

Pedestrian and Bike Mapping in New York City

A NYC Case Study
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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.

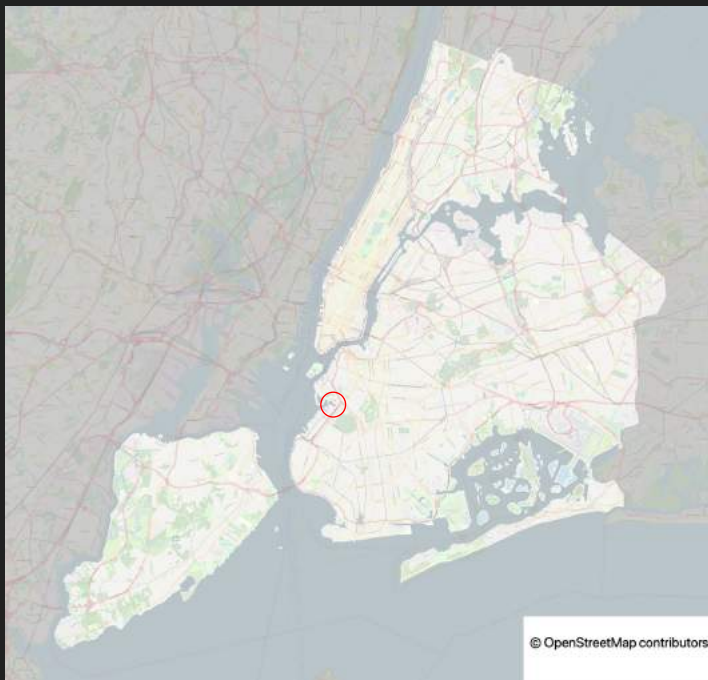
In this 1960 study, Kevin Lynch dives deeply into the theory behind mental maps and navigation among three US cities, Los Angeles (which has strong car influence), Boston (which can be curvy and winding), and Jersey City (which at the time was quite industrial).

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.

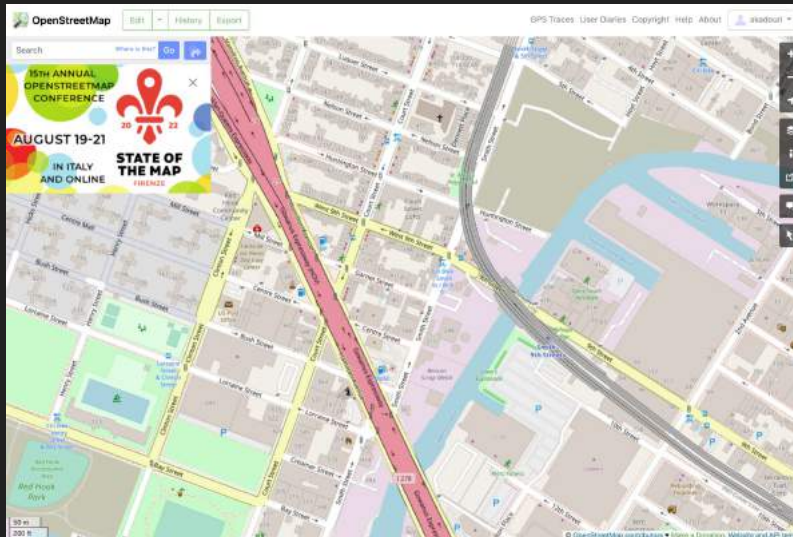
Why New York City? What's special about NYC that there needs to be a whole presentation on pedestrian mapping oriented around NYC?

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.

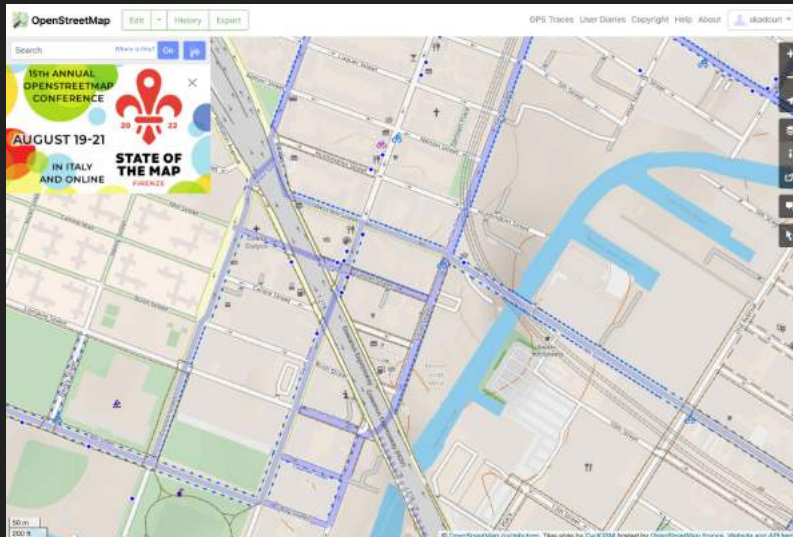
What's missing from OSM-Carto here?
Or rather what's obscured?

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?

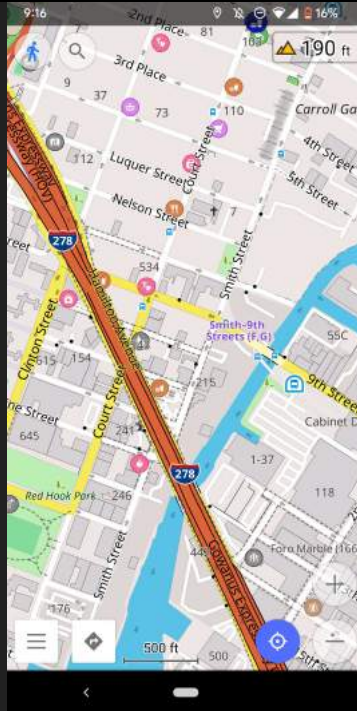


“Ok Ariel but OSM Carto isn’t meant for pedestrian routing”, well let’s try this layer then. What’s still missing?

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.

[illegible]

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.

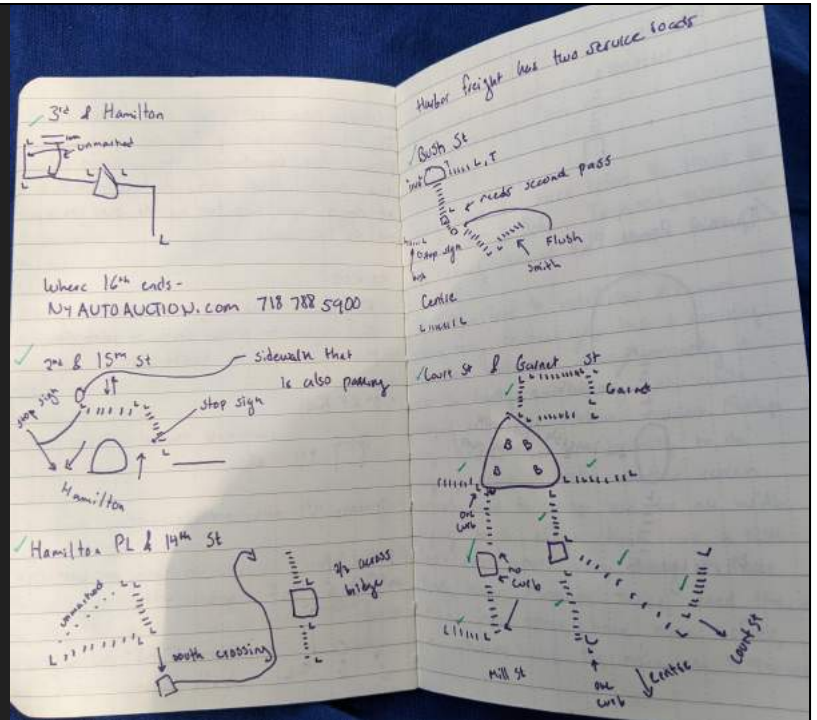


Hamilton Avenue

- 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?



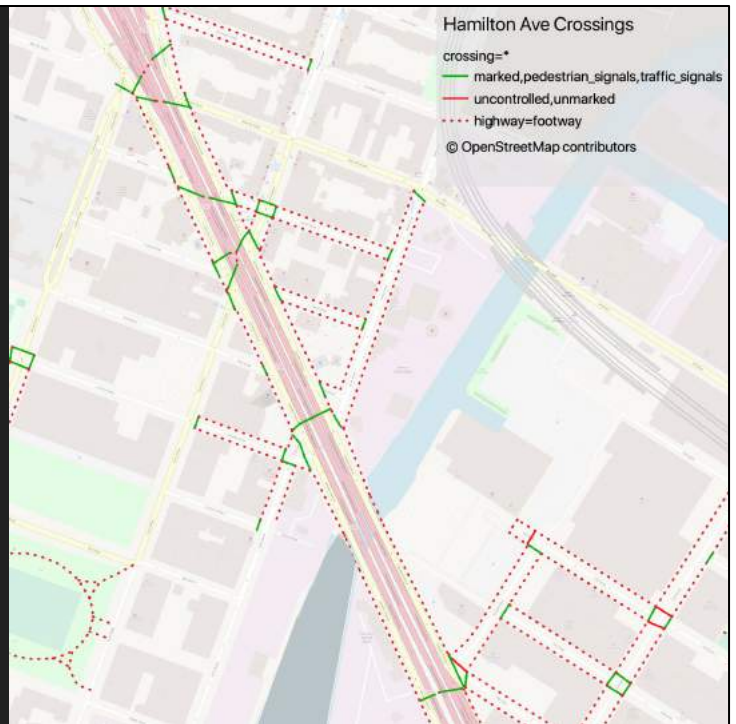
Armed with my phone, a notebook, and a purple pen I marked up this area. Without a printer to use something like fieldpapers, I had to settle for hand drawn intersections.

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!



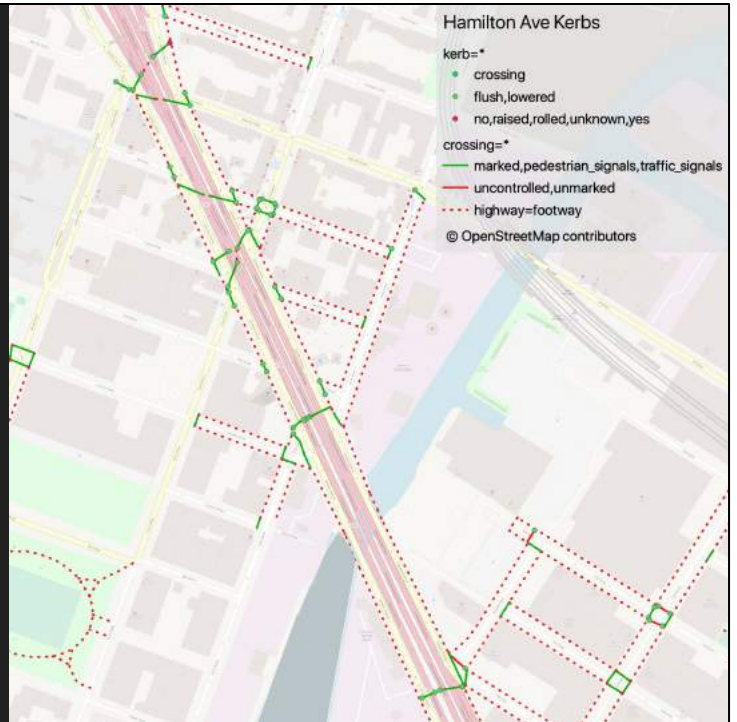
Here are the crosswalks! Now I can cross the street.

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!

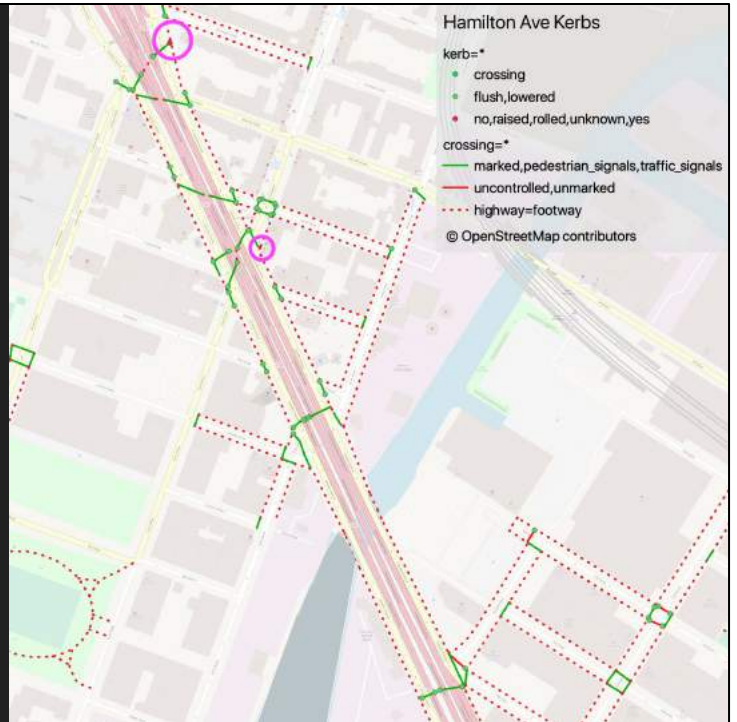
Almost.



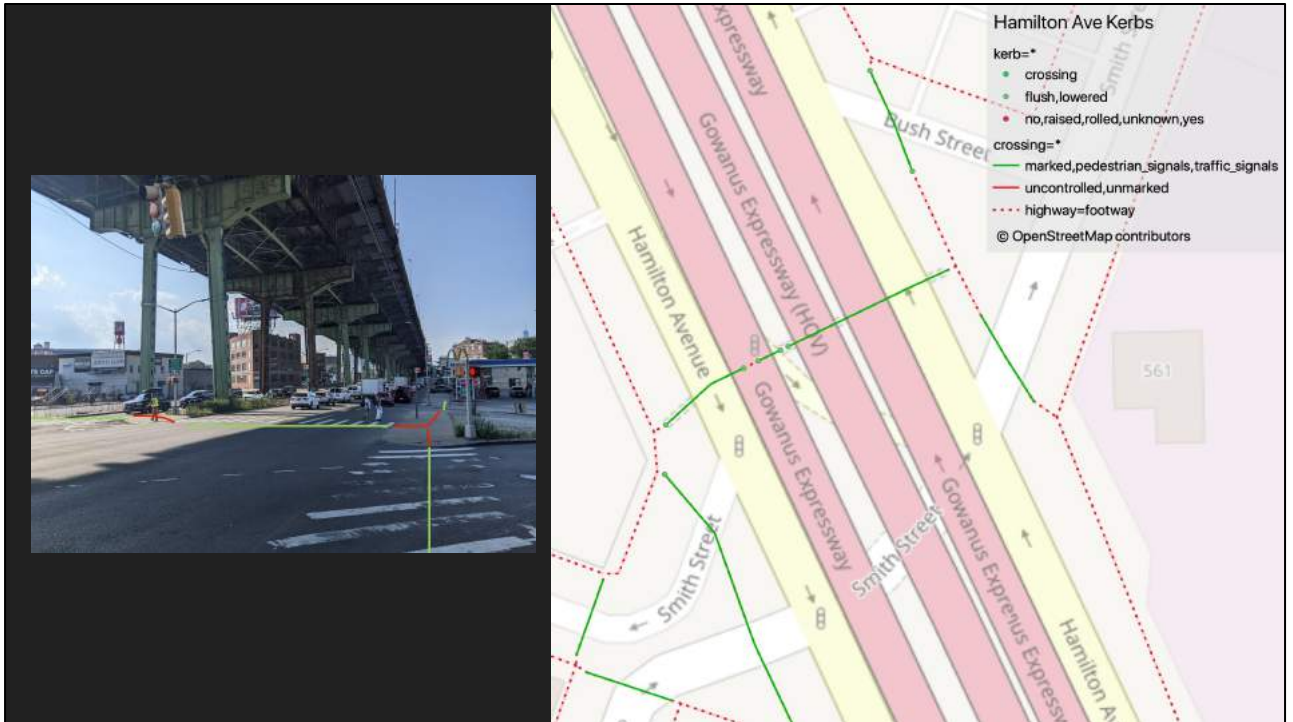
What can you do
with this map?

Cross the Street!

Almost.



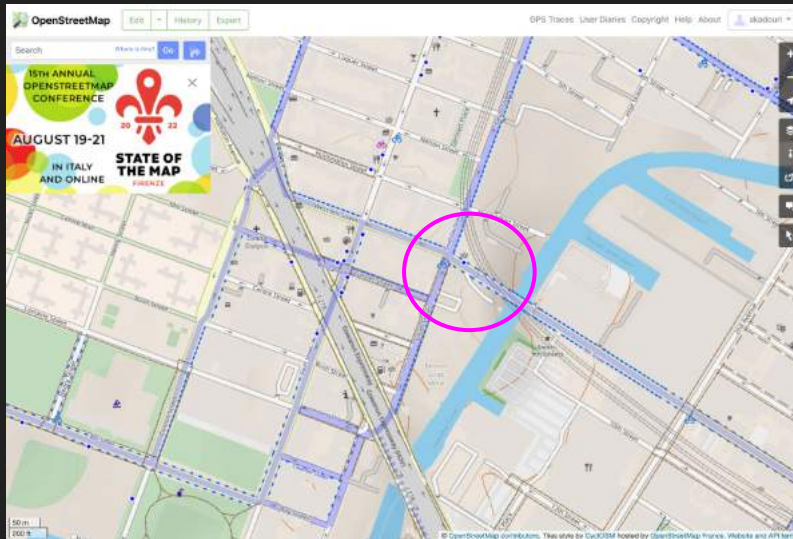
There is at least one raised curb in this area, which might need to be avoided for any number of reasons. Beyond a navigation tool, this is also a reminder to the city that this curb needs to be fixed.



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!

Where can you bike?



Protected Bicycle Lane with Access Point

Camino protegido para bicicletas con punto de acceso
有出入口的保護型腳踏車專用道



Conventional Bicycle Lane

Carril para bicicletas
腳踏車道



Shared Lane
Carril compartido
共用車道



Signed Route
Rutas señalizadas
有標示的車道

Map © City of New York 2022

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

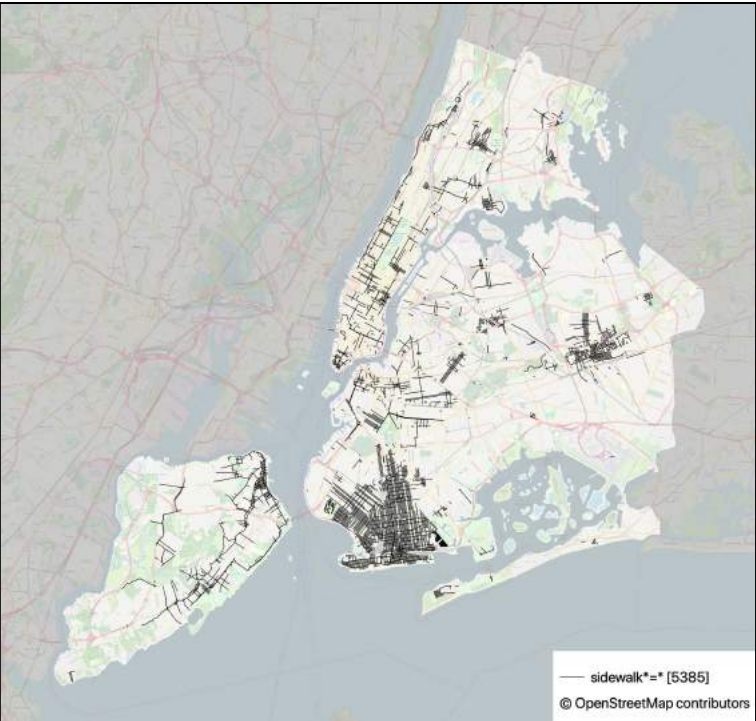
How are we capturing this environment in our tagging? This section is cut and mapped as cycleway=shared_lane while the other painted lanes are cycleway=lane.

Sidewalks on Roads

1,160,292m

of roads with sidewalk*=* tags

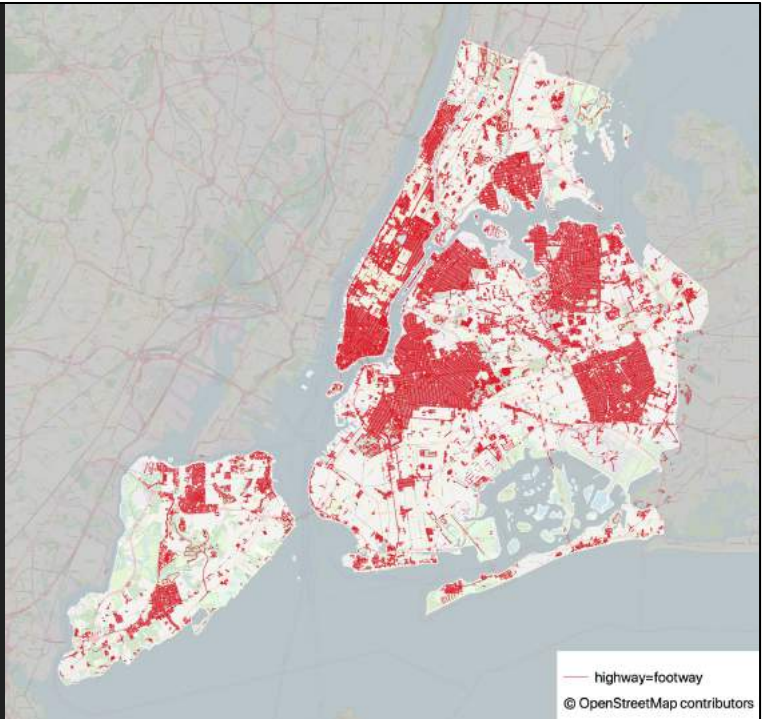
sidewalk	count
=both	3,335
=right	873
=separate	740
=no	219
:right=yes	192
:right=separate	139
=left	86
:left=no	55
:left=separate	45
:left=yes	32
:right=no	16
:right=both	3
=none	1



Sidewalks Off Roads

7,569,332m of
highway=footway mapped

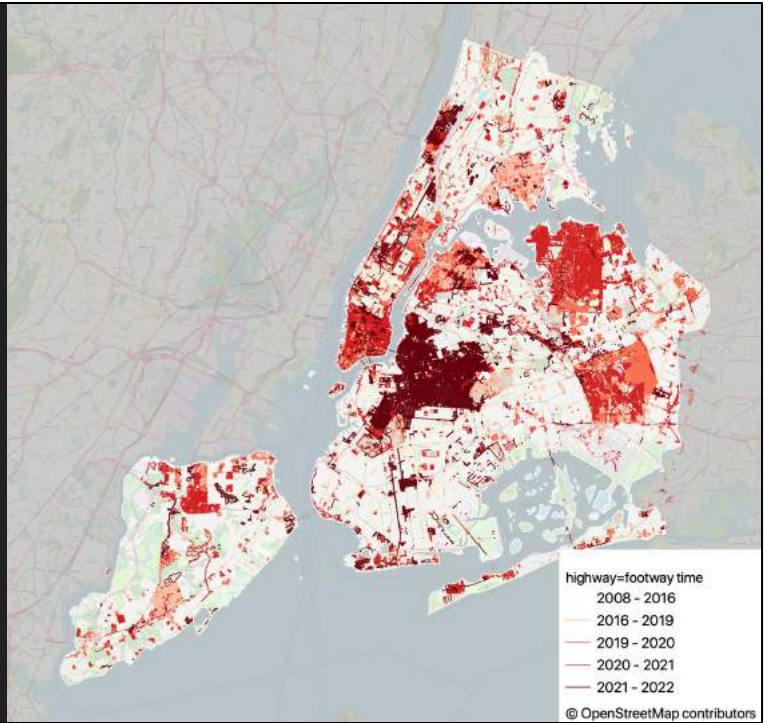
- Clusters in Lower Manhattan, Brooklyn, and Queens.
- Assorted Greenways and Trails
- Parks, Beaches
- Housing Complexes (thanks Amazon)



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

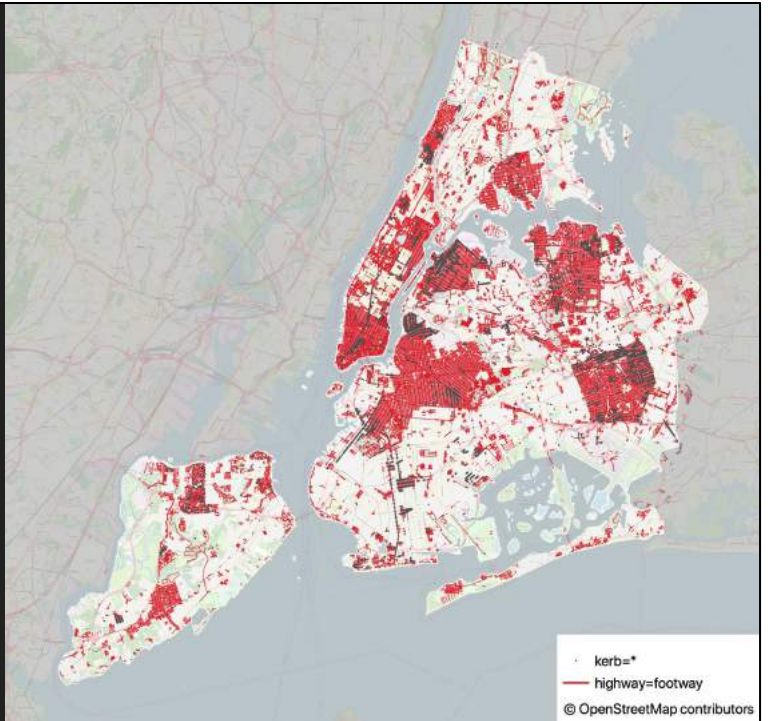
- highway=footway by year last edited
- Bulk of edits done in focused bursts (both geographically and time period)
- Which areas are being maintained?



Where our efforts are aging. What is still relevant today? Where do we need to revisit?

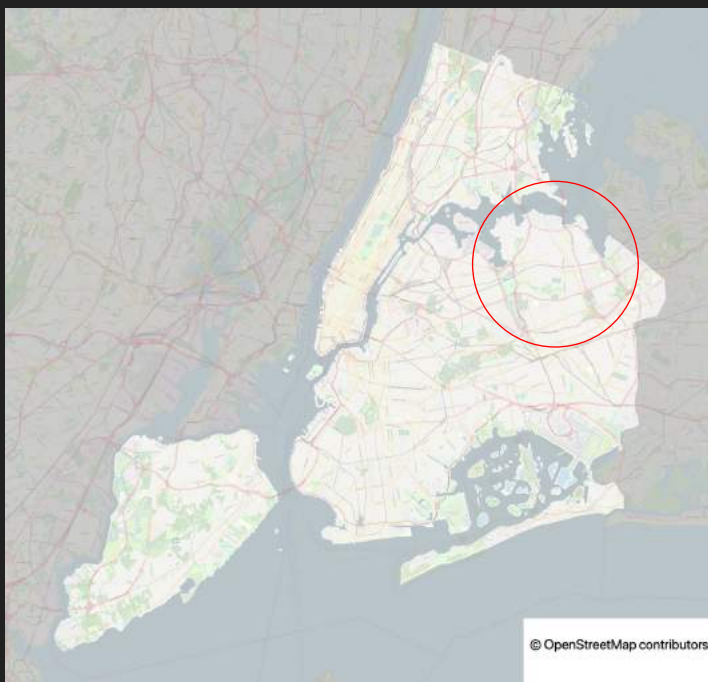
Kerbs!

- Late choice to start mapping curbs
- Inspired by OpenSidewalks' applications for accessible mapping (accessmap.io)
- City progress for ADA compliance nycpedramps.info/



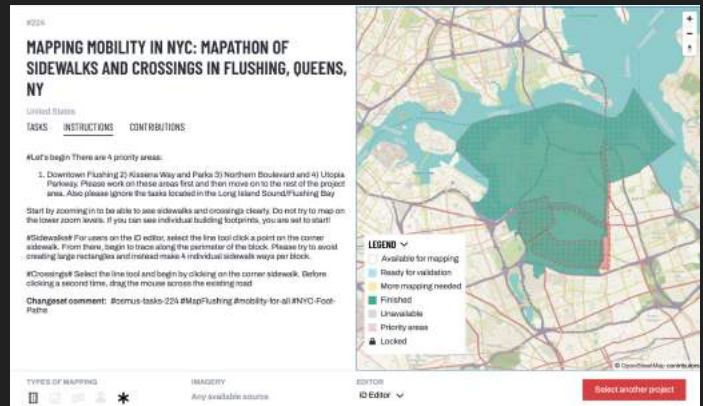
Later to our mapping efforts were kerbs. One of the big reasons to map sidewalks as separate ways at all is to be able to include curb information. In 2019 the city settled an ADA lawsuit with a plan to upgrade the cities' curb infrastructure to meet the ADA requirements. This is more or less an issue 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



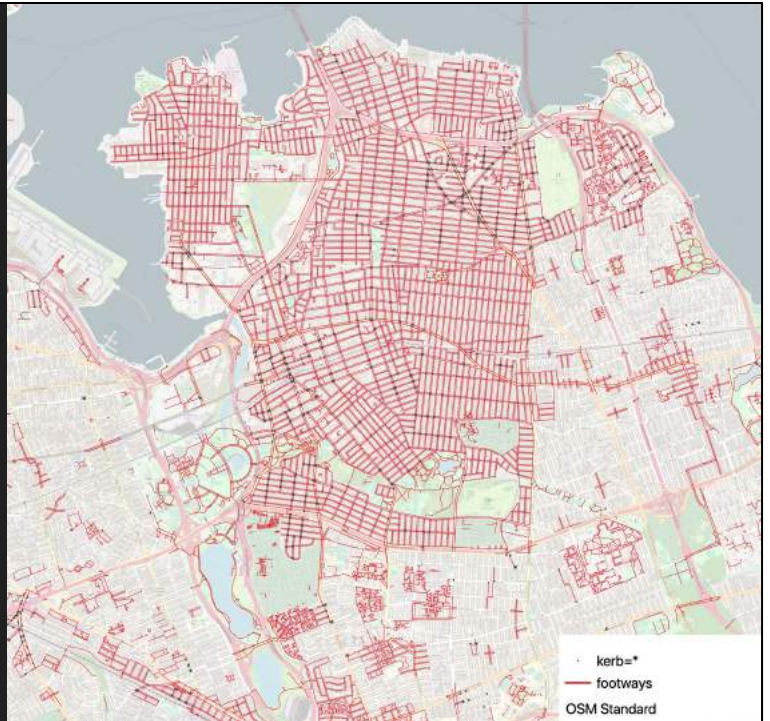
<https://tasks.openstreetmap.us/projects/224/stats/>

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

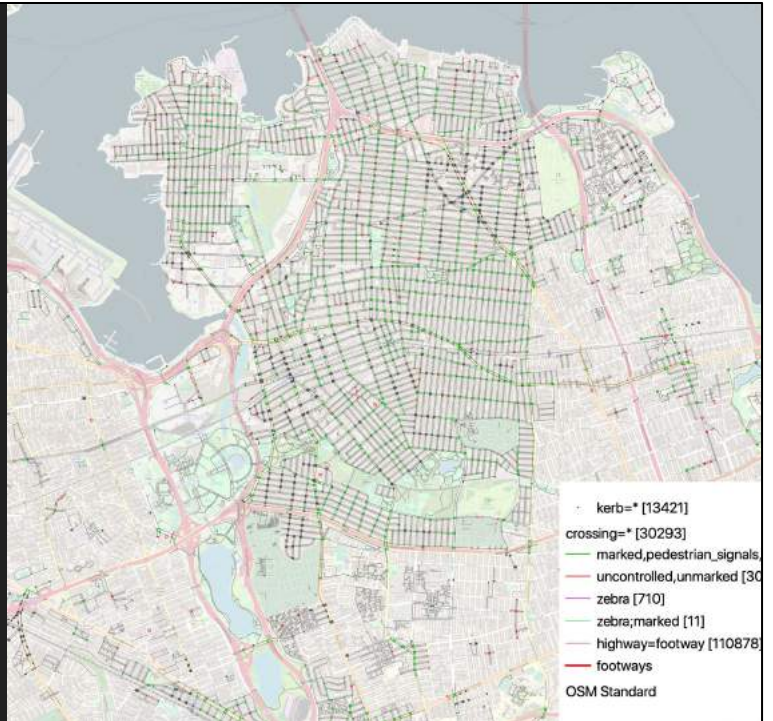
- Entire neighborhood mapped!
- Where is the infrastructure missing?
- Why is it missing?



- 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



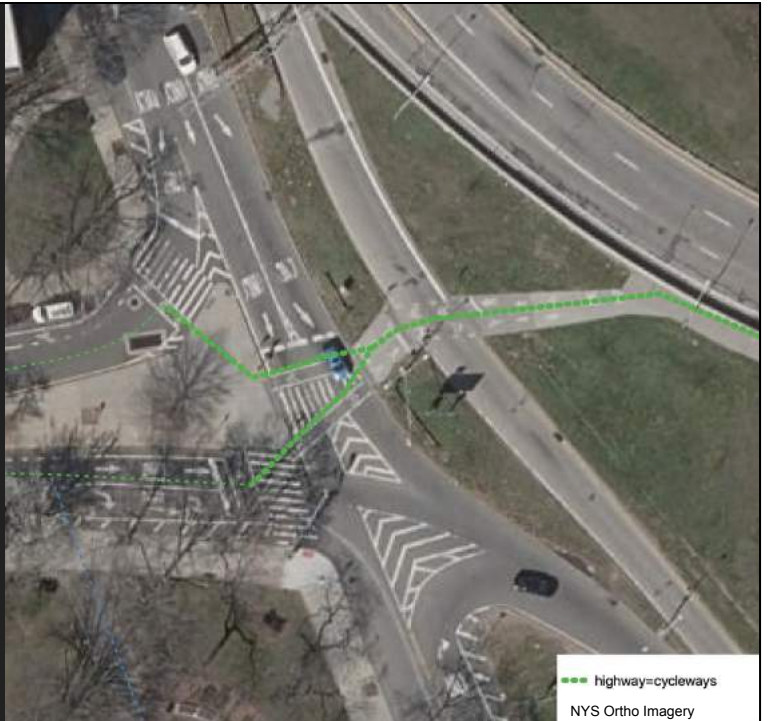
- Was this area recently repainted?
- Does this area have more frequent accidents?

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 an 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.

Streets Master Plan / City Council Initiatives



- 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.

Reporting to the city

Service Request Status

[Sign In](#) | [Sign Up](#)

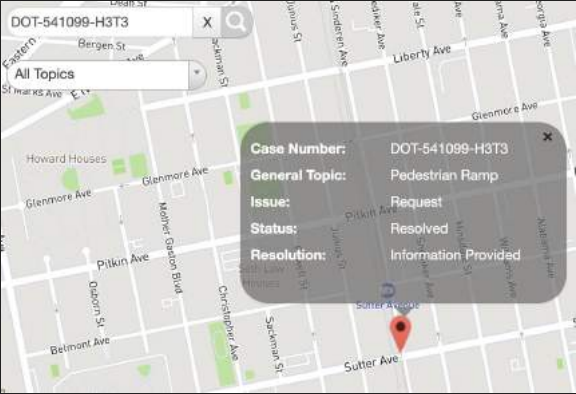
[Subscribe](#)

The Department of Transportation inspected the condition you reported. You can find additional information in the "Notes to Customer" field.

SR Number 311-10248769	Updated On 6/1/2022 12:04 PM
Date Reported 5/11/2022 9:26 PM	Date Closed 6/1/2022 12:04 PM
Problem Street Condition	
Problem Detail Line/Marking - Faded	
Additional Details N/A	

DOT-541099-H3T3

All Topics



Case Number: DOT-541099-H3T3
General Topic: Pedestrian Ramp
Issue: Request
Status: Resolved
Resolution: Information Provided

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.

Where you can't bike

A call for a more bike-friendly bridge

Councilman seeks higher fencing, open cycling lane on RFK-Triborough

by [Michael Gannon](#), Editor Sep 12, 2019



A Queens councilman and cycling advocates are asking the Metropolitan Transportation Authority to add safety fencing to the existing pedestrian lanes on the north side of the Triborough Bridge; and to reopen a lane on the south side for cyclists' use.

Way: 46738905

Version #10

bicycle ramps on Tri-Borough Stairs

Edited over 1 year ago by [daniel_solow](#)

Changeset #100940918

Tags

bicycle	dismount
foot	yes
handrail	yes
highway	steps
incline	down
ramp:bicycle	yes
surface	paved
tactile_paving	no

Nodes

▼ 3 nodes

349242413 (part of way ... 380355130)

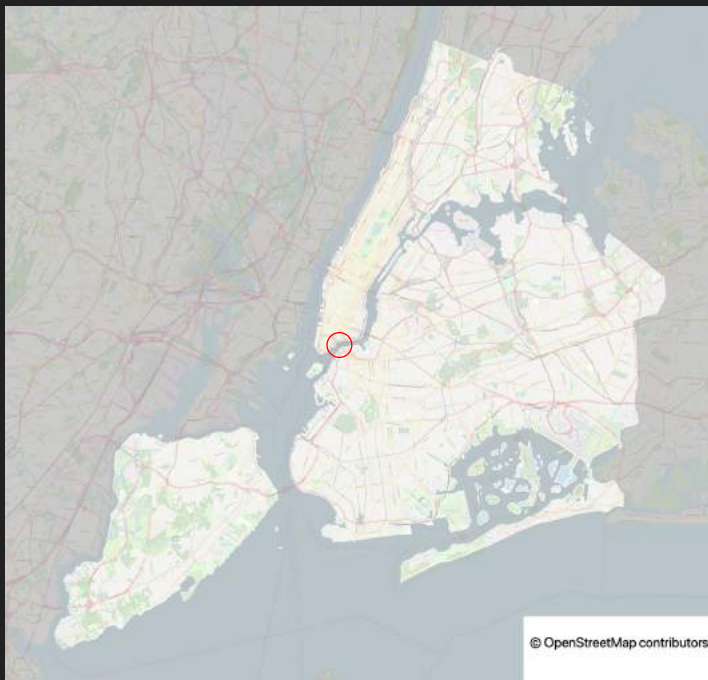
5010421179

2432981542 (part of way ... 457447812)

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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.



Community Efforts - Brooklyn Bridge



De Blasio Administration Opens Brooklyn Bridge Protected Bike Lane, Permanently Transforming Iconic Roadway for Cyclists

September 14, 2021

Fulfilling State of the City promise, protected bike lane to replace one vehicular lane; existing promenade space given entirely to 10,000 daily pedestrians

Version #3

New Brooklyn Bridge Bike path opened on 2021-09-14. Bike no longer allowed on old shared bike/ped path.

Edited 11 months ago by TheBestidea

Changeset #11 Tue, 14 Sep 2021 20:15:59 +0000

Tags

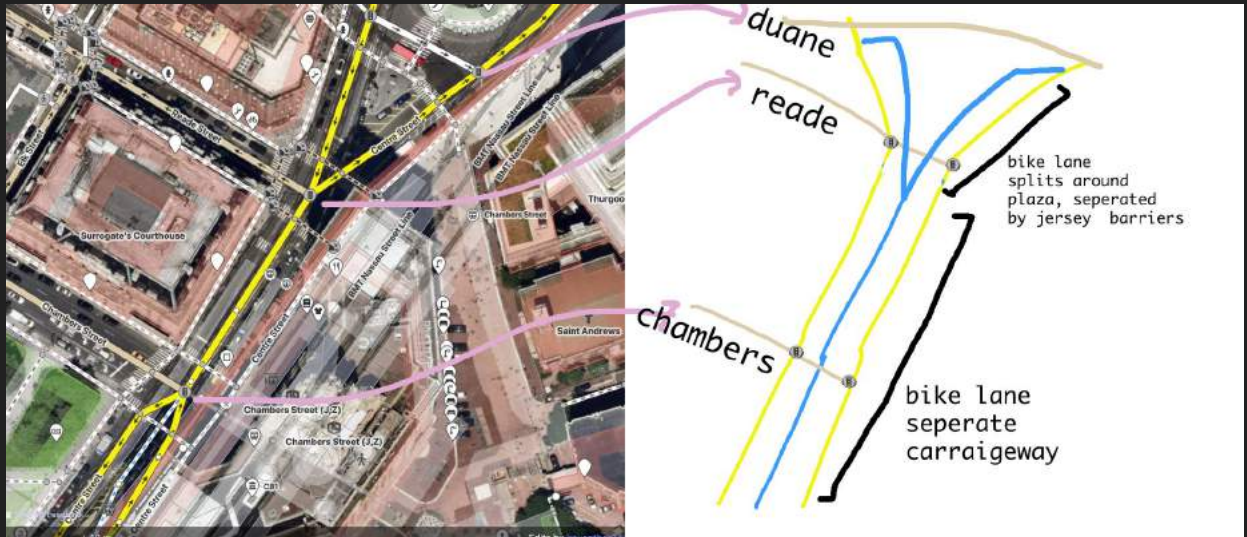
bridge	yes
highway	cycleway
layer	3
name	Brooklyn Bridge Bicycle Path
oneway	no
start_date	2021-09-14
surface	paved
width	8'0"

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.>)

<https://www1.nyc.gov/html/dot/html/bicyclists/bike-counts.shtml>

Updating the connections.



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

Bicycle Routes	
Location	Through
Woodson Ave., East Thicket Ave to Brava Path East - Corridor and Intersection Safety Improvements	Brava
East 10th Street, East 167th Street, and University Avenue	Brava
East 10th Street, Woodson Avenue, Brava Boulevard - East 242nd Street to East 258th Street	Brava
Washington Blvd, Lakeland Avenue to Washington Avenue	Brava
Corridor, Arva Bicycle Network	Brava
Woodson Avenue, Plumbline Avenue, and Lakeland Avenue	Brava
Washington Blvd Network Phase 1	Brava
Washington Avenue, Southern Boulevard to 89th Avenue	Brava
White Plains Road, Burke Avenue to East 228th Street	Brava
22nd Street - 21st Street & Corridorway	BicycleLynx
21st Avenue & 6th Avenue - 20th Street to 20th Street	BicycleLynx
21st St., 30th St., - Southern Boulevard, Brava Network, Esplanade	BicycleLynx
Arboretum Check & News Street	BicycleLynx
Douglas Community District 11 Bicycle Network Development	BicycleLynx
Douglas Community District 14 Bicycle Network Esplanade	BicycleLynx
Brava/Arva District Safety Improvements	BicycleLynx
Woodson Avenue, Jamaica Bay Greenway Corridor	BicycleLynx
Woodson Avenue and Monroe Street, Redwood Creek Corridorway	BicycleLynx
McGuinness Blvd Avenue, Market Avenue to 4th Street	BicycleLynx
Wicker Avenue, Metropolitan Avenue to South Street	BicycleLynx
Woodson Avenue, South Street Corridorway	BicycleLynx
3th Avenue, East 57th Street to East 58th Street Corridorway Street - Better Access Project	Marathon
7th Avenue, Central Path South to West 49th Street	Marathon
Anderson Avenue East, George Avenue, West 190th Street to St. Nicholas Avenue	Marathon
Corridor Avenue and East Houston Street Protected Bike Lane	Marathon
Corridor Street & Lakeland Street Protected Bicycle Lane	Marathon
33rd Street, Queensboro Bridge, South Court Roadway	Marathon
108th Street, 121st Street, 124th Avenue to 27th Avenue	Greenway
20th Avenue, 45th Street to 88th Street	Greenway
Lake Mead City Center's Point Protected Bike Lane Network	Greenway
Queens Community Board 11 Bicycle Network Development	Greenway
Queens Bridge Corridorway	Staten Island
Queens Bridge Corridorway - Page 2	Staten Island
104th Boulevard, Jefferson Street to Clark Avenue	Staten Island

- 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?



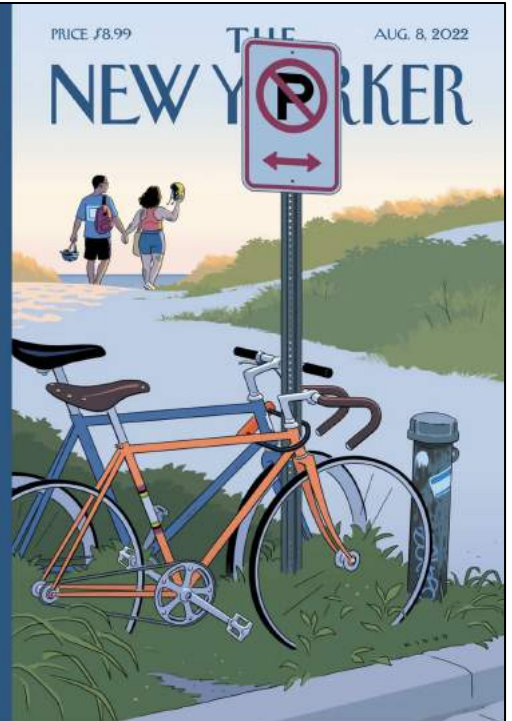
Where we can improve

- 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

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A NYC Case Study
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ariel@arielsartistry.com