

Bridging the Pedestrian Accessibility Informational Gap: User-Facing Applications and Large-Scale Virtual Auditing

accessmap

OpenSidewalks



Manaswi Saha, Nick Bolten

November 15, 2017

54.5 million People in the USA need assistive devices or have trouble walking more than a quarter mile.

”

Using a tool like directions on Google Maps doesn't really help me get around. Actually sometimes this does more harm than good. I'm sent down streets I can't cross, or up inclines that are impossible to climb. It can be deeply frustrating.

Google Maps solves problems for cars



Google Maps solves problems for cars

The image shows a Google Maps interface with a route calculated between two points in Seattle. The left sidebar displays the route options, and the main map area shows the path with callouts for origin, destination, and trip options.

Left Sidebar:

- 1201 1st Ave, Seattle, WA 98101
- 1004 Boren Ave, Seattle, WA 98104
- Add destination
- Leave now
- OPTIONS
- Send directions to your phone
- via Spring St
Fastest route now due to traffic conditions
8 min
0.7 mile
DETAILS
- via Spring St and Madison St
Heavy traffic, as usual
9 min
0.7 mile
- 11:31 AM—11:44 AM
13 min

Map Callouts:

- Set origin (at 1201 1st Avenue)
- Set destination (at 1004 Boren Avenue)
- Get trip options (for the 8 min route)

Map Details:

- Route 1: 8 min, 0.7 mile (via Spring St)
- Route 2: 9 min, 0.7 mile (via Spring St and Madison St)
- Route 3: 13 min, every 15 min (via 1st Ave and Boren Ave)

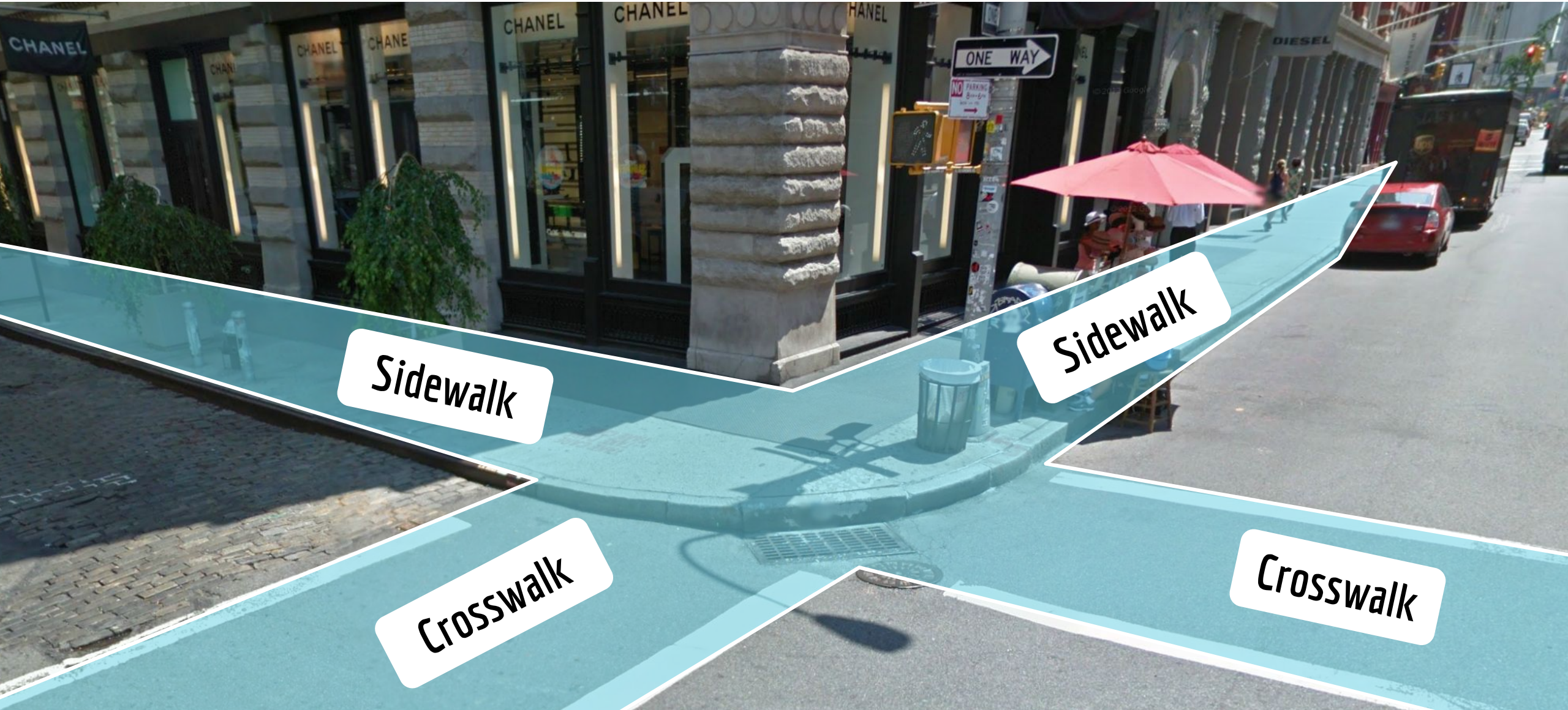
What about **pedestrians**?

What information would we need?



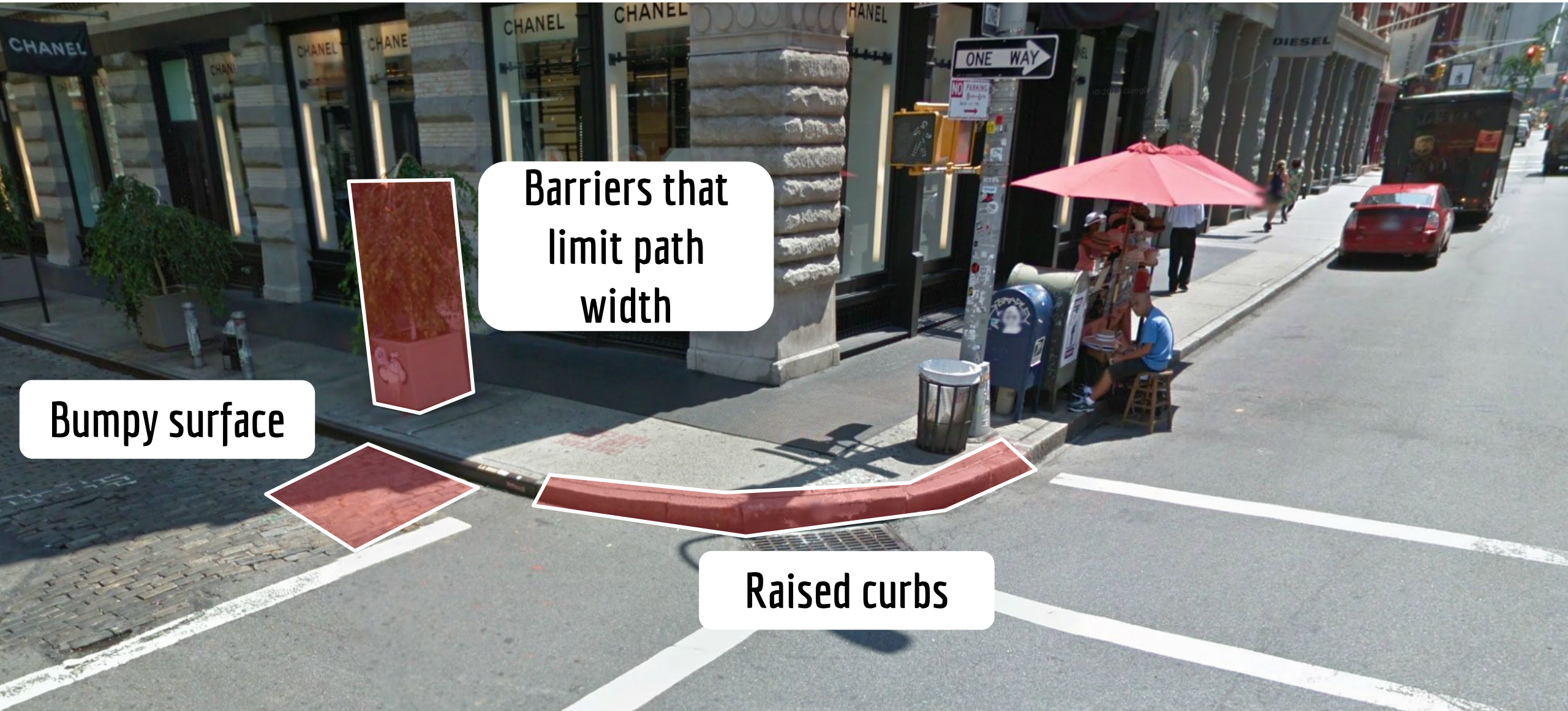
What information would we need?

Traversable Infrastructure



What information would we need?

Barriers.

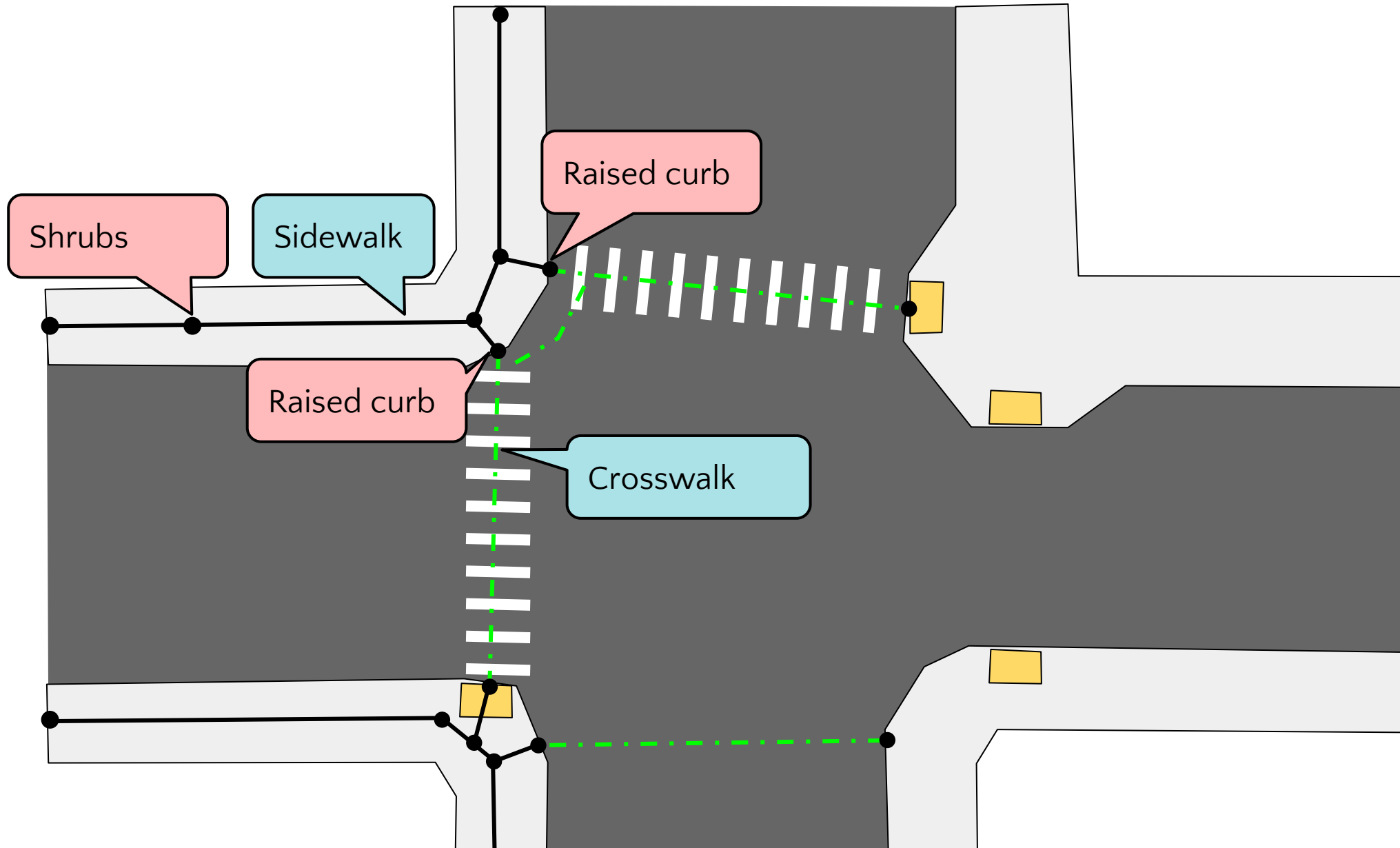


Barriers that
limit path
width

Bumpy surface

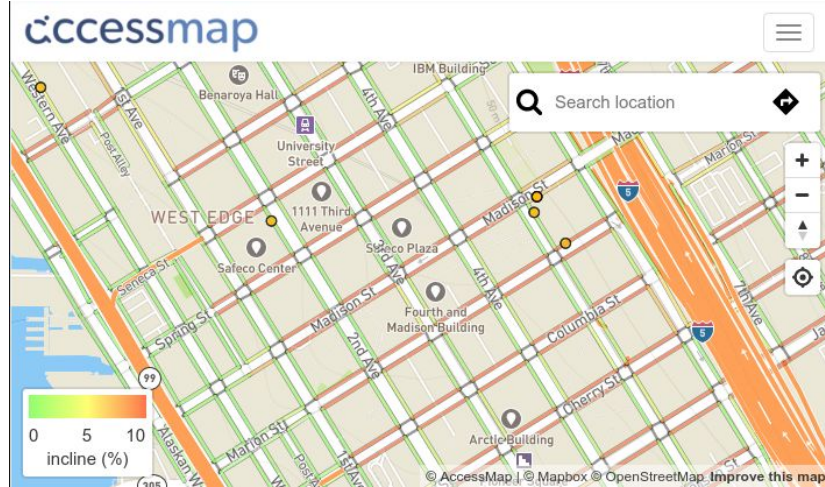
Raised curbs

An annotated **pedestrian** network

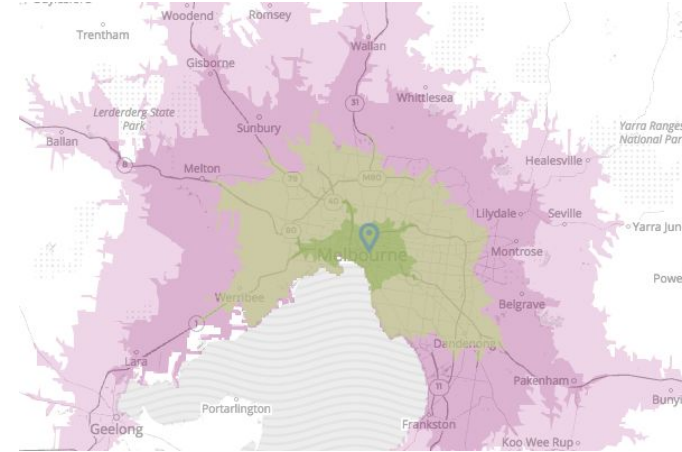


Potential Applications

User-facing maps and automatic trip planning



Transit planning

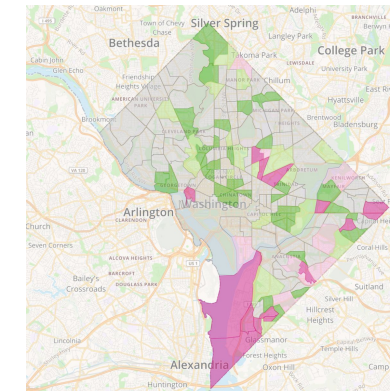


Advocacy



City comparisons & Viz

DC
VS
NYC



Where would we get the data?

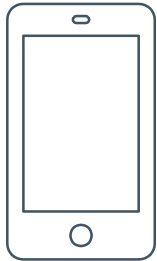
Cities



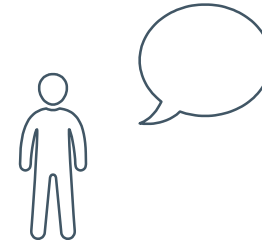
Satellite
imagery



On-site
surveys



Local
knowledge



Collect our
own imagery



Crowdsource
from imagery



Outline

The logo for accessmap, featuring a stylized blue 'a' icon followed by the word 'accessmap' in a blue sans-serif font.

Trip planning with accessibility in mind

The logo for OpenSidewalks, featuring a small globe icon inside the 'O' of 'Open', followed by the word 'Sidewalks' in a black sans-serif font.

Describing, sharing, and collecting
pedestrian-centric data



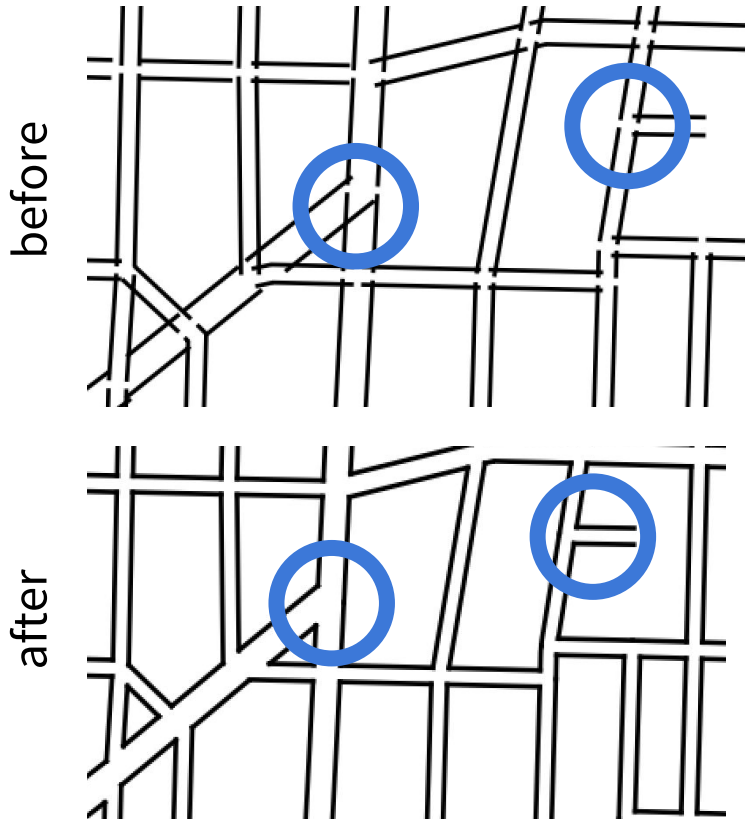
Crowdsourcing accessibility data from
street-level imagery

accessmap

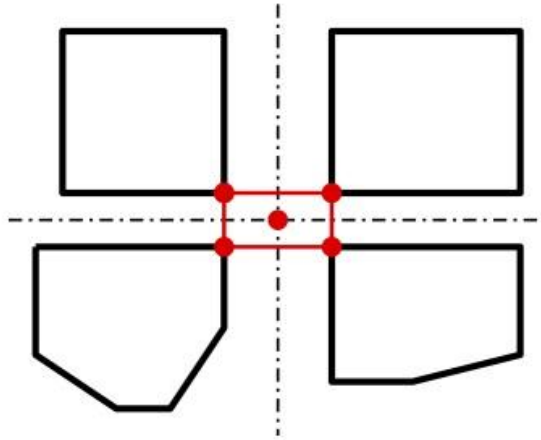
<https://www.accessmap.io>

AccessMap

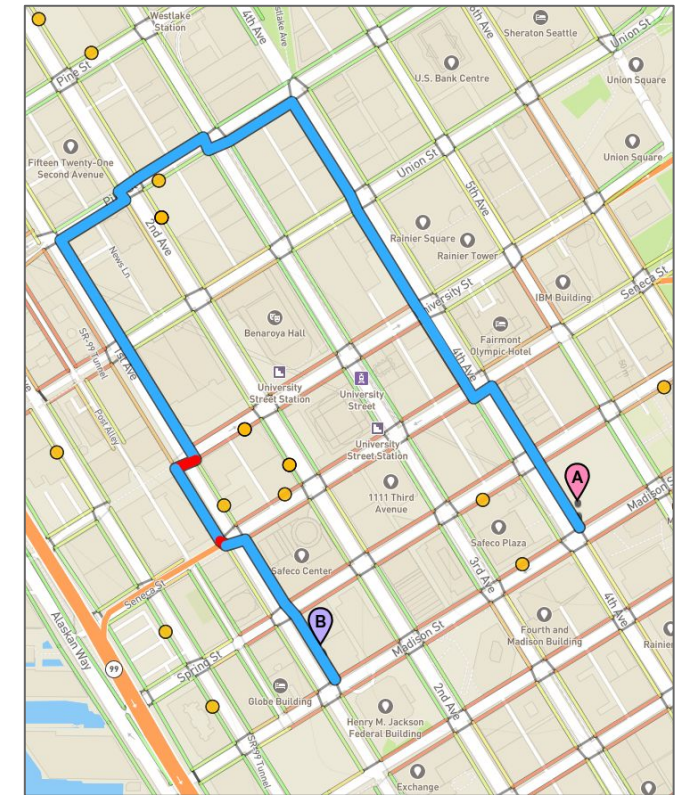
Synthesizes a pedestrian network from municipal data.



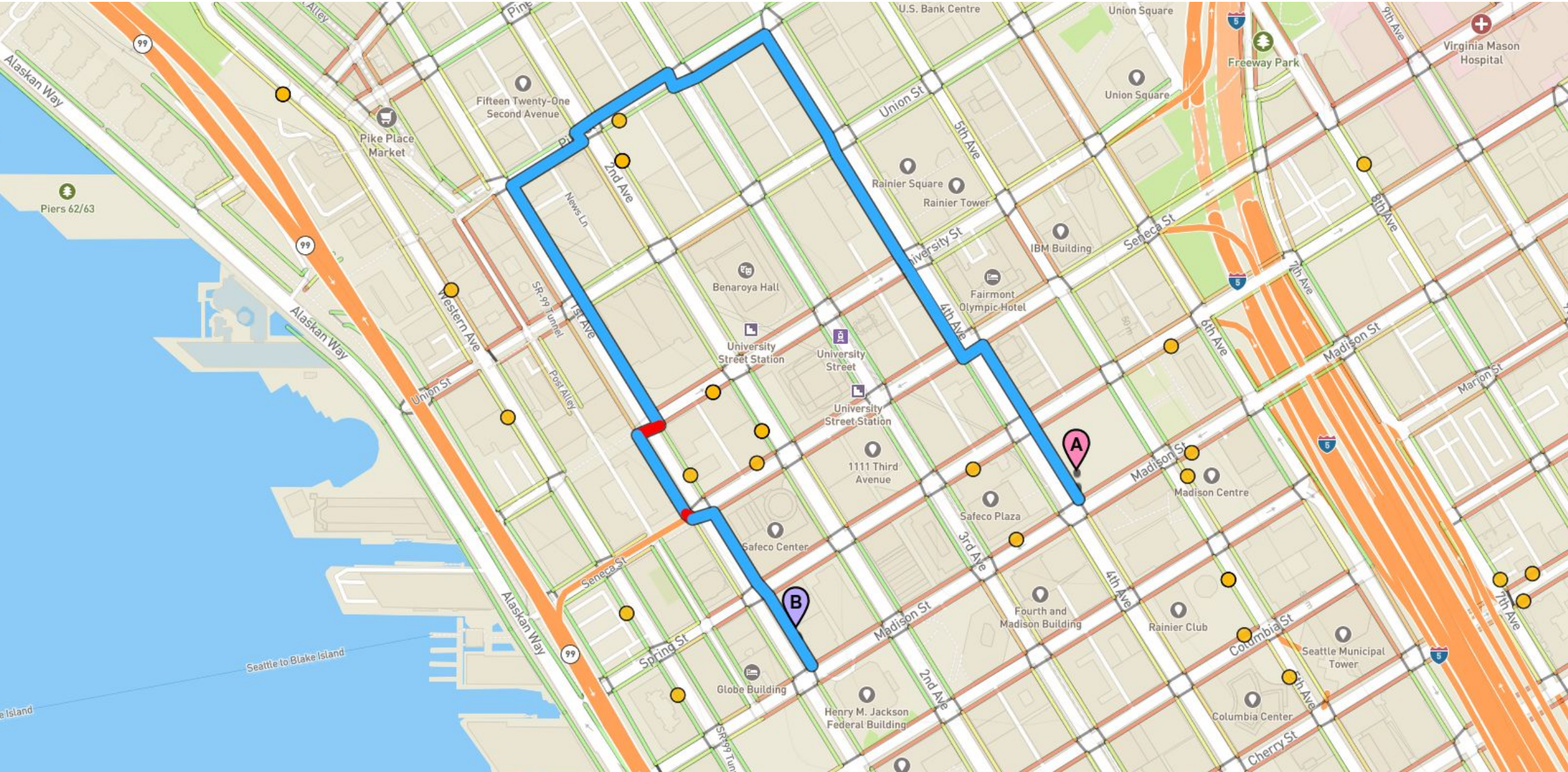
Algorithmically fills in gaps



Displays the data with visual metaphors and provides trip planning



Accessible Trips with AccessMap



Advocacy and Analysis with AccessMap's Network

Where can a manual wheelchair user get in X minutes,
starting a city hall?



Future Work for AccessMap

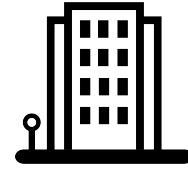
More cities and regions

 San Jose

 New York

 World?

More data



Paths through
buildings

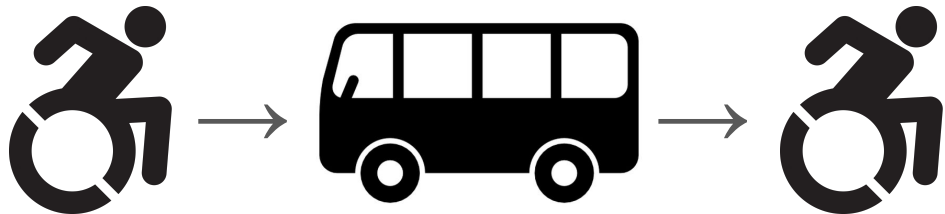


Parks

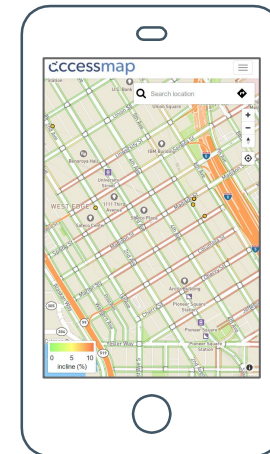


Elevators

Multi-modal trip planning



Mobile apps



Challenges

We need to describe more kinds of data and have it all related together



We need efficient methods for collecting the data



Stakeholders need to communicate:

municipalities
transportation
the public
AccessMap



Our approach needs to scale



OpenSidewalks

<https://www.opensidewalks.com>

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OpenSidewalks Solution

We need to describe more kinds of data and have it all related together



Stakeholders need to communicate:

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AccessMap



OpenStreetMap!

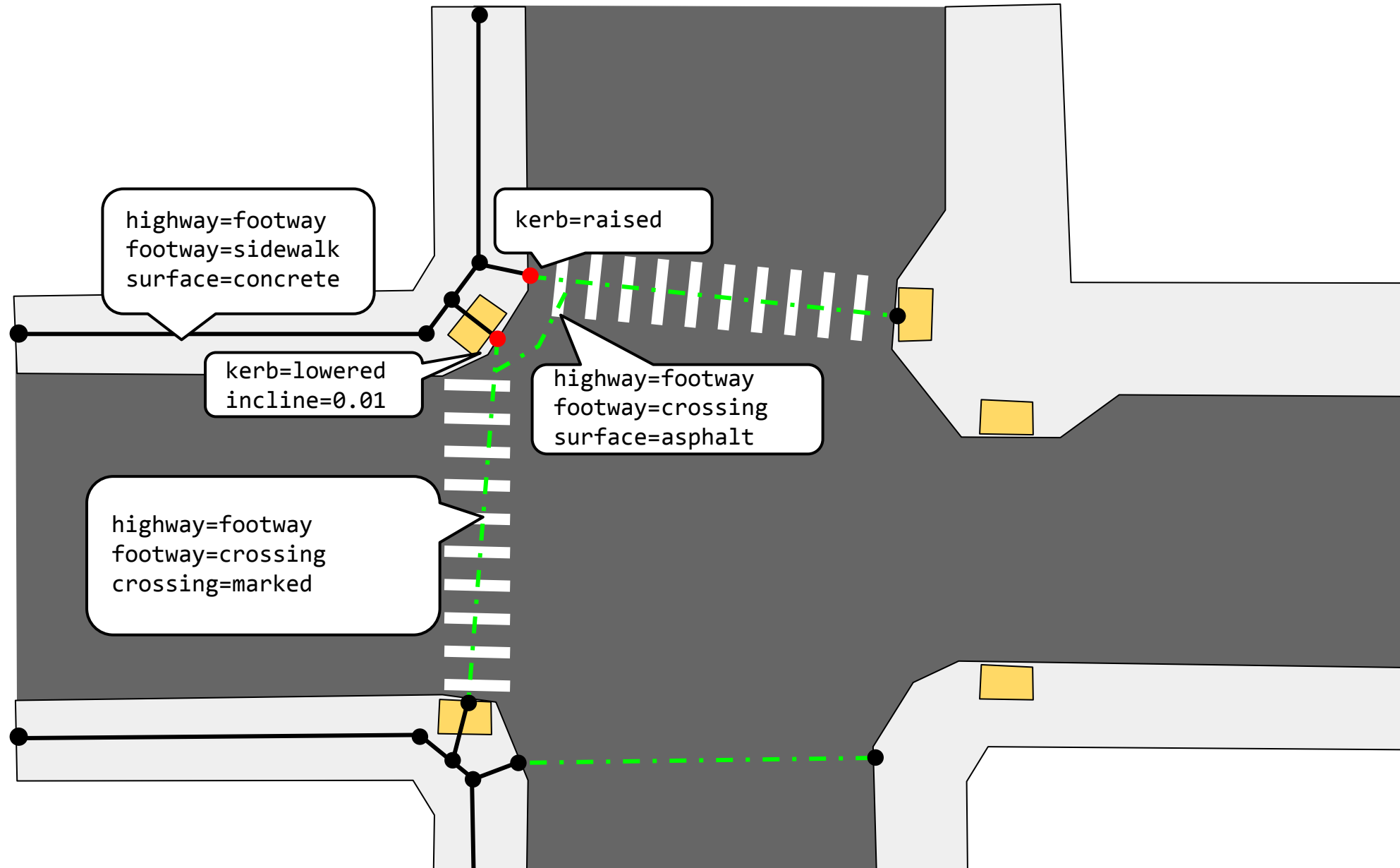


We need efficient methods for collecting the data



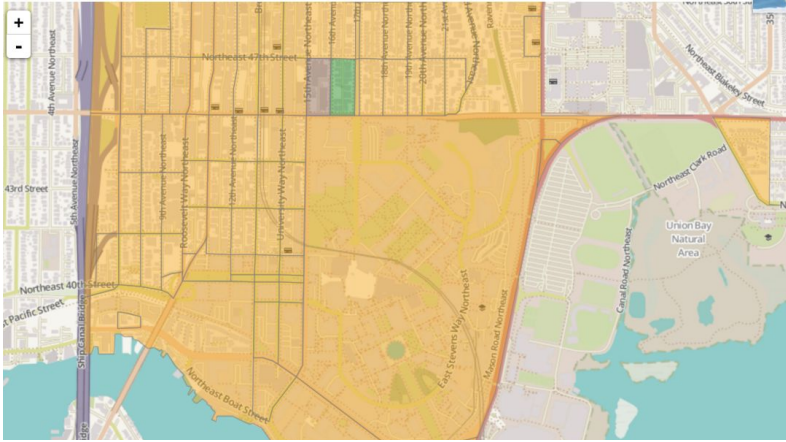
Our approach needs to scale

OpenSidewalks Schema: Data Standard

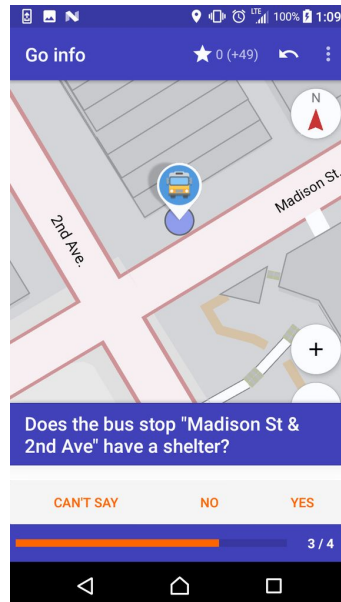


OpenSidewalks Tools for Getting Data

Municipal Data Import Workflows



On-site
survey app



Host mapathons

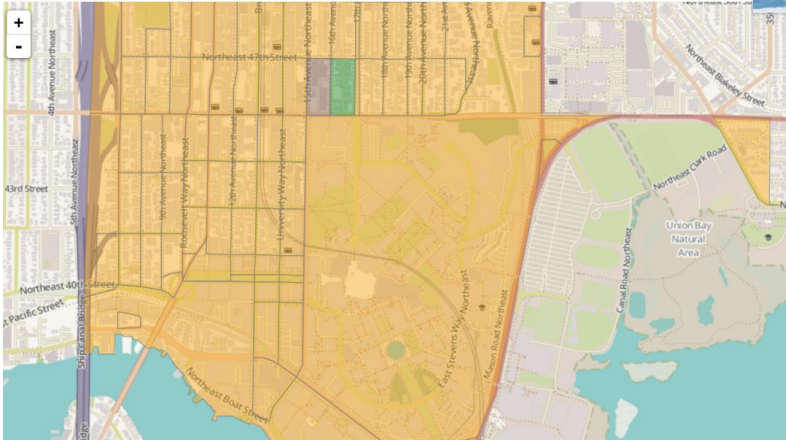


Open source street view imagery

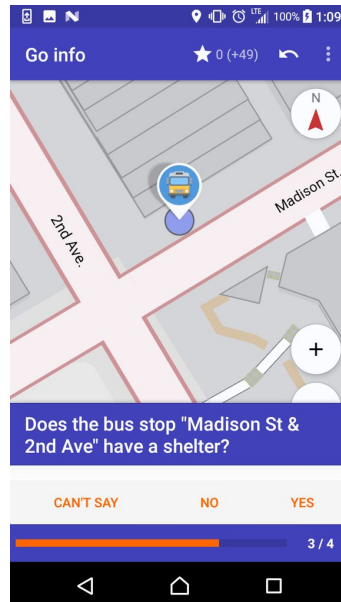


OpenSidewalks Tools for Getting Data

Municipal Data Import Workflows



On-site
survey app



Host mapathons



Open source street view imagery



What can
we do
with this?

Project Sidewalk

Manaswi Saha, Jon Froehlich

Paul Allen School of Computer Science and Engineering

Project Sidewalk

Leveraging Google Street-View Imagery for Assessing Urban Accessibility



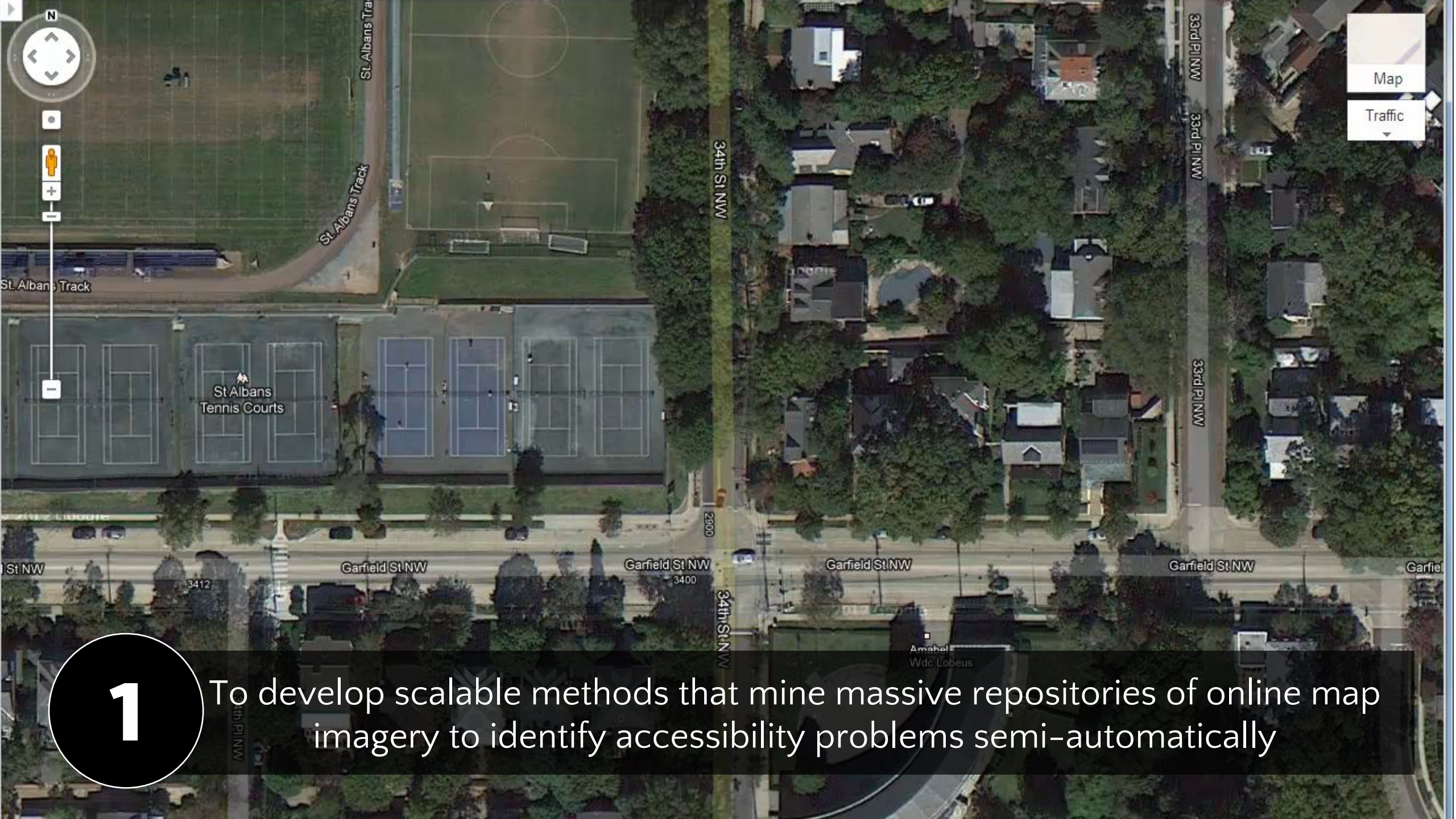
How can we...

develop scalable solutions that map the accessibility of urban infrastructure?

Project Sidewalk

[ASSETS'12, CHI'13, HCOMP'13, ASSETS'13 Best Paper, UIST'14, TACCESS'15, SIGACCESS'15, CHI'16, ASSETS'17]

We are pursuing a **two-fold solution**



1

To develop scalable methods that mine massive repositories of online map imagery to identify accessibility problems semi-automatically

Access Score_{beta}

Use the sliders below to adjust the significance of each accessibility feature.



2

To create new accessibility-aware mapping tools that support people with disabilities and provide unprecedented views of urban accessibility

● Curb Ramp ● Missing Curb Ramp ● Sidewalk Obstacle ● Surface Problem Inaccessible ■ ■ Accessible



PROJECT
SIDEWALK

[HTTP://PROJECTSIDEWALK.IO](http://PROJECTSIDEWALK.IO)



NO CURB RAMPS

A photograph of a sidewalk made of concrete slabs and brick pavers. A dark wooden post stands on the sidewalk, casting a shadow. In the background, there is a brick pillar, a metal fence, and a grassy area with some debris. A white callout box with the text "PHYSICAL OBSTACLES" is positioned over the wooden post, with a line pointing to its base.

PHYSICAL OBSTACLES



INCOMPLETE SIDEWALKS

SURFACE PROBLEMS





PHYSICAL OBSTACLES

NO CURB RAMPS

SURFACE PROBLEMS

A man with glasses and a dark jacket is sitting in a wheelchair on a paved path. The path is surrounded by trees and grass, with some fallen leaves on the ground. The man is looking off to the side with a slight smile.

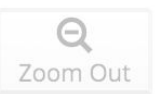
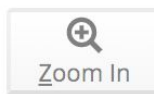
Let's create a path for everyone

[Start Mapping](#)

How you can help

Virtually explore city streets to find and label accessibility issues in three easy steps—right from the comfort of your

Find and label the following



Current Neighborhood
Mount Pleasant, D.C.

0.0 miles 20 labels

Audit 500ft in Mount Pleasant



Your mission is to audit 500ft in Mount Pleasant and find all the accessibility features that affect mobility impaired travelers!

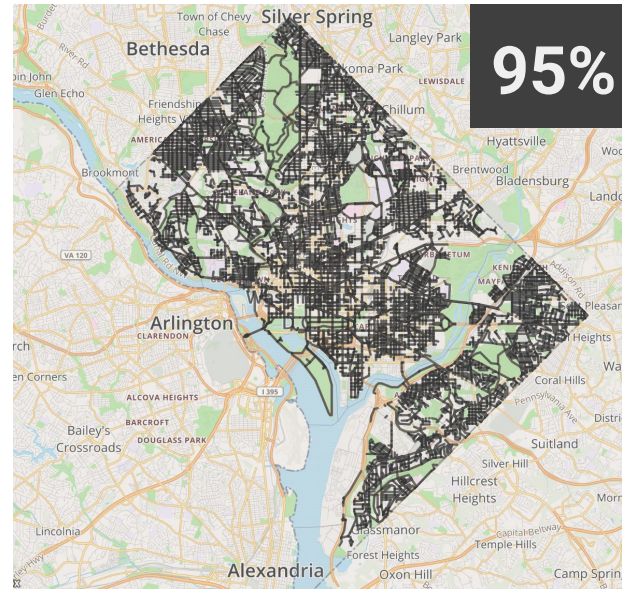
OK



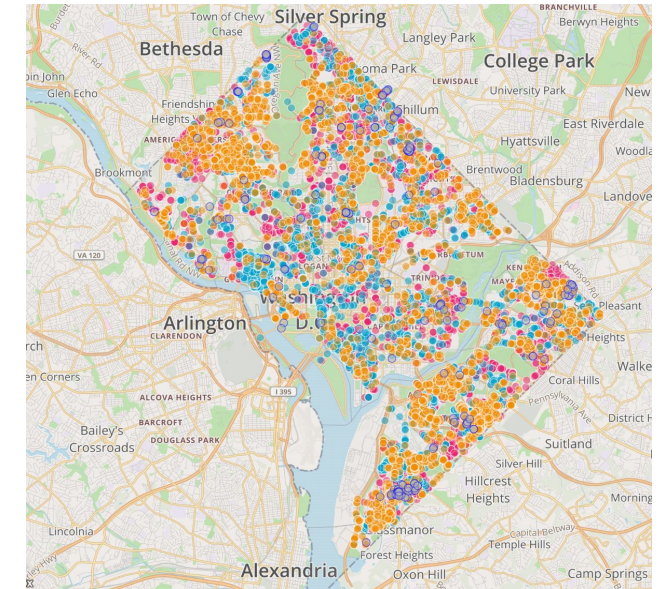
Project Sidewalk Deployment



700
Users



1,031
Miles audited



~150,000
Sidewalk Labels

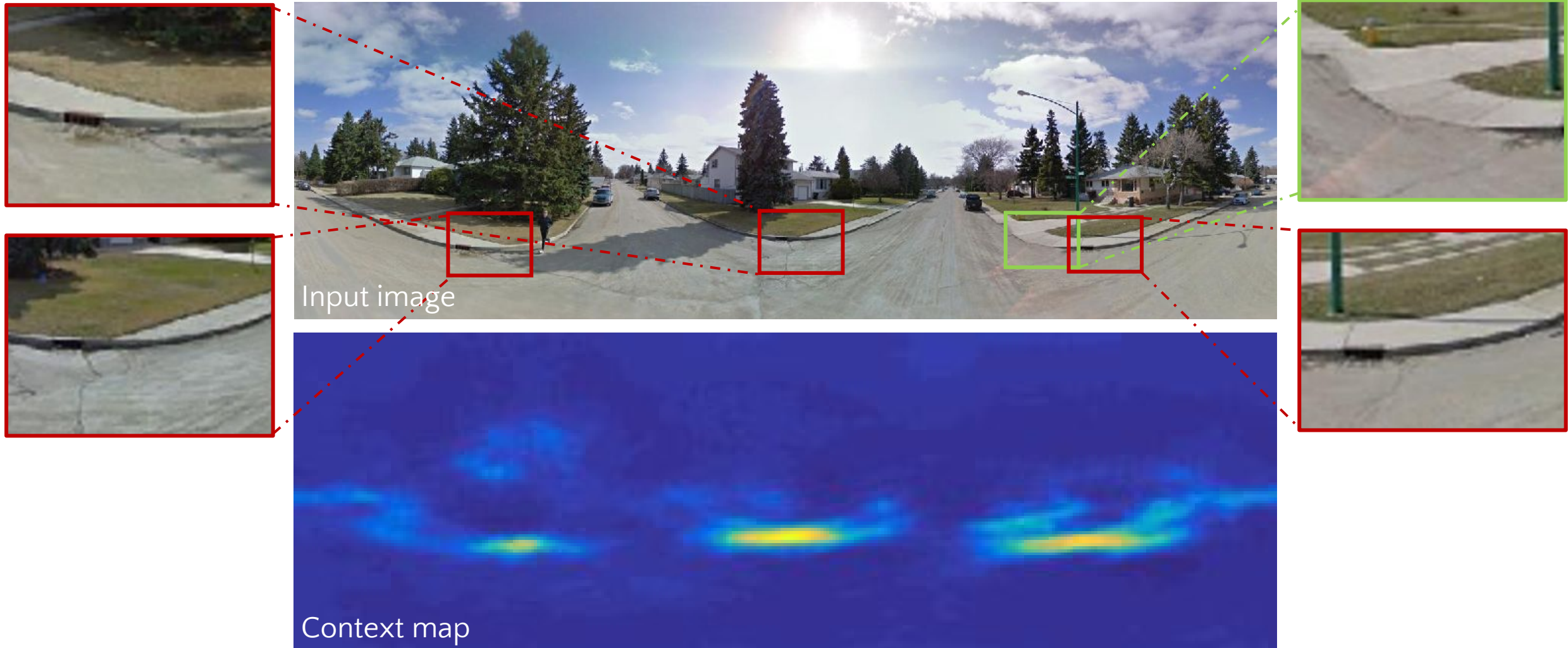
Current and Future Work



Current & Future work

Applying Convolutional Neural Networks

Recently accepted to CVPR'17

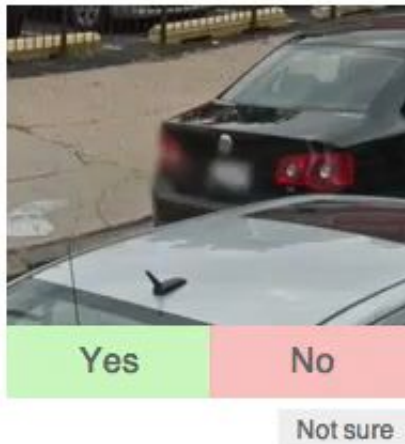


Current & Future work

New Hybrid Workflows & interfaces

Are there curb ramps in these pictures? [Click here for more instruction.](#)

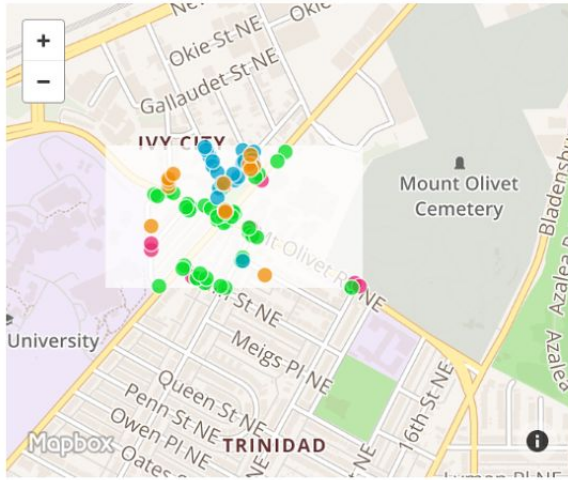
You have verified 0 images. 50 more to go!



Future Work

Tracking Accessibility infrastructure over time





Access Features

This API serves point-level location data on accessibility features. The major categories of the features include "Curb Ramp," "Missing Curb Ramp," "Obstacles," and "Surface Problem." You would occasionally find an accessibility feature like "No Sidewalk."

URL `/v1/access/features`

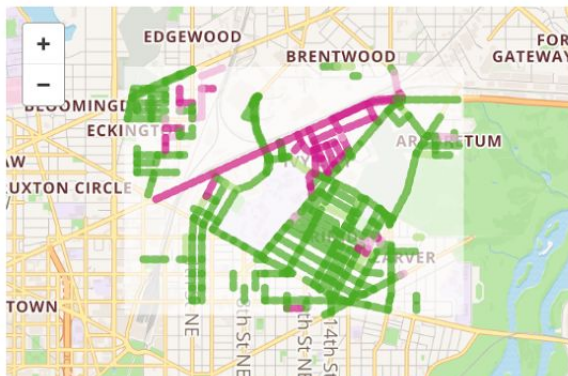
Method GET

Parameters Required:
You need to pass a pair of latlng coordinates to define a bounding box, which is used to specify where you want to query the data from.

- `lat1=[double]`
- `lng1=[double]`
- `lat2=[double]`
- `lng2=[double]`

Success Response **200**
The API returns all the available accessibility features in the specified area as a [Feature Collection](#) of [Point features](#).

Example `/v1/access/features?lat1=38.909&lng1=-76.989&lat2=38.912&lng2=-76.982`



Access Score: Streets

This API serves Accessibility Scores of the streets within a specified region. Accessibility Score is a numerical value between 0 and 1, where 0 means inaccessible and 1 means accessible.

URL `/v1/access/score/streets`

Method GET

Parameters Required:
You need to pass a pair of latlng coordinates to define a bounding box, which is used to specify where you want to query the data from.

The Team

Professors

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Alex Zhang	Sage Chen	Steven Bower	Aditya Dash	Chirag Shankar	

High School Students

Jonah Chazan	Anthony Li	Niles Rogoff	Ryan Holland
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AccessMap/OpenSidewalks acknowledgments



UNIVERSITY of WASHINGTON
eScience Institute

Urban@UW



GORDON AND BETTY
MOORE
FOUNDATION



Special thanks to Clifford Snow & Chase Stevens of
OSM Seattle