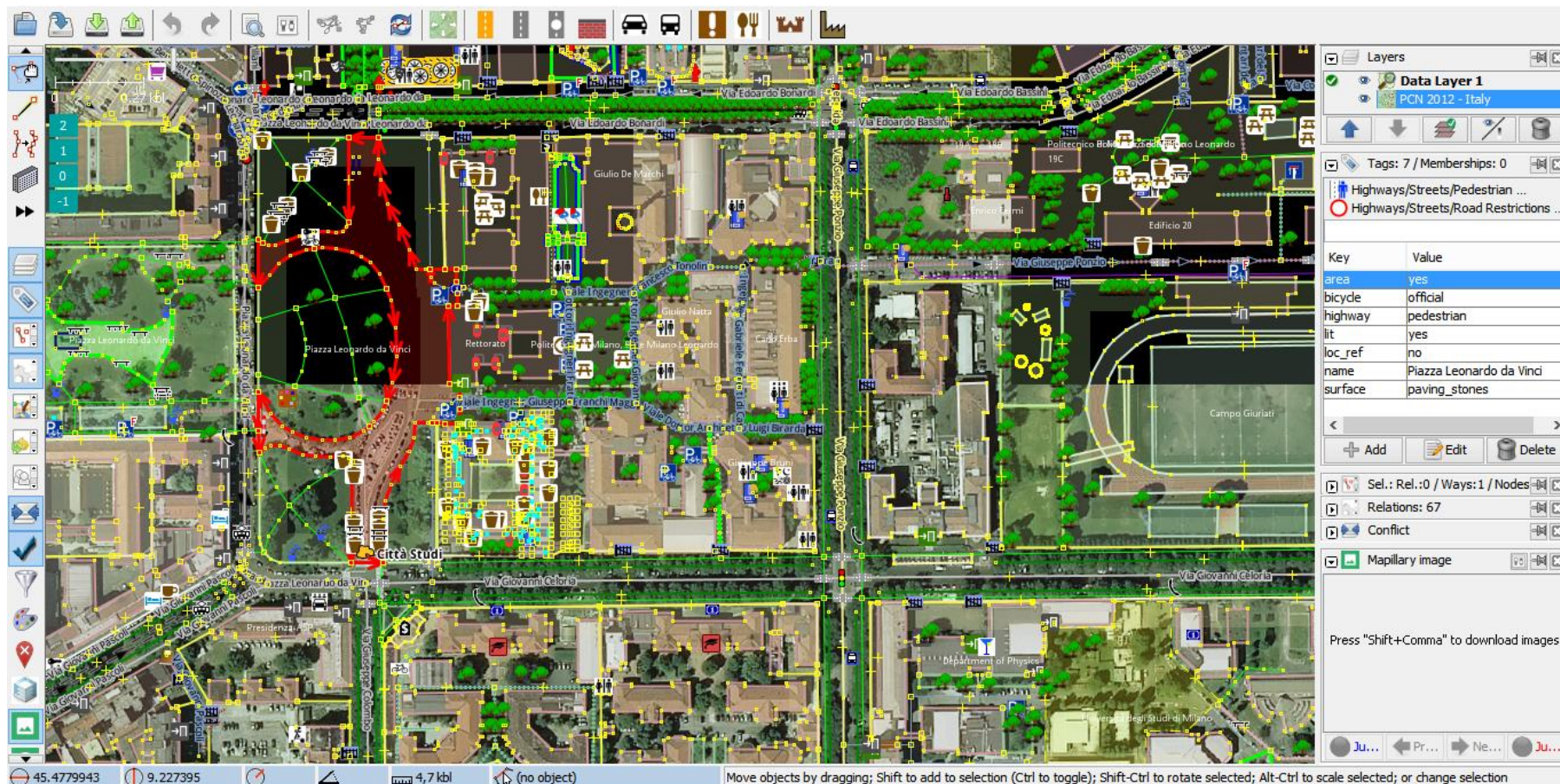




# How to add/edit OpenStreetMap data?

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



<https://josm.openstreetmap.de>

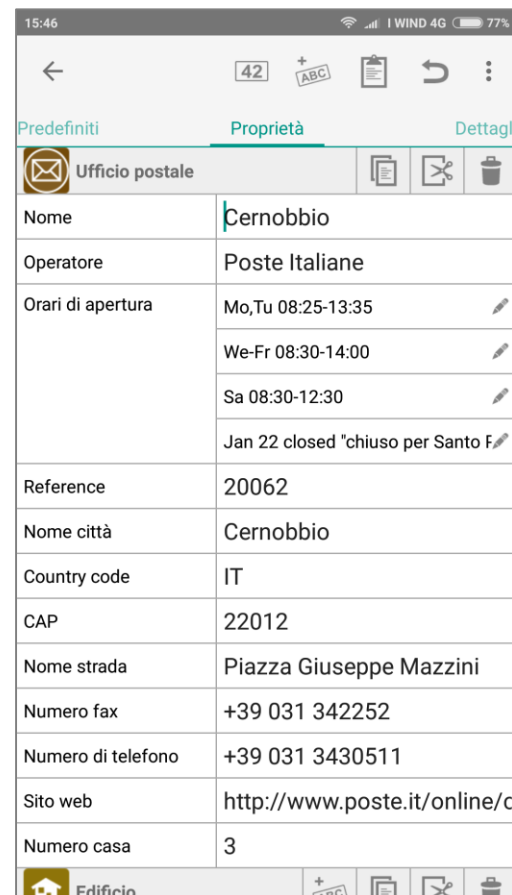
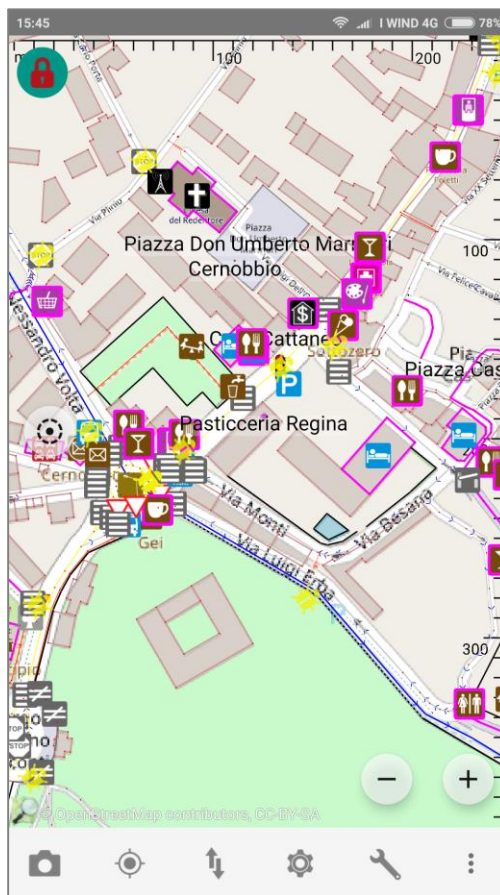
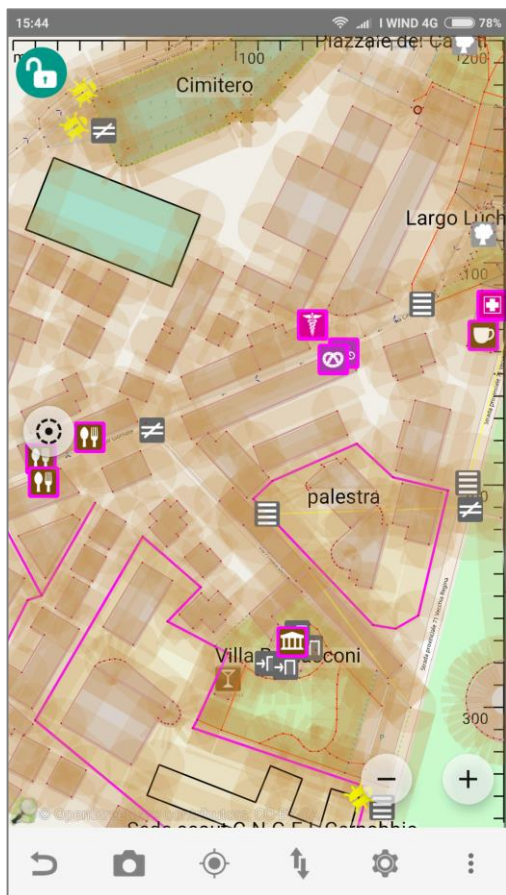




# How to add/edit OpenStreetMap data?

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



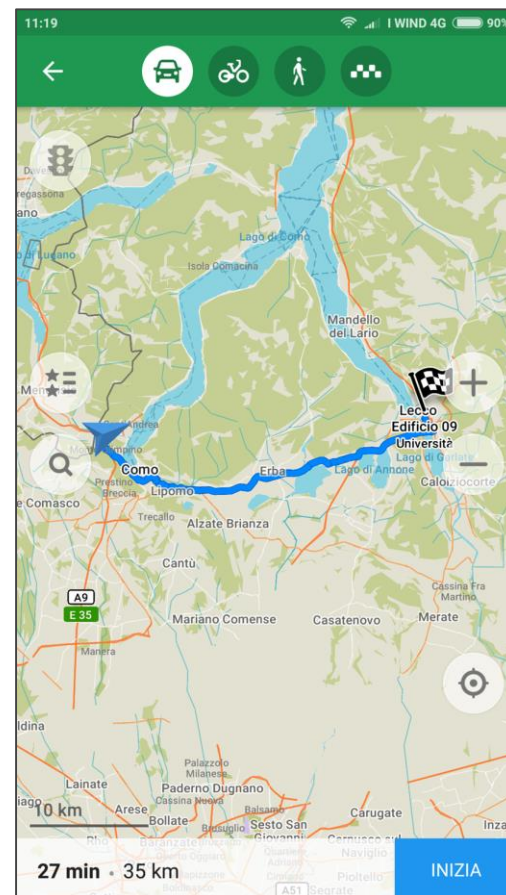
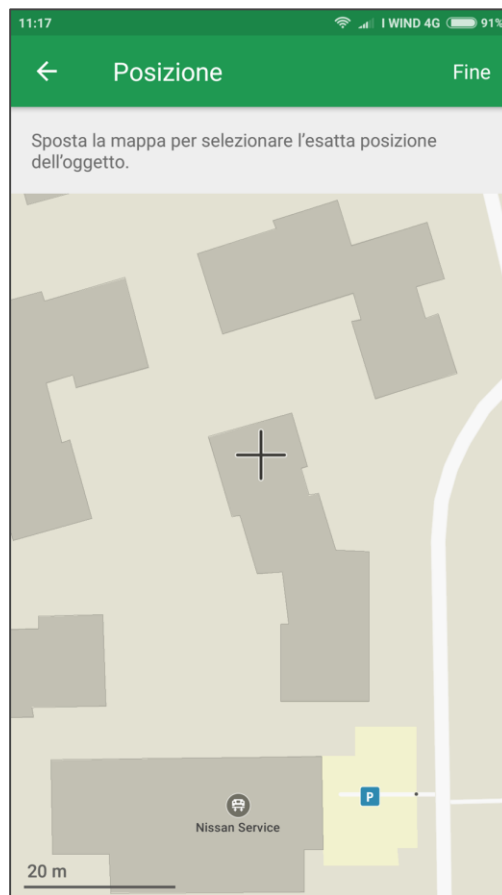
<https://wiki.openstreetmap.org/wiki/Vespucci>



# How to add/edit OpenStreetMap data?

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- 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?

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



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



# How to add/edit OpenStreetMap data?

29

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

The screenshot shows the OpenStreetMap web interface. At the top, there's a search bar with the text "Cerca" and a "Vai" button. Below the search bar, there's a map of a forested area with various trails and landmarks. The map is overlaid with several colored lines representing different types of trails or boundaries. On the right side, there's a sidebar with a "Livelli mappa" (Map layers) section. It includes a "Standard" map style, a "Mappa ciclabile" (Bicycle map), a "Mappa dei trasporti" (Transport map), and a "Umanitario" (Humanitarian) map. Below the map layers, there's a section for "Abilita sovrapposizioni per la risoluzione dei problemi della mappa" (Enable overlays for map problem resolution). It includes checkboxes for "Note sulla mappa" (Map notes), "Dati della mappa" (Map data), and "Tracciati GPS pubblici" (Public GPS tracks). The bottom of the map shows a scale bar (50 m, 200 ft) and a copyright notice: "© OpenStreetMap contributors".

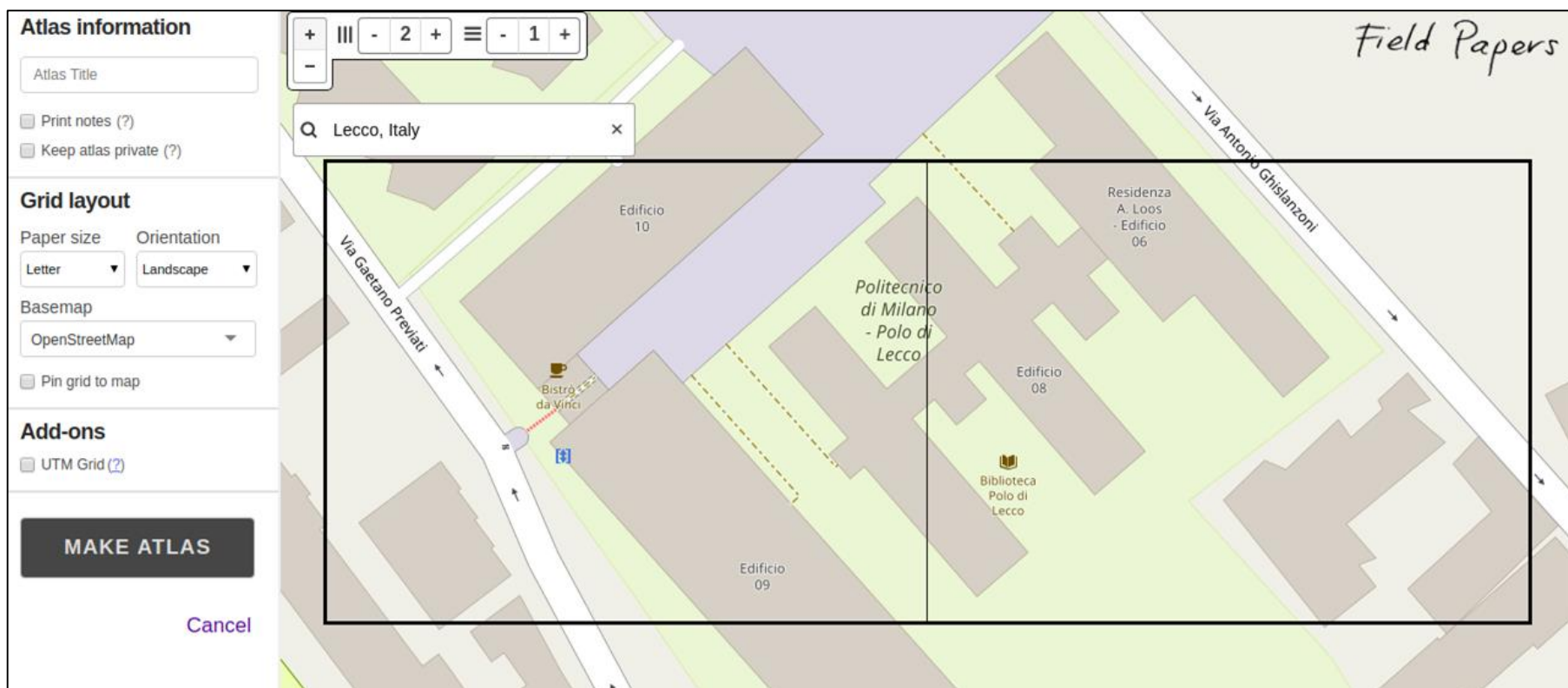




# How to add/edit OpenStreetMap data?

30

- 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



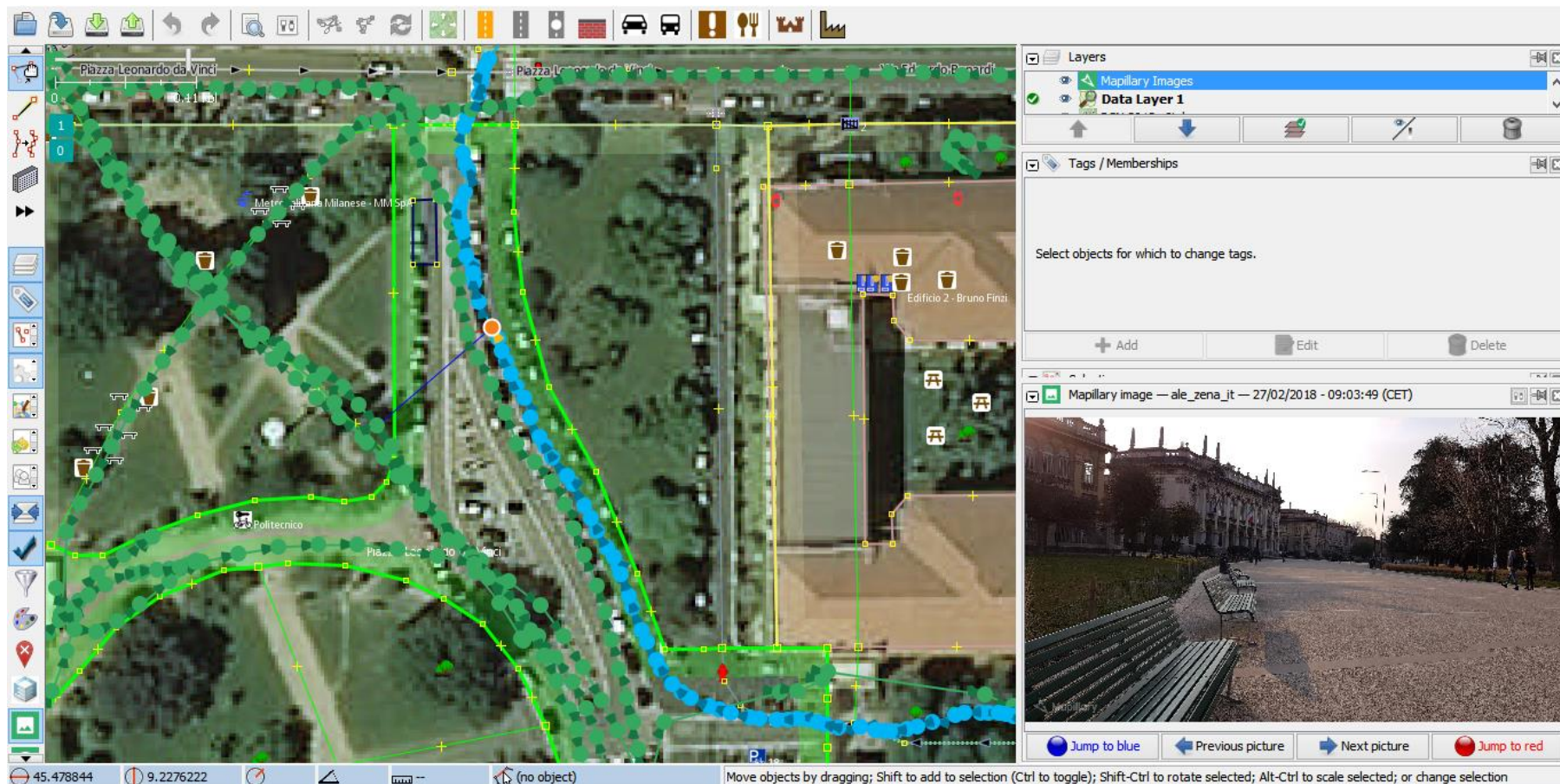
<http://fieldpapers.org>



# How to add/edit OpenStreetMap data?

31

- 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?<sup>33</sup>

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

86, Via Bellinzona, Folcino Superiore, Monte Olimpino

Comunità Montana Triangolo Lariano, Via Partigiana,

18.8 km, 36 min

Via Nino Bixio, Via Partigiana

- Head southwest 20 m
- Turn left onto Via Bellinzona 15 m
- Enter the roundabout and take the 1st exit onto Via Luigi Camozzi 10 m
- Turn right onto Via Luigi Camozzi 150 m
- Enter the roundabout and take the 2nd exit onto Via Nino Bixio 30 m
- Make a slight right onto Via Nino Bixio 1.5 km
- Turn right onto Via Borgovico 450 m
- Make a slight right onto Viale Innocenzo XI 800 m

Leaflet | © Mapbox | © OpenStreetMap | Improve this map

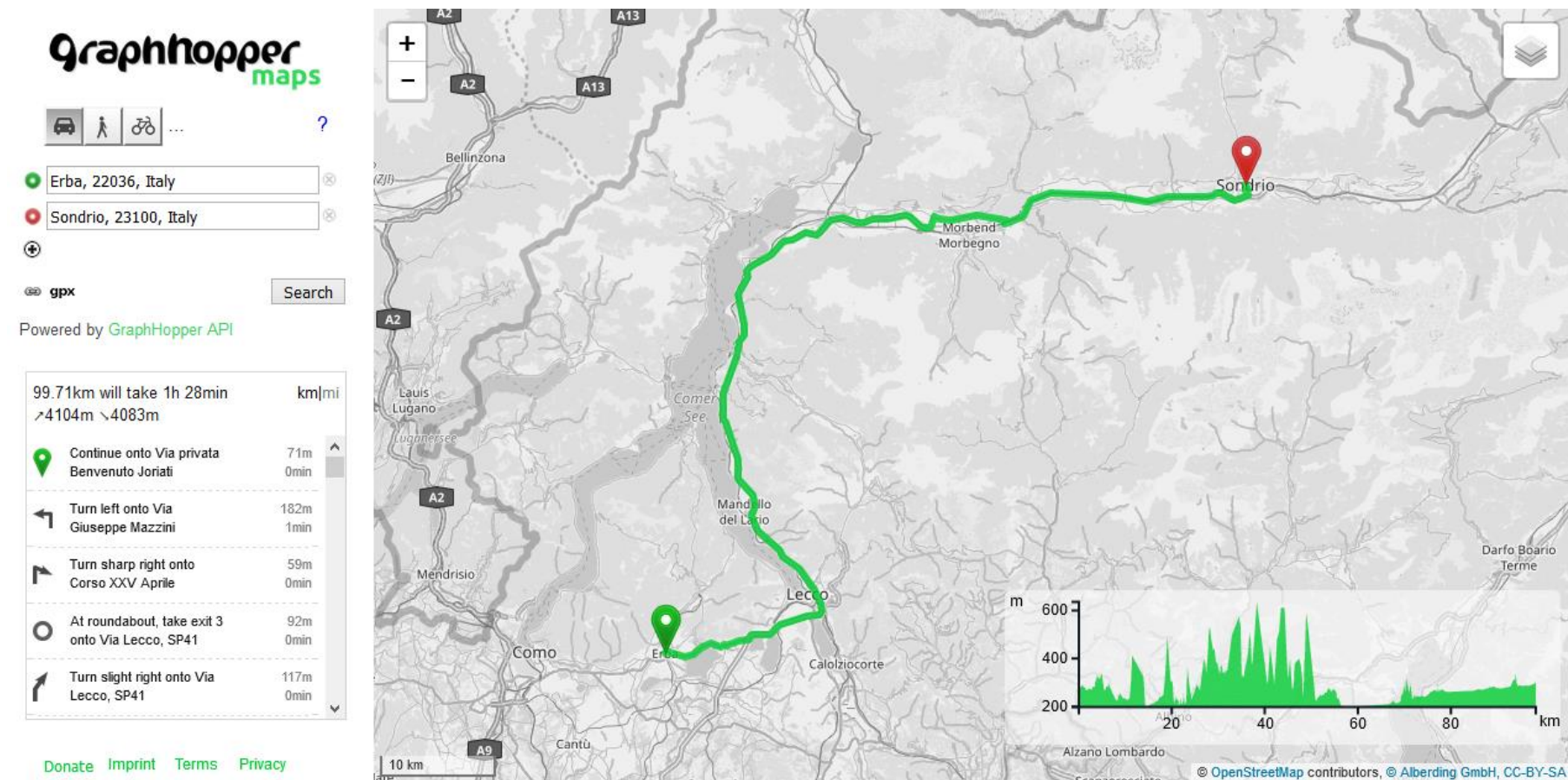
<http://project-osrm.org>





# How to compute routes using OSM roads?<sup>34</sup>

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



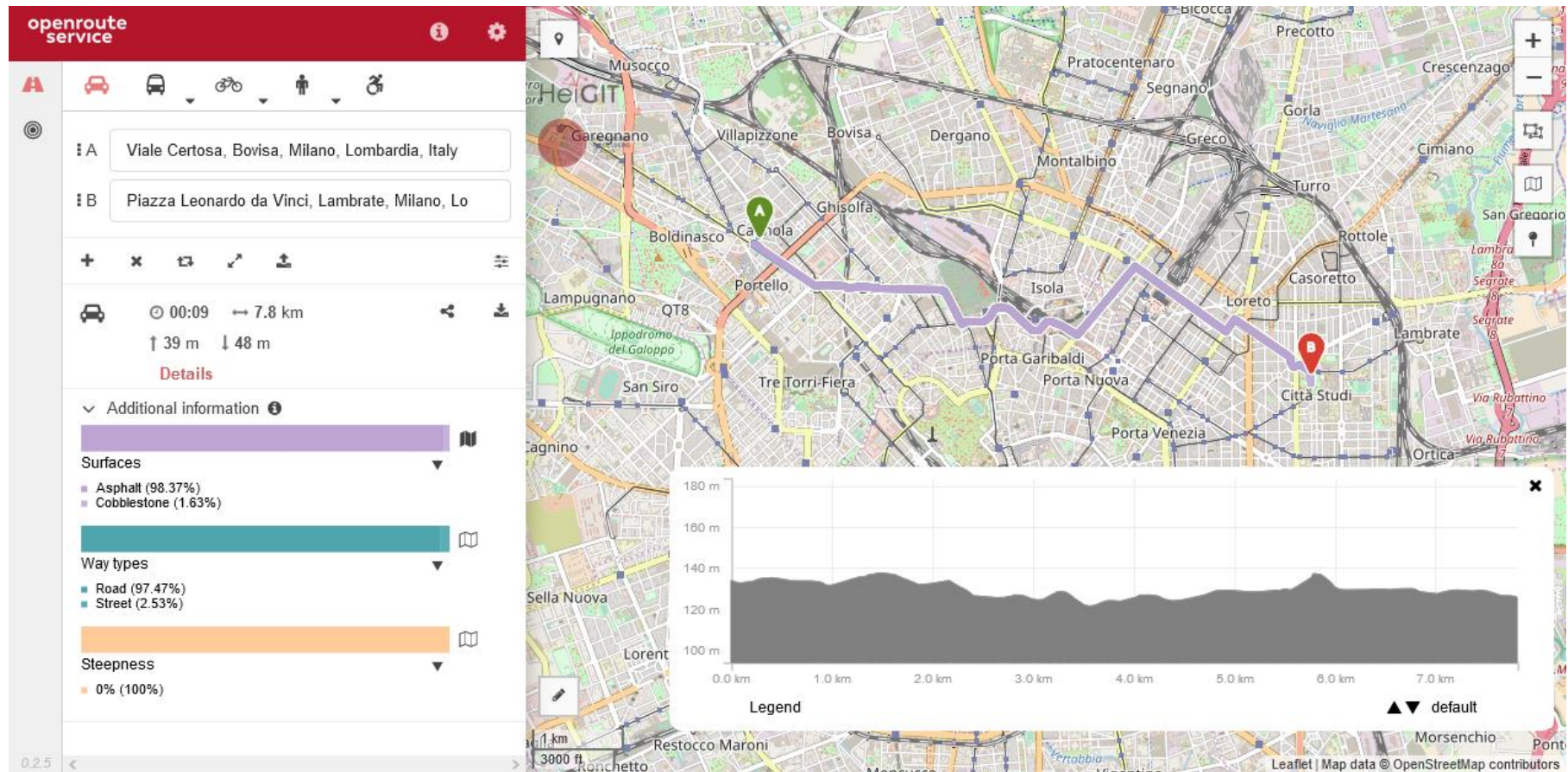
<https://www.graphhopper.com>



# How to compute routes using OSM roads?

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



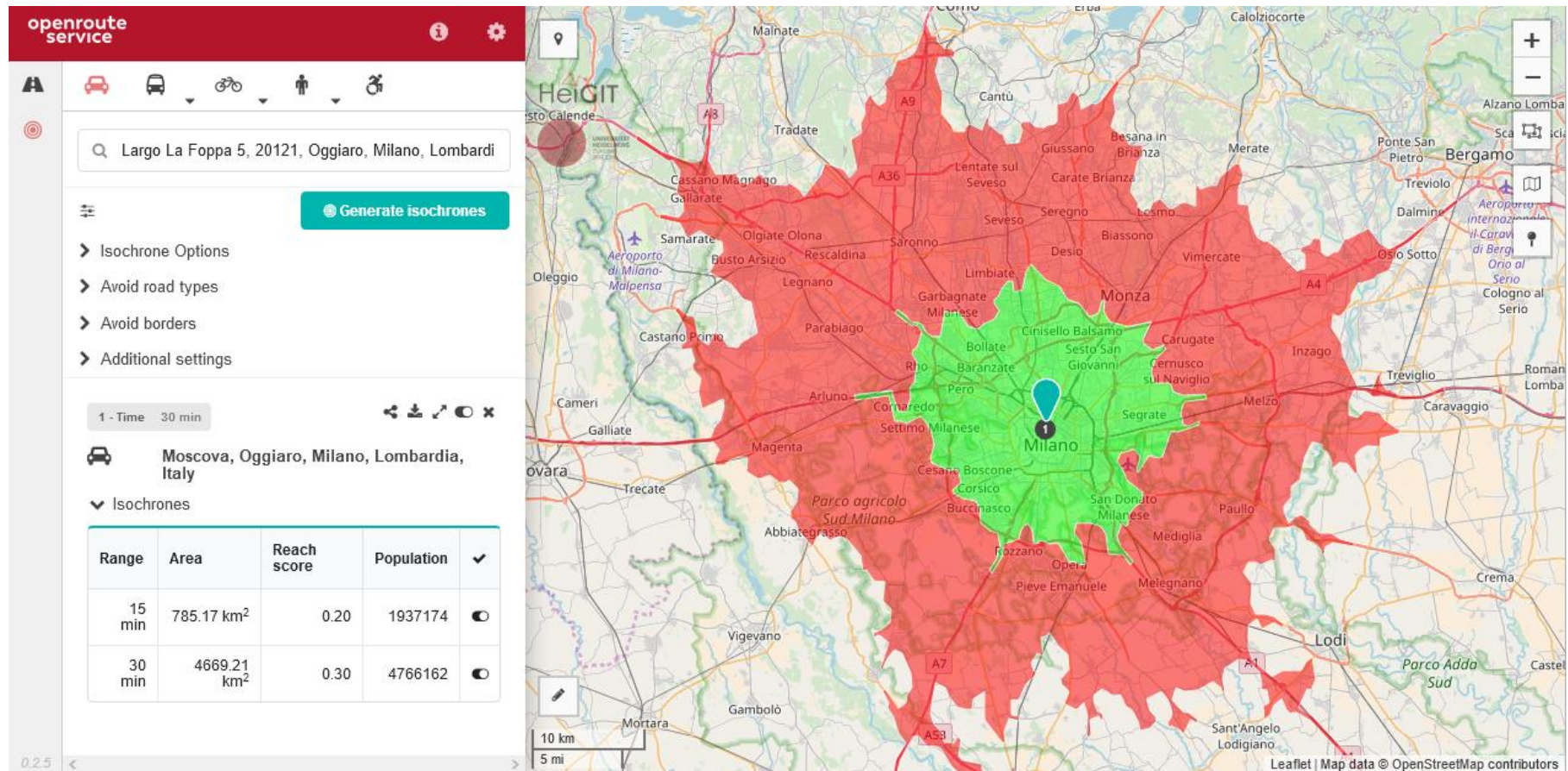
<https://maps.openrouteservice.org>





# How to compute routes using OSM roads?<sup>36</sup>

- 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?<sup>37</sup>

- 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

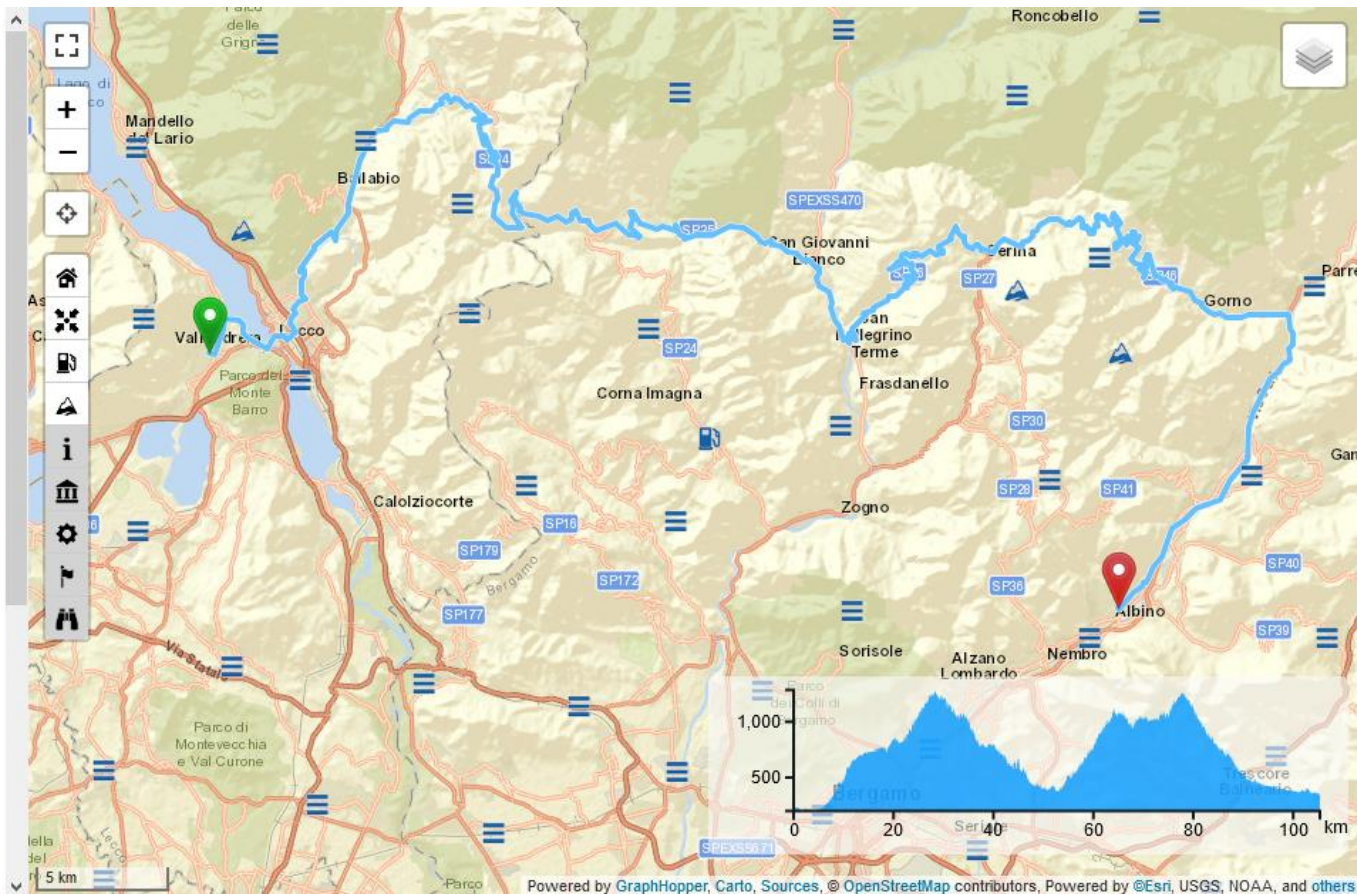
Tourcode

Turn instructions

Advanced Options

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

Deutsch Français  
Español Nederlands



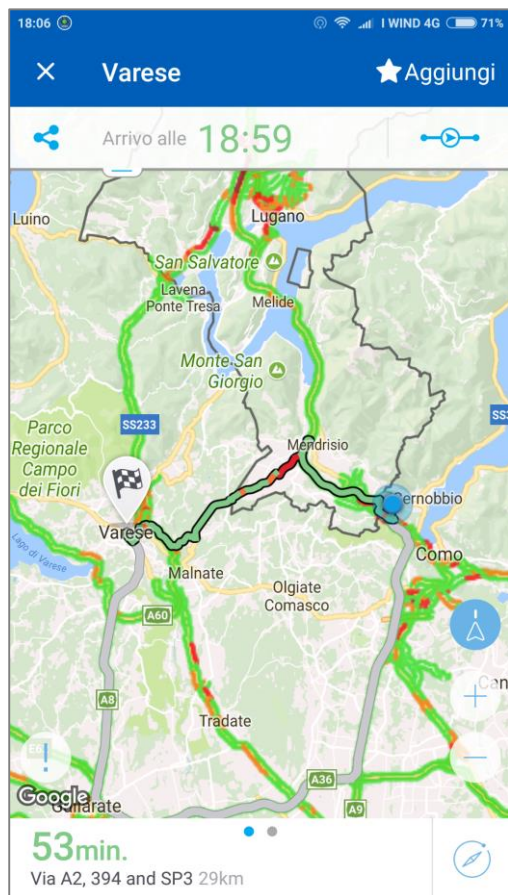
<https://kurviger.de/en>





# How to compute routes using OSM roads?<sup>38</sup>

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

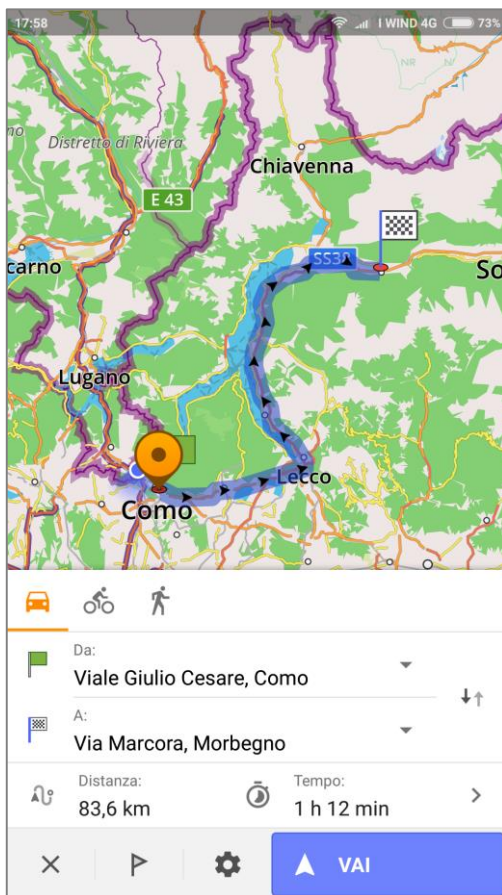


<http://inrix.com/mobile-apps>



# How to compute routes using OSM roads?<sup>39</sup>

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



<http://osmand.net>



# Data download

# How to download OSM data?

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

The screenshot displays the OpenStreetMap website's export interface. On the left, the 'Esporta' (Export) panel is visible, showing a search bar with 'Cerca', a 'Vai' button, and a map icon. Below this, the 'Esporta' section contains a table with coordinates: 45.81318, 9.07955, 9.08337, and 45.81146. A 'Licenza' (License) section states that the data is released under the 'Open Data Commons Open Database (ODbL)' license. A blue 'Esporta' button is present. Below the button, there is a note about export attempts and a list of alternative sources: 'Overpass API', 'Pianeta OSM', and 'OpenStreetMap completo'. The main map area shows a detailed view of a city street grid, including landmarks like 'Piazza Cavour', 'Piazza Volta', and 'Piazza Duomo'. The map includes various icons for points of interest, buildings, and roads. The bottom right corner of the map shows the 'OpenStreetMap contributors' logo and a link to 'Fai una donazione' (Make a donation).

<https://www.openstreetmap.org>



- 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: 80f22f7ad2996f36aebd0be74ed0a2ad.

<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.

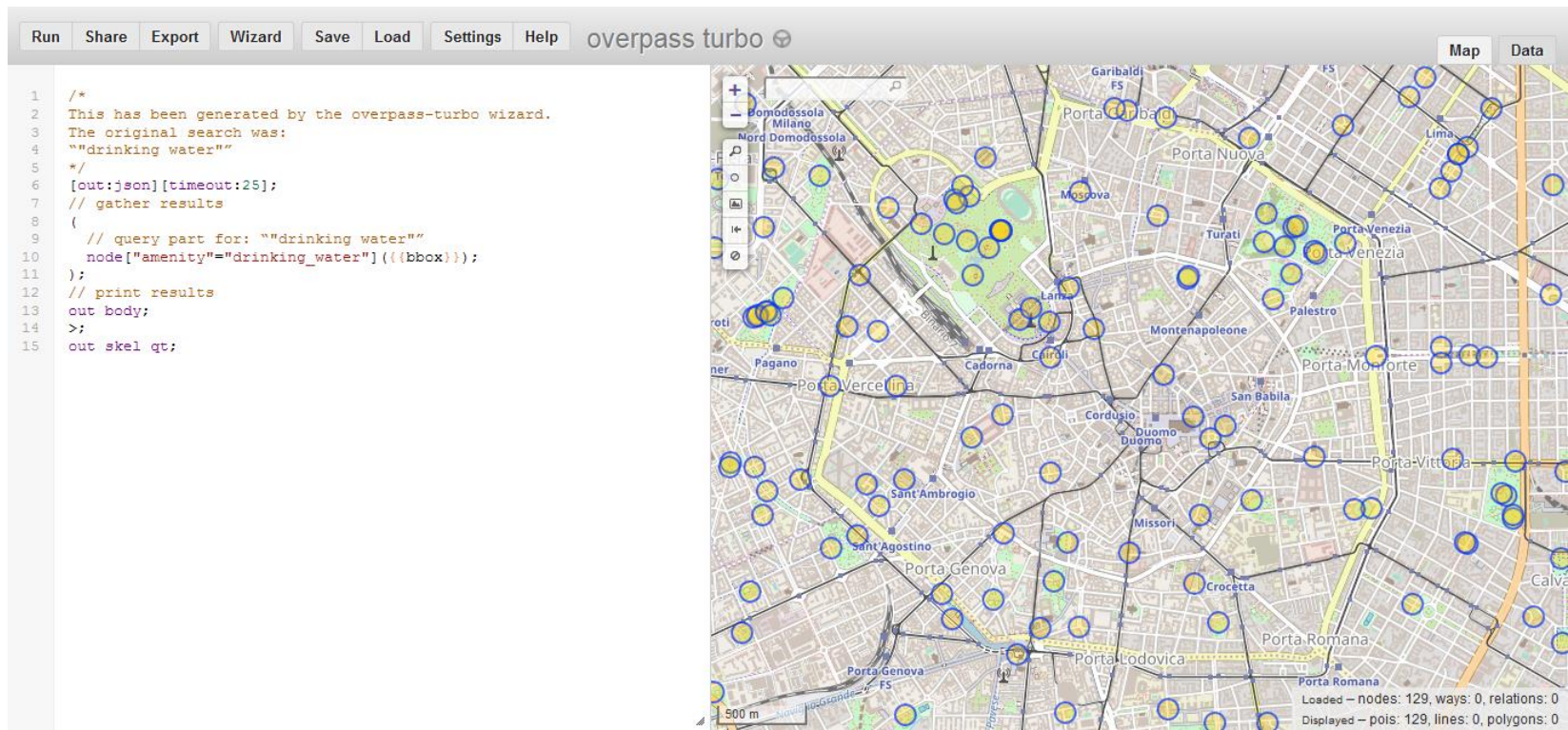
md5: 4815ac8b6da2b3a073cd91da79f8a4dd.

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

# How to download OSM data?

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- 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**



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

[https://wiki.openstreetmap.org/wiki/Overpass\\_API](https://wiki.openstreetmap.org/wiki/Overpass_API) | <http://overpass-turbo.eu>



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

## 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

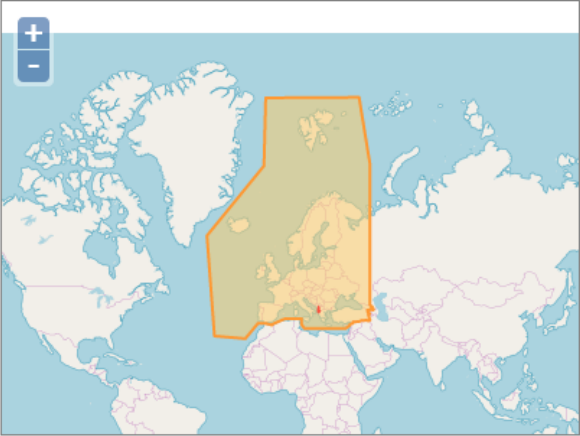
- [europe-latest.osm.bz2](#), yields OSM XML when decompressed; use for programs that cannot process the .pbf format. This file was last modified 1 day ago. File size: 32.2 GB; MD5 sum: [6e06ceb99c8dcf814adb229c661cf66f](#).
- [europe.osh.pbf](#), a file that contains the full OSM history for this region 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
<a href="#">Albania</a>	<a href="#">[.osm.pbf]</a> (26.5 MB)	<a href="#">[.shp.zip]</a>	<a href="#">[.osm.bz2]</a>
<a href="#">Andorra</a>	<a href="#">[.osm.pbf]</a> (1.5 MB)	<a href="#">[.shp.zip]</a>	<a href="#">[.osm.bz2]</a>

## GEOFABRIK downloads



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?

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- 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)

[Export \(will take around 30 minutes\)](#)

#### GIS options (ignored for Garmin and PBF)

**Coordinate system**

UTM Zone 32, northern hemisphere

**Detail level**

Full detail

© 2015-2017 HSR Hochschule für Technik Rapperswil

<https://osmaxx.hsr.ch>



# How to download OSM data?

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

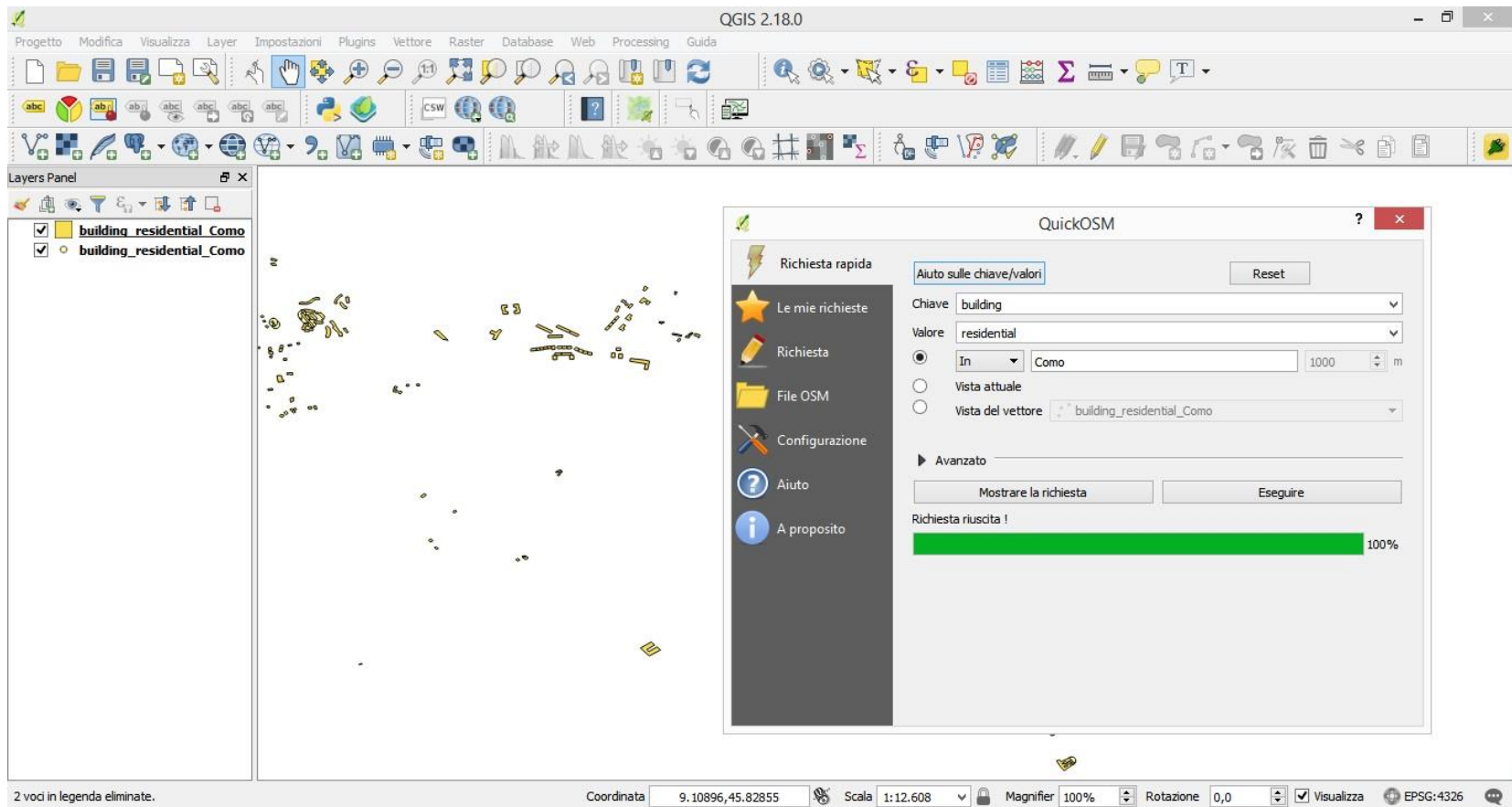
The screenshot displays the HOT Export Tool web interface. On the left, the 'EXPORT TOOL' header is visible. Below it, a tabbed interface shows '1 Describe', '2 Formats', '3 Data', and '4 Summary'. The '2 Formats' tab is active, listing various file formats with checkboxes: Shapefile (.shp), GeoPackage (.gpkg), Garmin (.img), Google Earth (.kml), OSM (.xml), OSM (.pbf), MAPS.ME (.mwm), OsmAnd (.obf), and MBTiles (.mbtiles). A 'Next' button is located at the bottom right of this section. Below the list, a status bar indicates 'OpenStreetMap database last updated 2 minutes ago'. On the right, a map of Puerto Rico is shown with a blue dashed outline indicating the 'Area Of Interest (AOI)'. The map includes labels for major cities like San Juan, Ponce, and Mayagüez. A search bar at the top right of the map contains the text 'puerto rico'. A 'Tools' sidebar on the far right includes options like 'BOX', 'DRAW', 'THIS VIEW', and 'IMPORT'. At the bottom right of the map, there is a 'ZOOM TO SELECTION' button and a scale bar for 50 km. The footer of the map area credits 'OpenStreetMap contributors' and 'Mapbox'.

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

# How to download OSM data?

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- 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)<sup>49</sup>

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



<https://www.hotosm.org>

@hotosm 



[https://www.youtube.com/watch?v=oNZ\\_ZBCTRqc](https://www.youtube.com/watch?v=oNZ_ZBCTRqc)





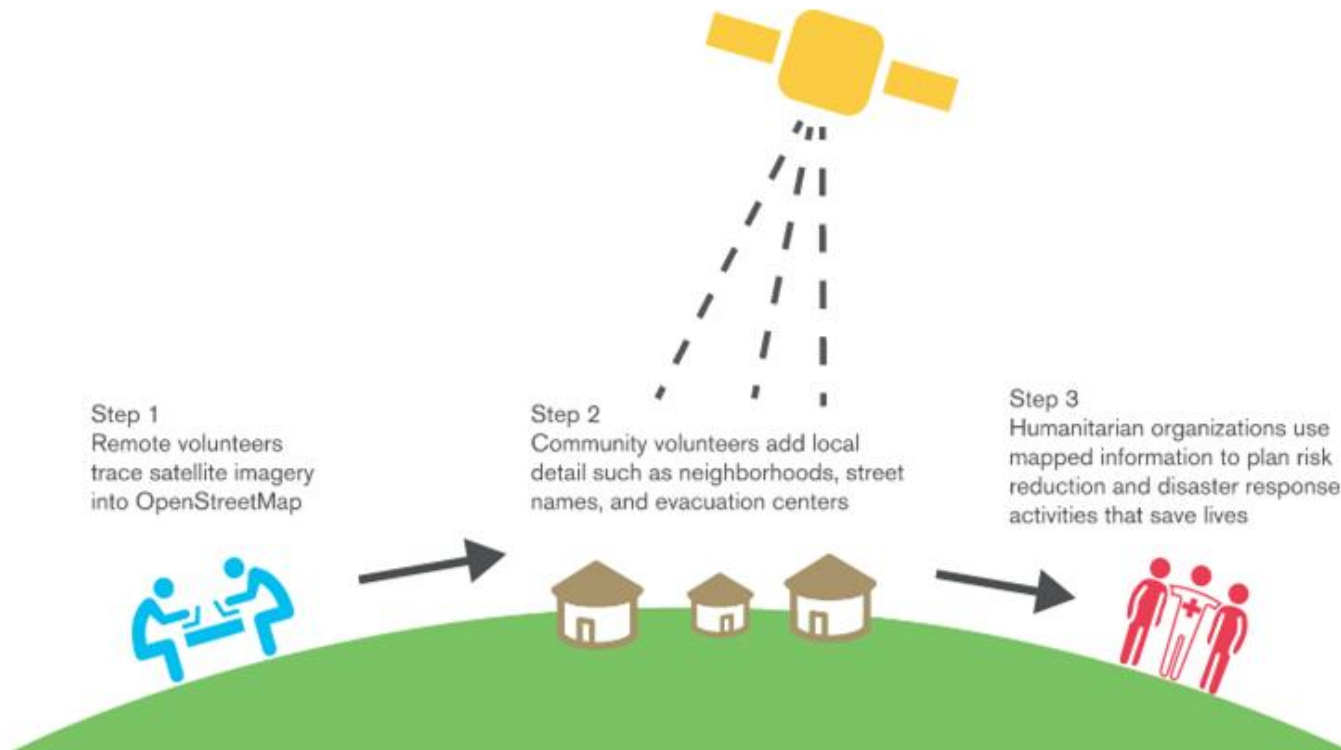
- Focused on anticipating humanitarian crises by identifying and mapping the **most vulnerable areas** of the world where maps do not exist.



**MISSING  
MAPS**

<http://www.missingmaps.org>

@TheMissingMaps 





# How to use OSM for humanitarian applications?

51

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

**HOT TASKING MANAGER** Contribute Learn About What is New? English mingo23

### Instructions

**Entities to map**  
Buildings only

**Changeset Comment**  
#hotosm-project-4371 #Mapgive #hotosm #withrefugees #missingmaps

**Imagery**  
tms[22]:https://{switch:services,server}.arcgisonline.com/arcgis/rest/services/World\_Imagery/MapServer/tile/{zoom}/{y}/{x}?blankTile=false

For this task, mappers are being asked to map buildings only across the entire area

- In the ID editor: label the area as "Building", then correct for right angles with the "S" key
- In JOSM: from the Tags/Memberships window, click "Add" and use the tag "building=yes"; then correct for right angles using the "Q" key. For this task, mappers are being asked to map buildings only across the entire area

The imagery will show buildings as a mixture of 'formal' constructions, huts and other structures

### Shelters

- In the ID editor: label the area as "Building", then correct for right angles with the

**Legend**

- Ready
- Mapped
- Bad imagery
- Validated
- Invalidated
- Locked
- Locked by you

2 km

OpenStreetMap contributors

<https://tasks.hotosm.org>

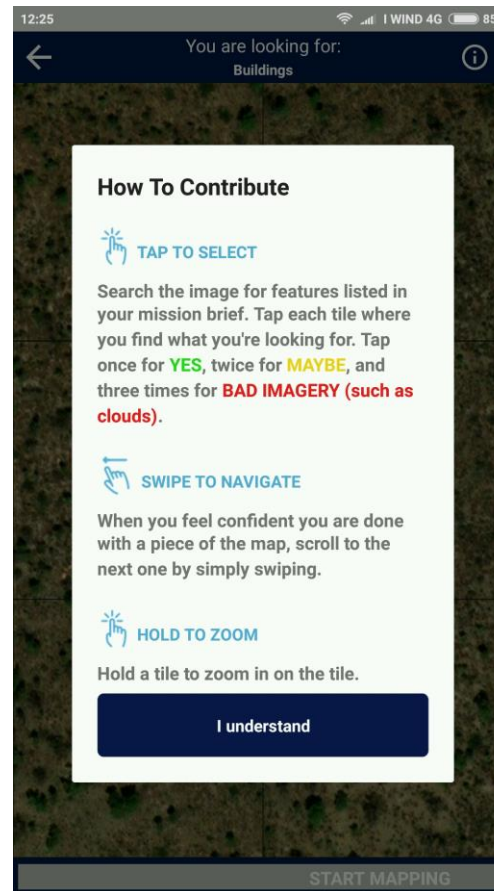
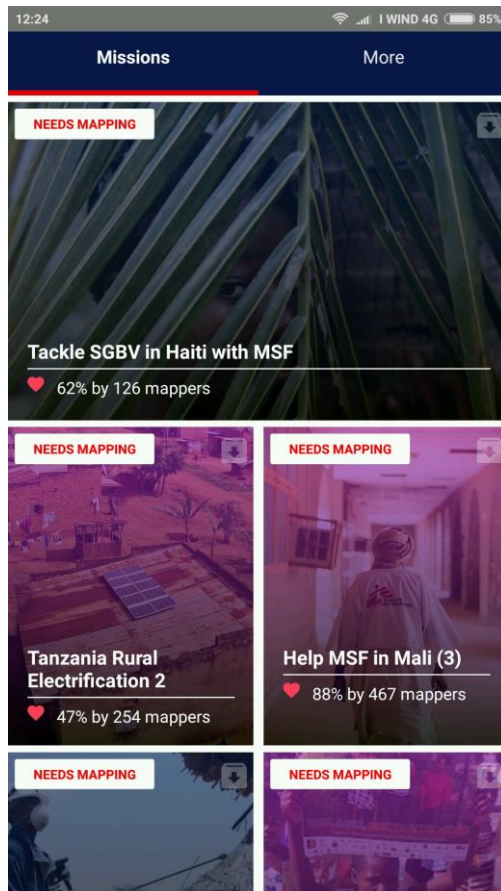




# How to use OSM for humanitarian applications?

52

- 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?

54

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

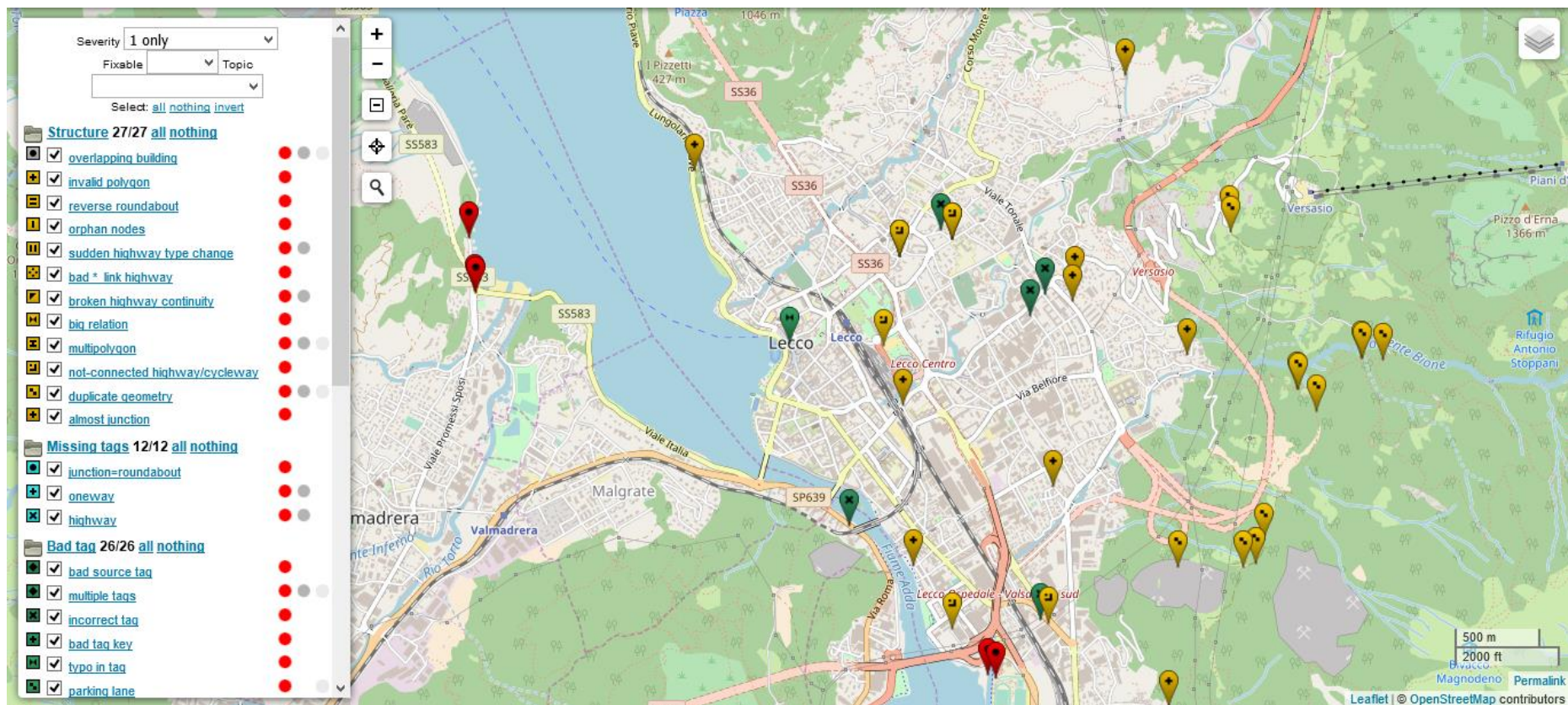
[http://keepright.ipax.at/report\\_map.php](http://keepright.ipax.at/report_map.php)



# How to check the quality of OSM data?

55

- 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>

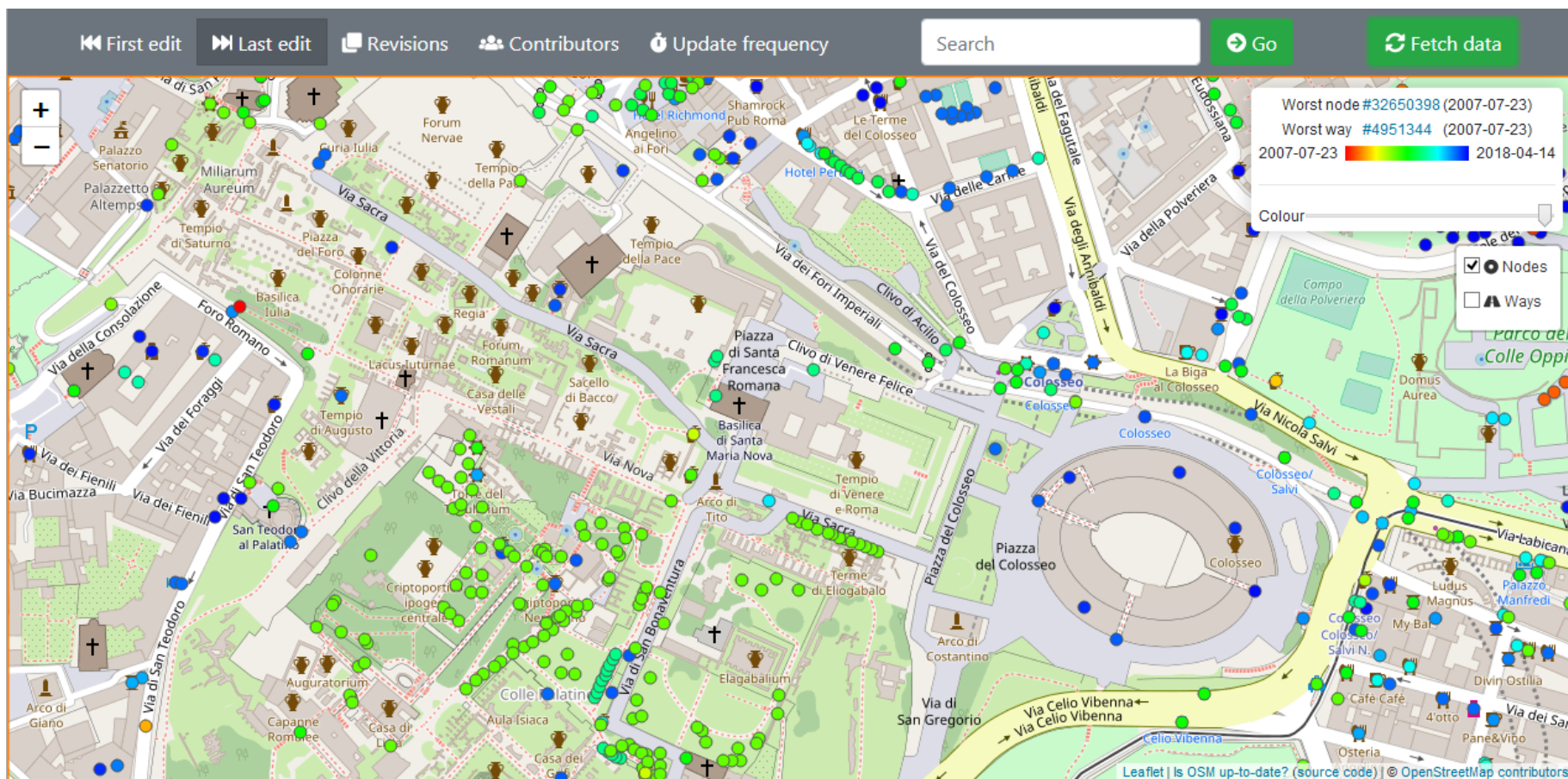




# How to check the quality of OSM data?

56

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



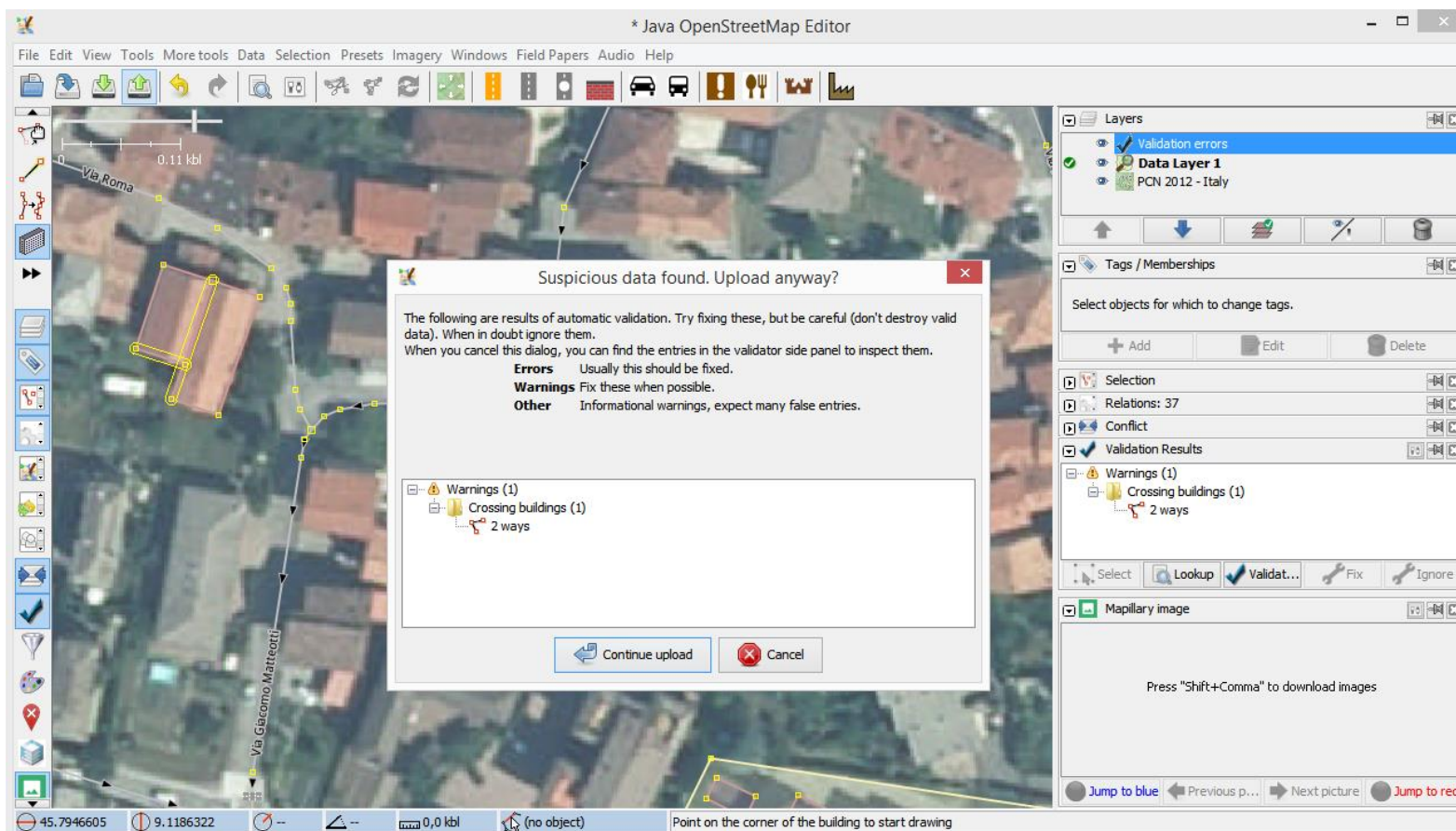
<https://is-osm-uptodate.frafra.eu>



# How to check the quality of OSM data?

57

- 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?

58

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



English

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

[KEYS](#) · [TAGS](#) · [RELATIONS](#) · [PROJECTS](#) · [REPORTS](#) · [ABOUT](#)

## 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?

59

- Many tools are available to check for mistake/inconsistencies in OSM data:
  - **Italian street directory**: finds mistakes in the Italian street names

Ricerca per nome del Comune

Q Como

Cerca

— Strade a Como 75

<b>Piazza Pietro Amato Perretta</b> ortografia	3	
<b>SP ex SS35 Statale dei Giovi</b> DUG non conosciuta	12	
<b>Strada Monte Boletto</b> ortografia	1	
<b>Via Adriano Auguadri</b> ortografia	2	
<b>Via Agliati</b> ortografia	1	
<b>Via Alberina</b>	1	

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



# Games



# How is OSM used in games?

61

- Many games use OSM as the base map source:

- X-Plane



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

- Tom Clancy's The Division



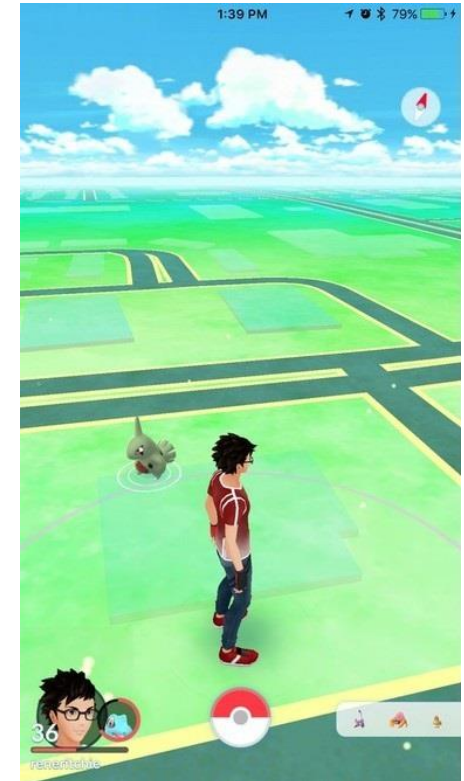
<https://tomclancy-thedivision.ubisoft.com/game/en-us>

- Collapse



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

- Pokemon Go



<https://pokemongolive.com>

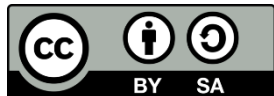




- A nice reference:
  - Mooney P. & Minghini M. (2017) A review of OpenStreetMap data. In: Foody G., See L., Fritz S., Mooney P., Olteanu-Raimond A.-M., Fonte C.C. and Antoniou V. (Eds) *Mapping and the Citizen Sensor*, 37-59. London: Ubiquity Press.  
<https://www.ubiquitypress.com/site/books/10.5334/bbf>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

# Thank you!

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