

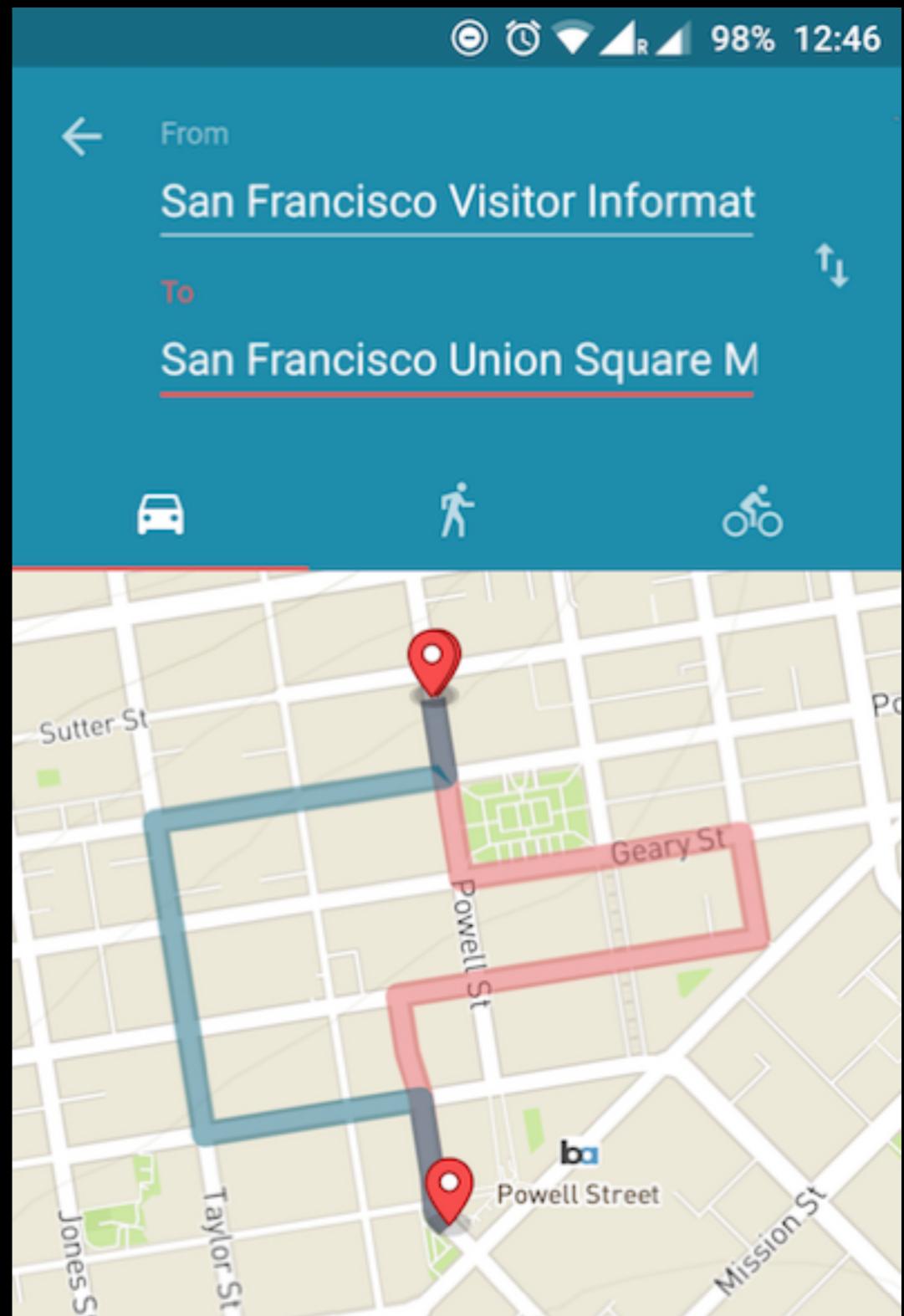
Making the Map Navigable

State of the Map Asia, Philippines

Abhishek Saikia, Mapbox

Why navigation data?

- Navigation engines:
Navigation map and routing profiles
- Navigation profiles for: in car navigation, walking/cycling apps, location based services
- **OSRM**
- OSM for personal navigation/
business?



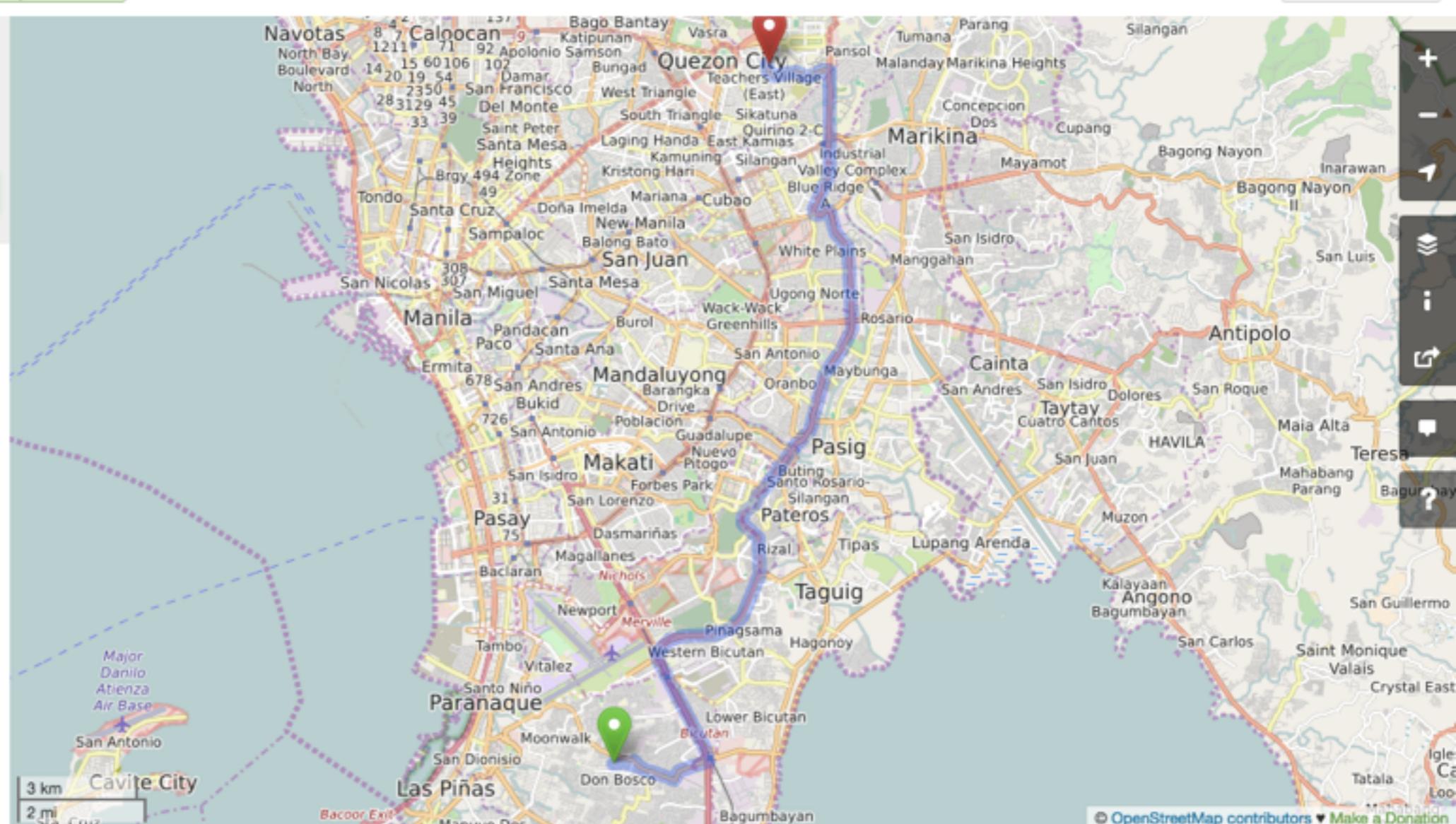
United Nations, Better Living Subdivision, Don
Diliman, Quezon City, District IV, Quezon City, M
Car (OSRM)

Go

Directions

Distance: 27km. Time: 0:21.

- ↑ 1. Start at end of United Nations 500m
- ↑ 2. Turn left onto Russia 90m
- 3. Turn right onto Doña Soledad Avenue 2.3km
- ↑ 4. Turn left on the ramp onto SLEX Bicutan NB Entrance 300m
- ← 5. Merge left onto South Luzon Expressway 2.1km
- ↑ 6. Take the ramp on the right onto C-5 Entrance 800m
- ↑ 7. Continue on C-5 Exit 500m
- ↑ 8. Continue on Carlos P. Garcia Avenue 7km
- ↖ 9. At the fork turn left onto unnamed road 6km





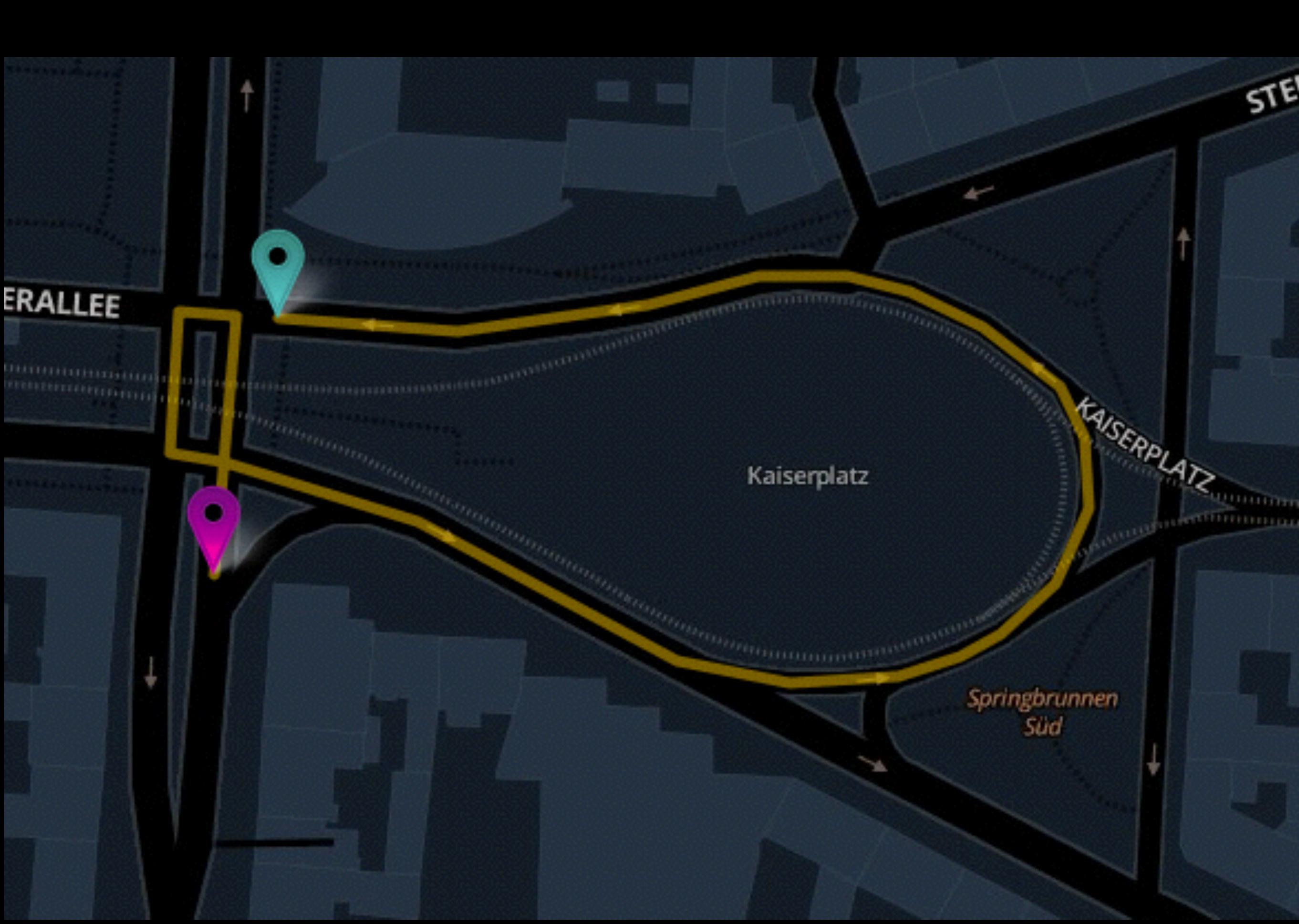
Navigation features in OSM

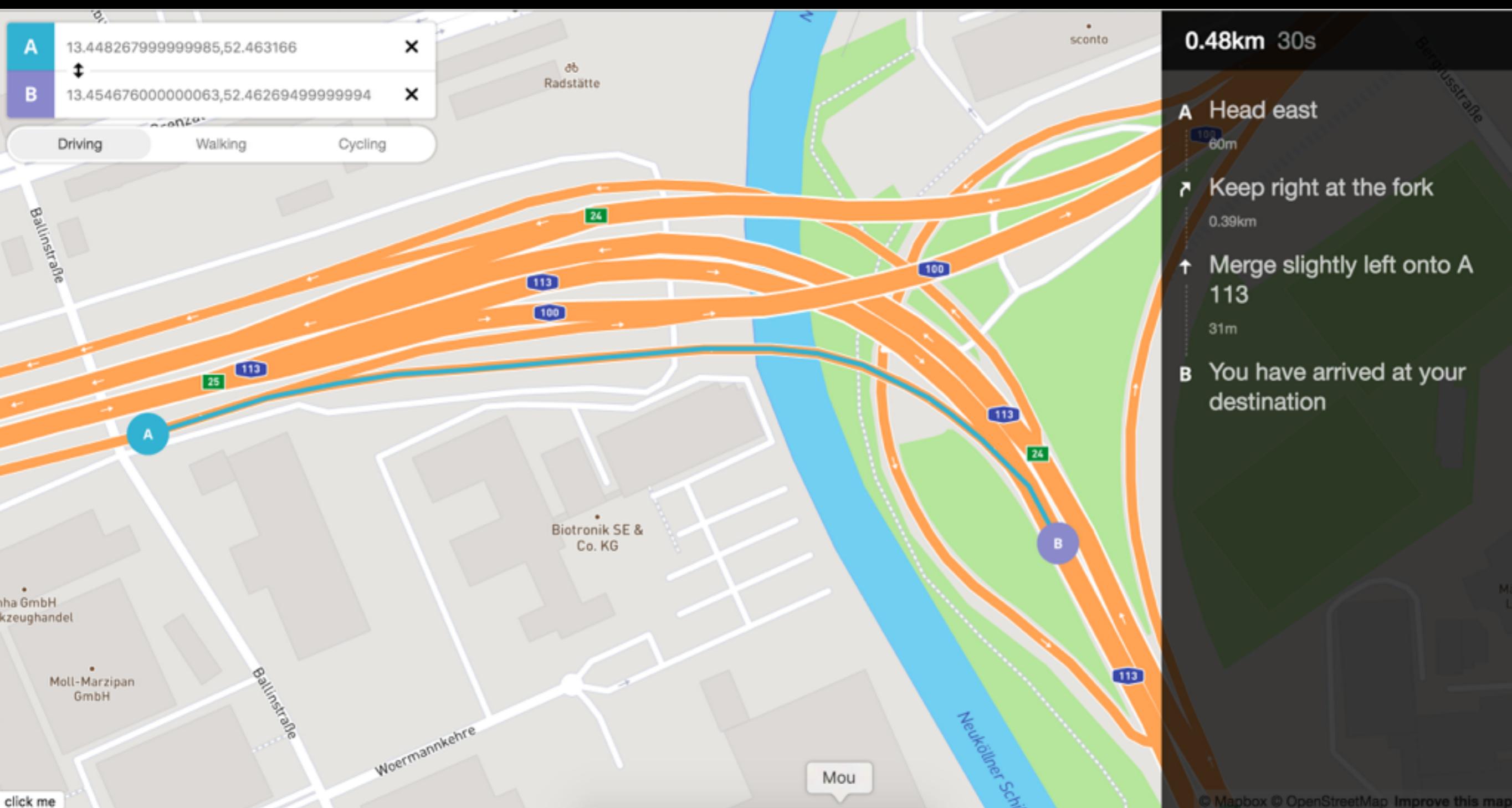
Routing:

- highway classification
- turn restrictions,
- oneway
- traffic signals
- access restrictions

Guidance:

- Turn lanes
- Exit and destination numbers and lanes





Mapping navigation features

- **Turn restrictions** (routing)
- **Turn lanes** (guidance)
- **Exit/destination numbers** (guidance)

Turn restrictions

Symbol	Description
	No straight through
	No Right Turn
	No Left Turn
	No Turns
	No U-turn
	No Left or U-turn

- Turn restrictions regulate traffic flow at intersections and accurately mapping them is critical for calculating valid routes on a map.
- 3 components: from, via and to



Search

Where am I?

[Go](#)**Relation: 5500349**

C. M. Recto-Rizal Avenue: split ways and add turn restrictions

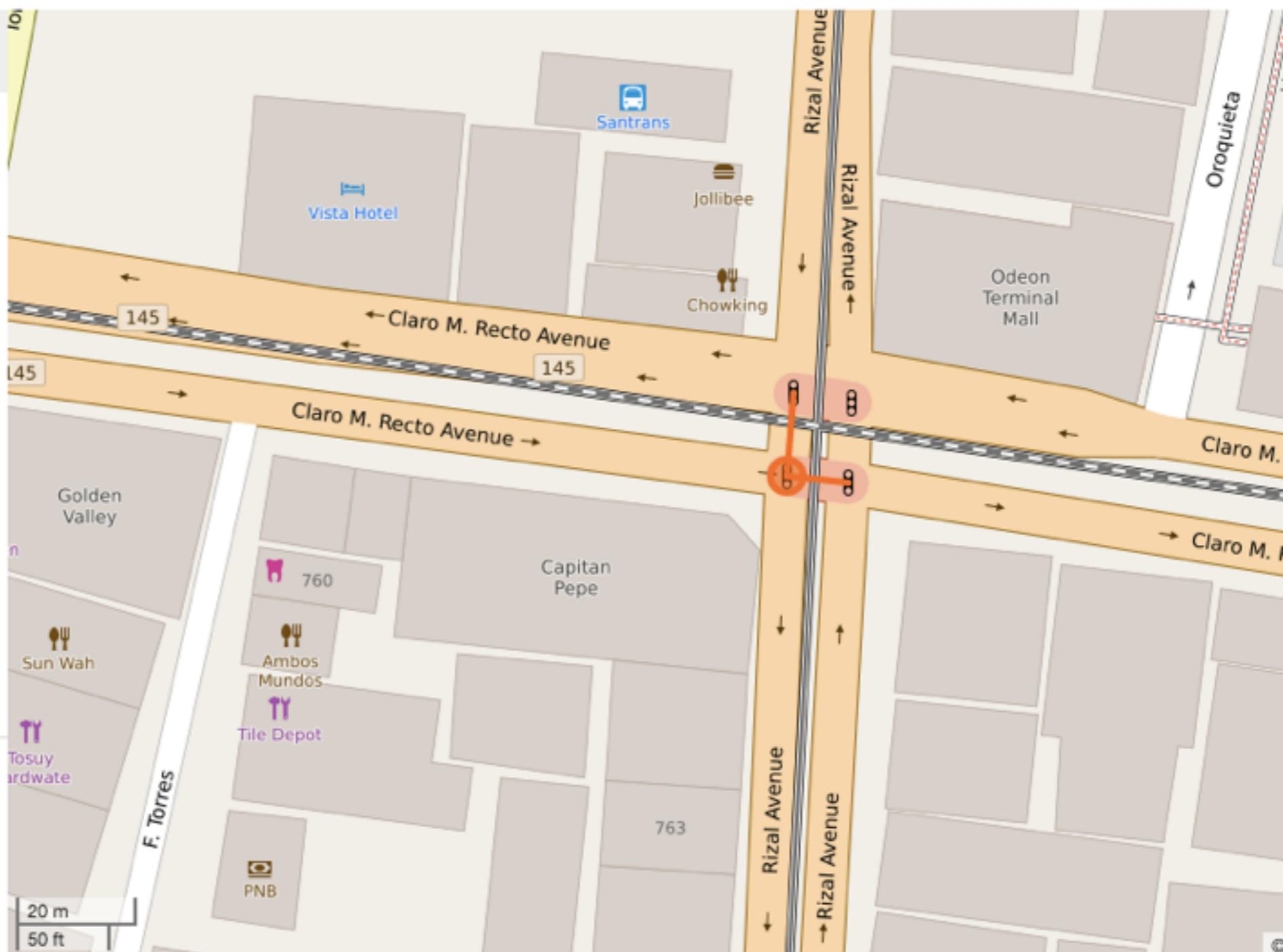
Edited about 1 year ago by [TagaSanPedroAko](#)
Version #1 · Changeset #33958820

Tags

restriction	no_left_turn
type	restriction

Members

- Way Rizal Avenue (370191607) as from
- Way Claro M. Recto Avenue (370191604) as to
- Node 185351944 as via

[Download XML](#) · [View History](#)

Search

Where am I?

Go

**Relation: 5500348**

C. M. Recto-Rizal Avenue: split ways and add turn restrictions

Edited about 1 year ago by [TagaSanPedroAko](#)

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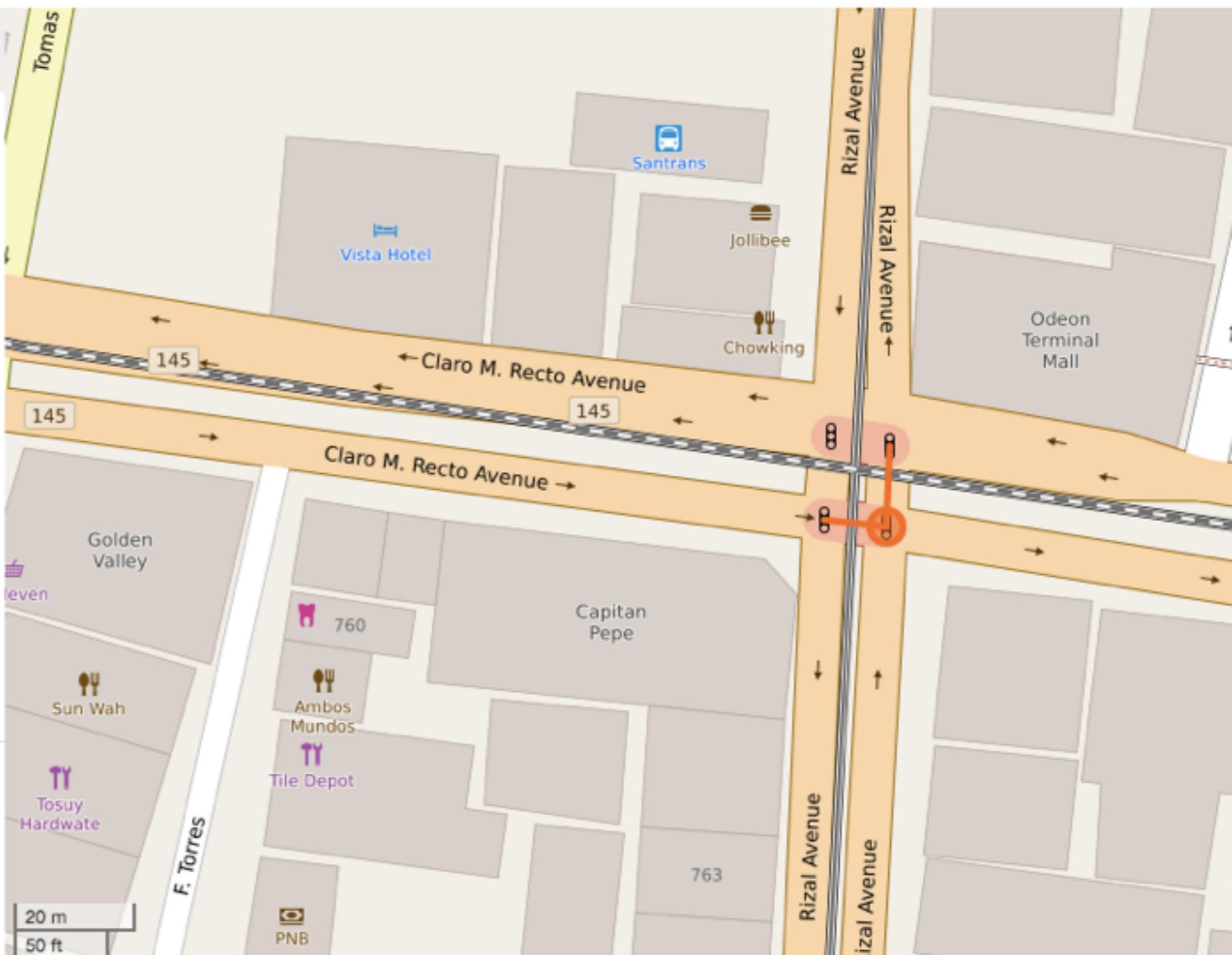
Members

Way Claro M. Recto Avenue (370191604) as from

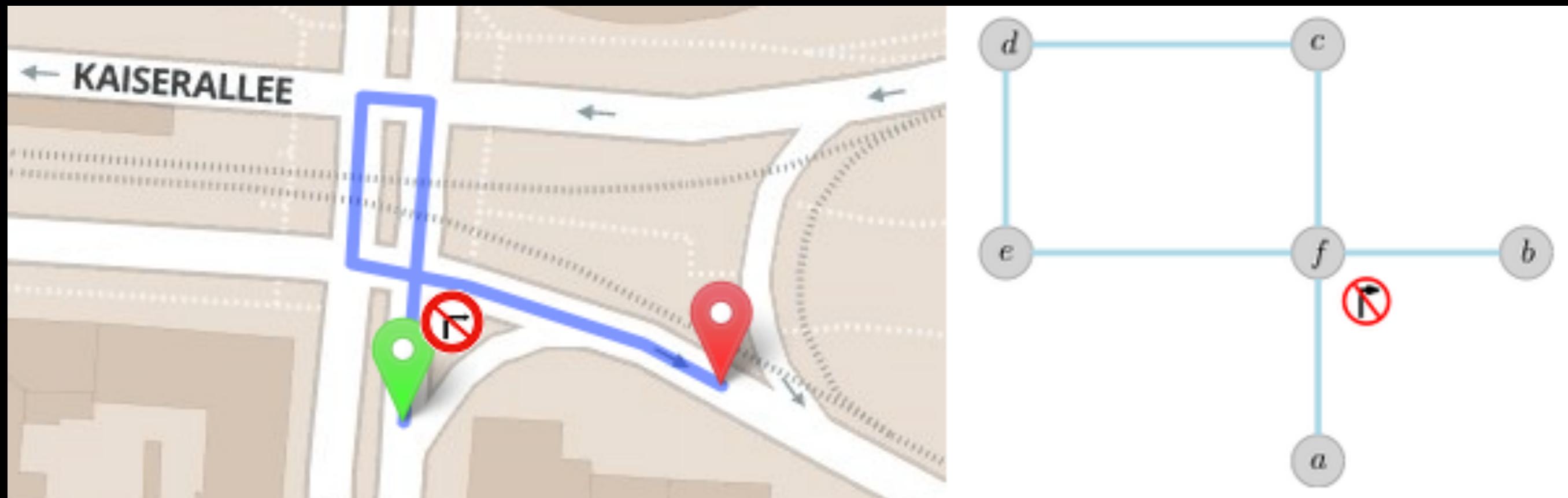
Way Rizal Avenue (370191606) as to

Node 67751575 as via

[Download XML](#) · [View History](#)



Turn restriction (routing)



Lane guidance

A photograph of a yellow school bus parked on a street. The street features white lane markings, including arrows indicating traffic flow. The word "through" is overlaid on the image at three different points along the arrows.

through

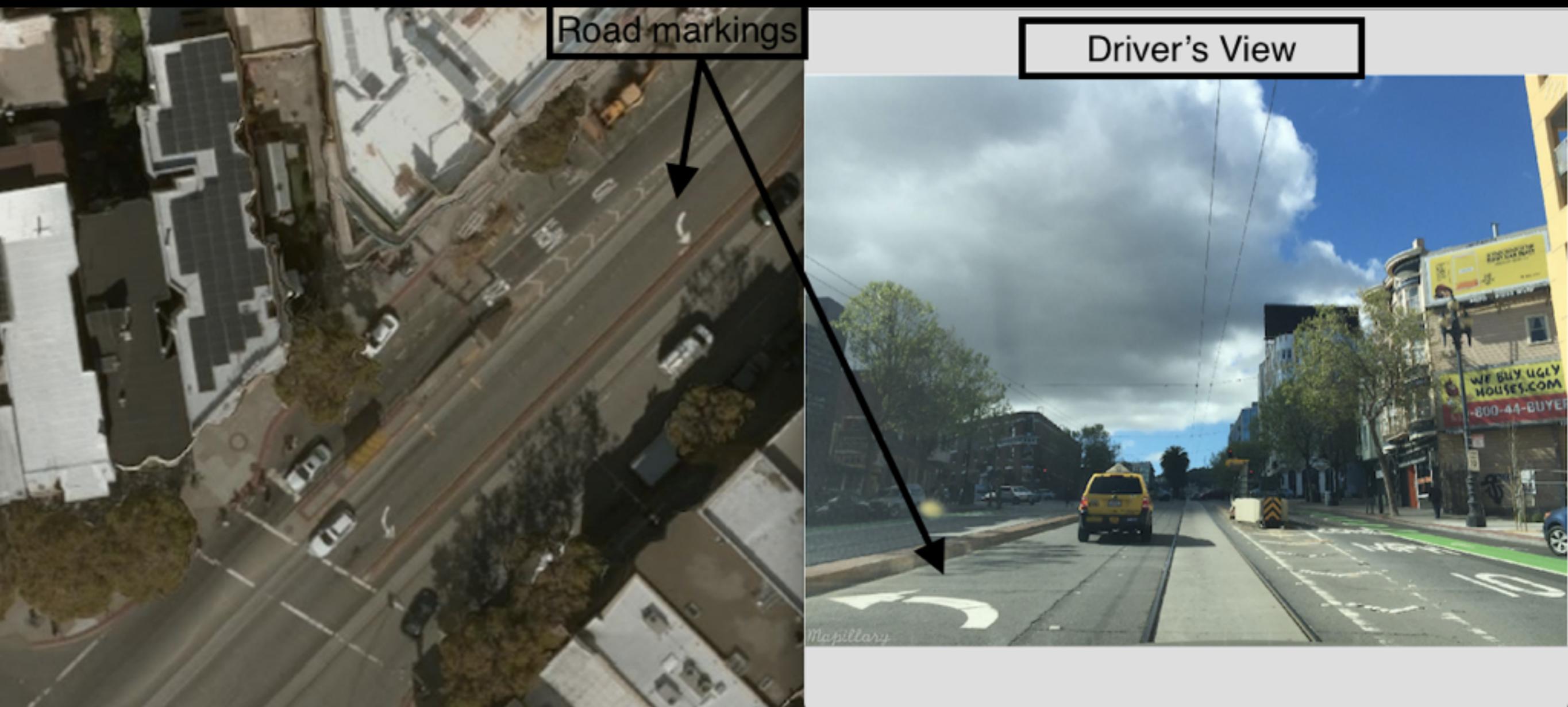
through

through

left;through

left

Turn lanes





Mapillary picture — mpmckenna8 — 28/01/2015 - 6:35:22 AM (IST)

Driver's view

A driver's perspective of a multi-lane highway during sunset. The sky is filled with warm orange and yellow hues. In the foreground, there are road markings: a dashed white line on the left and a solid white line on the right. A blue arrow points from the text "Driver's view" to the center of the dashed white line. The highway is flanked by concrete barriers and streetlights. In the background, there are buildings, trees, and power lines under a clear blue sky.

Mapillary

View in website

Jump to blue Previous picture Next picture Jump to red

+ Add Edit Del... Map Paint Styles

Image courtesy of LAR-IAC © 2016 Microsoft Corporation

2.7 km

Theodore Roosevelt Pkwy



Turn lanes



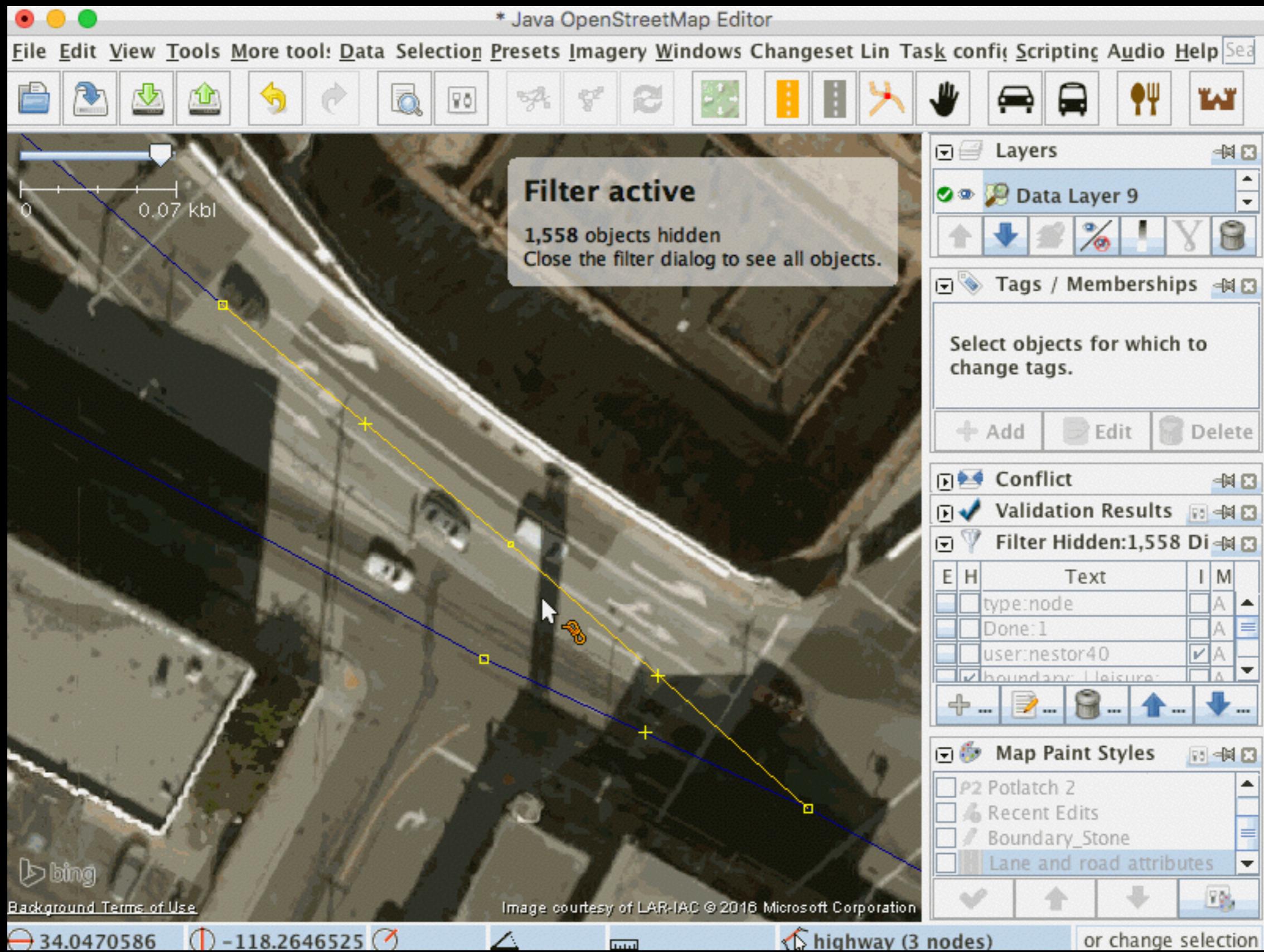
Creek and Potomac Pkwy NW

Creek Trail



heodore Roos

Mapping turn lanes



Exit and Destination Mapping



Exits in OSM

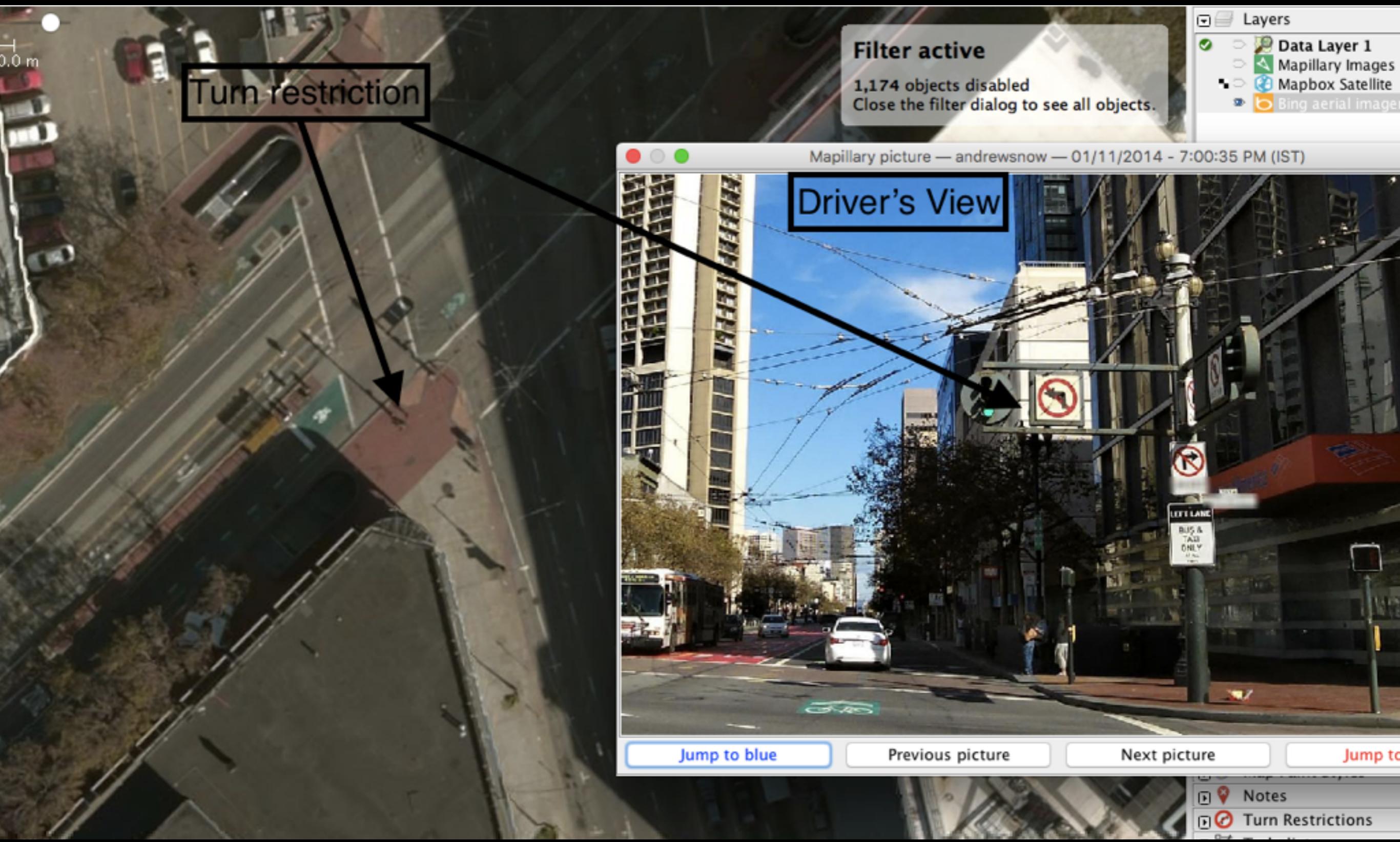


Destinations in OSM



Data Sources

- Satellite imagery
- Street view photos: Mapillary and OpenStreetView
- Wikipedia
- Department of Transportation (DOT) Websites
- Open Data Portals



Current Exits [edit]

Kilometer No.	Exit	Interchange type	Location	Remarks
9	Balintawak Interchange	Cloverleaf (End of Expressway)	Quezon City	Southbound traffic defaults onto Andres Bonifacio Avenue, to Caloocan (East Grace Park) and is the expressway's interchange with Epifanio de los Santos Avenue (EDSA) over elevated Light Rail Transit (LRT-1). Going right is going to Manila, Navotas, and Malabon and going left is going to Quezon City proper, Marikina, San Juan, Mandaluyong, Makati and Pasay. Before NLEX was built, it was a roundabout connecting EDSA, A. Bonifacio Avenue and Quirino Highway.
10 Northbound	Novaliches Exit	Half Y		Northbound exit only. This exit is directly connected to Quirino Highway (R-8 Alternate). It is an alternate route to other parts of Quezon City and Bulacan province. Motorists from EDSA northbound must take the service road to Quirino Highway.
11 Southbound	Libis Baesa Exit	One-way Exit Ramp		Southbound exit only. This serves as an alternate route for vehicles going to Caloocan and Malabon cities and to Quirino Highway through Baesa, Quezon City and Santa Quiteria, Caloocan.
12 Northbound	Balintawak Toll Plaza		Caloocan (South)	Proceeding northbound, motorists pay the open system toll at this plaza. If the motorist exits on or before Marilao Exit, it will encounter no further plazas. Beyond this, motorists enter the closed system and will pay the closed system's toll at the toll plaza for their exit. There is a runaway truck ramp next to the toll plaza. The corporate offices of Manila North Tollways Corporation and Tollways Management Corporation are also located here.
13	Smart Connect Interchange	Cloverleaf		Formerly named NLEX-C5/Mindanao Avenue Link Interchange. Eastbound goes to Mindanao Avenue (NLEX segment 8.1), Westbound goes to MacArthur Highway and Navotas (NLEX Segments 9 and 10).
14 NLEX Segment 9	Gen. T. de Leon Exit	Folded Diamond		Exits to Captain Cruz Street in Barangay Gen. T. de Leon.
15	Paso de Blas Exit	Diamond		Exits to Maysan Road and formerly named Malinta Exit. West goes to Malinta, Valenzuela proper and MacArthur Highway. East goes to Bagbaguin and Novaliches in Caloocan (North) and Quezon City. Renamed to Paso de Blas Exit with the opening of Karuhatan Exit.

Wikipedia: North Luzon Expressway

County	Direction of Travel	Interchange with	Exit No.
<u>USH 10</u>			
Wood	E B and WB	STH 13 North and CTH A - Marshfield	186
Portage	EB and WB	STH 13 South and STH 34 South – Junction City and Wis Rapids	204
Portage	EB	STH 34 North, CTH P and CTH HH – Knowlton and Stevens Point	208
Portage	WB	STH 34 North, CTH P and CTH HH – Knowlton and Junction City	208
Portage	WB	IH 39 and USH 51 North - Wausau	213
Portage	EB and WB	CTH J	230
Portage	EB	Amherst Jct. and Lake Road	237
Portage	EB and WB	CTH B West – Plover and Amherst	238
Portage	EB and WB	CTH A and CTH B East - Amherst	240
Waupaca	EB	STH 49 North and STH 54 West - Waupaca	250
Waupaca	WB	STH 49 North and STH 54 West - Waupaca and Wis. Rapids	250
Waupaca	EB and WB	STH 22 South and CTH K - Waupaca and Wild Rose	252
Waupaca	EB and WB	Churchill St	253
Waupaca	EB and WB	STH 22 North, STH 54 East, CTH A, and CTH K North - Waupaca	254
Waupaca	EB and WB	STH 110 North and CTH A - Weyauwega	260A
Waupaca	WB	CTH F - Weyauwega	260B
Waupaca	EB and WB	STH 49 and STH 110 – Berlin and Fremont	264
Waupaca	EB and WB	STH 96, STH 110, CTH II - Fremont	267
Winnebago	EB and WB	USH 45 North – New London	273
Winnebago	EB and WB	USH 45 South – Oshkosh	276
Winnebago	EB and WB	STH 76	283
Winnebago	EB	STH 76 and USH 41 North – Oshkosh and Shiocton	284

Department of transportation (DOT)
 Source: DOT , Wisconsin

Tools

- OSM Navigation Map
- CheckAutoPista2
- Mapillary plugin
- Overpass
- Turn lanes tagging plugin
- Knife tool

OPENSTREETMAP NAVIGATION DATA MAP

Create an open database of navigation data in your city. See [instructions](#) on how to use this tool to map turn restrictions.

78
3421,1878

3422,1878

3423,1878

3424,1878

3425,1878

3426,1878

3427,1878

3428,1878

3429,1878

79
3421,1879

3422,1879

3423,1879

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3425,1879

3426,1879

3427,1879

3428,1879

3429,1879

80
3421,1880

3422,1880

3423,1880

3424,1880

3425,1880

3426,1880

3427,1880

3428,1880

3429,1880

81
Tile Boundary (z10+)

Oneways 0

Mapillary Street Photos

Search

Upper Marikina River Basin Protected Landscape

saikabhi

Logout



3424,1878

3425,1878

3426,1878

3424,1879

3425,1879

3426,1879

3424,1880

3425,1880

3426,1880

3423,1881

3424,1881

3425,1881

3426,1881

3427,1881

Total Mapillary restrictions reviewed 5428,1881 9063

3429,1881

Valid 4438

Redundant 3607

Invalid 887

Laguna de Bay

OSM Navigation Map

The screenshot shows the "OPENSTREETMAP NAVIGATION DATA MAP" interface. The main area is a map of a street intersection with arrows indicating one-way traffic flow. A specific restriction is highlighted at the center of the intersection, labeled "regulatory--no-u-turn--". To the left of the map, there is a small image viewer showing a street view photo of the intersection. On the right side, there is a summary of reviewed restrictions: "Total Mapillary restrictions reviewed 9019", "Valid 4416", "Redundant 3597", and "Invalid 875". The top right corner features zoom controls (+, -, ▲). The bottom left contains navigation buttons for the street view photo.

OPENSTREETMAP NAVIGATION DATA MAP

Create an open database of navigation data in your city. See instructions on how to use this tool to map turn restrictions.

Search

Fulton St

Tulare St

regulatory--no-u-turn--

Fulton St

Tulare St

Restriction Validator

Total Mapillary restrictions reviewed 9019

Valid 4416

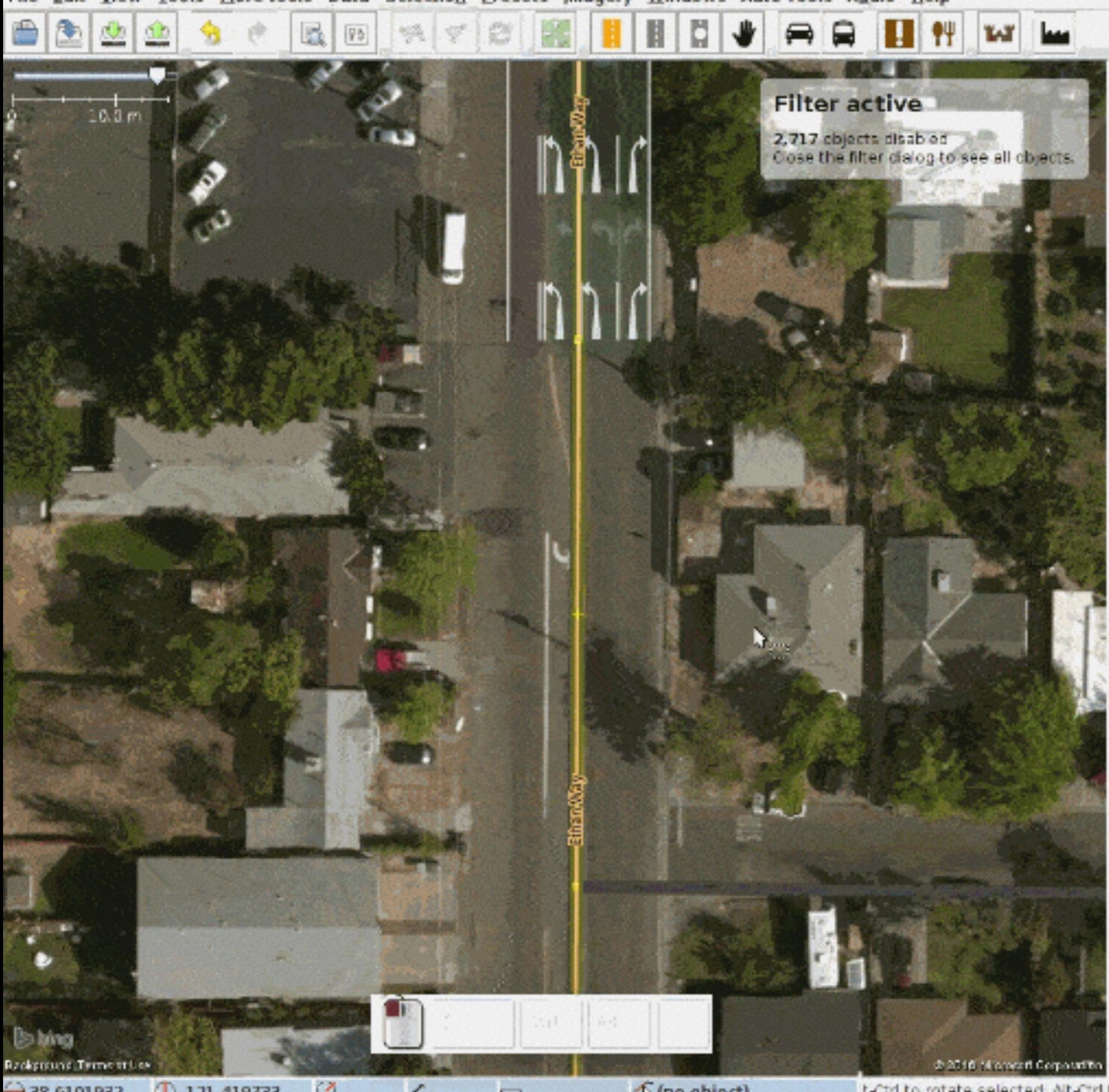
Redundant 3597

Invalid 875

Tile Boundary (z10+)

Oneways 29

Mapillary Street Photos



Layers

- Data Layer 1
- Bing aerial imagery

Tags / Memberships

Select objects for which to change tags.

Add Edit Delete

Conflict Validation Results Filter Hidden:0 Disabled

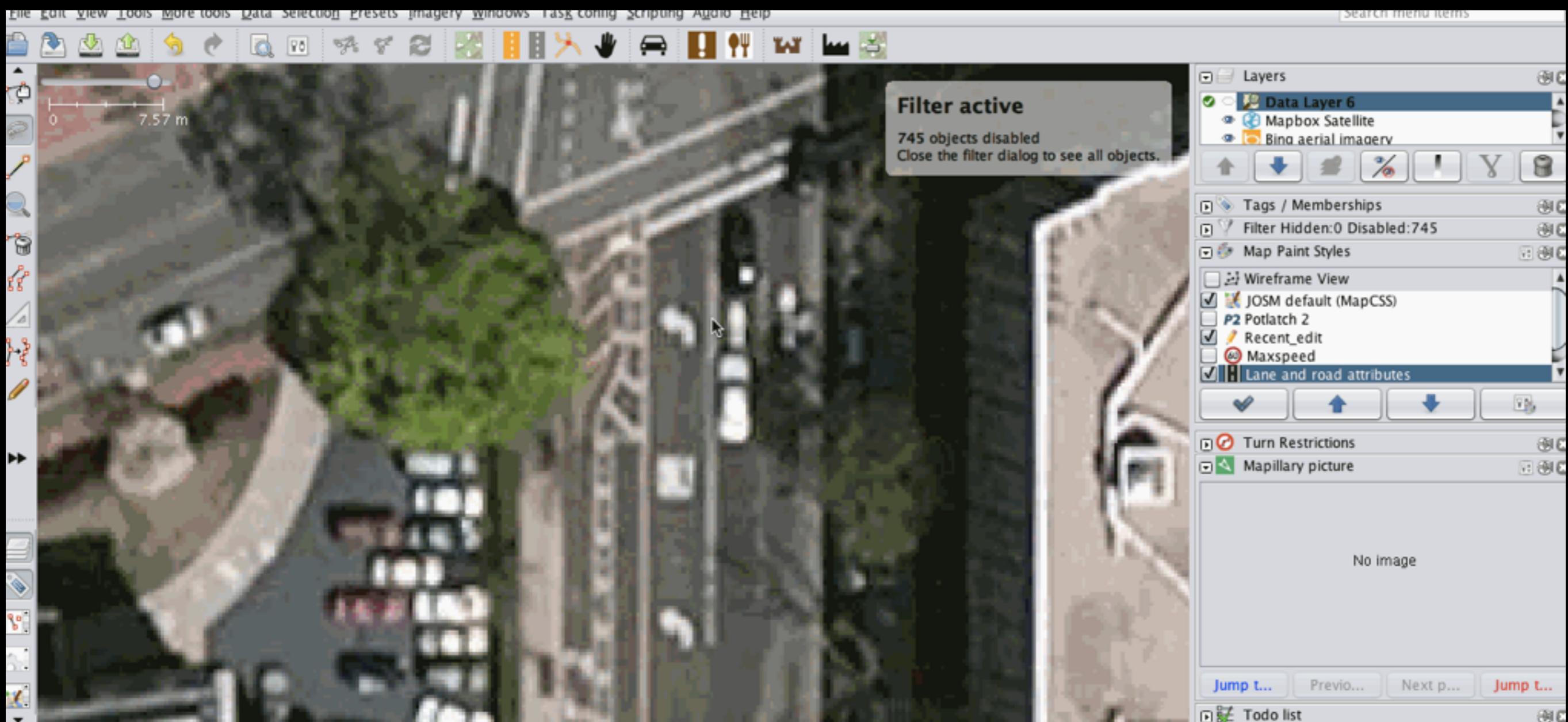
E	H	Text	I	M
<input type="checkbox"/>	motorway trunk		A	
<input type="checkbox"/>	Building		A	
<input type="checkbox"/>	boundary leisure island		A	
<input type="checkbox"/>	man_made		A	
<input type="checkbox"/>	residential unclassified		A	
<input type="checkbox"/>	barrer		A	
<input type="checkbox"/>	houseNumber		A	
<input type="checkbox"/>	place		A	
<input type="checkbox"/>	tourism		A	
<input type="checkbox"/>	powerLine		A	
<input type="checkbox"/>	underground		A	
<input type="checkbox"/>	powerCable		A	

Up Down

Map Paint Styles Todo list To-fix

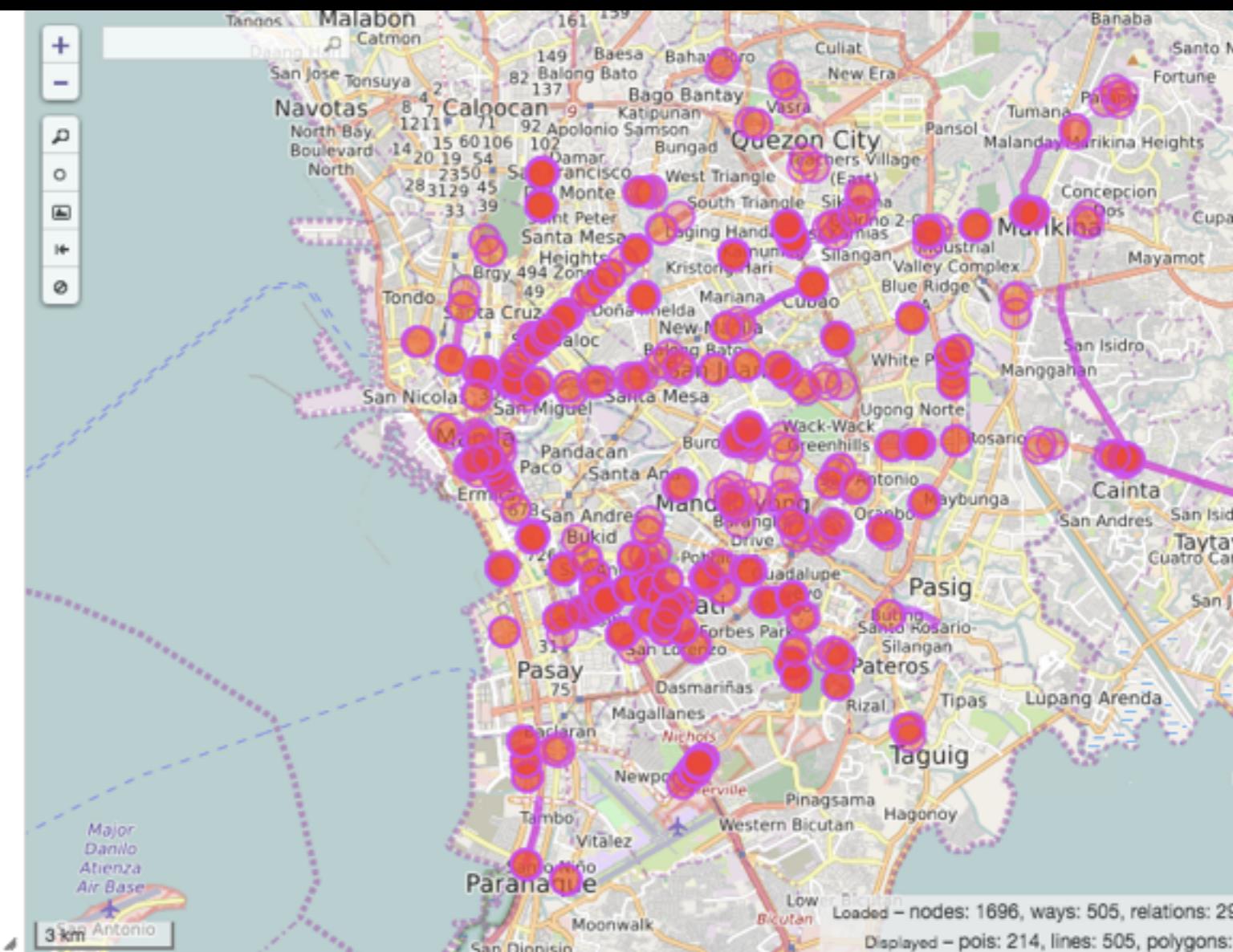
Knife JOSM tool

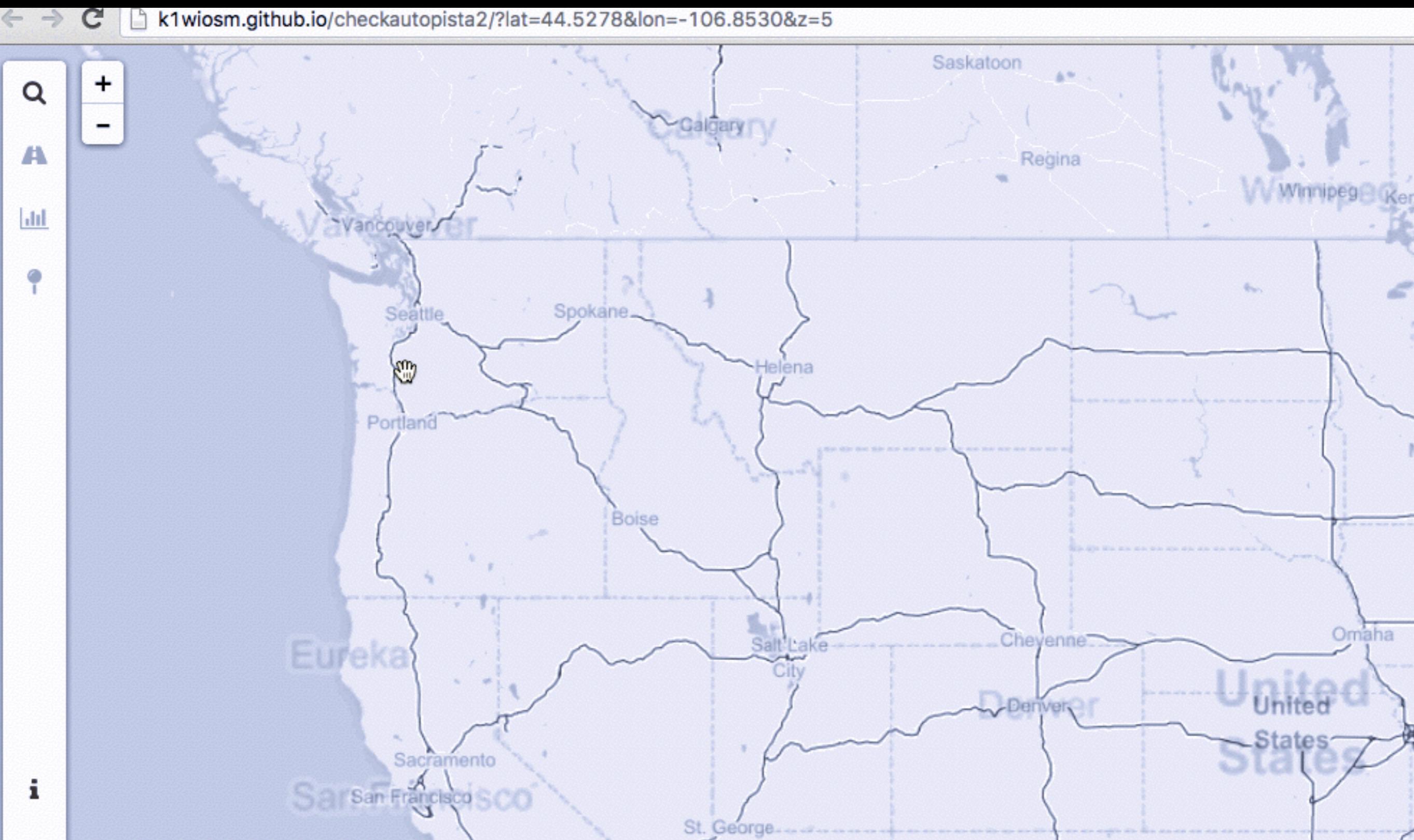
Mapillary JOSM plugin



Overpass

```
/*
This has been generated by the overpass-turbo wizard.
The original search was:
"restriction"
*/
[out:json][timeout:25];
// gather results
(
    // query part for: "restriction"
    relation["type"="restriction"]({{bbox}});
);
// print results
out body;
>;
out skel qt;
```





Checkautopista

Editors

- iD
- Java OpenStreetMap Editor (JOSM)

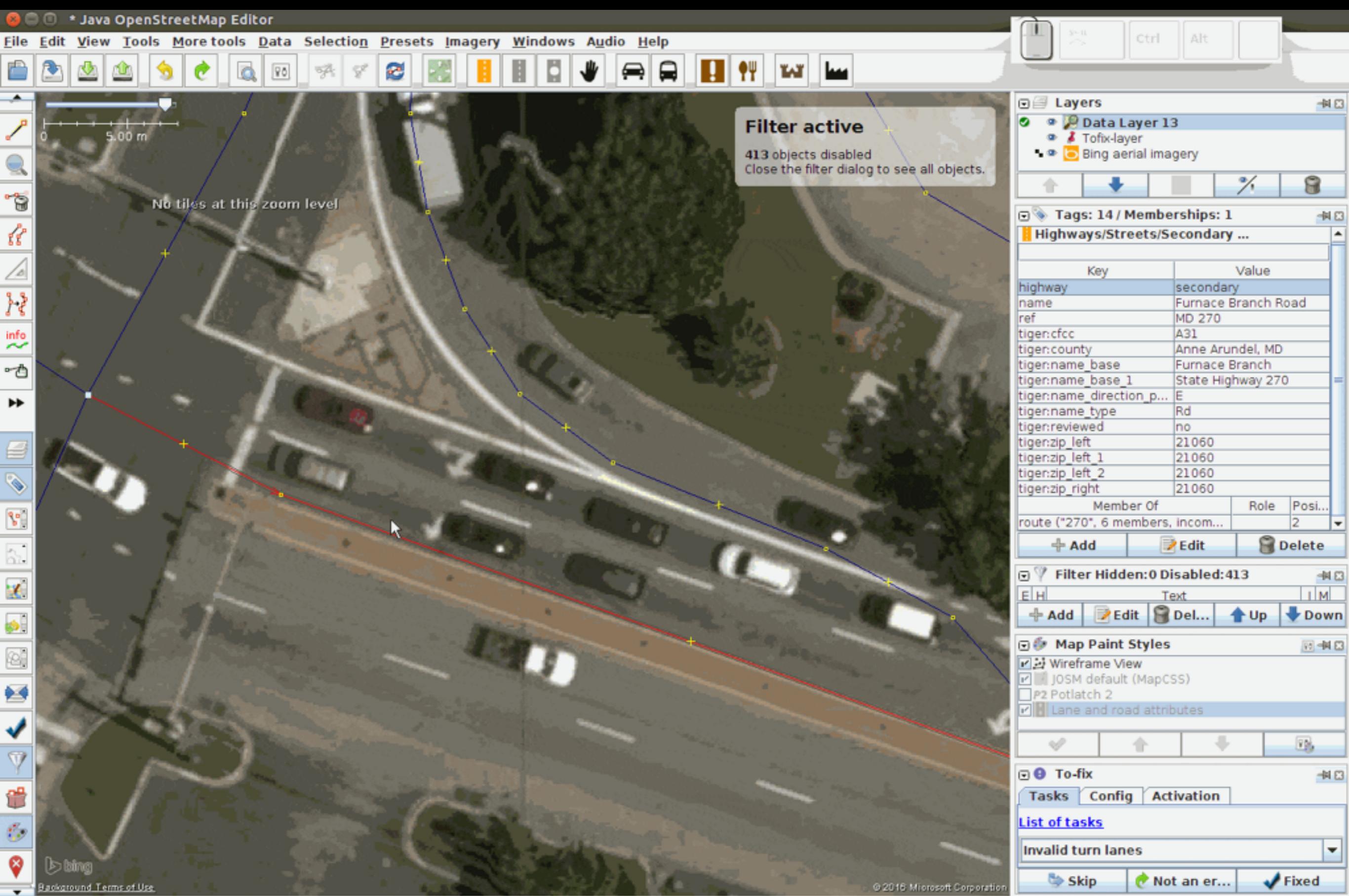
iD editor

Search features

Search

The image shows a satellite view of a city street intersection. A red line with arrows is drawn across the intersection, indicating a path or route. Several buildings and businesses are labeled: "Go Go Market", "Go Go Market & Deli", and "Rodeway Inn". Street names visible include "Mission Street" and "9th Street". The interface includes a toolbar at the top with buttons for "Point", "Line", "Area", "undo", "redo", and "Save". A "1" in a box indicates one edit has been made. The bottom of the screen shows the "bing" logo and copyright information, along with user statistics: "Edits by Aaron Lidman, Gregory Arenius, Rub21, and 15 others" and version "1.4.0".

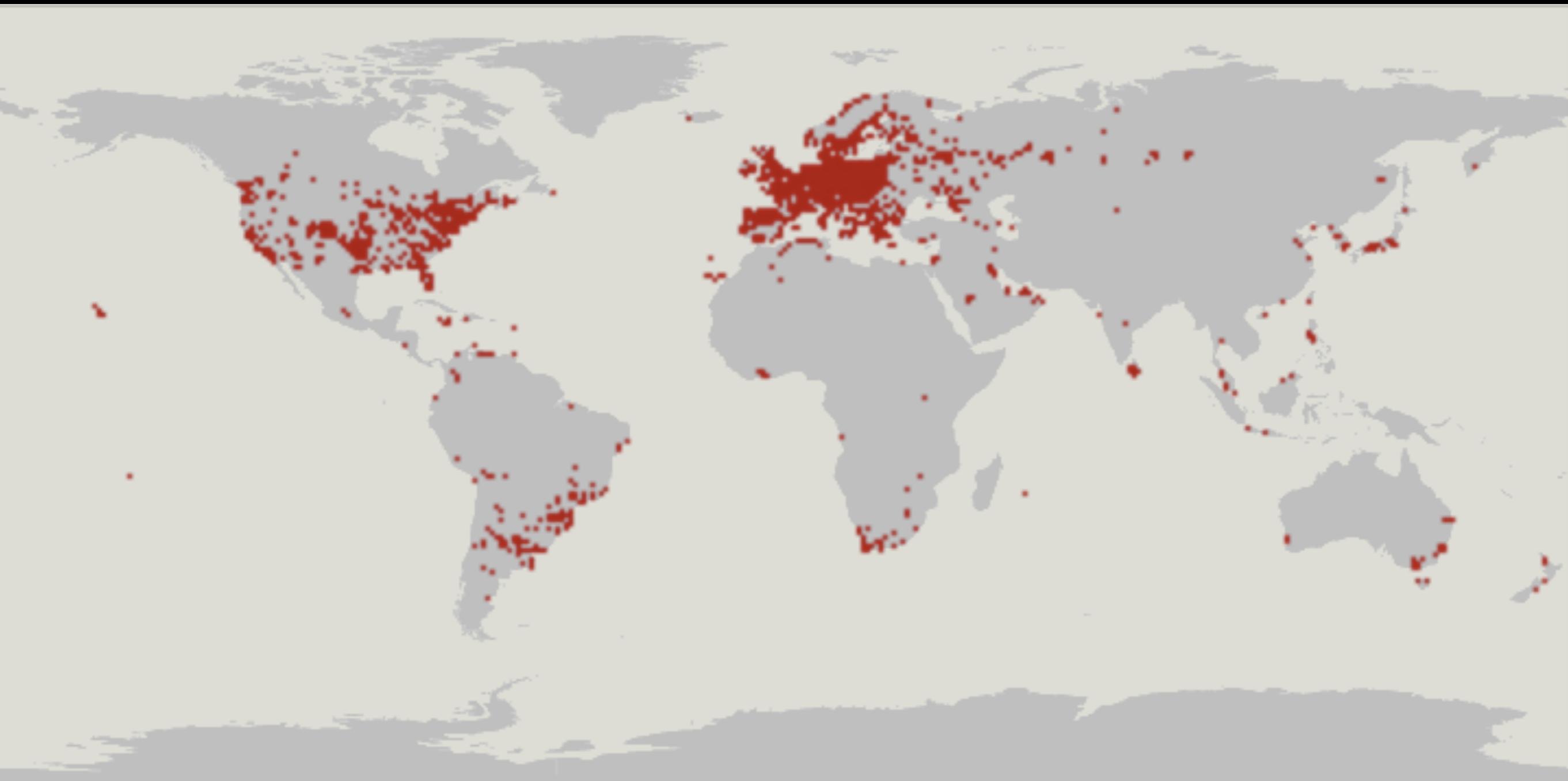
JOSM Turn Lane plugin



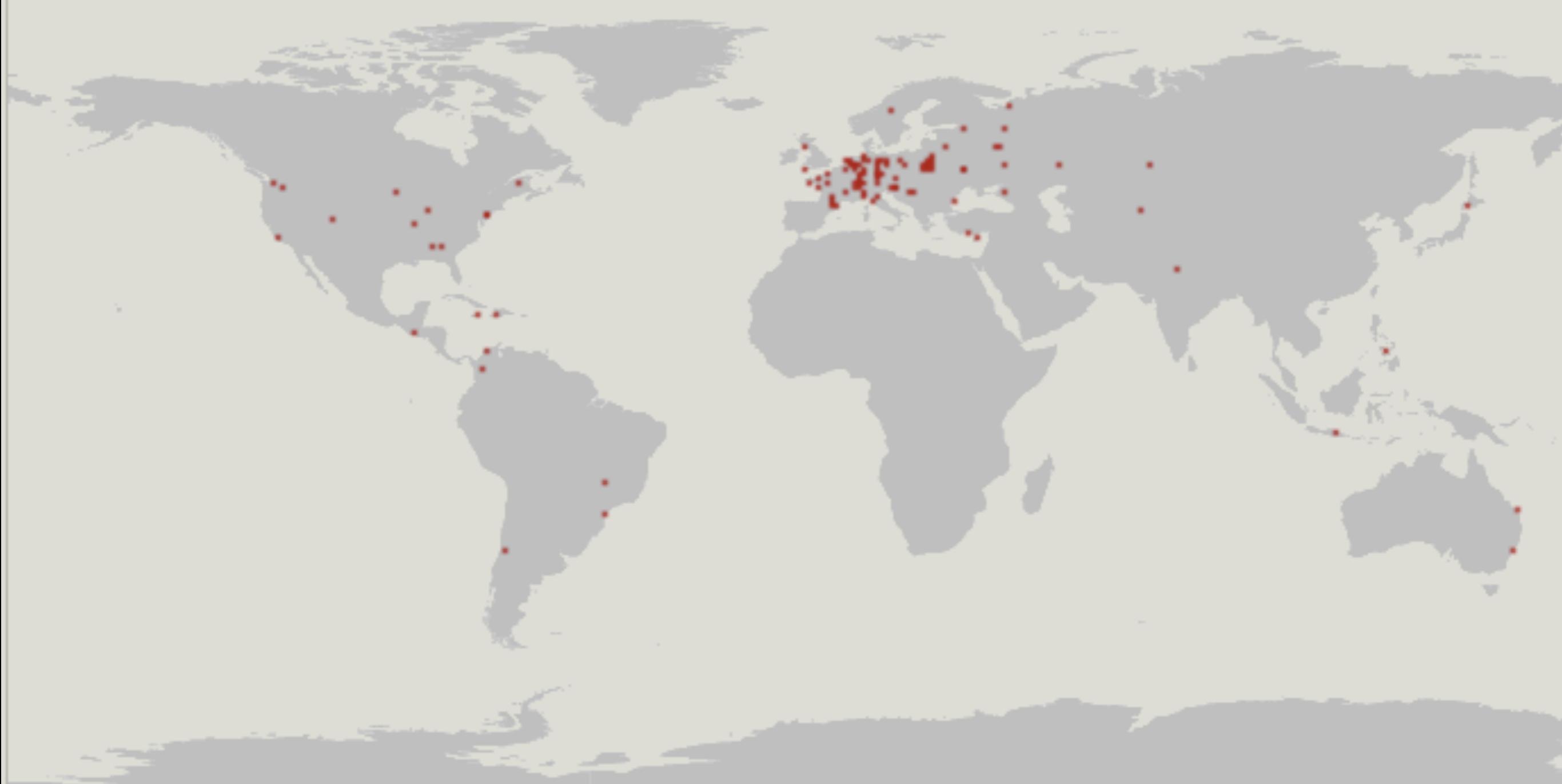
Navigation Features in OSM: Some numbers

- > 98,594,600 “highways”
- > 553,000 “turn restrictions”
- > 256,000 “turn lanes”
- > 169,000 “destinations”
- > 6,865,154 “maxspeed”

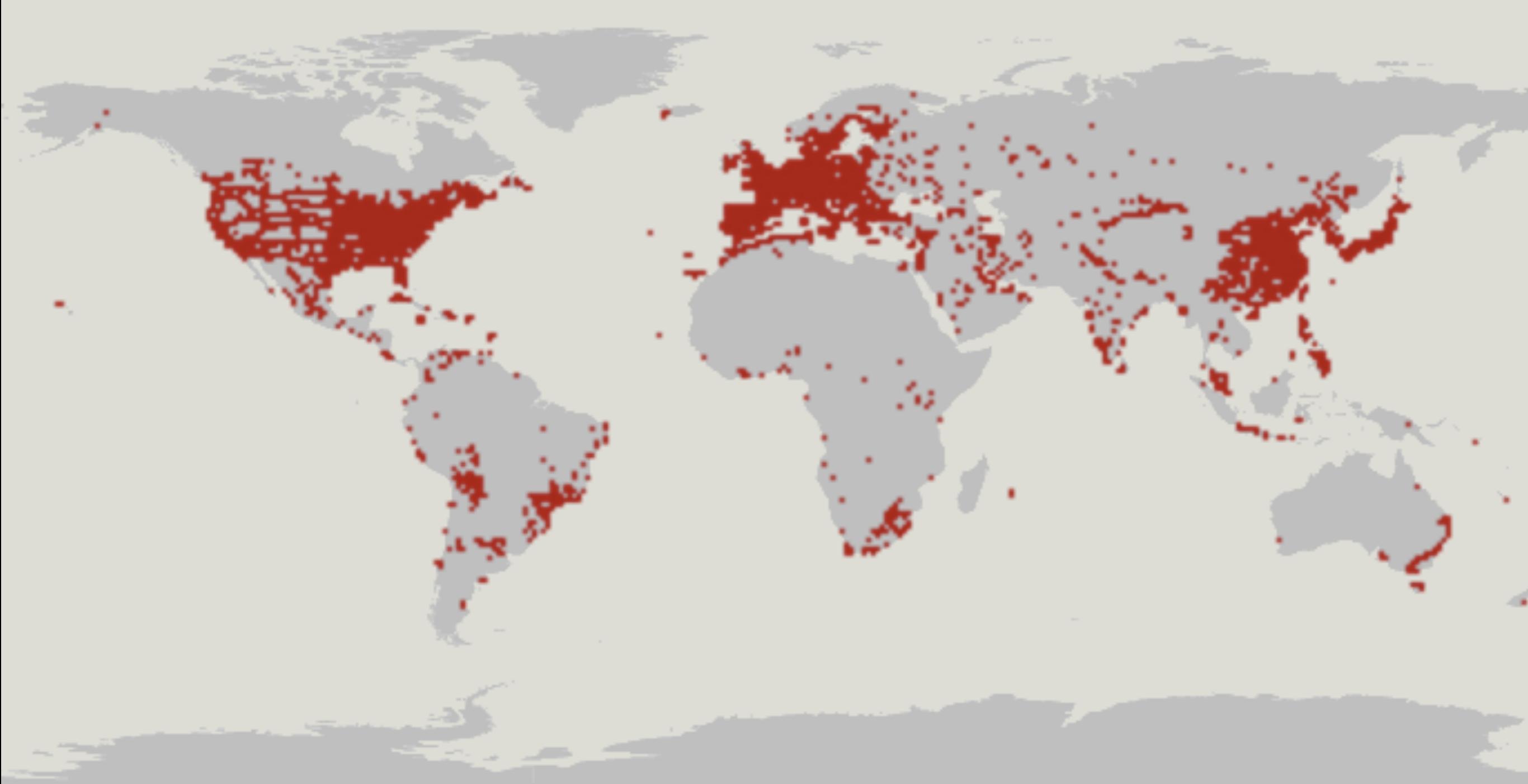
Source: taginfo



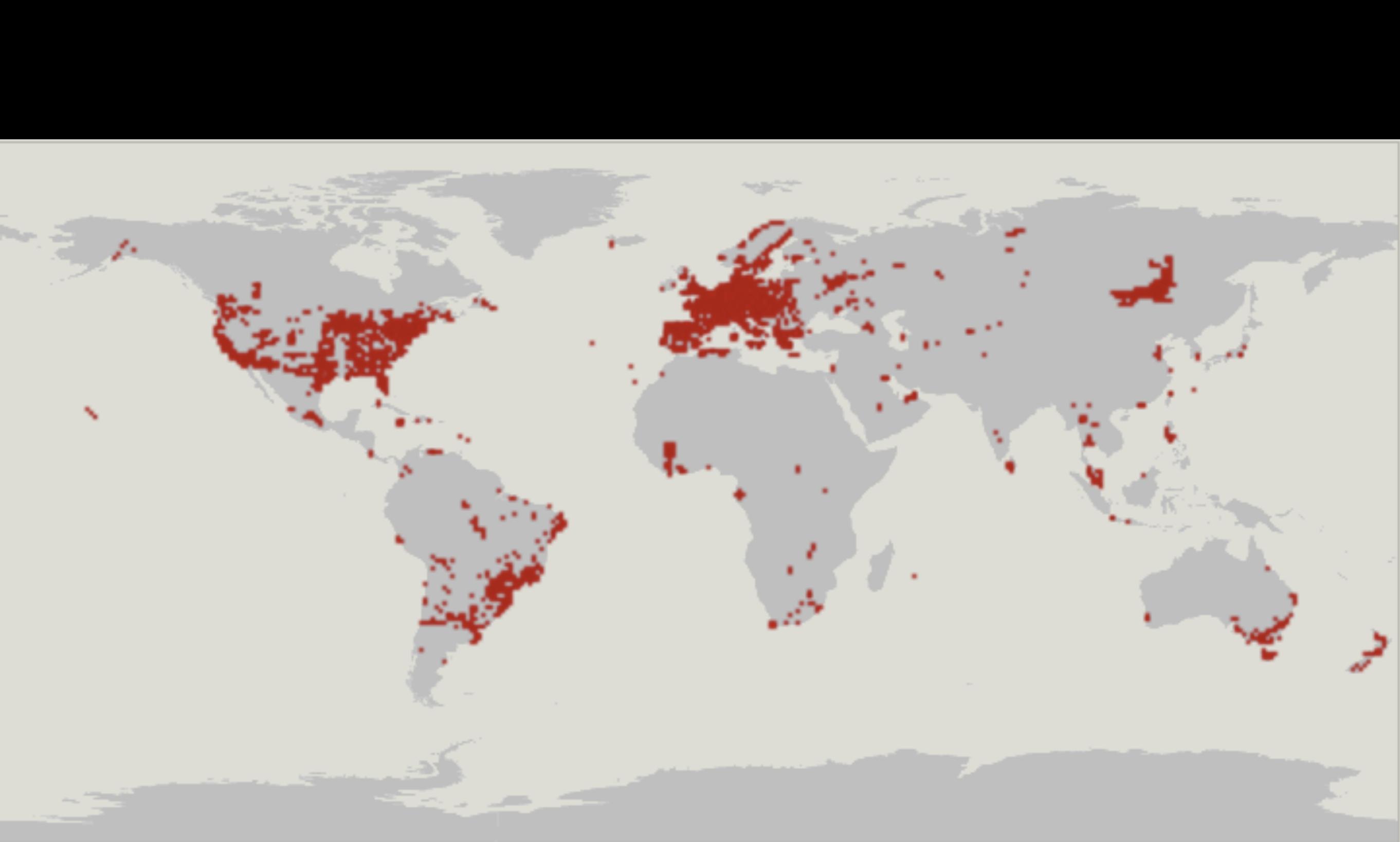
Turn lanes distribution



Turn Restrictions distribution



Exits in OSM: motorway junctions



Destinations in OSM

State of Navigation Data: Asia

Cities	Turn Restriction	Turn Lanes	Exits/Destinations
Metro Manila	360	75	20/724
Jakarta	40	0	84/13
Kuala Lumpur	42	583	90/137
Tokyo	746	154	411/1
New Delhi	15	0	21/0

Source: Overpass

Challenges

- Street View Coverage: Mapillary, OpenStreetView
- Hi-Resolution satellite imagery
- Government opendata access for mapping
- Data formats
- OSM Vs. actual coverage

Asia

- State of base data: highways alignment, missing streets, missing oneways
- Lack of government/open data sources
- (Relative) lack of street level photos/satellite

Future of navigation





- Hi resolution satellite/aerial imagery: Drones (cost, security?)
- Automatic feature detection, Machine Learning

Mapbox Navigation Mapping

- North America: US and Canada
- Europe: Germany and France
- Asia: Taiwan (road realignment and missing streets)



Community engagement

- Talk & mailing lists
- Diaries
- Social media
- Country specific guidance
- Validation
- Missing data
- German, Canadian, Japan, Taiwan, US and Indian OSM communities

Resources/References

- OSM wikis: Lanes, restrictions, highway classifications, turning indications per lane, oneway
- Navigation Mapping Guide: <https://github.com/mapbox/mapping/wiki/Improving-navigation-data-in-OpenStreetMap>

Navigation Mapping Guide

- Detailed documentation and workflow on mapping : turn restrictions, turn lanes and exit/ destination.
- Country specific guides: US, Canada and Germany

***“Let’s make OpenStreetMap the best map
in the world”***

@saikabhi1

abhishek@mapbox.com