Hello, I’m Ariel Kadouri and my day job is as a software engineer at Woven Planet on the Advanced Mapping Platform. Woven Planet is focused on building holistic mobility solutions, building the safe transportation of the future.

In my free time I help contribute to pedestrian and cycling mapping in New York City. While Woven Planet supports safe infrastructure and mapping projects, the views presented in the presentation are my own.

I’ve been mapping in OSM for a couple years now, picking up when I moved back to NYC in 2020.

I frequently use OSM for bicycle routing and planning running routes, mainly with OSMAnd, Gaia, and Strava which uses OSM via Mapbox. Regardless of the tool, I can usually be assured that the pedestrian routes are coming from OSM, which means if I want them to be better I know where to start looking.
“Every citizen has had long associations with some part of his city, and his image is soaked in memories and meanings.”

The Image of the City, Kevin Lynch (p1)

A couple weeks ago as I was procrastinating writing this presentation I was wandering around a local bookstore and I found a great book on urban geography.

In this 1960 study, Kevin Lynch dives deeply into the theory behind mental maps and navigation among three US cities, Los Angeles (which has strong car influence), Boston (which can be curvy and winding), and Jersey City (which at the time was quite industrial).

One of the great themes throughout the book, written at a time before such detailed web maps and routing software, is the way we understand the cities we live in through the ways we navigate their built environments.

Why New York City? What's special about NYC that there needs to be a whole presentation on pedestrian mapping oriented around NYC?

The idea isn’t that NYC is some special place. It’s that it’s the place I’ve been mapping. I hope that when we’re done here you can start to think about the memories and meanings of your city, and how that best translates to our shared OSM.

NYC is also a city in crisis, with rising traffic deaths over the past several years reversing a statistic that was trending downward until 2017.
What is missing from this map?

Let’s start with why we map pedestrian infrastructure at all with some examples of NYC streets. This map is the border between Carroll Gardens and Red Hook.

What’s missing from OSM-Carto here?
Or rather what’s obscured?

Without having ever been to this neighborhood, this map gives us a feel of where it is divided.

- There is a bright red highway
- There is a waterway with two pictured crossings
- A train of some sort

What this doesn’t show you is how you can cross through this neighborhood.
What is missing from this map?

“Ok Ariel but OSM Carto isn’t meant for pedestrian routing”, well let’s try this layer then. What’s still missing?

Here in the center of the road is a highway viaduct above a local surface road. What I can’t tell from this map, or almost any other web map styling is where I can cross the road as a walking pedestrian.
What is missing from this map?

Another map style.
And mobile for good measure.

What I'm most likely to be using when I'm navigation in the field to begin with. Note this is OSMAnd’s Walking Layer.
Hamilton Avenue

- Only one N-S crossing in this photo, separated by a large crosswalk E-W which forks into a 5 (?) way intersection.
- If I don’t cross here, where can I cross next?
Field Survey

- What is important when walking through an area?
- What is important to other mappers and the OSM model?

Armed with my phone, a notebook, and a purple pen I marked up this area. Without a printer to use something like fieldpapers, I had to settle for hand drawn intersections.

Note that you may appear strange in public staring at the sidewalk and writing things down. I have since acquired a reflective vest and a slightly bolder attitude. Photos also work well, checkout the Mapillary mobile app for a way to upload spatially tagged images.

As well as doing this a couple times you start to get an understanding of what's important to data consumers. So I make note of those things as well.
What can you do with this map?

Cross the Street!

Here are the crosswalks! Now I can cross the street.

Notice the crosswalks are not fully mapped beyond this segment. This is a work in progress and a sign that not every sidewalk in your area needs to be mapped before it is useful for data consumers.
What can you do with this map?

Cross the Street!

Almost.
What can you do with this map?

Cross the Street!

Almost.

There is at least one raised curb in this area, which might need to be avoided for any number of reasons. Beyond a navigation tool, this is also a reminder to the city that this curb needs to be fixed.
Close up look at one crossing mapped well in OSM.

- Curb availability
- Does not match road network
- Path surface types for the island
Where can you bike?

Anywhere the blue lines are!
The city also provides a free cycle map, if you’re ever in NYC come to a shop and grab one. This is meant for print and navigation, and so it has thick lines for the types of lanes there are.
Cycle Merging Left Sign

The Truth Ain’t On Google Maps

How are we capturing this environment in our tagging? This section is cut and mapped as cycleway=shared_lane while the other painted lanes are cycleway=lane.
Let’s zoom out a bit. Here is all of NYC’s sidewalks. They are clustered mainly around parks, green ways, beaches, where community efforts to map sidewalks took place, and where the local OSM community lives.
Our Progress By Year

- highway=footway by year last edited
- Bulk of edits done in focused bursts (both geographically and time period)
- Which areas are being maintained?

Where our efforts are aging. What is still relevant today? Where do we need to revisit?
Later to our mapping efforts were kerbs. One of the big reasons to map sidewalks as separate ways at all is to be able to include curb information. In 2019 the city settled an ADA lawsuit with a plan to upgrade the cities’ curb infrastructure to meet the ADA requirements. This is more or less an issue among every US city.

You may have noticed the gray line of kerbs that isn’t mapped as sidewalks. Those kerbs are mapped on the traffic signals. It turns out making these maps was a great QA exercise.
Task Manager

- One way we organized was via the task manager, this allowed for bringing in beginners and validating their contributions to community standards
- 15 mappers, 3 validators
- 18,672 edits across 988 changesets

https://tasks.openstreetmap.us/projects/224/stats/

Together we mapped Flushing, Queens using the OSM US Tasking Manager. In this mapping effort we took the time to validate the areas mapped before. This found several issues due to either inexperienced mappers, construction, or evolving tagging schemas.

This effort works great for mapping a neighborhood from home and mapping just the sidewalk graph but it is difficult to see kerbs without street imagery.
Flushing

- Entire neighborhood mapped!
- Where is the infrastructure missing?
- Why is it missing?

- Able to notice the areas missing infrastructure when you’re aware the area has been mapped well.
Crosswalks

While we're still at a birds eye view, what else can we see?

Areas without marked crossings, whether it be against highways or within more residential areas.
Missing Crosswalks

Here we can see one example from the map before with a high concentration of missing and unmarked crosswalks

- Was this area recently repainted?
- Does this area have more frequent accidents?
Slip Lanes

Where does multimodal conflict occur?
Has it been mapped?

(legend is missing the roads with cycleway=* tags also colored green)

On the areas near the parks the sidewalks lines on the map become far and fewer between, this isn’t because they aren’t mapped it’s because they don’t exist. We can know this because we know the area has been mapped.

- The lane on the right has no traffic control for motor vehicle traffic but a bike and pedestrian trail crosses it.
- It isn’t quite a highway on ramp but is a long lane of one way traffic
“Not only is the city and object which is perceived (and perhaps enjoyed) by millions of people of widely diverse class and character, but is the product of many builders who are constantly modifying the structure for reasons of their own.”

The Image of the City, Kevin Lynch (p2)

- So we live and learn our city, enjoy the environment of our city and learn to push for change.
NYC wants to increase protected bike lanes by 50 miles/80 km per year through 2025 but only has capacity to do 30 miles / 50km per year.

Citibike/Bikeshare hit a record 130k rides in a single day last week

As NYC’s streets change to meet the transportation demands of the next decade, OSM is poised to be the way of measuring whether those efforts are successful or not

Both at the city-wide scale

And at the block level scale

Council members routinely ask for requests for bike parking, city does not know where bike parking is

https://twitter.com/BrandonWC/status/1466169613847310336 Review of city’s bike lane map
Believe it or not this intersection was upgraded from stop signs to traffic lights but the city did not deem it time to improve the crossing situation. The area on the right of the image is also a subway station entrance.
This is what I call a “sad bus stop”. Both of the crosswalks don’t lead to pavement but instead grass. It’s an “improvise” scenario.
Here are two separate pedestrian improvements I have reported to the city. Tracking implementation is a block level effort.

On the left is a faded crosswalk in a traffic circle, this has been leading to cars not stopping for pedestrians anymore.

On the right is an area where there are crosswalks leading to fences.
There are several bridges owned by the Metropolitan Transportation Agency that refuse to allow cycling due to the way they've been constructed. So all we can do is map them as bicycle=dismount and advocate for change. This article was written in 2019 and despite local support there is still no change. In fact not only is the lane closed, you may even be ticketed for cycling over it.
After much advocacy, a Manhattan bound lane was removed from the Brooklyn Bridge and turned into a bike lane. The local community was so excited we raced to see who could map it first. It was initially mapped as proposed, then under construction, and nearly minutes after the ribbon was cut the changeset was in.

550,594 in 2020 to 700,093 in 2021 Bike New York with new lane
(https://nyc.streetsblog.org/2022/03/07/brooklyn-bridge-bike-lane-led-on-going-boom-through-2021/#:~:text=The%20number%20of%20annual%20trips,compiled%20by%20Bike%20New%20York.)

After the bridge opened there were connections to the on/off ramps that had been updated which required surveying and then some discussion on how to best map which paths should be separated, where the roads should merge and whatnot.
Continued upgrades

- Many ongoing projects
- Limited summer work season
- Various stages of completion

- Many ongoing projects from design to implementation phases
- Implementation can take weeks, months, or even years
Nearly a year to construct this lane, many intermediate stages mapped as they progressed to the right image.
Where the sidewalk breaks the schema

- How do we map this?
- How long do you expect the conditions to remain like this?
Where we can improve

- **Painted curb bulbs**
  - Tagging is new / proposed
  - area:highway=prohibited
  - crossing:kerb_extension=
    - right/left/both
- **What can we capture?**
  - Paint color?
  - Bollards?
  - Street bumps?
- **What should we capture?**
Where we can improve

- Concrete curb islands
  - landuse=traffic_island
  - traffic_calming=island
  - crossing:kerb_extension=* (?)

- This isn’t new
  - Some features I queried were 8+ years old!
Closing Notes

- How can we improve or create a map style to highlight deficiencies in the pedestrian network?
- What features do we need to confirm the tagging for?
- What applications would make keeping our maps up to date easier?

https://www.newyorker.com/culture/cover-story/cover-story-2022-08-08
Shout outs

- All the past STOM sidewalk, pedestrian and bike presenters
- Local community - including but not limited to Jmapb, zhik, TheBestIdea, MxxCon, HDevine825, daniel_solow, Stereo
- The #sidewalks and #bicycle channels in the OSM US Slack
- Anyone that walks anywhere

Mention

- mailing lists
- wiki-writers
- router developers
Tools Used

- QGIS
- osm2pgsql, PostGIS, dbeaver

Data sources

- OpenStreetMap
- NYS Orthoimagery
- Microsoft Street Imagery
- Surveying
Pedestrian and Bike Mapping in New York City

A NYC Case Study
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