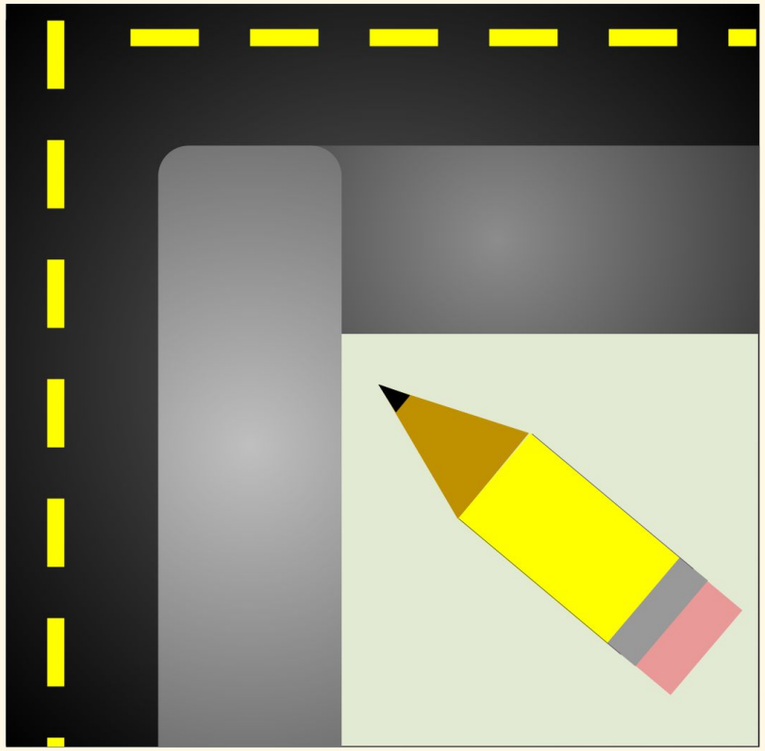


OSM SidewalKreator

A QGIS plugin for automated sidewalk drawing for OSM

Kauê de Moraes Vestena

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

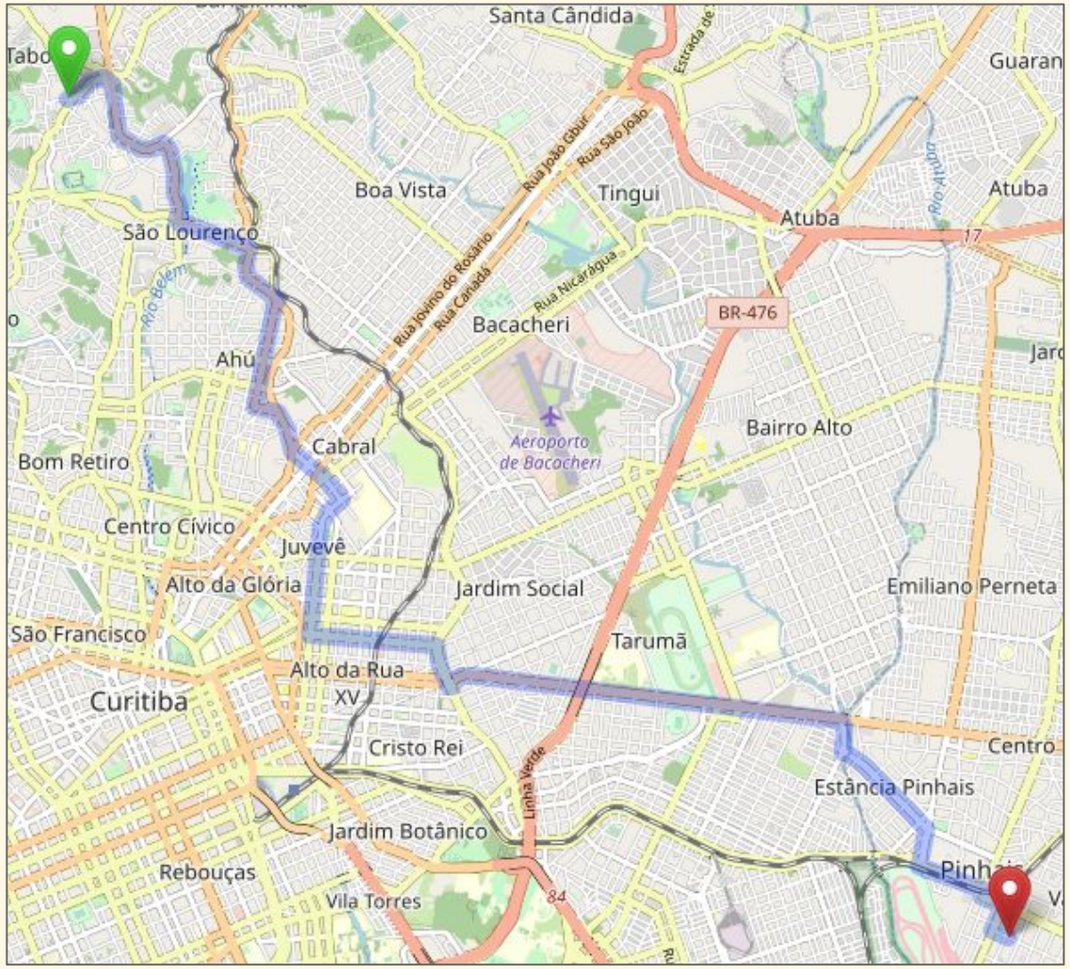
Advisors:
Silvana Philippi Camboim
Daniel Rodrigues dos Santos

first of all...

why i'm here??

because there are lots of accessible routes...

because there are lots of accessible routes...



FOR CARS!!

and there also plenty of fine access ramps!

and there also plenty of fine access ramps!

but just FOR CARS!!

now,

(more)

seriously...

sidewalks are very important!!

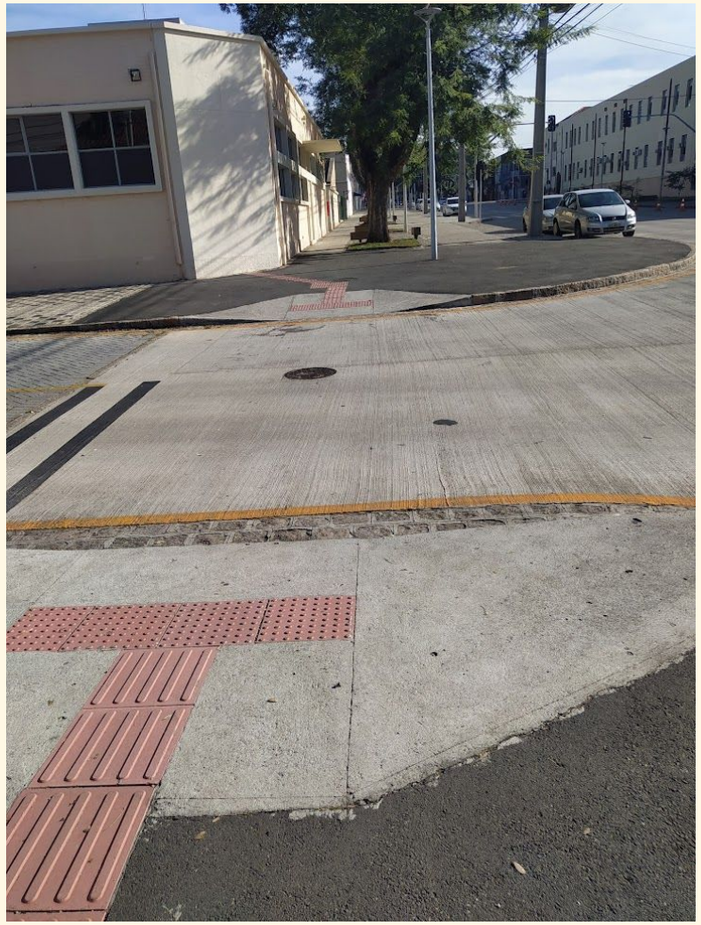
They mean safety...

U.S. Department of Transportation
National Highway Traffic Safety Administration

Pedestrians Killed	2008
	Land Use
Rural	28%
Urban	72%
	Non-Motorist Location
Intersection	24%
Non-Intersection	76%

"Roadways without sidewalks are more than twice as likely to have pedestrian crashes as sites with sidewalks on both sides of the street"

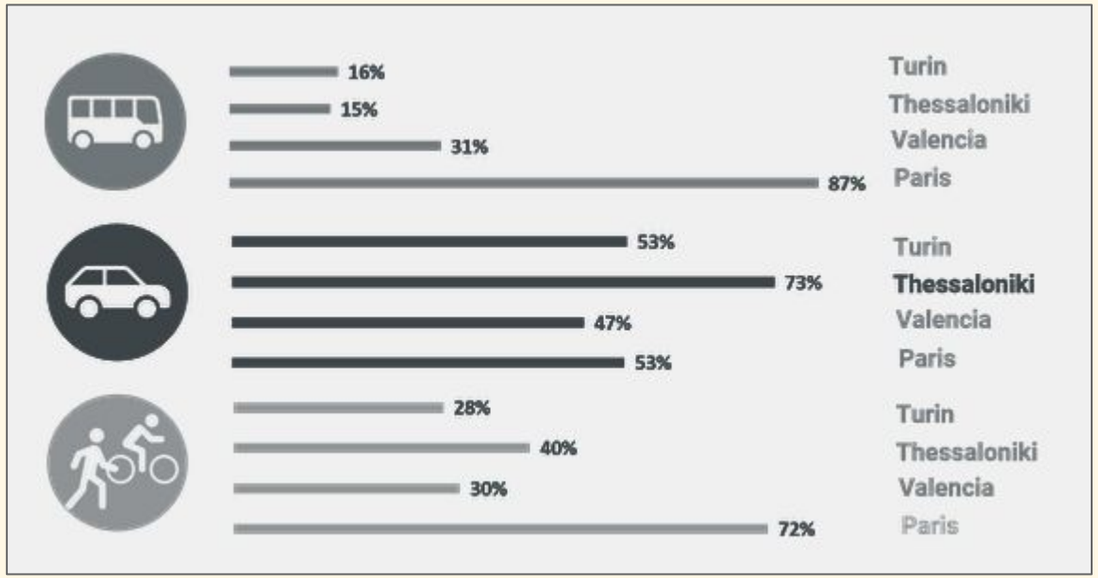
US NHTSA



They can mean acessibility!

sidewalks are very important!!

Modes of transport used in the metropolitan areas



TInnGO
European Observatory
for **GENDER SMART TRANSPORT**

WORLD BANK GROUP

They are ubiquitous **and needed for a brighter future!!**

but they are frequently in a bad shape!









so

how to

solve this?

we probably

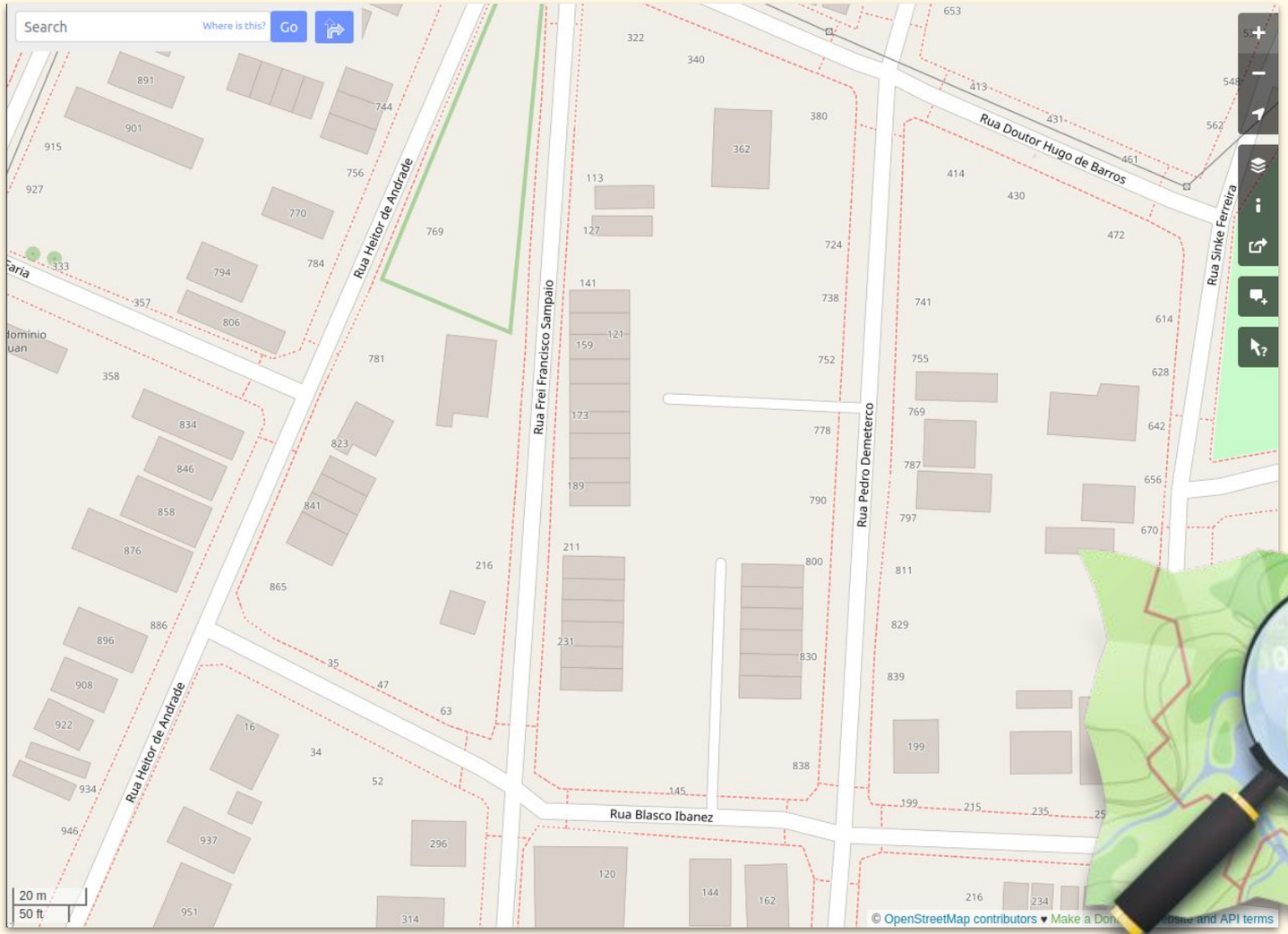
CAN'T.

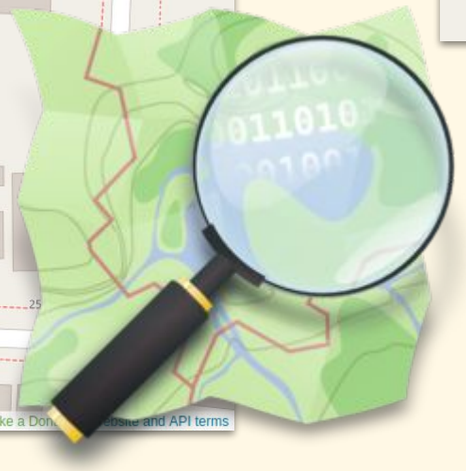
but...

we can help the ones who actually CAN!!

but how?

through (detailed and collaborative) MAPPING of Sidewalks!!





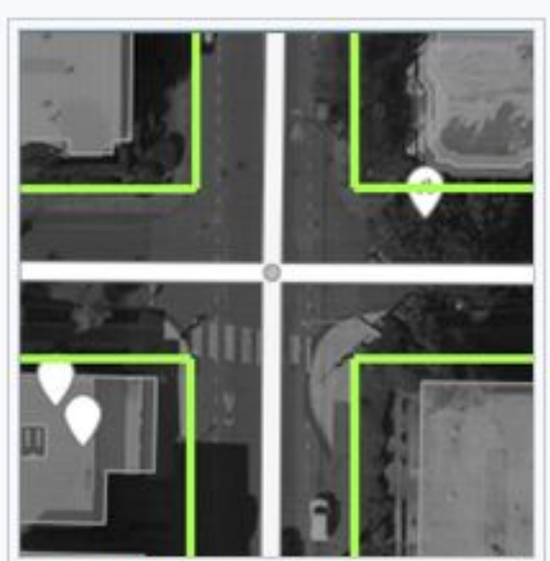
of course i’m talking about **OpenStreetMap** !!

but how to represent sidewalks on OSM?

there's divergence:

Sidewalks as Geometries

Using highway=footway + footway=sidewalk



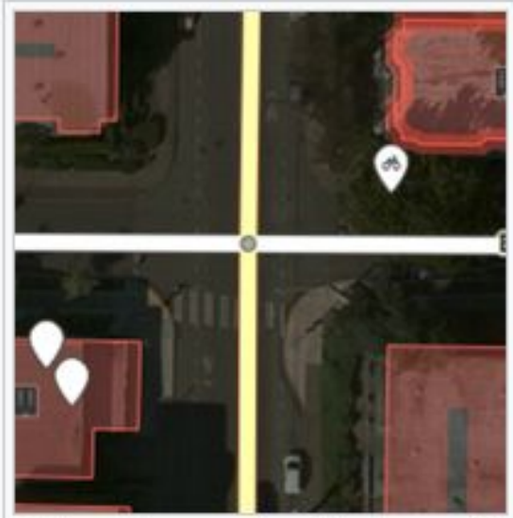
Sidewalks are described with footpath lines

attribute tags are stated with clear and simple keys, like:

- surface; smoothness; width; incline...

Sidewalks as Tags

Using sidewalk=both/right/left



Sidewalks are described as street metadata (not displayed by default)

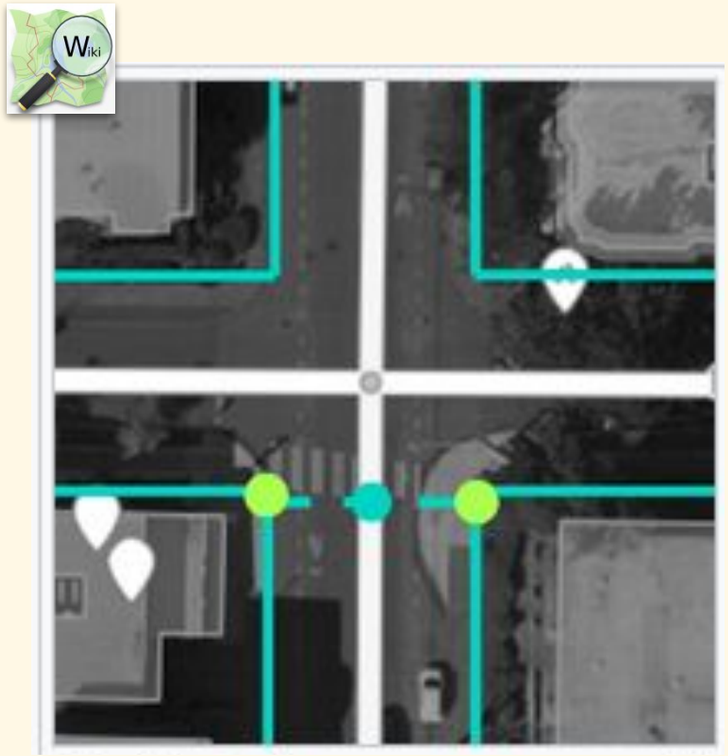
some users argue that this schema is simpler and *overrepresentation* pollutes the map

attribute tags need to be stated by *compound keys* starting with sidewalk:both/left/right, such as: sidewalk:left:width=*; sidewalk:both:surface ....

relying on "left" and "right" can be tricky and misleading

and sidewalk *networks**?

Sidewalks as Geometries



Crossings and Kerb Access Points are also geometries on their *actual positions*, enabling for richness of information

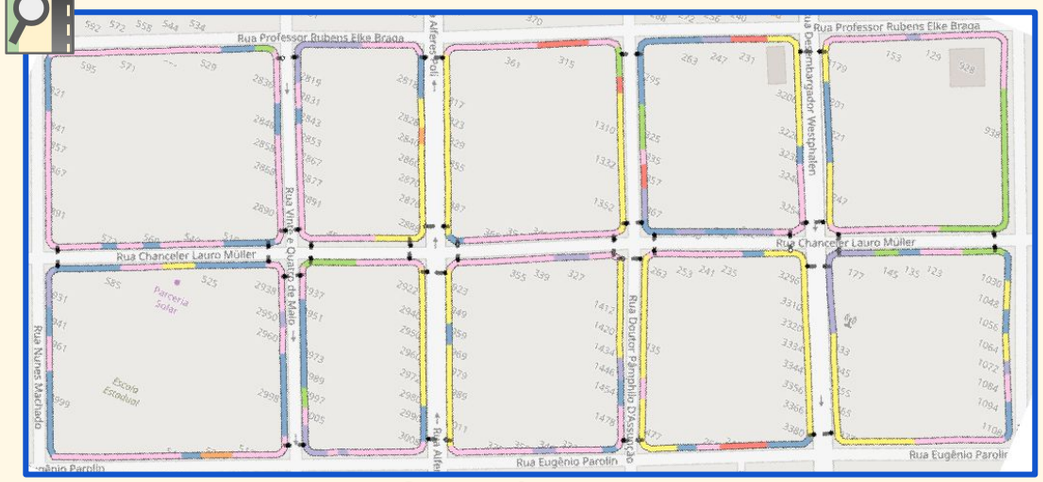
Sidewalks as Tags

all the information must be stored on node(s), and there's lot of **ambiguity**: **nodes doesn't have sides; what's the actual road-sidewalk distance?**

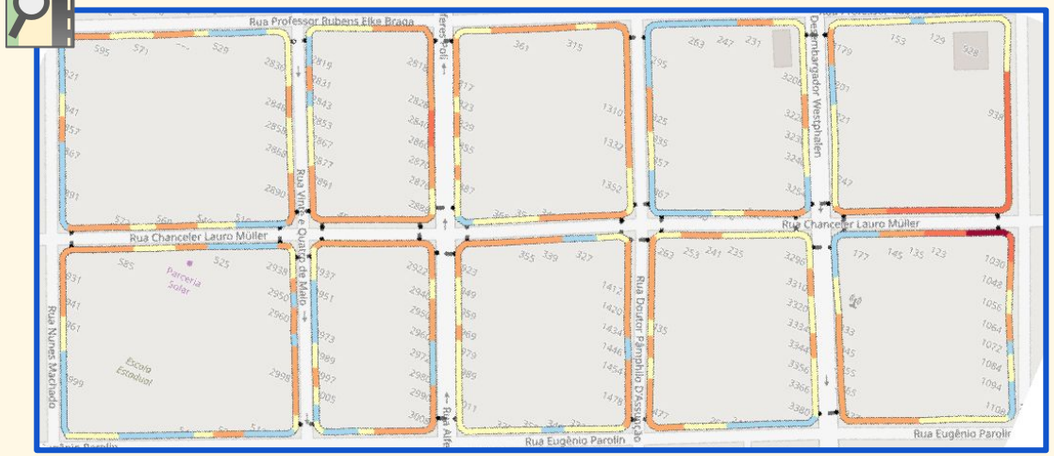
*: *sidewalk networks* also includes **CROSSINGS** and **KERB/CURB ACESS POINTS, topologically conected to sidewalks and roads**

why we advocate for sidewalks as geometries?

because reality is complex!!

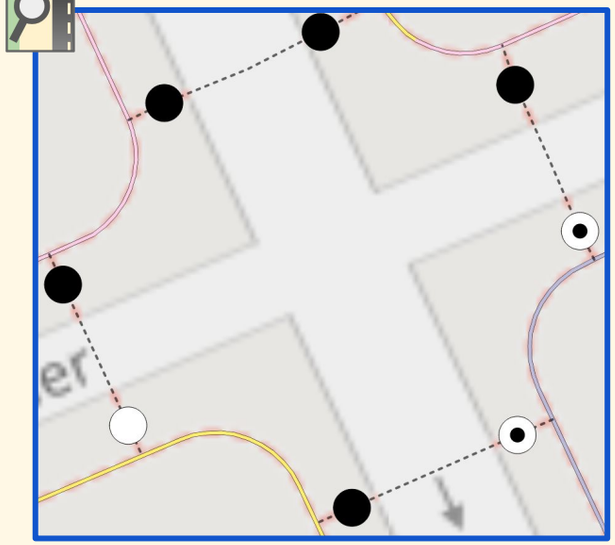


surface=* mapping



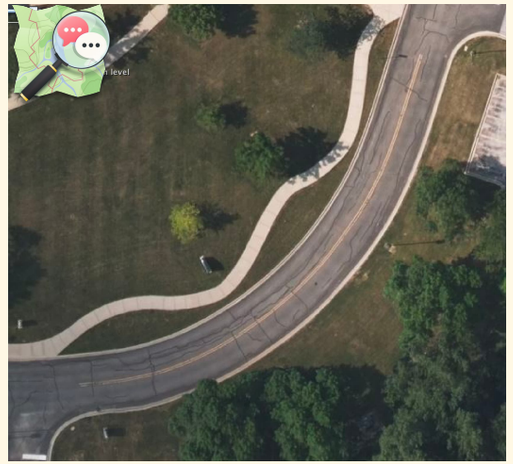
smoothness=* mapping

https://kauevestena.github.io/opensidewalkmap_beta



2 road intersection has **8 access points**, in this one: 5 raised and 3 lowered (2 with tactile paving)

there also crossing islands...



and complex-shaped sidewalks

SPOILER ALERT: these geometries were created with OSM SidewalKreator

but then, apart from that...

what is the State of the sidewalk Map?

well, not that good...

let's take a look at taginfo...

I - highway=* tag

highway

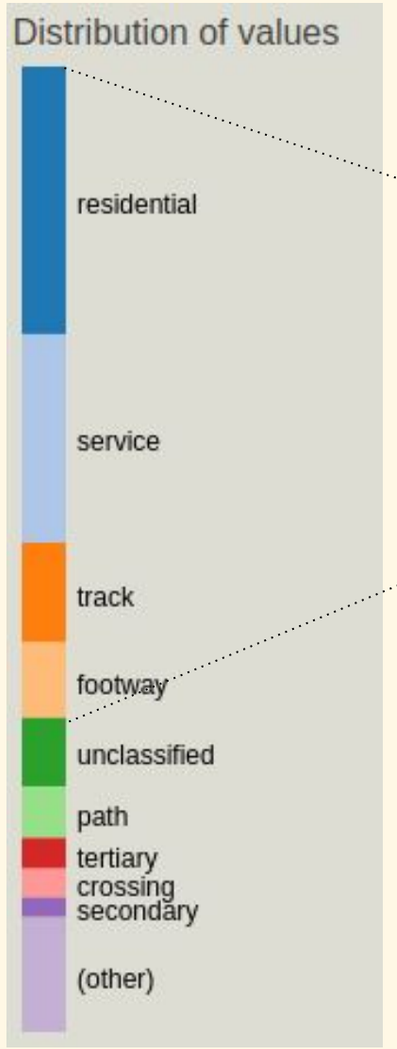
Used for roads and road-related facilities.

Overview | Values | Combinations | Si

Overview

Type	Number of objects	
All	226 043 202	2.58%
Node	19 485 513	9.84%
Way	206 506 523	23.46%
Relation	51 166	0.50%

Way 206 506 523



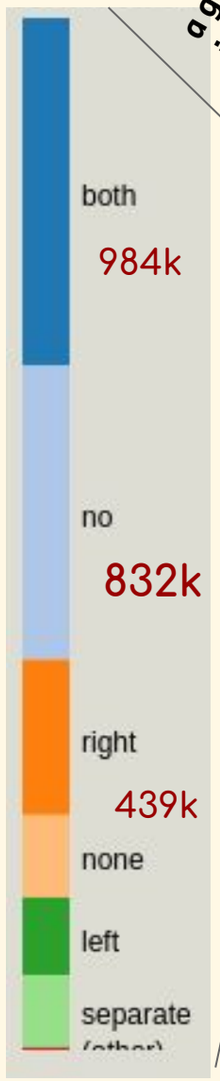
residential	62 653 569	27.72%
service	48 781 459	21.58%
track	23 417 473	10.36%
footway	17 631 633	7.80%

probably most residential ways have a sidewalk on both sides

let's take a look at taginfo...

II - sidewalk=* and footway=* tags

a good part is trivial information



Keys

Page 1 of 13

Count	Key
2 921 221	sidewalk
73 516	sidewalk:right
70 429	sidewalk:left
45 480	sidewalk:both:surface
28 991	sidewalk:right:surface
19 284	sidewalk:left:surface
11 167	sidewalk:both
6 683	sidewalk:surface *
5 182	sidewalk:right:bicycle
3 470	sidewalk:width *

only this ~100k are ACTUAL relevant information for ACESSIBILITY

footway

Further refinement of footways

Overview | Values | Combinations

Overview

Type	Number of o	
All	5 335 528	0.06%
Node	4 164	0.00%
Way	5 330 115	0.61%

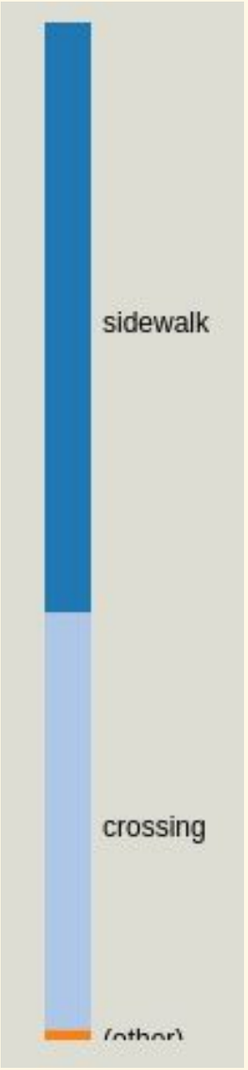
Overview | Values | Combinations | Similar

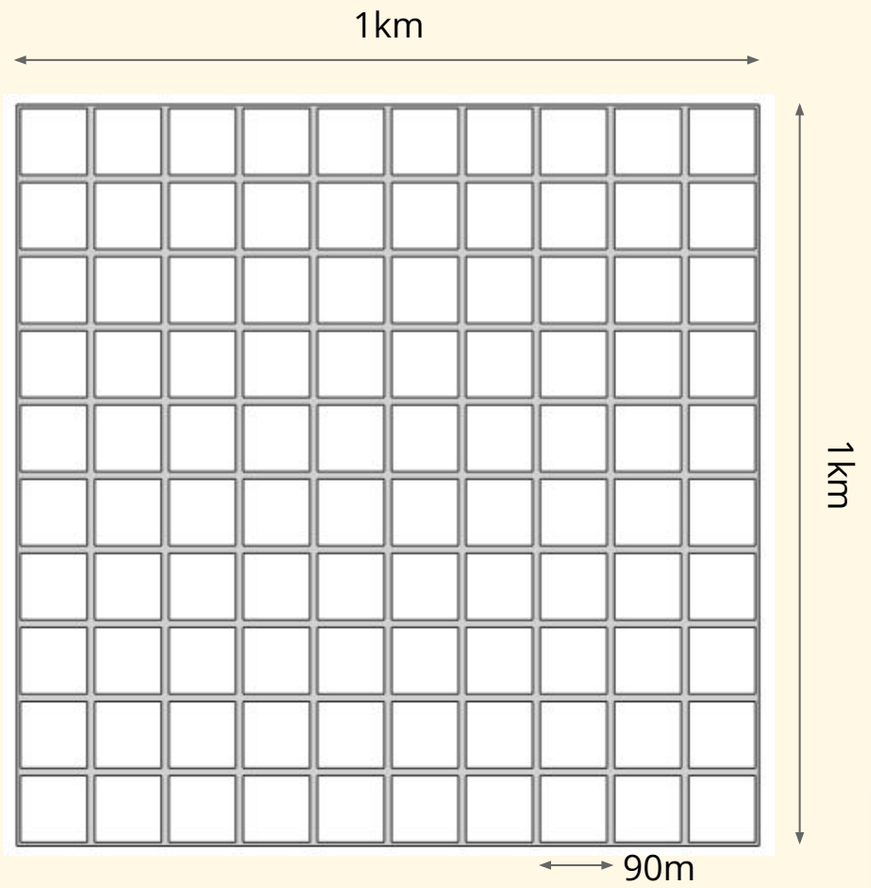
Values used with this key

Page 1 of 16 JSON

Value	Coun	
sidewalk	3 096 123	58.03%
crossing	2 187 569	41.00%
access_aisle	32 263	0.60%

as all sidewalks need crossings,
3 million is a more reprentative number





imagine urban area with only 1km^2
90x90m blocks
(100m between road intersections)

This would have:
22km of roads
and
23.4km of sidewalks!!

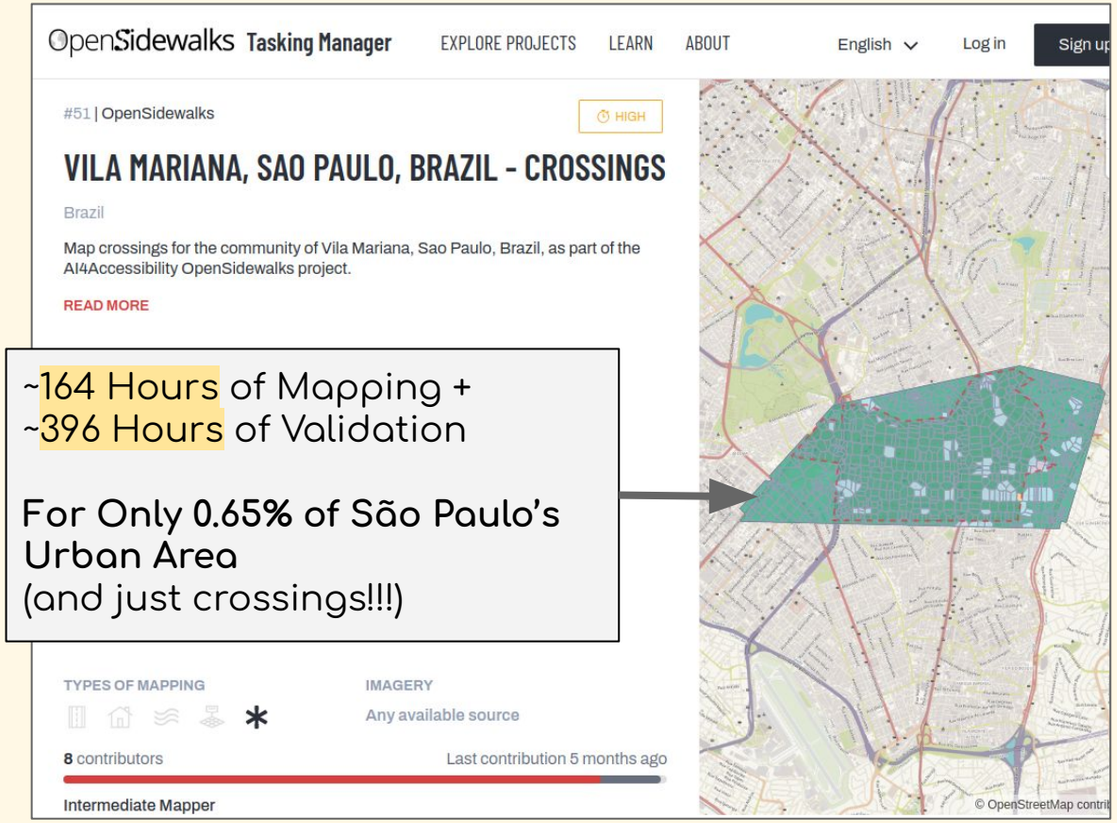
so, considering the world's VASTNESS

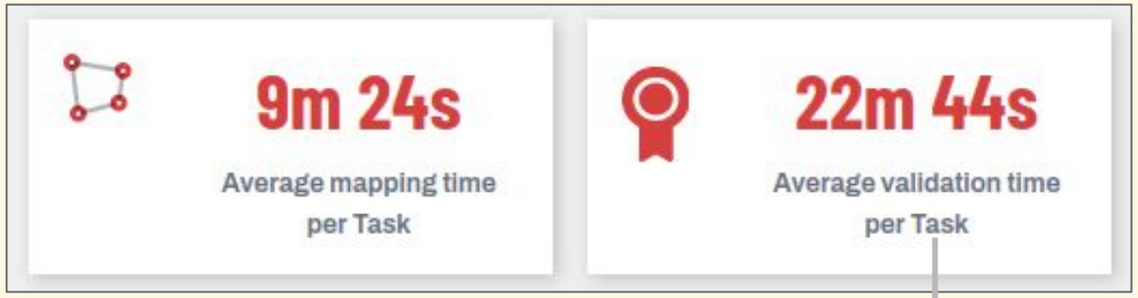
how to cover (at least a part of) this GAP?

well, draw it only manually may not be the best idea...

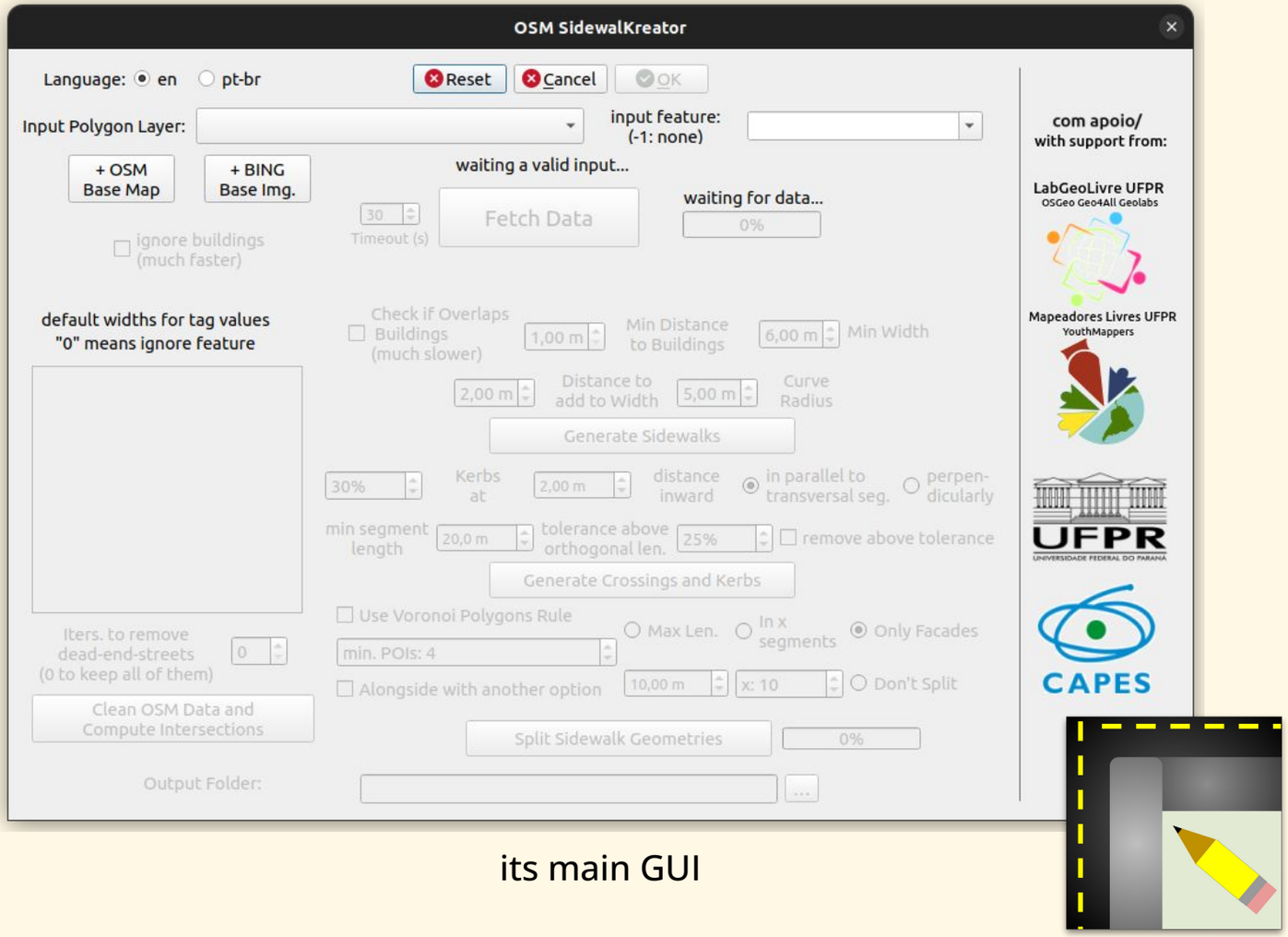
it can be *error-prone*

demanding ability to draw it properly





then we have created OSM SideWalkreator!!



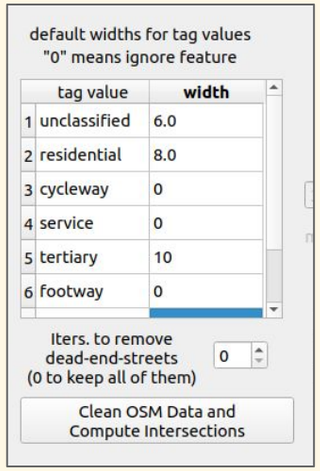
its main GUI

- Its main purpose is to Automatically create *sidewalk network* geometries with basic descriptive tags
- Does not try to be a fully-automated-one-click-solution, but one that guides the user, allowing control through the entire process!!
- takes advantage of QGIS resourcefulness

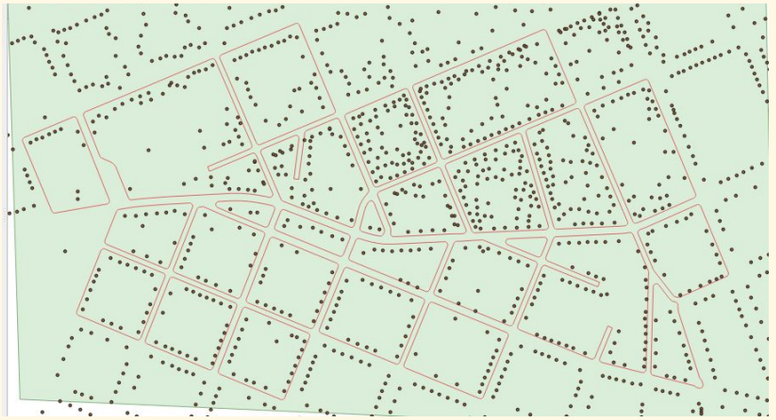
available at **https://github.com/kauevestena/osm_sidewalkreator** and **https://plugins.qgis.org/plugins/osm_sidewalkreator/**

and how does OSM SidewalKreator does its job?

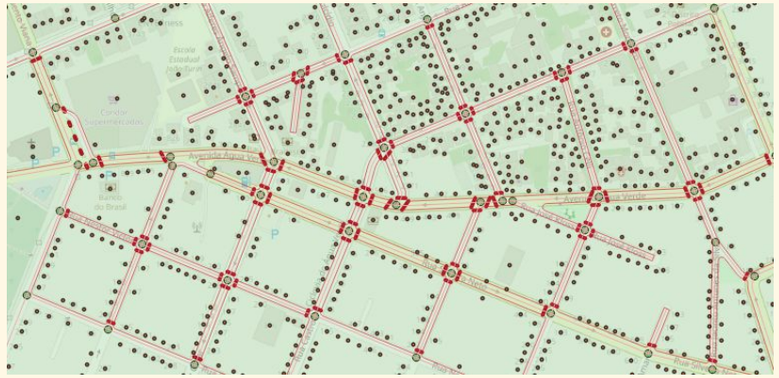
1. Fetch OSM Data



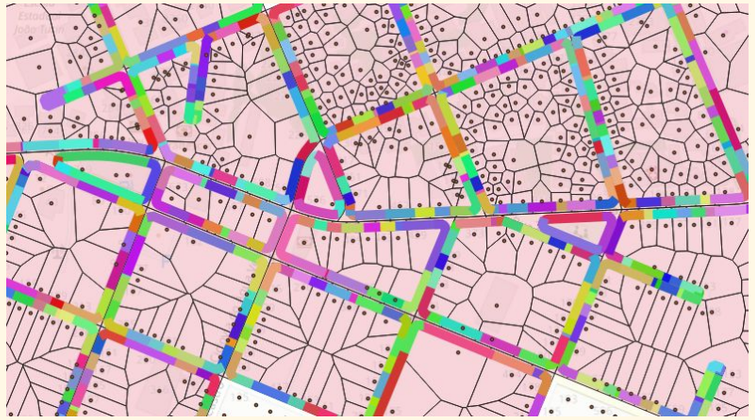
2. Fill Street Widths and Filter Data



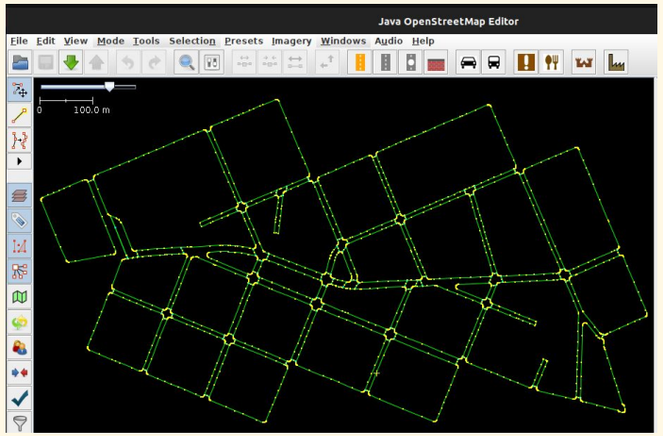
3. Draw Sidewalks



4. Draw Crossings & Kerbs



5. Split Sidewalk Geometries



6. Export and Open at JOSM

1. Fetch OSM Data

For an input polygon, downloads:

- **Highways (all the Linear)**
- Buildings
- Addresses

2. Fill Street Widths and Filter Data

default widths for tag values
"0" means ignore feature

	tag value	width
1	unclassified	6.0
2	residential	8.0
3	cycleway	0
4	service	0
5	tertiary	10
6	footway	0

Iters. to remove dead-end-streets (0 to keep all of them) 0

Clean OSM Data and Compute Intersections

Hint: You Can Set Widths for Each Segment...

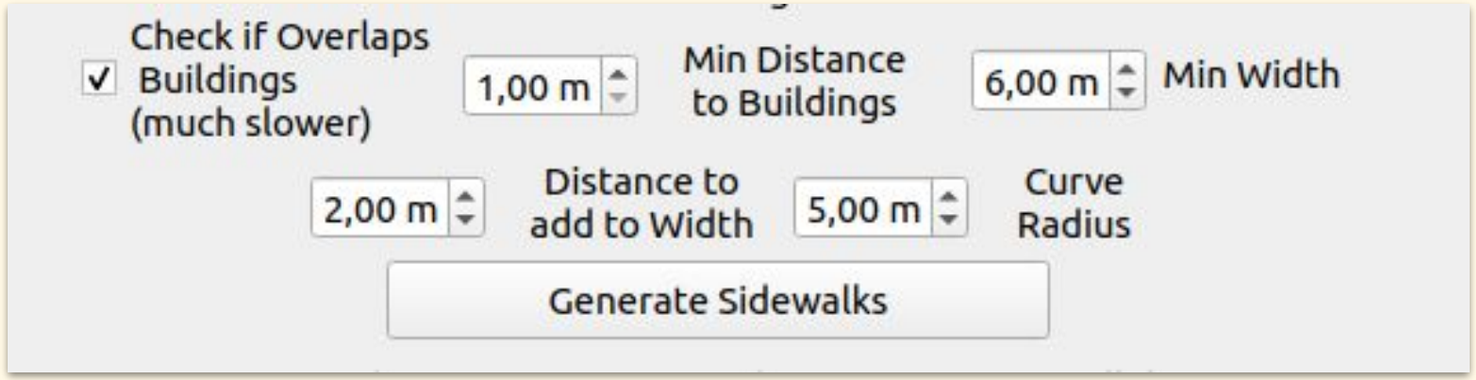
→ Manual editing/refinement is always encouraged

As most roads doesn't have a width=* tag

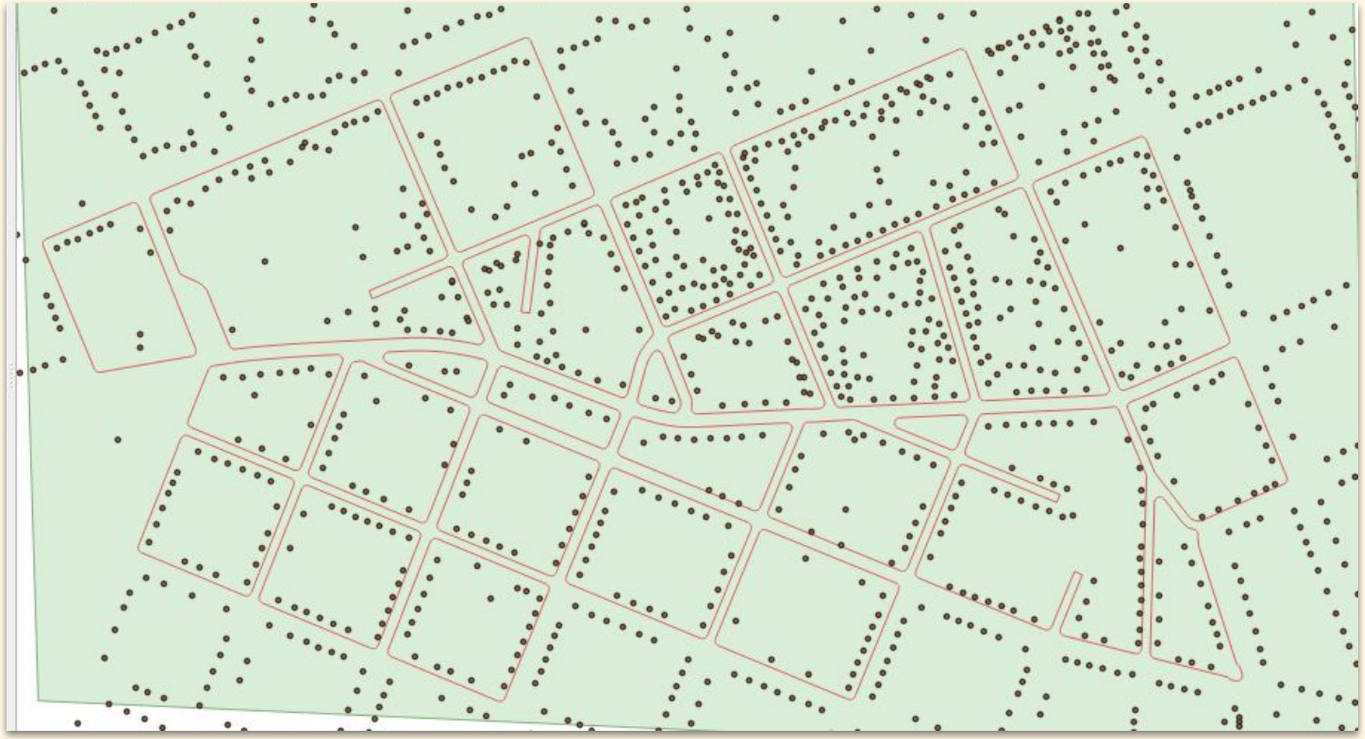
(needed for *buffering*)

we establish it for the missing/invalid ones, based on higway=* tag values

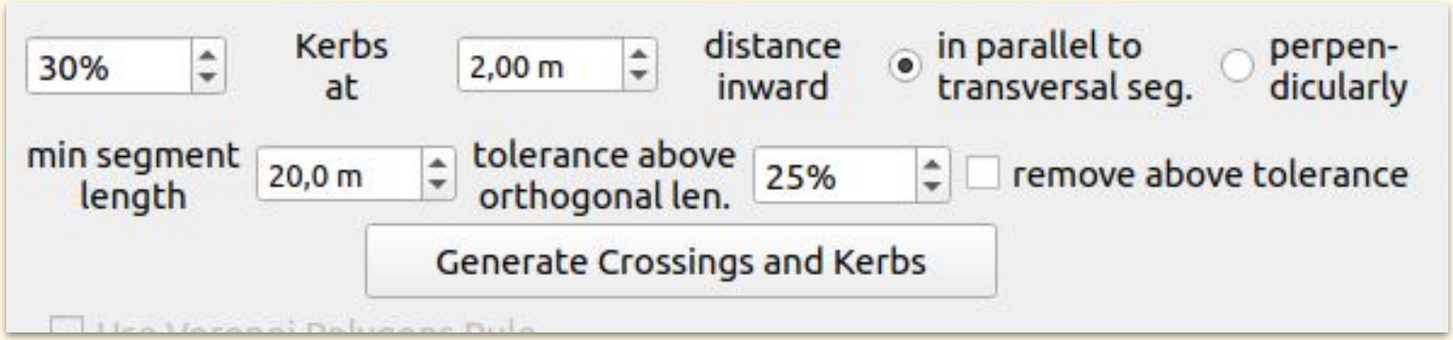
3. Draw Sidewalks



basically a constrained
(to not overlap buildings)
buffer operation
with some tricks
to ensure a custom
block-corner-curve-radius

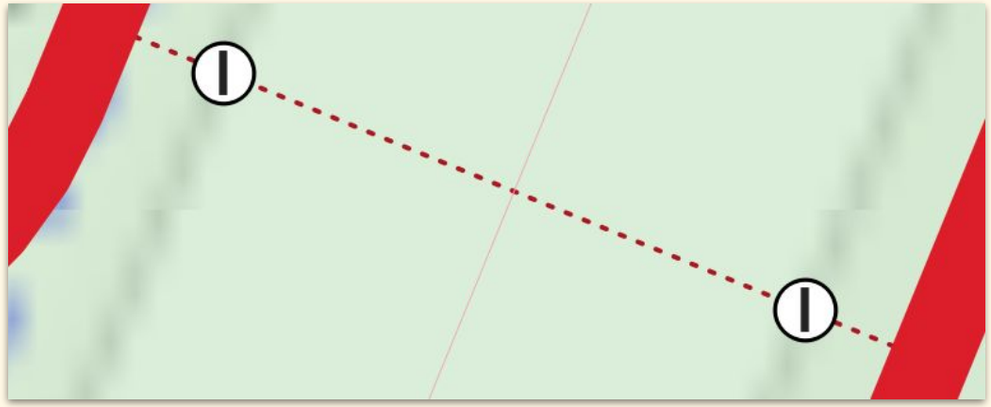


4. Draw Crossings & Kerbs

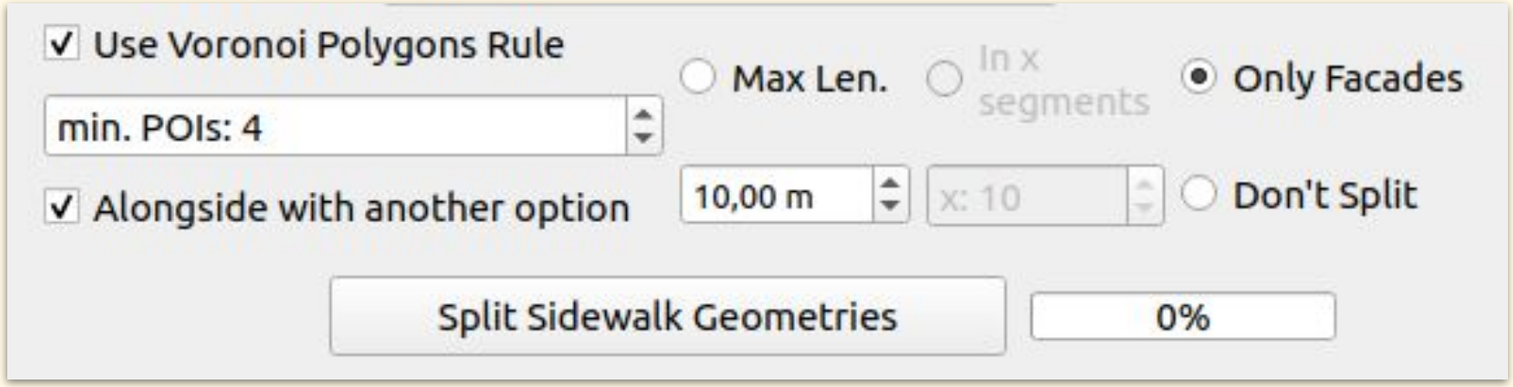


expands a perpendicular/parallel-to-transverse vector using linear algebra until finds *intersection*

There's also options to filter out crossings that are possible outliers

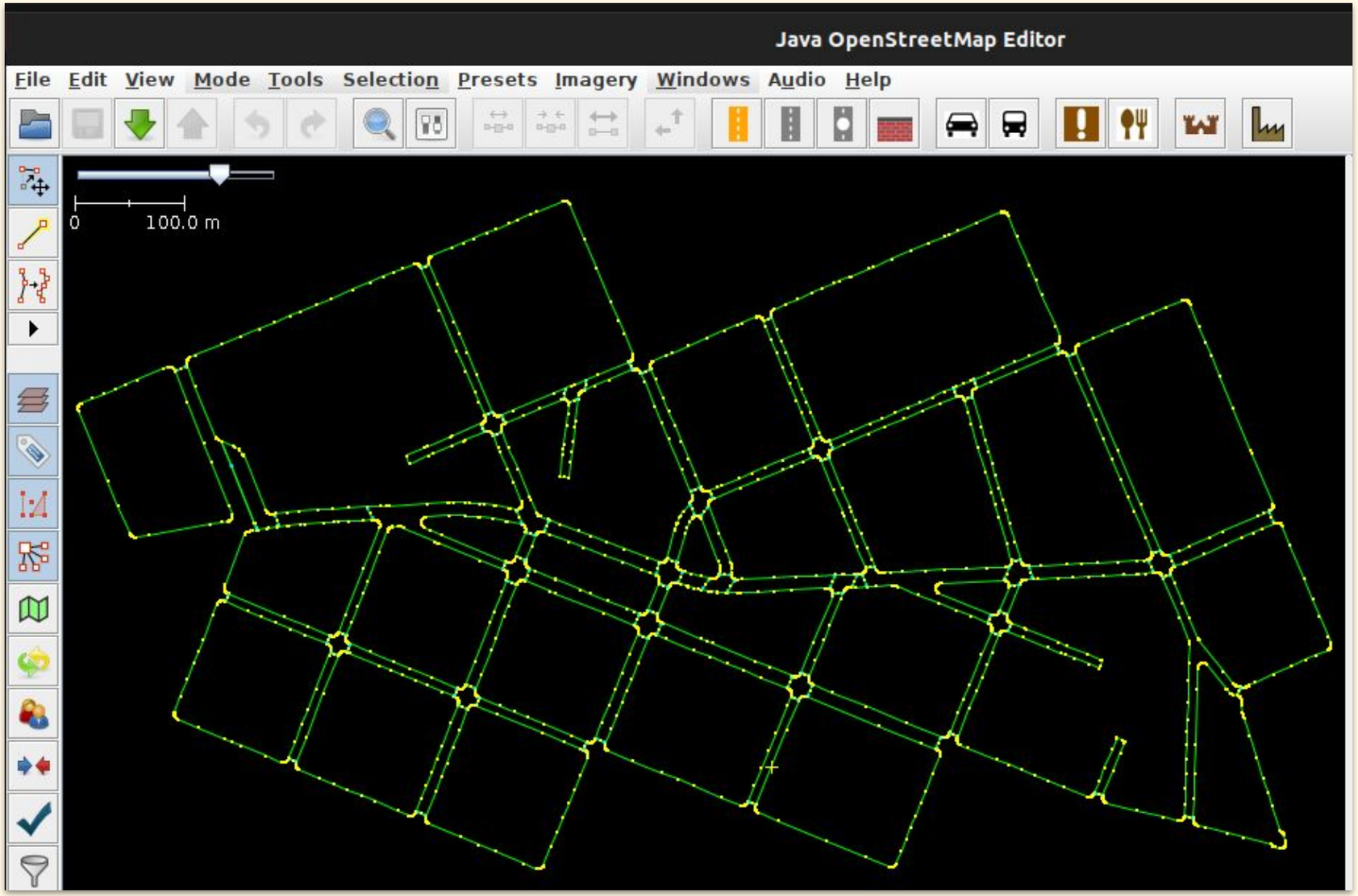


5. Split Sidewalk Geometries



Highlighting a voronoi-polygon (*from adresses and building centroids*) based split, it includes other options like distance-based and also *don't split at all*

6. Export and Open at JOSM



exporting to a uniquely-named folder, you may proceed to JOSM

At this part the nodes of intersection between roads and crossings are created

You can also carry out some manual adjustments

please include #OSM_SidewalKreator at changeset comment!

Final Remarks

- **There's a lot of room for improvement!**
  - (opening issues with comments, suggestions, bug reports and also Pull Requests are welcome!)
  - Future releases shall include:
    - Deal properly if there's already a drawn sidewalk
      - correclty handle the crossings
    - Take advantage of information in the tag scheme, allowing for the replacement
      - Switching any information and placing a sidewalk:both=separate tag
      - Not drawing and maintaining at sidewalk:*=no (where the tag scheme still shines)
        - Creation of "exclusion zones"
- The local reality must always be taken into account, not all places have sidewalks!! The Plugins works better for regular sidewalk grids…
- **We can make OSM a more pedestrian-oriented map, and also a tool for ableism combat enabling acessibility-optimized routing and urban planning!**
  - **Sidewalks worth being *geometries***, they are ways themselves!!

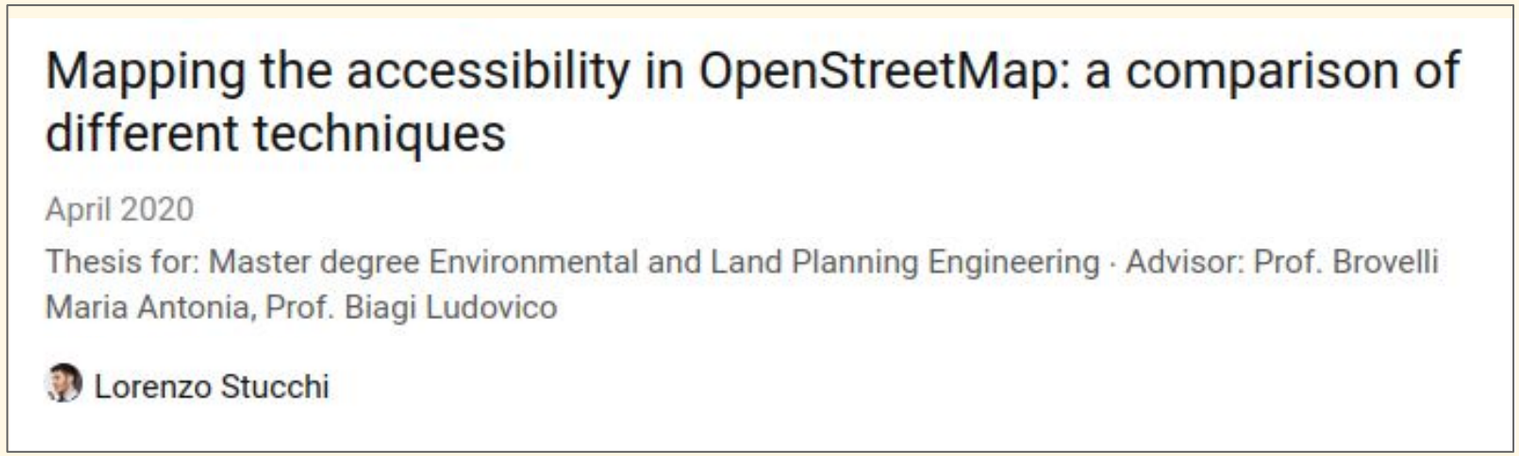
too hard challenge?

OSM data of Europe (circa April 2006) placed onto a satellite image.

so they say...

(not a long time ago!)

References



[1] US Department of Transportation, Federal Highway Administration - FHWA Safety Program (2013). Safety benefits of walkways, sidewalks, and paved shoulders. Retrieved from https://Safety.Fhwa.Dot.Gov/Ped_bike/Tools_solve/Walkways_trifold

[2] OpenStreetMap Wiki (2011). Proposed features/Sidewalk as separate way. Retrieved from https://wiki.openstreetmap.org/w/index.php?oldid=2312766

[3] Biagi, L., Brovelli, M.A., & Stucchi, L. (2020). Mapping The Accessibility In Openstreetmap: A Comparison Of Different Techniques. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLIII-B4*, 229–236.

[4] OpenStreetMap Wiki. (2016). Proposed features/sidewalk schema. OpenStreetMap Wiki. Retrieved April from https://wiki.openstreetmap.org/wiki/Proposed_features/sidewalk_schema

[5] OpenStreetMap contributors (2022). Taginfo. Retrieved from https://taginfo.openstreetmap.org

[6] Neis, P., & Zielstra, D. (2014). Recent developments and future trends in volunteered geographic information research: The case of OpenStreetMap. *Future Internet, 6*(1), 76–106.

[7] Camboim, S., Bravo, J., & Sluter, C. (2015). An investigation into the completeness of, and the updates to, OpenStreetMap data in a heterogeneous area in brazil. *ISPRS International Journal of Geo-Information, 4*(3), 1366–1388.

[8] Mobasheri, A., Bakillah, M., Rousell, A., Hahmann, S., & Zipf, A. (2015). On the completeness of sidewalk information in OpenStreetMap, a case study of Germany. In: *Proceedings of the 18th AGILE International Conference on Geographic Information Science*, Lisbon, Portugal, 9-12 June 2015.

[9] Mobasheri, A., Sun, Y., Loos, L., & Ali, A. (2017). Are crowdsourced datasets suitable for specialized routing services? Case study of OpenStreetMap for routing of people with limited mobility. *Sustainability, 9*(6), 997.

[10] Ertz, O., Fischer, A., Ghorbel, H., Hüsser, O., Sandoz, R., & Scius-Bertrand, A. (2021). Citizen Participation & Digital Tools To Improve Pedestrian Mobility In Cities. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLVI-4/W1*, 29–34.

[11] Jiang, Y., Lobo, M. J., Christophe, S., & Jouffrais, C. (2021). Mapping road crossings for visually impaired people. *30th International Cartographic Conference (ICC 2021)*, Florence, Italy, 14-18 December 2021, 1–2.

[12] Gjeruldsen, E. (2020). *Detecting sidewalks in OpenStreetMap using machine learning LATEX Version*. Master's thesis, Østfold University. Retrieved from https://hdl.handle.net/11250/2676606

[13] Mobasheri, A., Huang, H., Degrossi, L., & Zipf, A. (2018). Enrichment of OpenStreetMap data completeness with sidewalk geometries using data mining techniques. *Sensors, 18*(2), 509.

[14] Taskar Center for Accessible Technology, University of Washington (2021). OpenSidewalks. Retrieved from https://www.opensidewalks.com

[15] Taskar Center for Accessible Technology & Humanitariam OpenStreetMap Team (2021). OpenSidewalks Tasking Manager. Retrieved from https://tasks.opensidewalks.com

[16] Taskar Center for Accessible Technology & Humanitariam Openstreetmap Team (2021). OpenSidewalks Mapping statistics Vila Mariana, Sao Paulo, Brazil - Crossings. Retrieved from https://tasks.opensidewalks.com/projects/51/stats

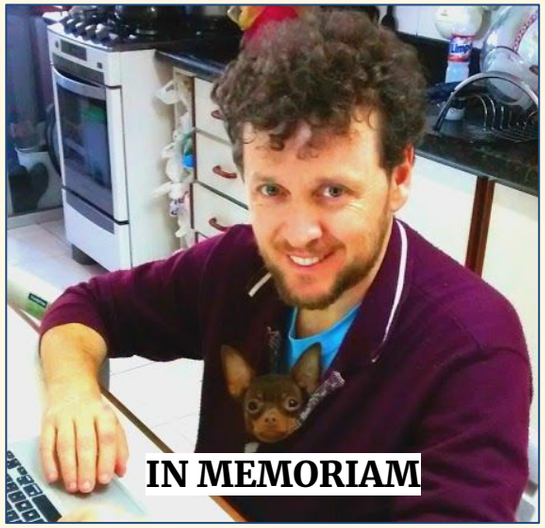
Lots of Thanks:

FUNDING

advisors

Silvana Camboim

Daniel Santos



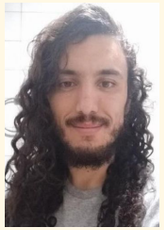
and above all...

to my favourite scientist!

he would be so proud...

THANK YOU,

AUDIENCE!!



you can contact me at:
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(Twitter/Instagram/OSM Profile/GitHub)