

BikeButler:

Personalized, Context-Sensitive Bike Routing



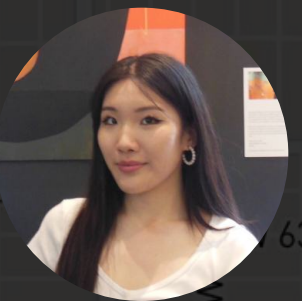
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Jasmine Zhang
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Jon E. Froehlich
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SLOW AND SAFE V1 SEGMENTS



Segment 1



Good: Slope **Bad:** Vegetation, Street Type



Segment 2



Good: Vegetation, Speed Limit **Bad:** Slope



Which path would you take?



+15 minutes

Best 7 min 11 min 25 min 7 min

Search along the route... Restaurants Coffee Groceries Things to do

Options
Send directions to your phone Copy link

via Broadway E 7 min 1.2 miles
Details Preview

via 12th Ave E and E Pine St 8 min 1.4 miles

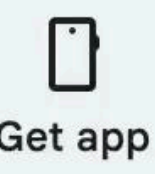
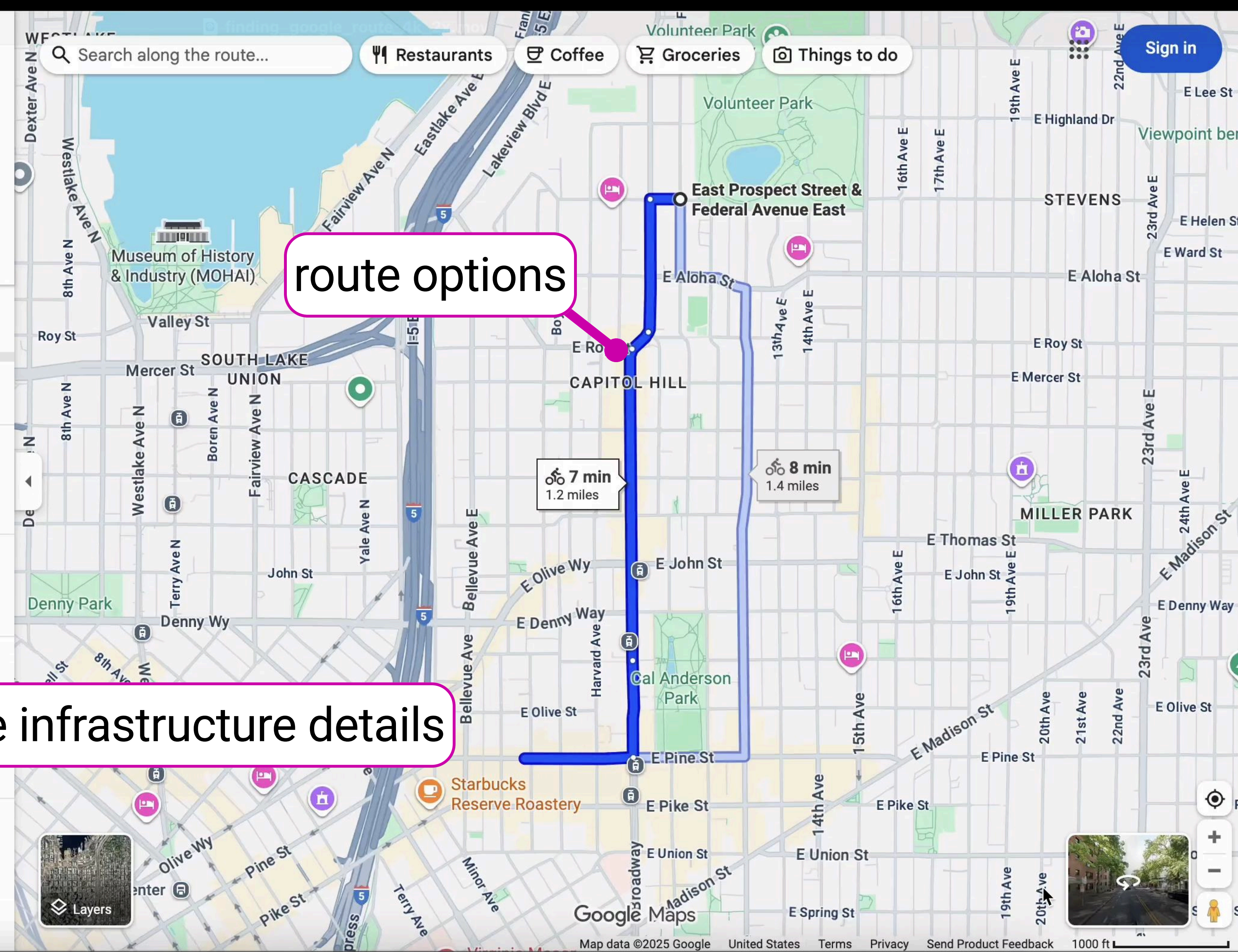
↑ 0 ft · ↓ 108 ft

maybe some infrastructure details

route options

7 min 1.2 miles

8 min 1.4 miles



Get app



Layers

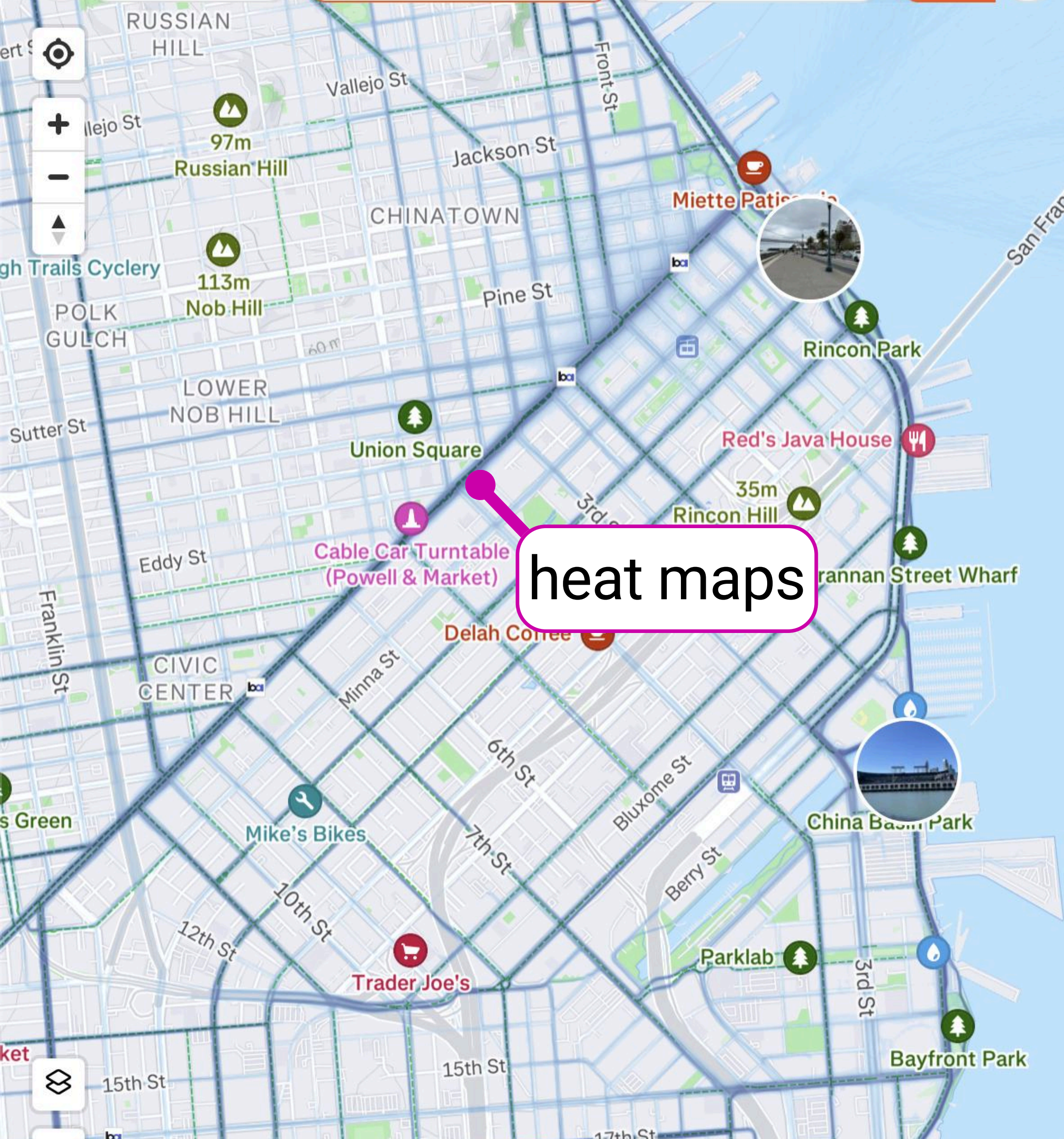
Google Maps

Strava

Search for a location

Heatmaps (1) X

Segments V



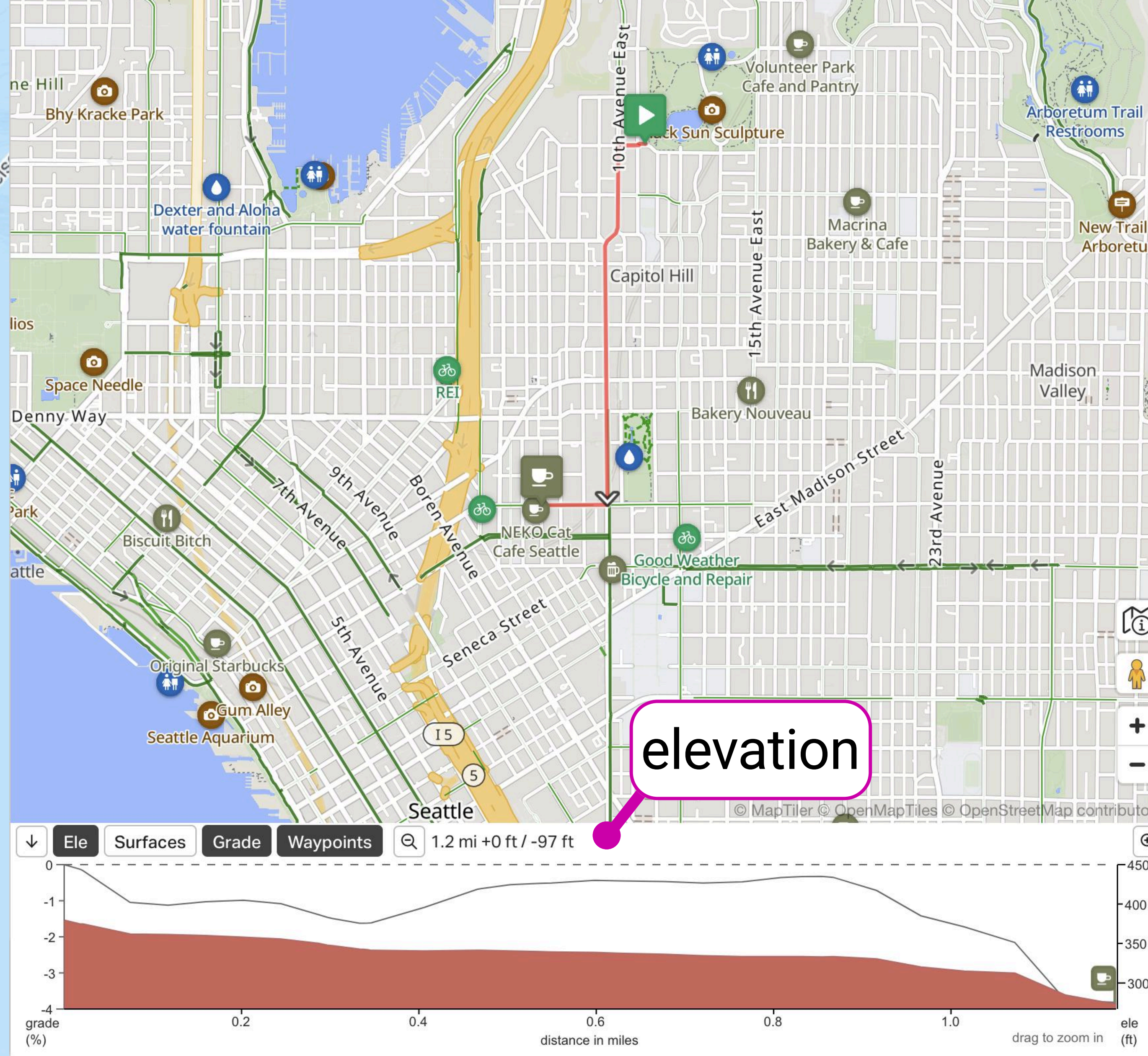
RideWithGPS

Layers V

Heatmaps V

Settings V

RWGPS Cycle V



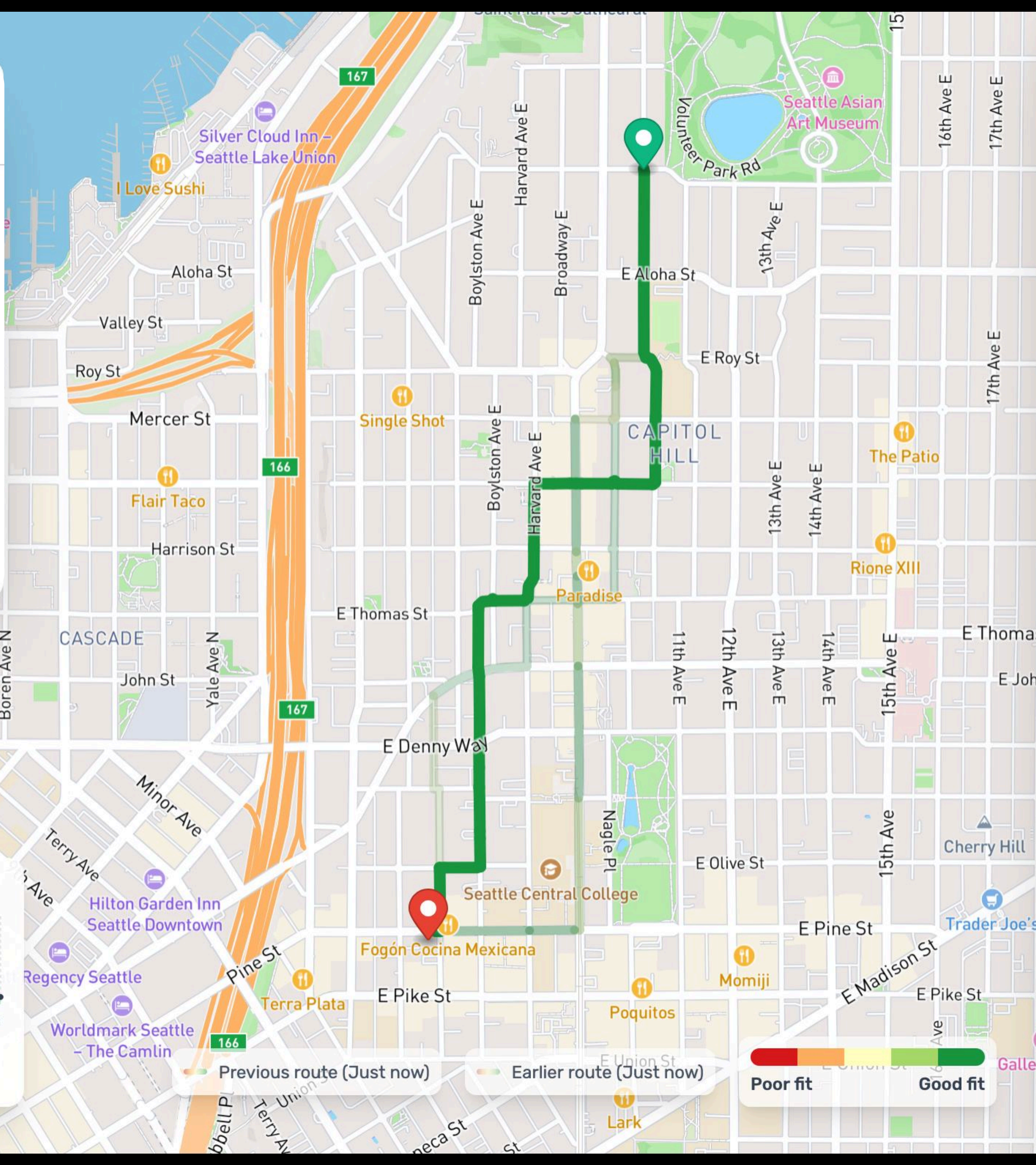
Bike Butler

Origin
East Prospect Street &

Destination
NEKO Cat Cafe Seattle,

Profile
Slow and Safe

Get Bike Route



SLOW AND SAFE V1 SEGMENTS ⓘ



Segment 1



Good: Slope, Vegetation, Speed Limit



Segment 2



Good: Slope, Vegetation, Speed Limit



Introducing BikeButler

Generate

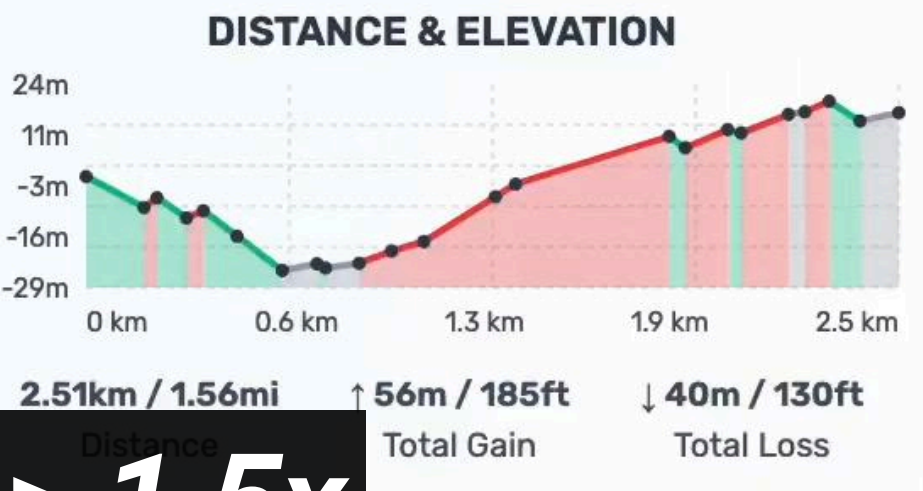
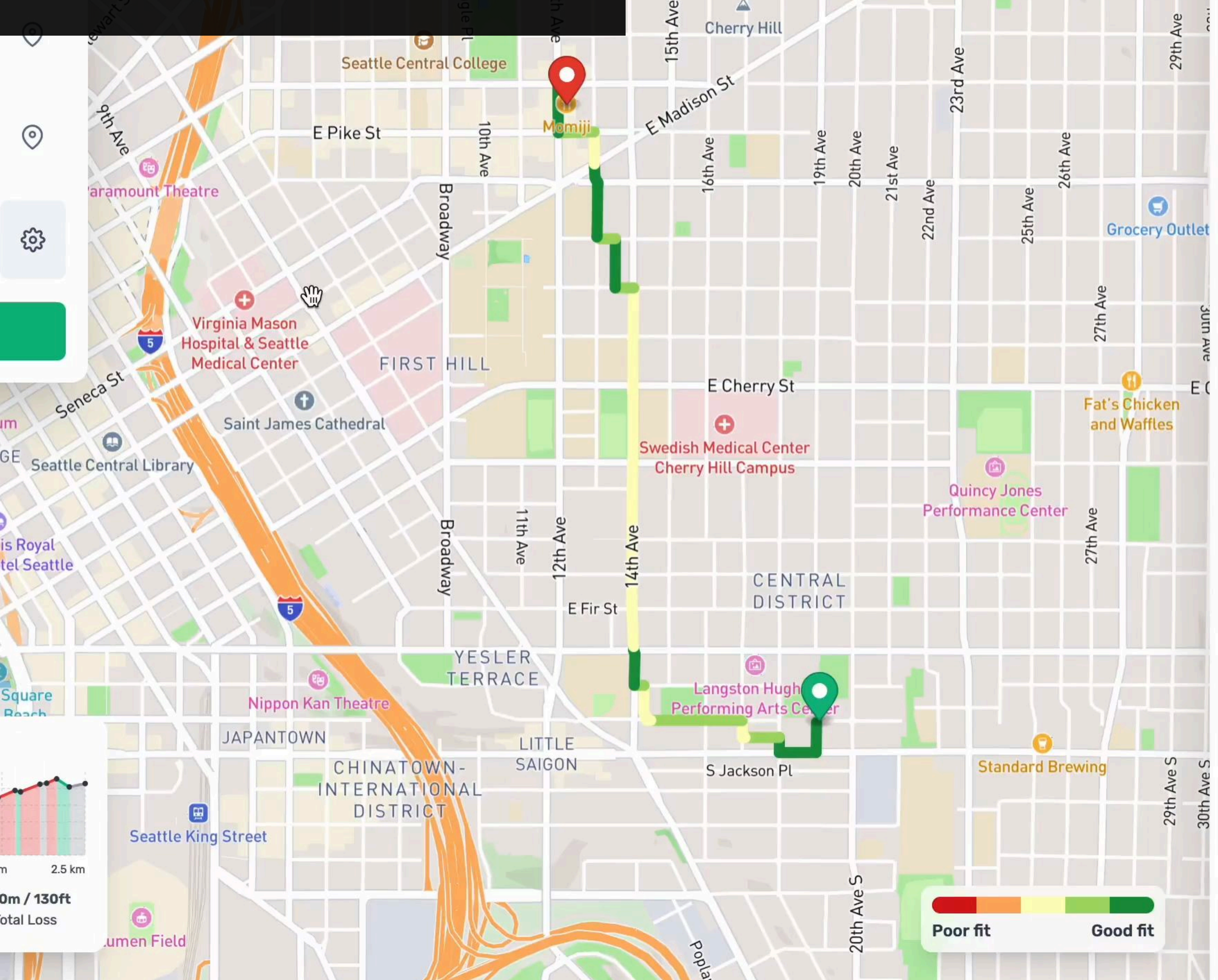
Compare

Preview

Origin
Street, Seattle, WA, USA

Destination
USA

Profile
Fast and Loose



>> 1.5x

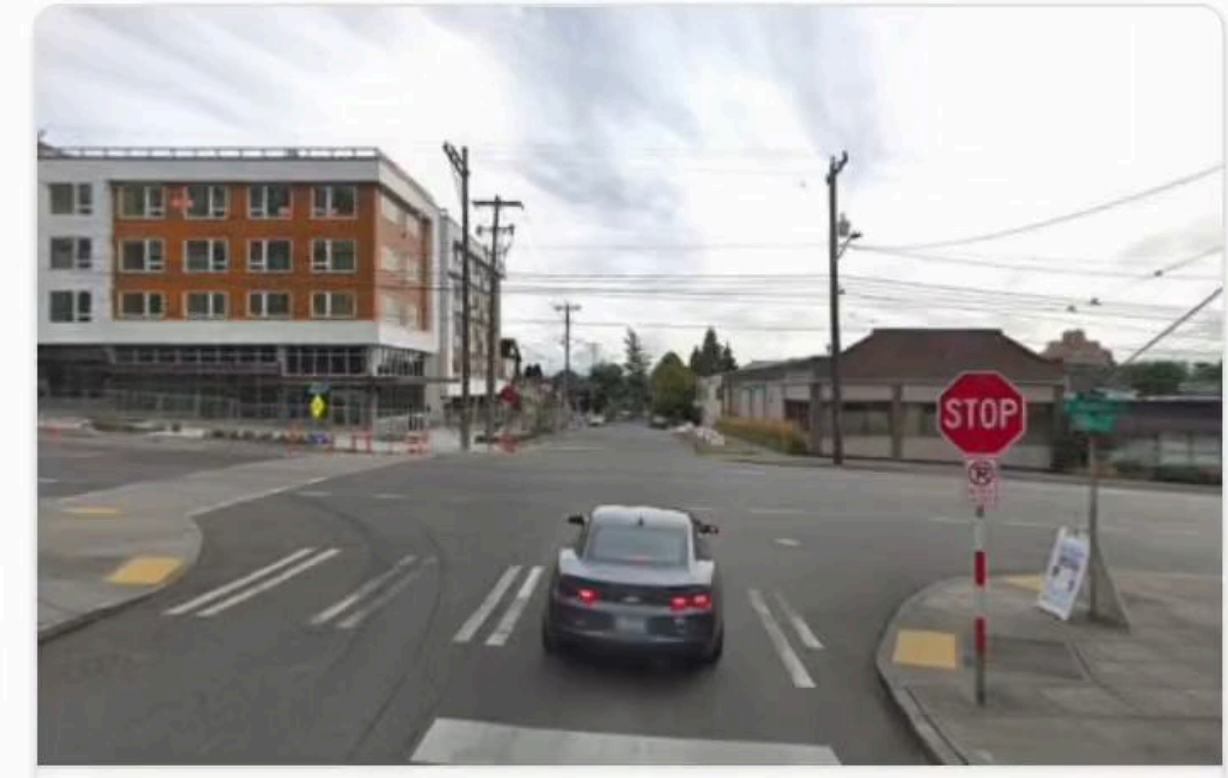
FAST AND LOOSE V1 SEGMENTS ⓘ



Segment 1



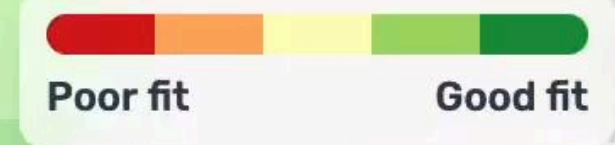
Good: Surface Qual, Slope



Segment 2



Good: Surface Qual Bad: Slope



Bike Butler

Origin
East, Seattle, WA, USA

Destination
Street, Seattle, WA, USA

Profile
Fast and Loose

Get Bike Route

FAST AND LOOSE V1 SEGMENTS (i)



Segment 1



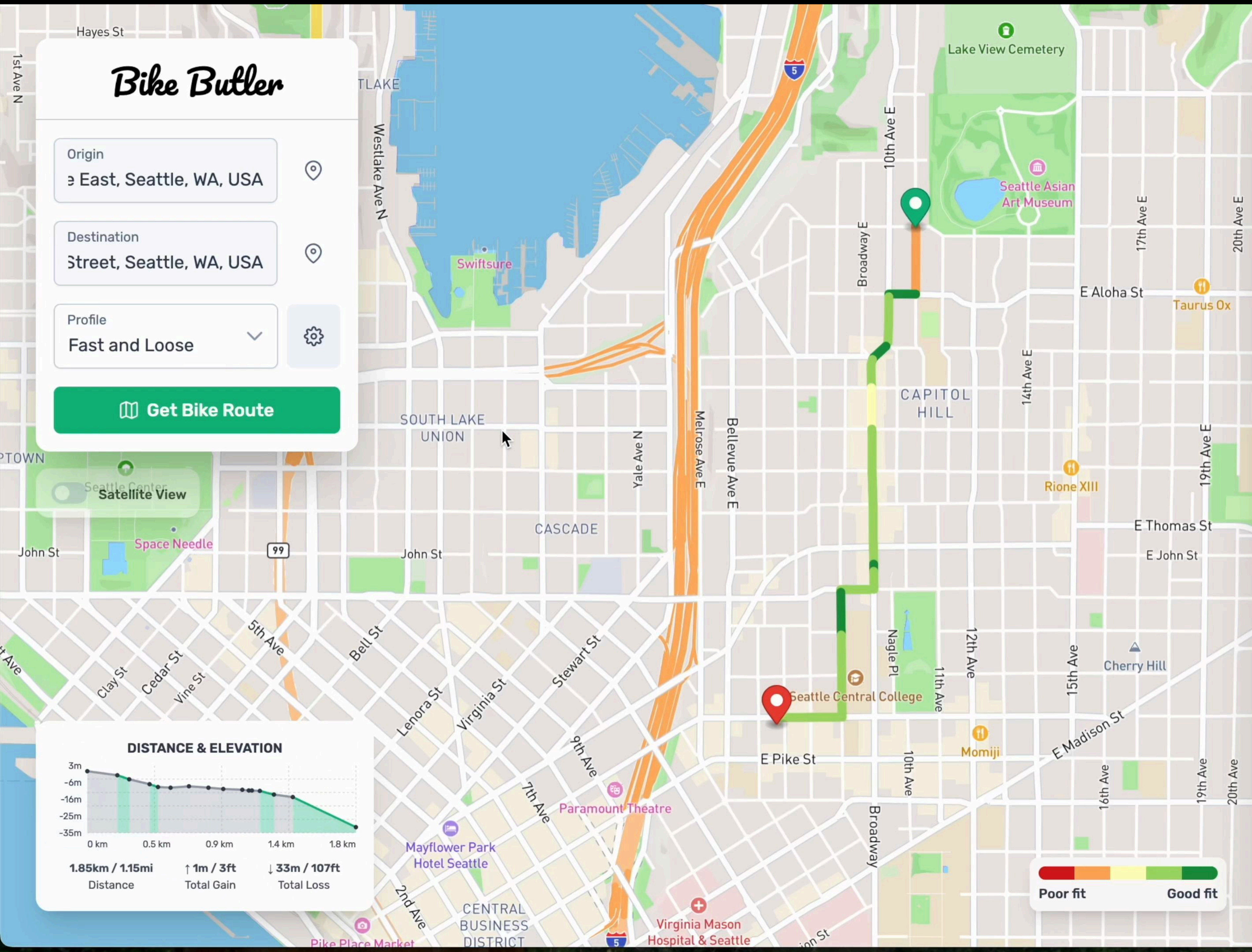
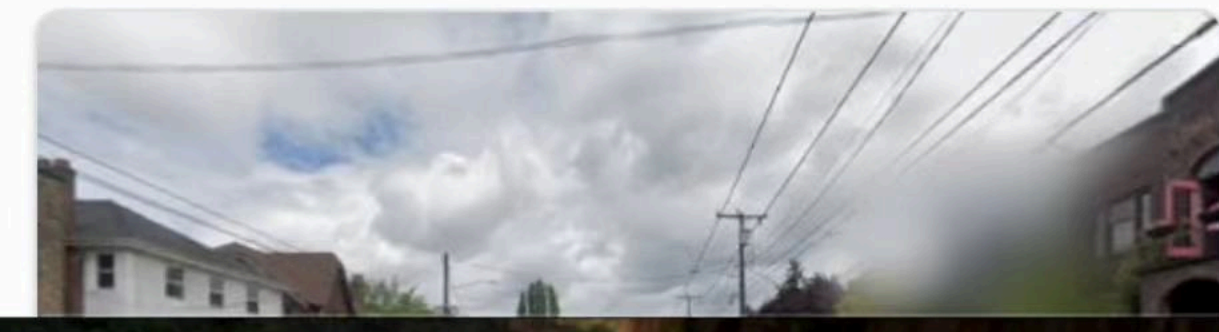
Good: Slope Bad: Surface Qual



Segment 2



Good: Surface Qual, Slope



Bike Butler

Origin
47.628683, -122.319164

Destination
47.615086, -122.324793

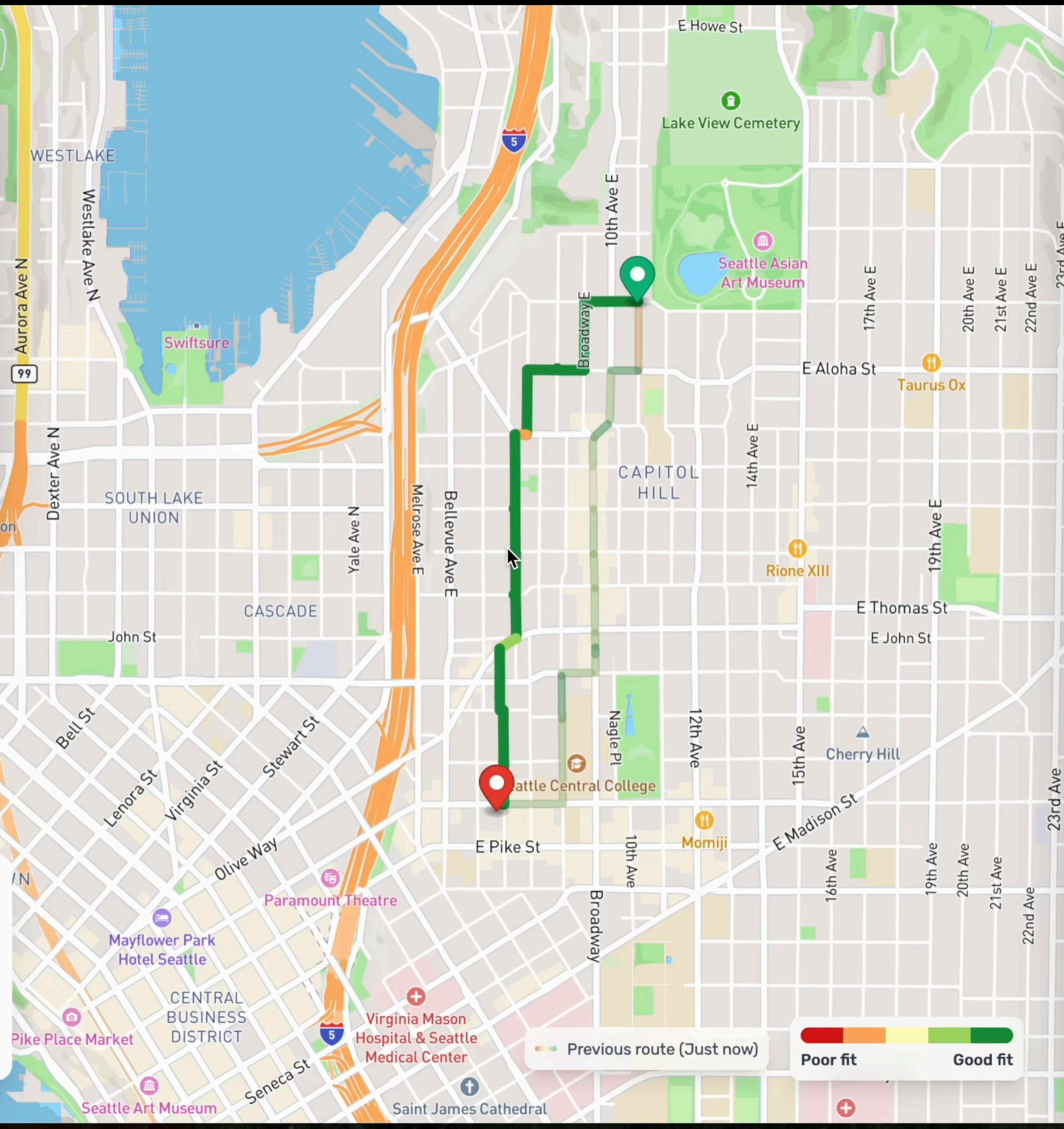
Profile
Slow and Safe

Get Bike Route

DISTANCE & ELEVATION



1.92km / 1.20mi Distance
↑ 1m / 2ft Total Gain
↓ 33m / 107ft Total Loss



SLOW AND SAFE V1 SEGMENTS ⓘ



Segment 5



Good: Slope, Vegetation, Speed Limit

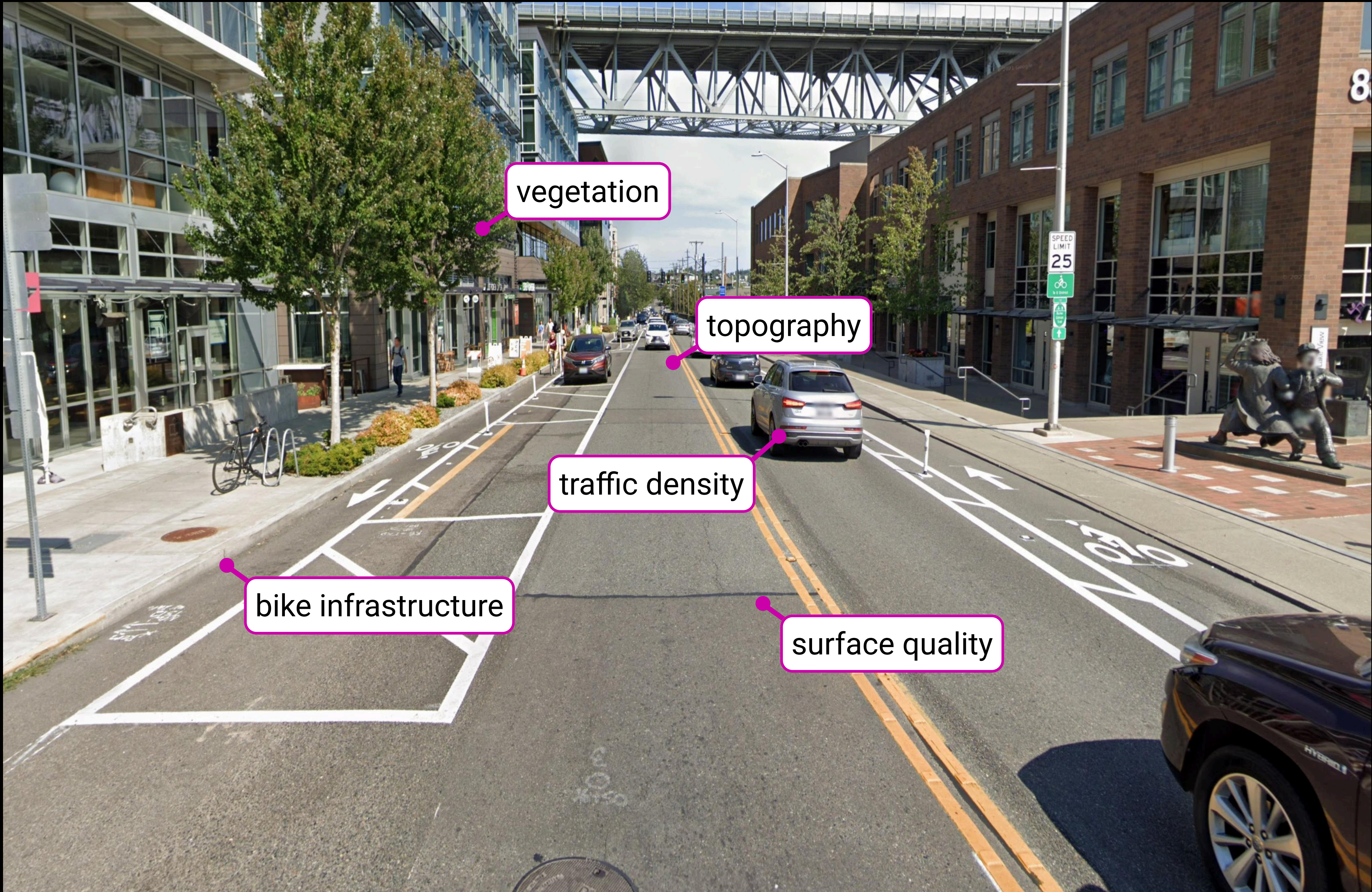


Segment 6



Good: Slope, Vegetation, Speed Limit





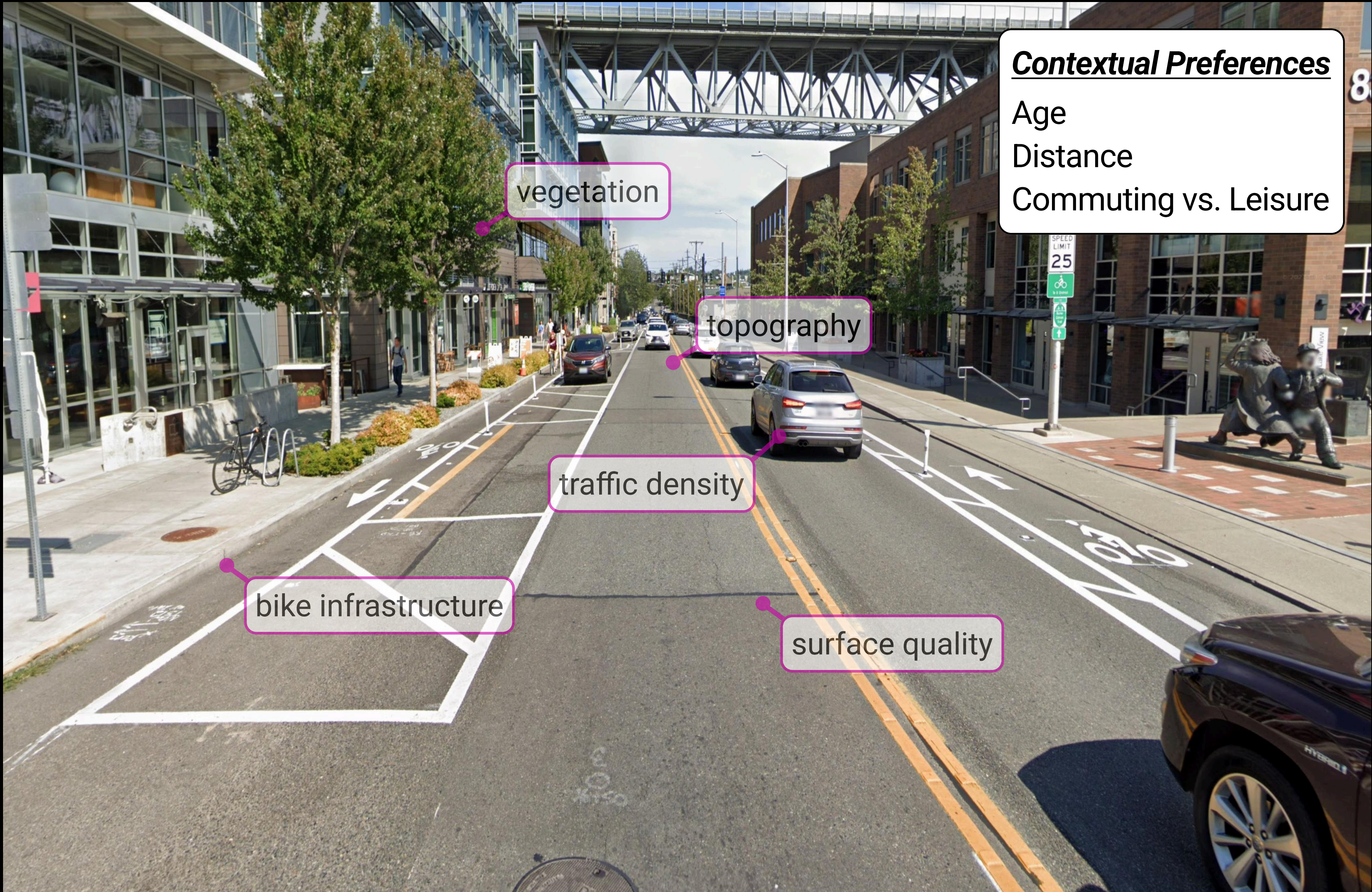
vegetation

topography

traffic density

bike infrastructure

surface quality



vegetation

topography

traffic density

bike infrastructure

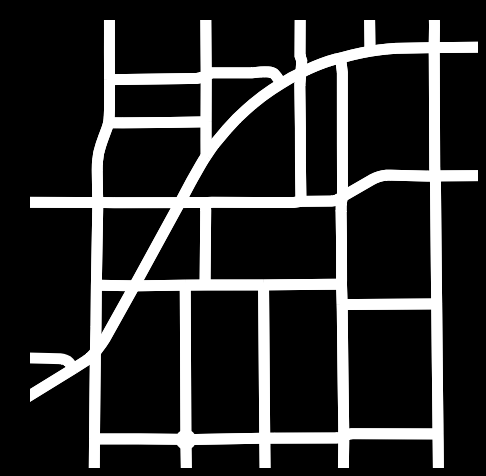
surface quality

Contextual Preferences
Age
Distance
Commuting vs. Leisure

Data Sources

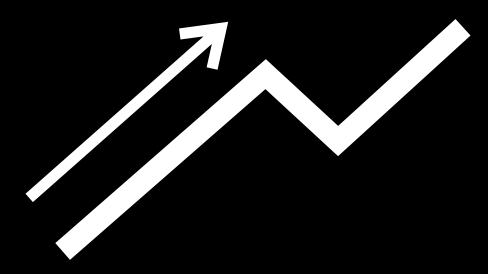


OpenStreetMap



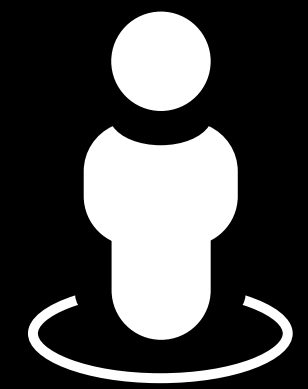
- Bike lanes
- Sidewalks
- Speed Limit
- Street type

Open-Source Elevation



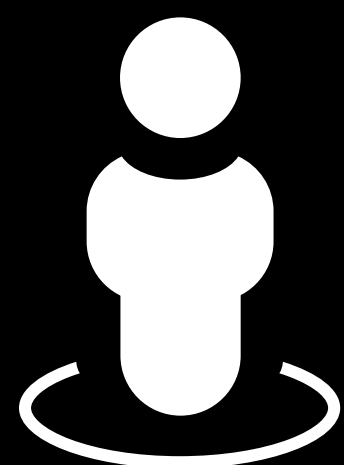
- Elevation

VLM on Street View Images



- Vegetation
- Surface quality

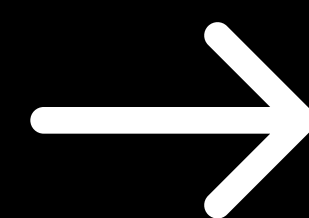
VLM on Street View Images




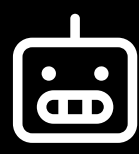

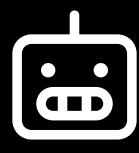


- **Vegetation**
- **Surface quality**


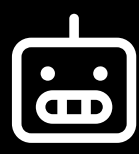

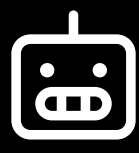




“ Rank vegetation on a scale from 1-5, where 1 is barren and 5 is lush ”



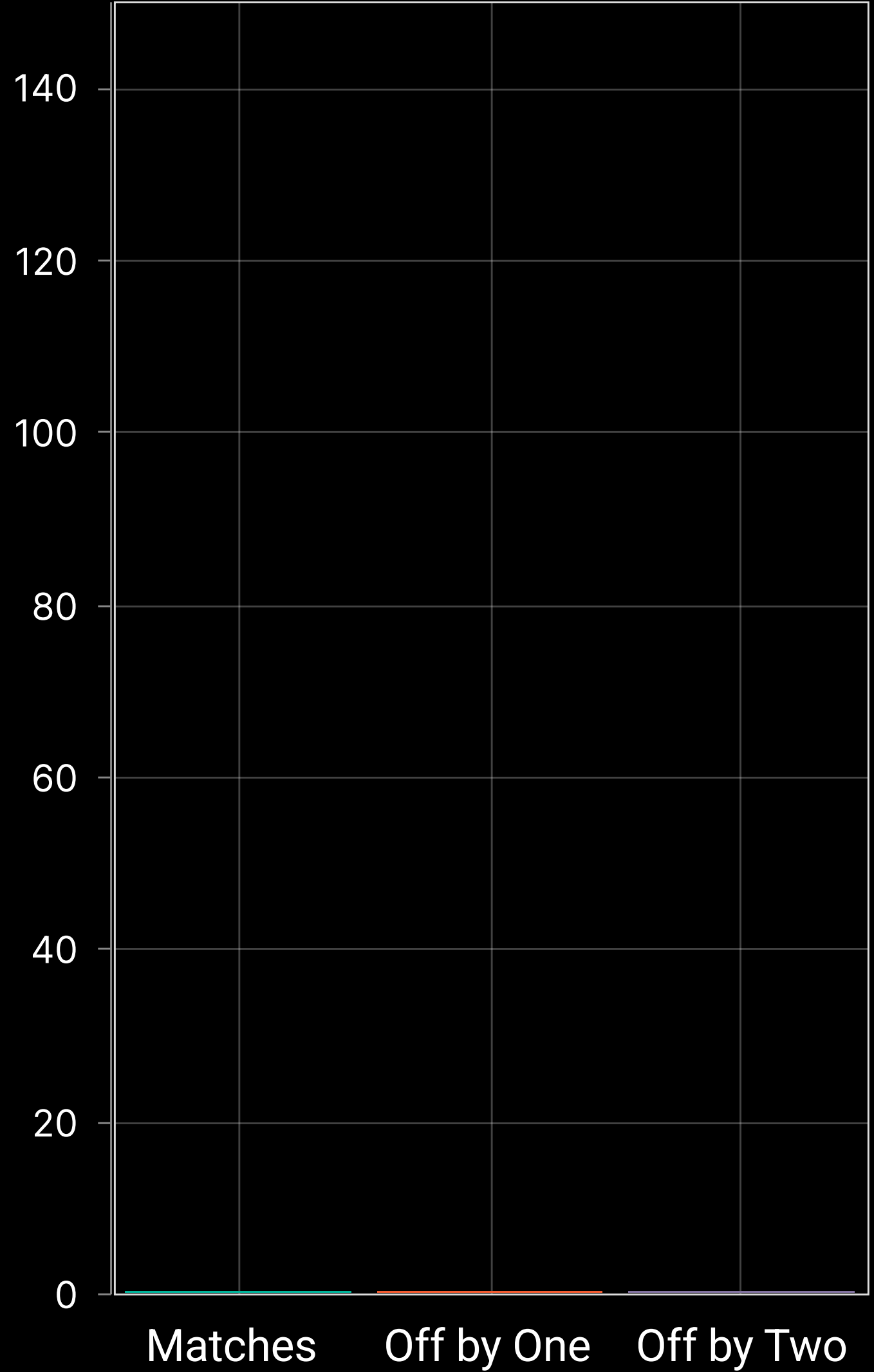
*output = {
 ‘vegetation’ = 4,
 ‘surface_quality’ = 3
}*

 vs. 
 vs. 
 vs. 

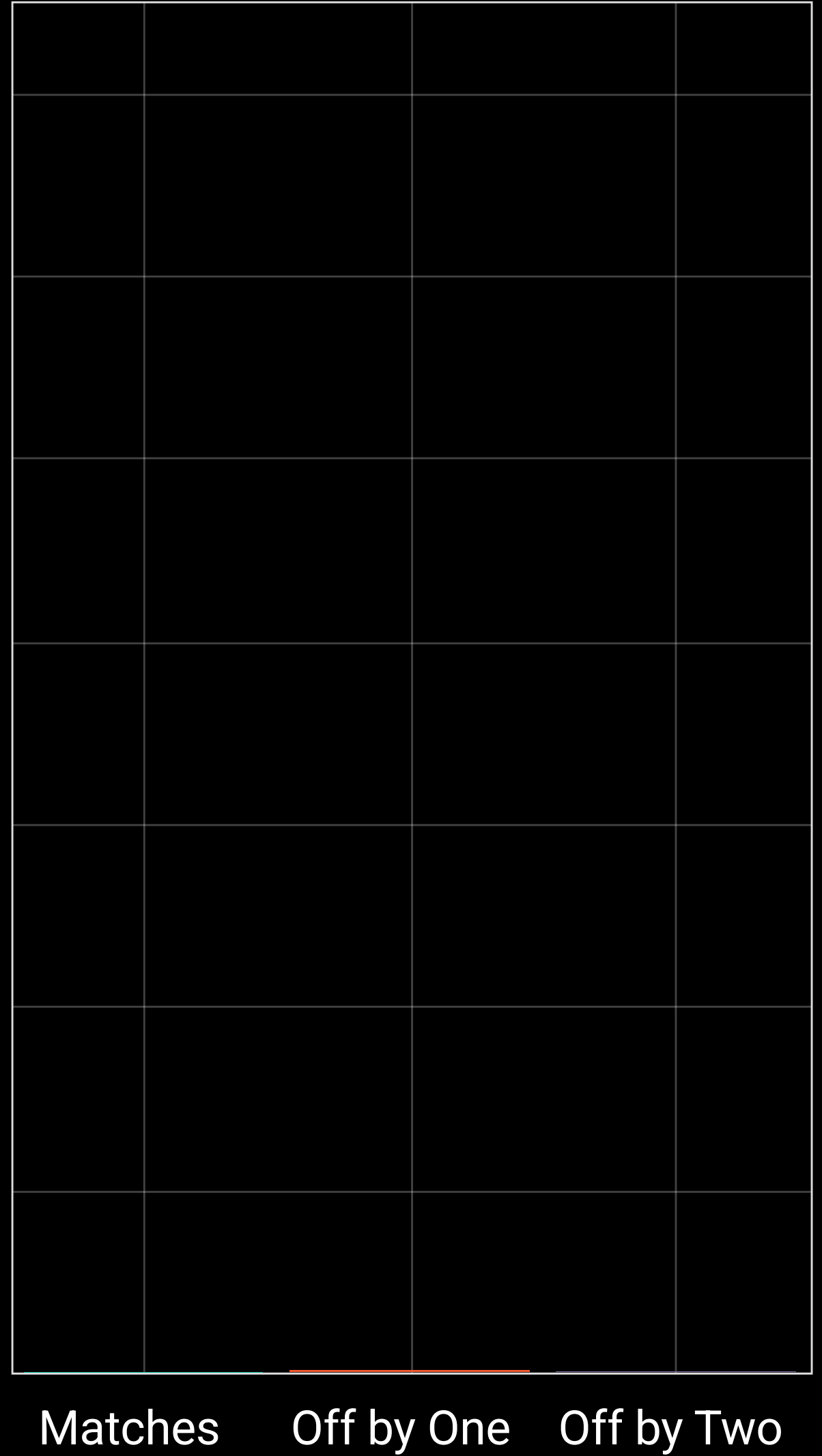
	Vegetation	Surface Quality
 vs. 	0.61	0.50
 vs. 	0.55	0.27
 vs. 	0.63	0.23

Cohen’s Kappa

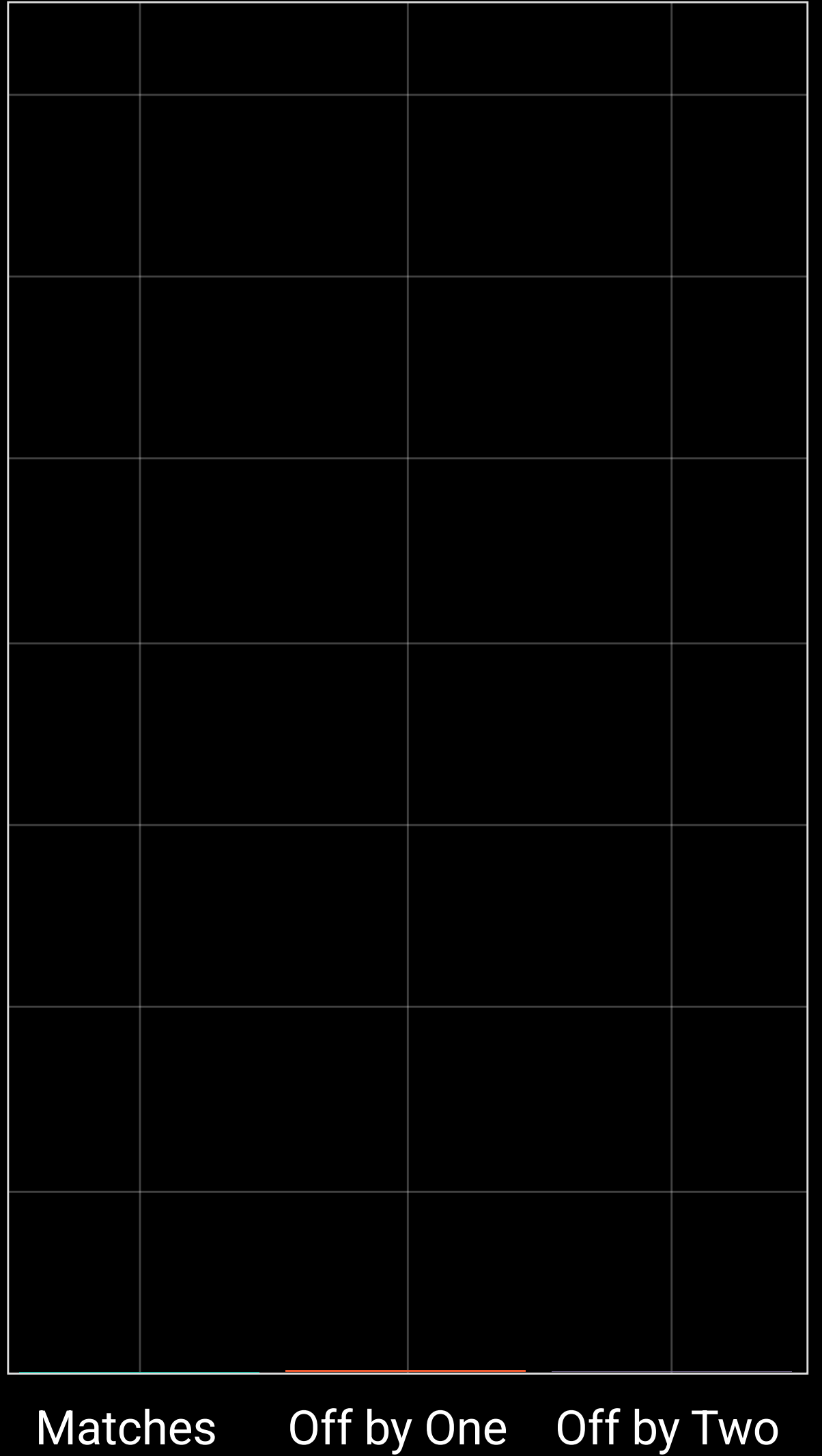
Gemini Compared to Humans: Vegetation



👤₁ vs. 🤖

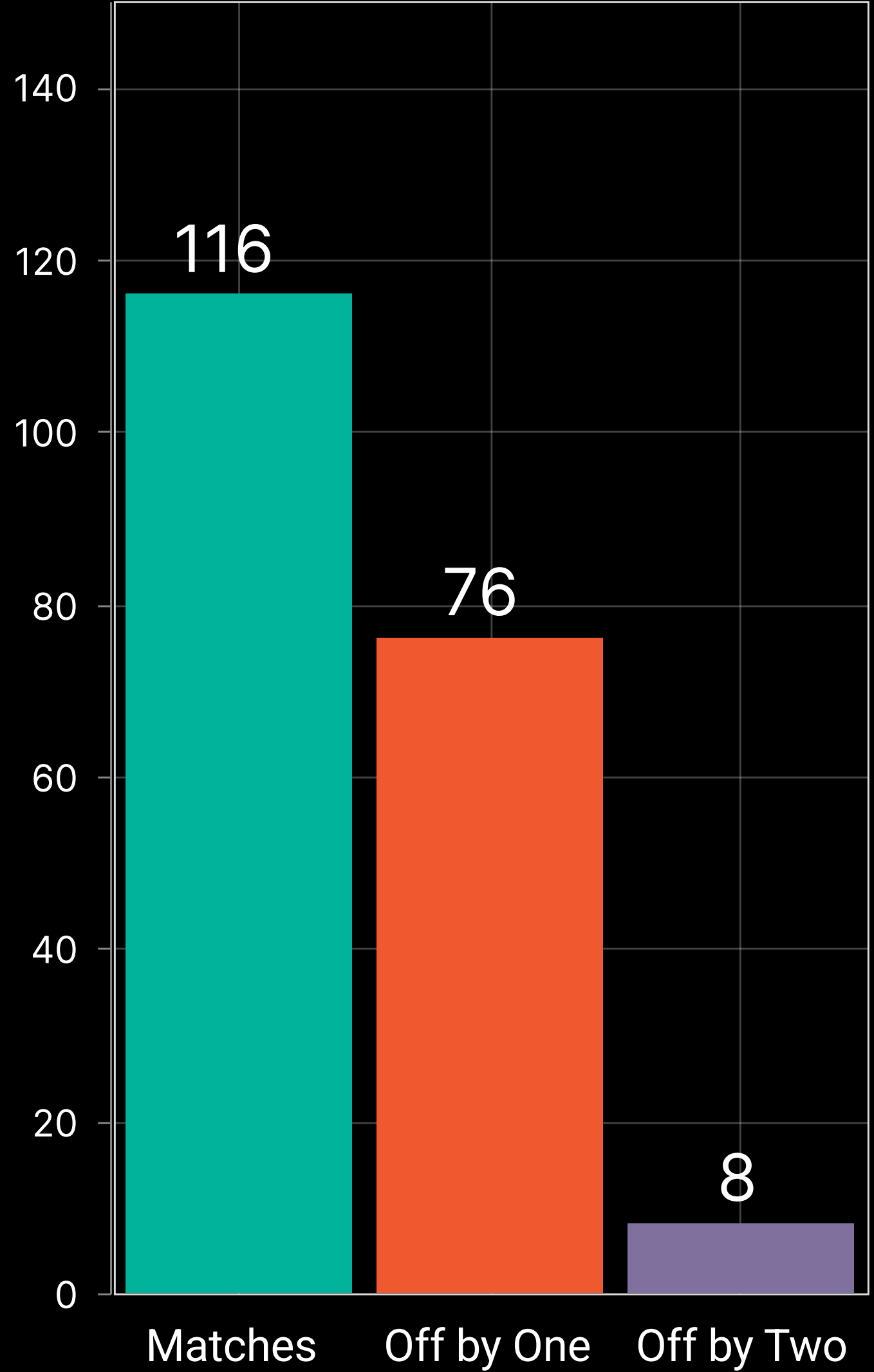


👤₂ vs. 🤖

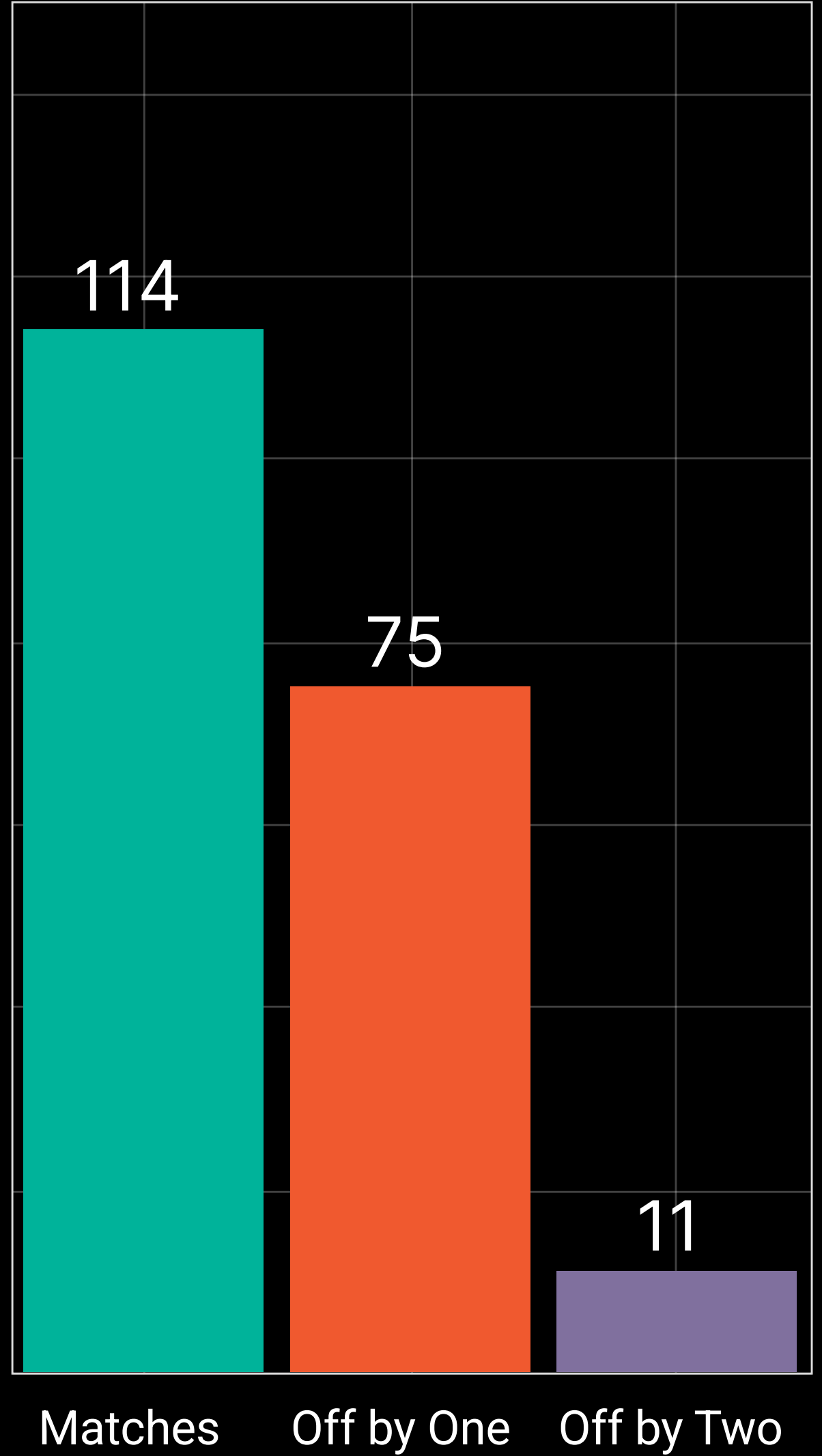


👤₁ vs. 👤₂

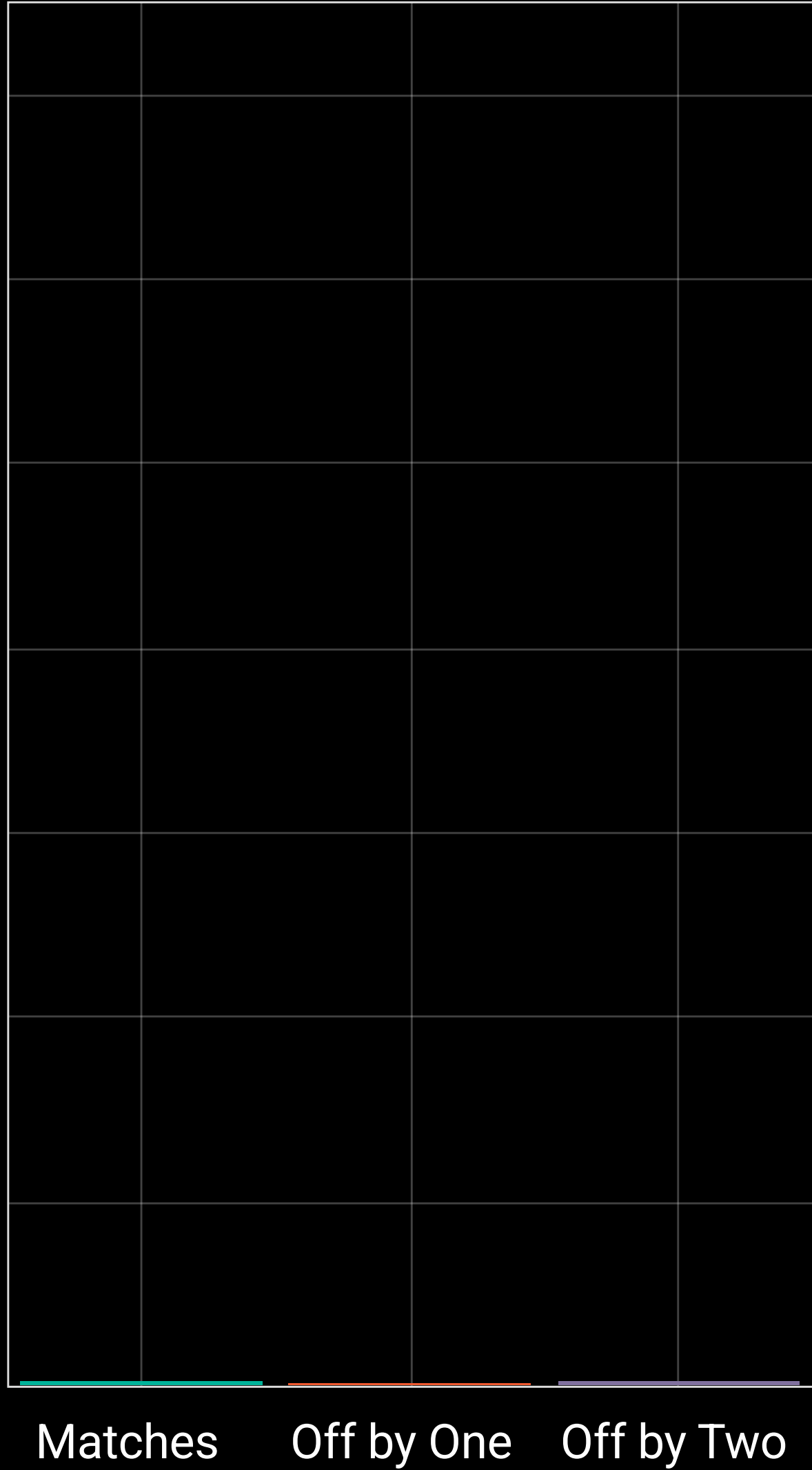
Gemini Compared to Humans: Vegetation



👤₁ vs. 🤖

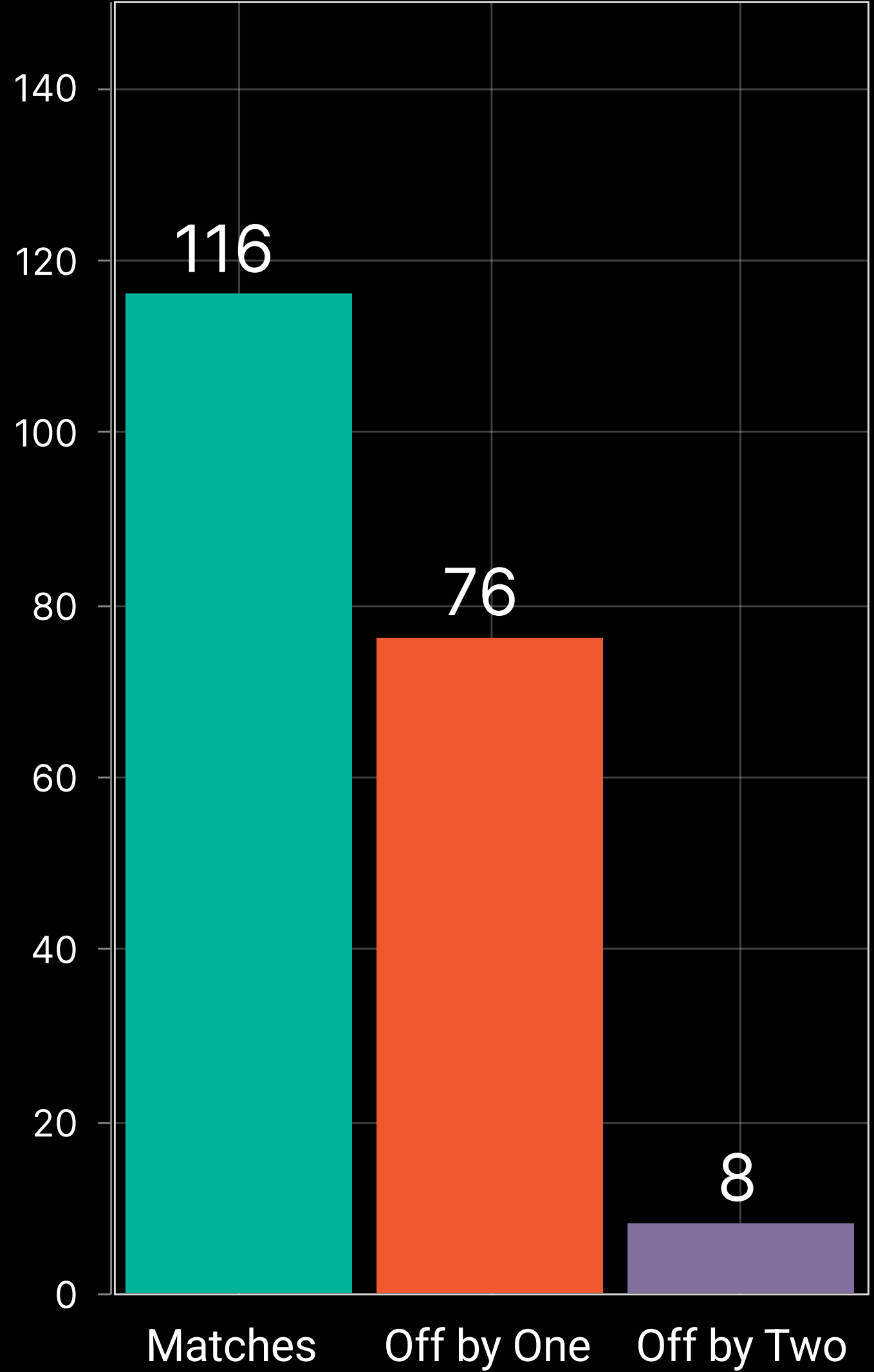


👤₂ vs. 🤖

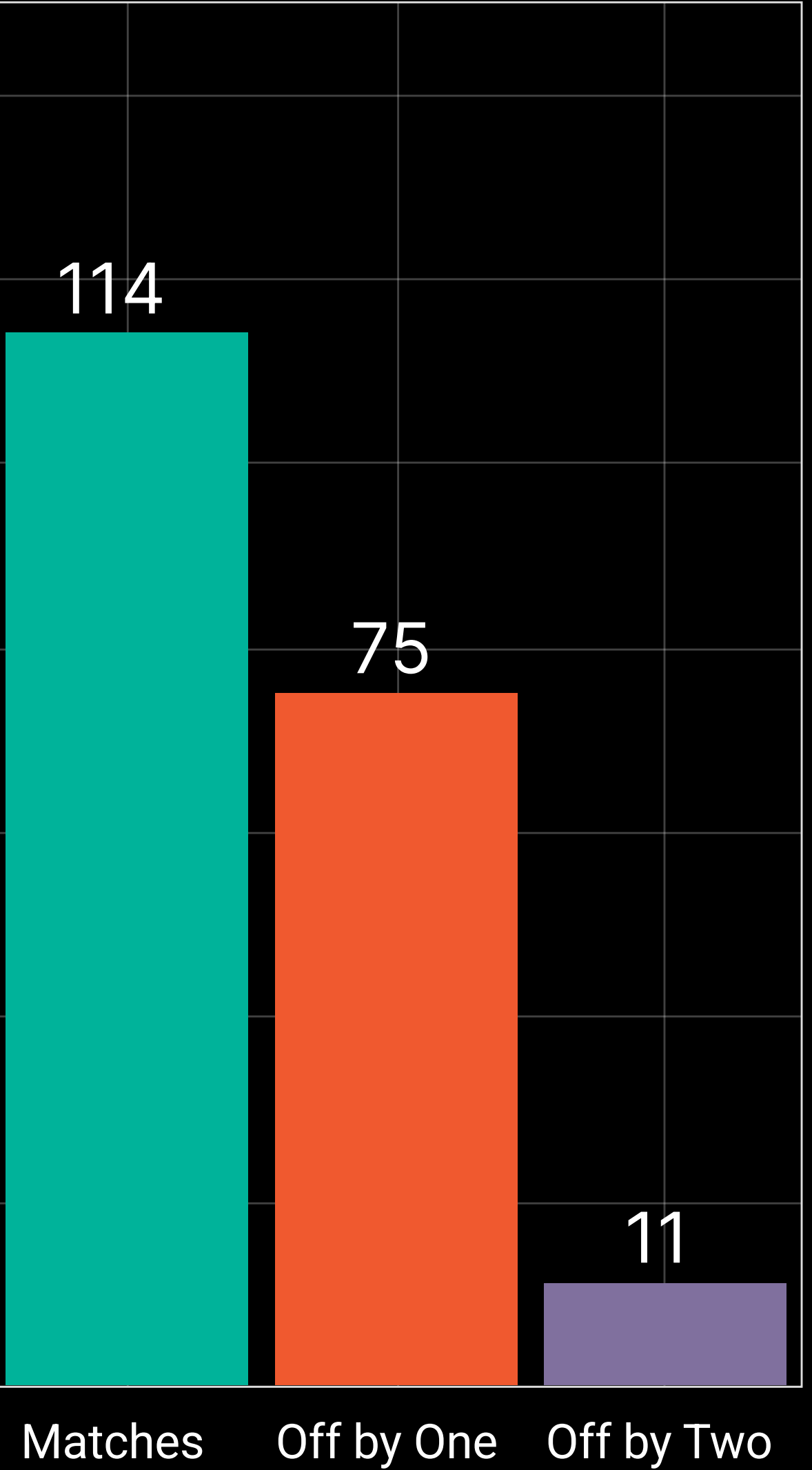


👤₁ vs. 👤₂

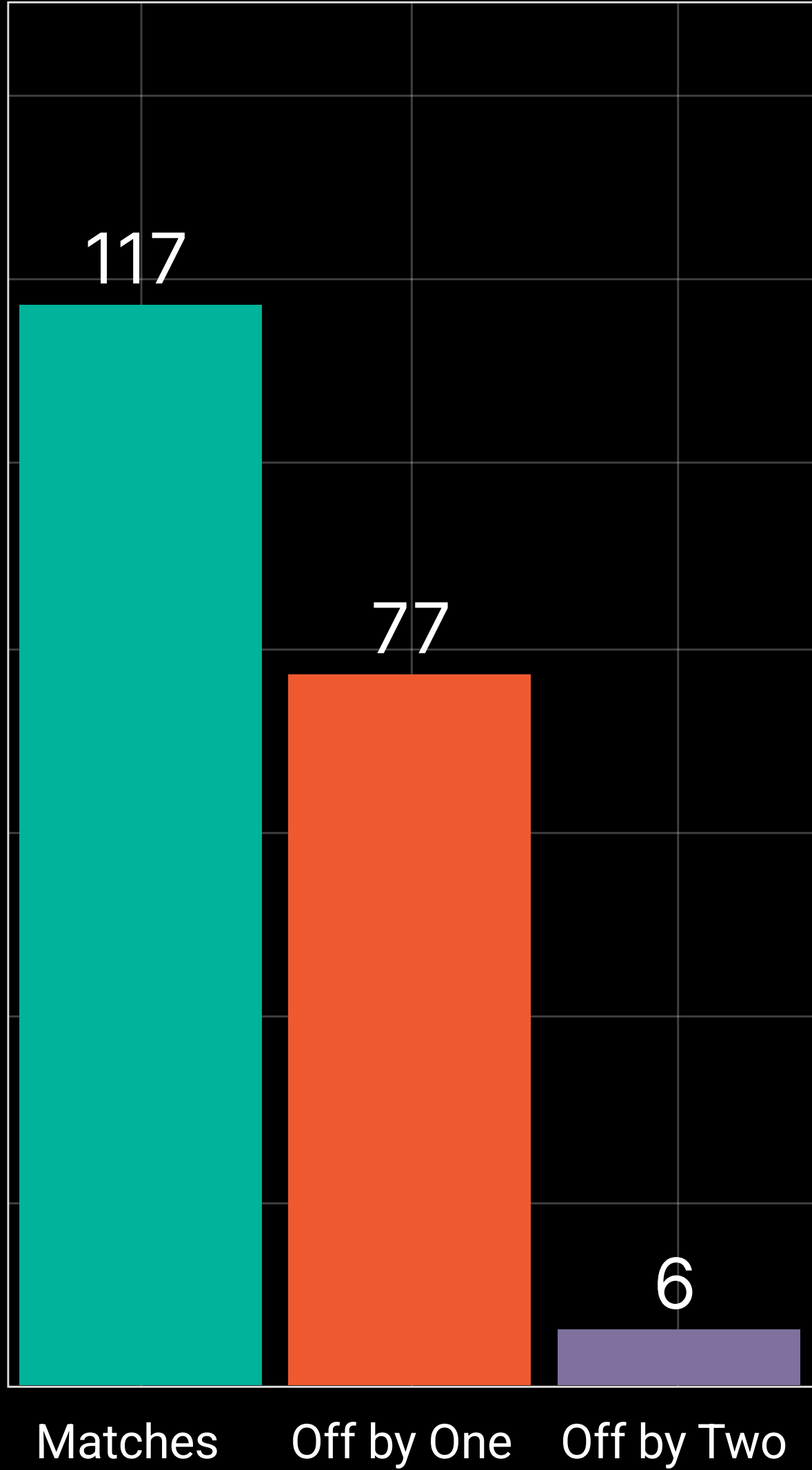
Gemini Compared to Humans: Vegetation



👤₁ vs. 🤖



👤₂ vs. 🤖



👤₁ vs. 👤₂

Altering Profiles

Saved Profiles

Profile Manager

✓ All Around

Slow and Safe

Fast and Loose

New Profile

All Around

Low speed limits | I don't care | High speed limits

More bike friendly roads | More car friendly roads

Bike lanes | No bike lanes

Sidewalks | No sidewalks

Flat road | Hilly road

Lots of greenery | No greenery

Smooth pavement | Rough pavement

A better route | A faster route

Profile History (3 versions)

Version 3	9/3/2025 07:50 PM	
Version 2	9/3/2025 07:49 PM	Switch
Version 1	9/2/2025 10:39 PM	Switch

- New
- Delete
- Copy
- Export
- Close

DISTANCE & ELEVATION



Segment 1

Good: Slope Bad: Street Type, S



Segment 2

Good: Street Type Bad: Bike La



Good fit

Altering Profiles

Get Bike Route

DISTANCE & ELEVATION

5.64mi Total Gain 76m / 251ft Total Loss 49m / 161ft

Profile Manager

- ✓ All Around
- Slow and Safe
- Fast and Loose
- New Profile

All Around

Low speed limits | I don't care | High speed limits

More bike friendly roads | More car friendly roads

Bike lanes | No bike lanes

Sidewalks | No sidewalks

Flat road | Hilly road

Lots of greenery | No greenery

Smooth pavement | Rough pavement

A better route | A faster route

Adjust Infrastructure Preferences

Detour Tolerance

Profile History (3 versions)

Version 3	9/3/2025 07:50 PM	
Version 2	9/3/2025 07:49 PM	Switch
Version 1	9/2/2025 10:39 PM	Switch

- New
- Delete
- Copy
- Export
- Close

Segment 1

Good: Slope Bad: Street Type, S

Segment 2

Good: Street Type Bad: Bike La

Altering Profiles

Get Bike Route

DISTANCE & ELEVATION

5.64mi Total Gain ↑ 76m / 251ft Total Loss ↓ 49m / 161ft

Profile Manager

- ✓ All Around
- Slow and Safe
- Fast and Loose
- New Profile

All Around

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Profile History (3 versions)

Version 3	9/3/2025 07:50 PM	
Version 2	9/3/2025 07:49 PM	Switch
Version 1	9/2/2025 10:39 PM	Switch

- New
- Delete
- Copy
- Export
- Close

Revert to a Previous Version

Segment 1

Good: Slope Bad: Street Type, S

Segment 2

Good fit

Bad: Bike La

Altering Profiles



Fast and Loose v1

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Slow and Safe v1

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Shortest Route

Shortest Route v2

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Smooth and Fast

Slow and Tree-Lined



Altering Profiles

Shortest Route

Fast and Loose v1

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Slow and Safe v1

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Shortest Route v2

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Smooth and Fast

Slow and Tree-Lined



Altering Profiles

Shortest Route

Fast and Loose v1

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Slow and Safe v1

Low speed limits I don't care High speed limits

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Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

Shortest Route v2

Low speed limits I don't care High speed limits

More bike friendly r... More car friendly r...

Bike lanes No bike lanes

Sidewalks No sidewalks

Flat road Hilly road

Lots of greenery No greenery

Smooth pavement Rough pavement

A better route A faster route

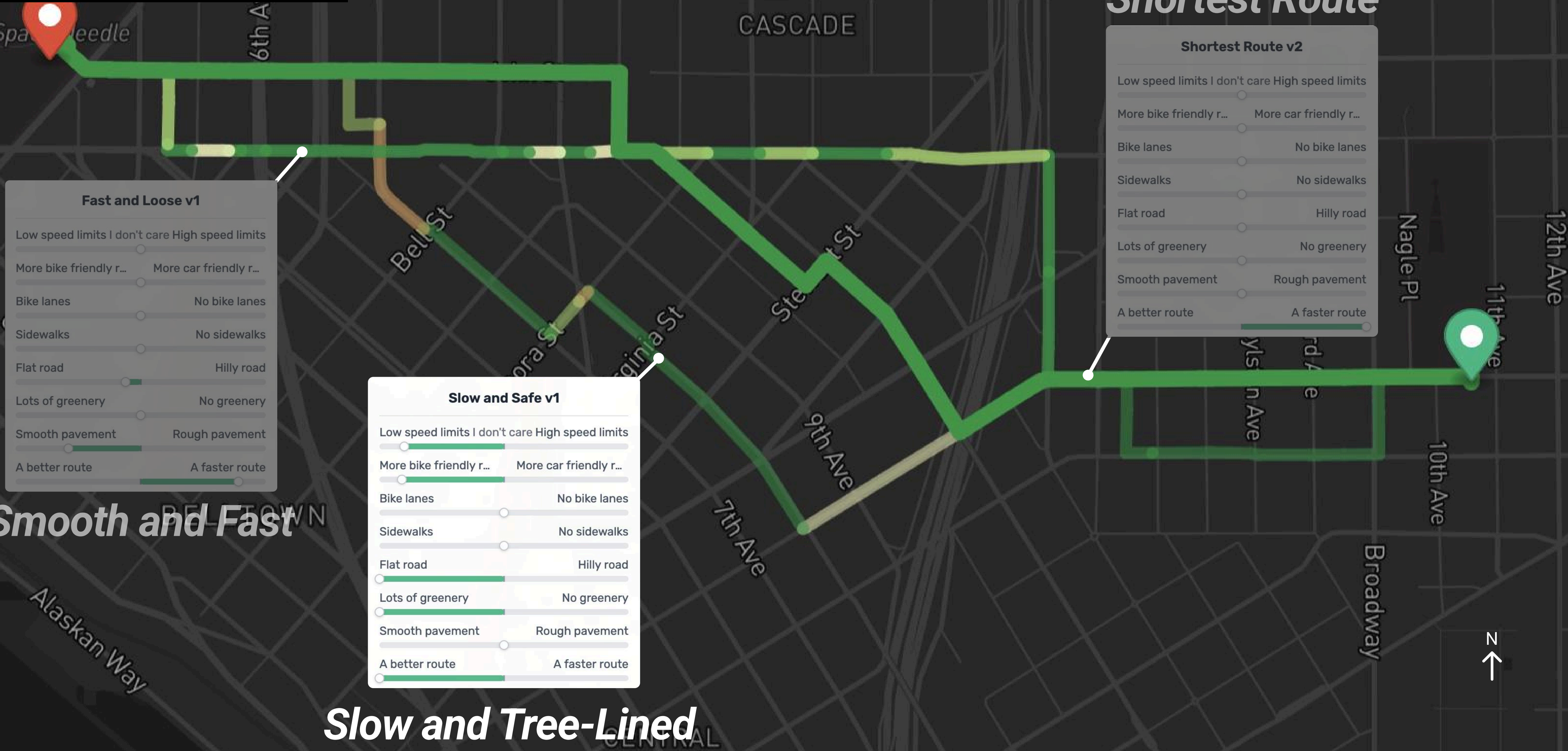
Smooth and Fast

Slow and Tree-Lined



Altering Profiles

Shortest Route



Smooth and Fast

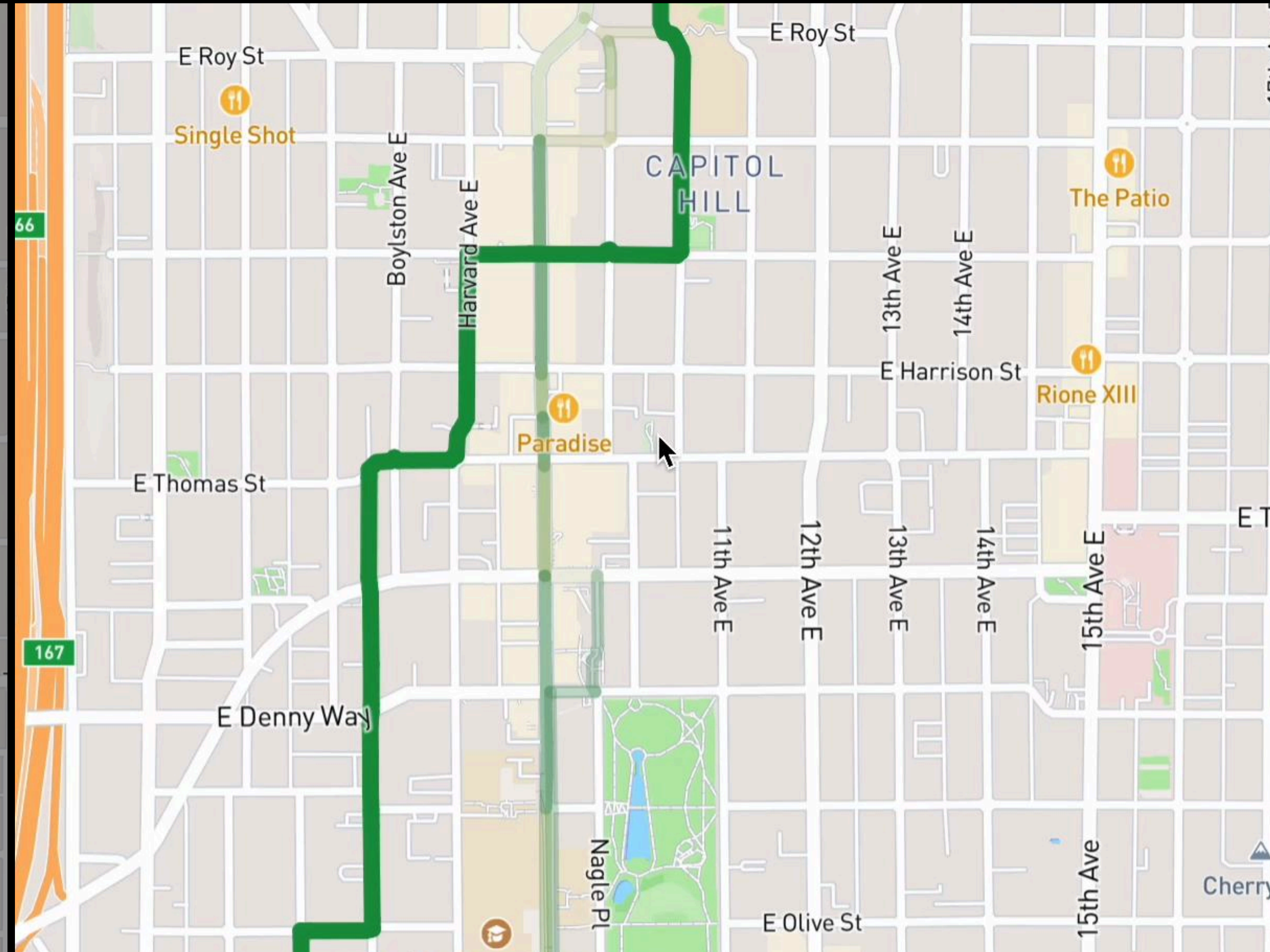
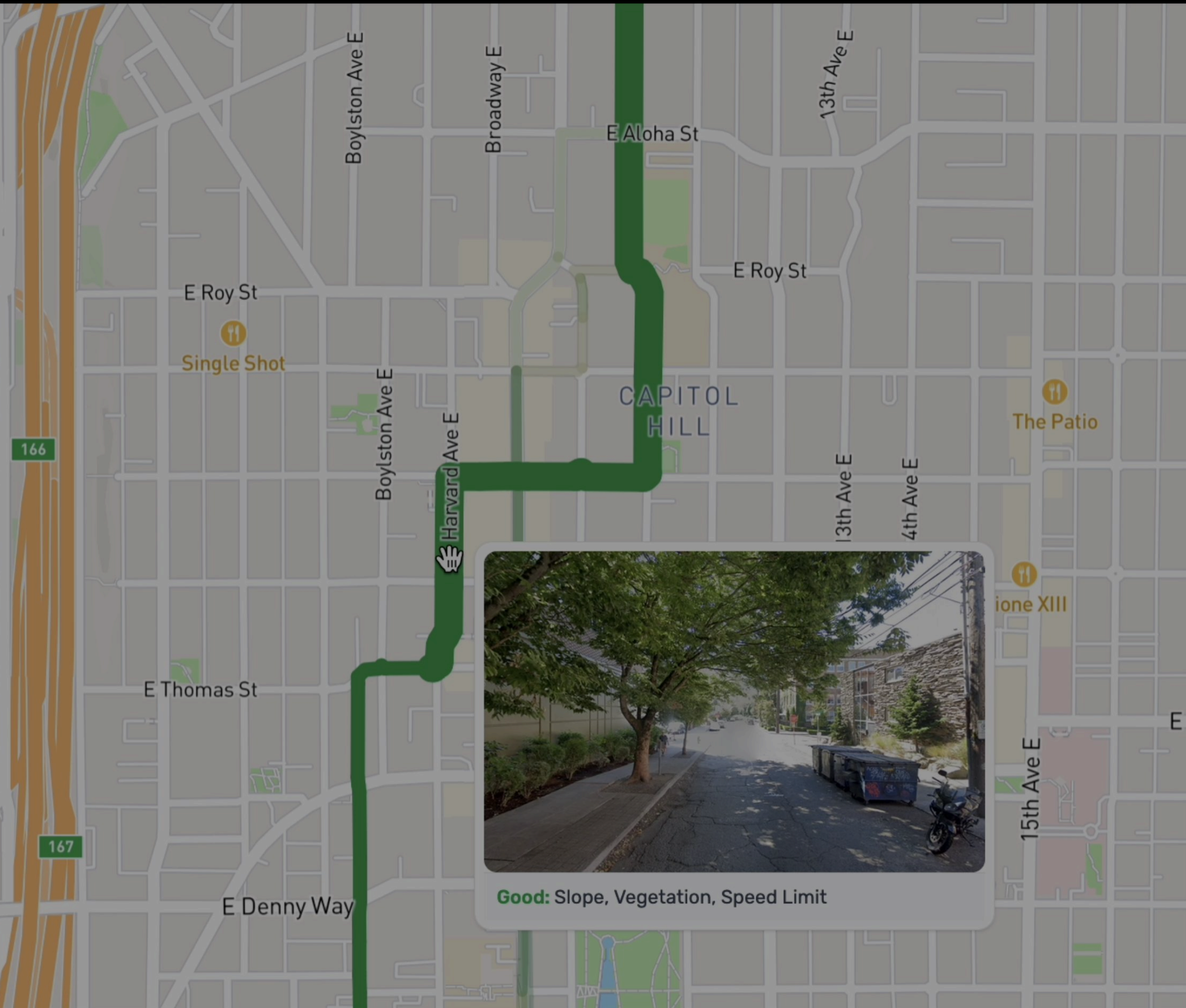
Slow and Tree-Lined



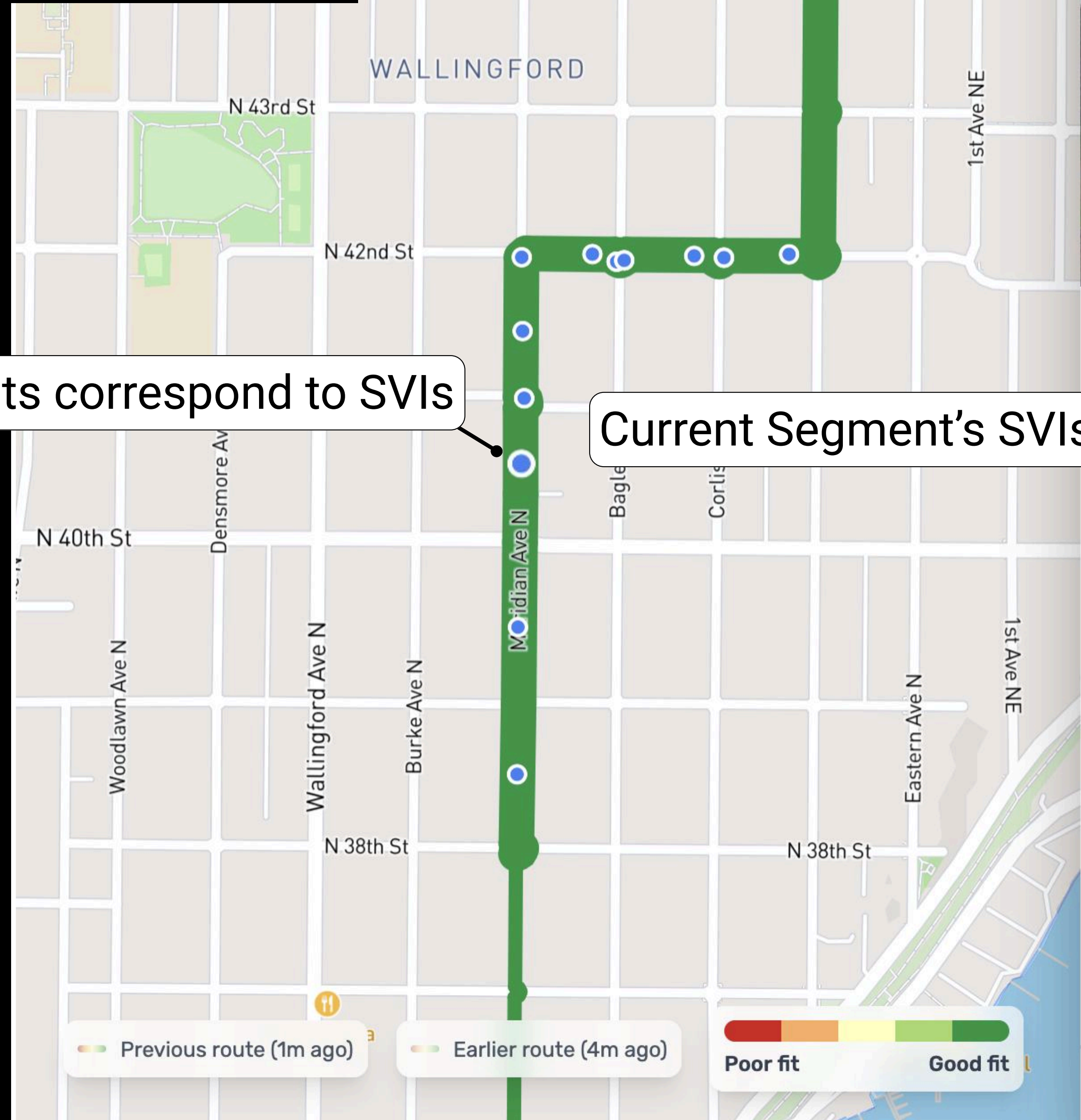
Hover to...

See SVIs

See profiles



Inspecting Routes



Dots correspond to SVIs

Current Segment's SVIs



Hover to highlight on map

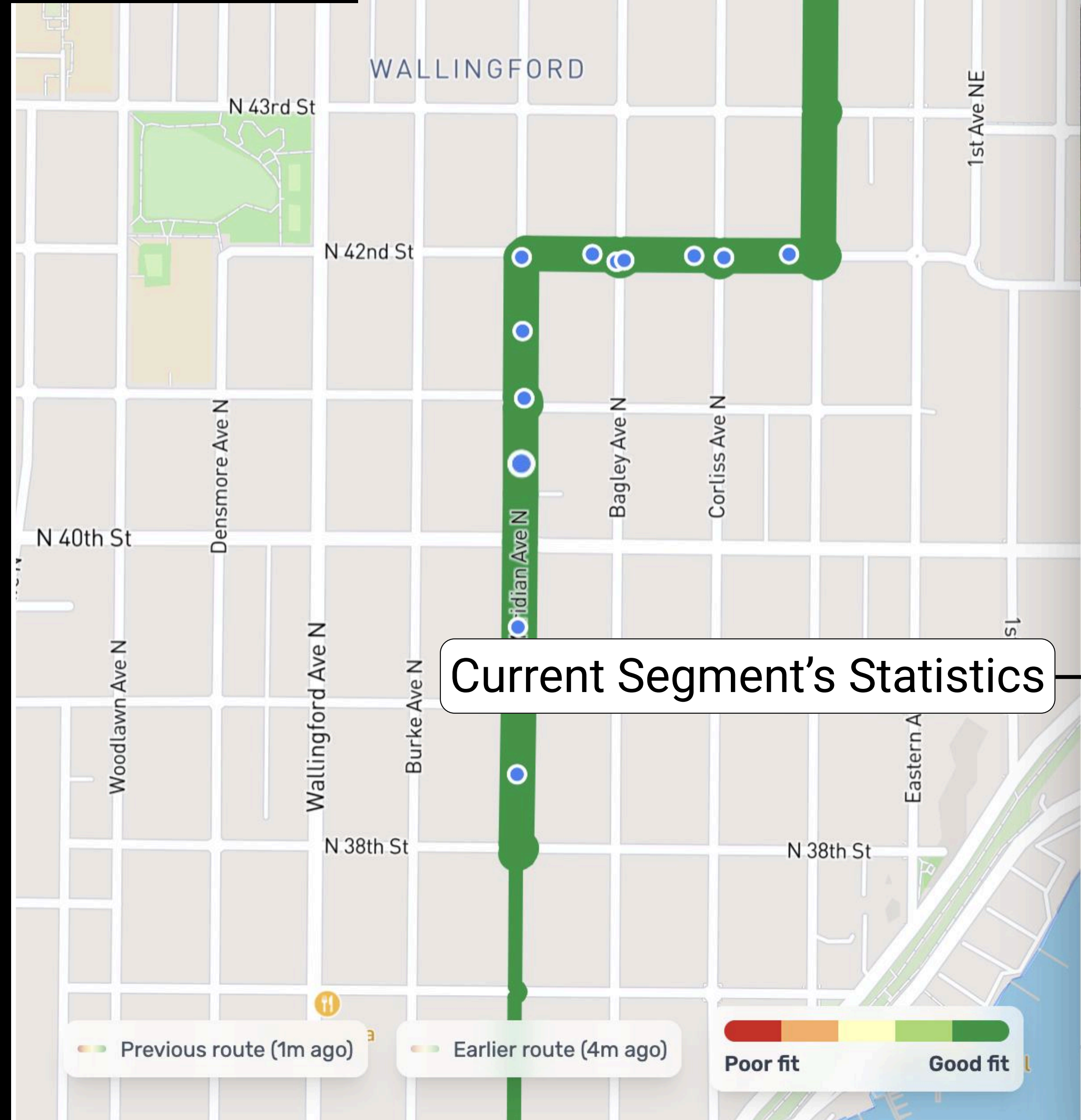


- Bike lane mostly present **No**
- Sidewalk mostly present **Yes**
- Average speed limit **20 mph**
- Most common street type **residential**
- Average steepness **3%**
- Length **1.10 km / 0.69 mi**



[Previous](#) [Next](#)

Inspecting Routes



Current Segment's Statistics



Bike lane mostly present	No
Sidewalk mostly present	Yes
Average speed limit	20 mph
Most common street type	residential
Average steepness	3%
Length	1.10 km / 0.69 mi

User Study Cyclists, N = 16

Three Tasks:

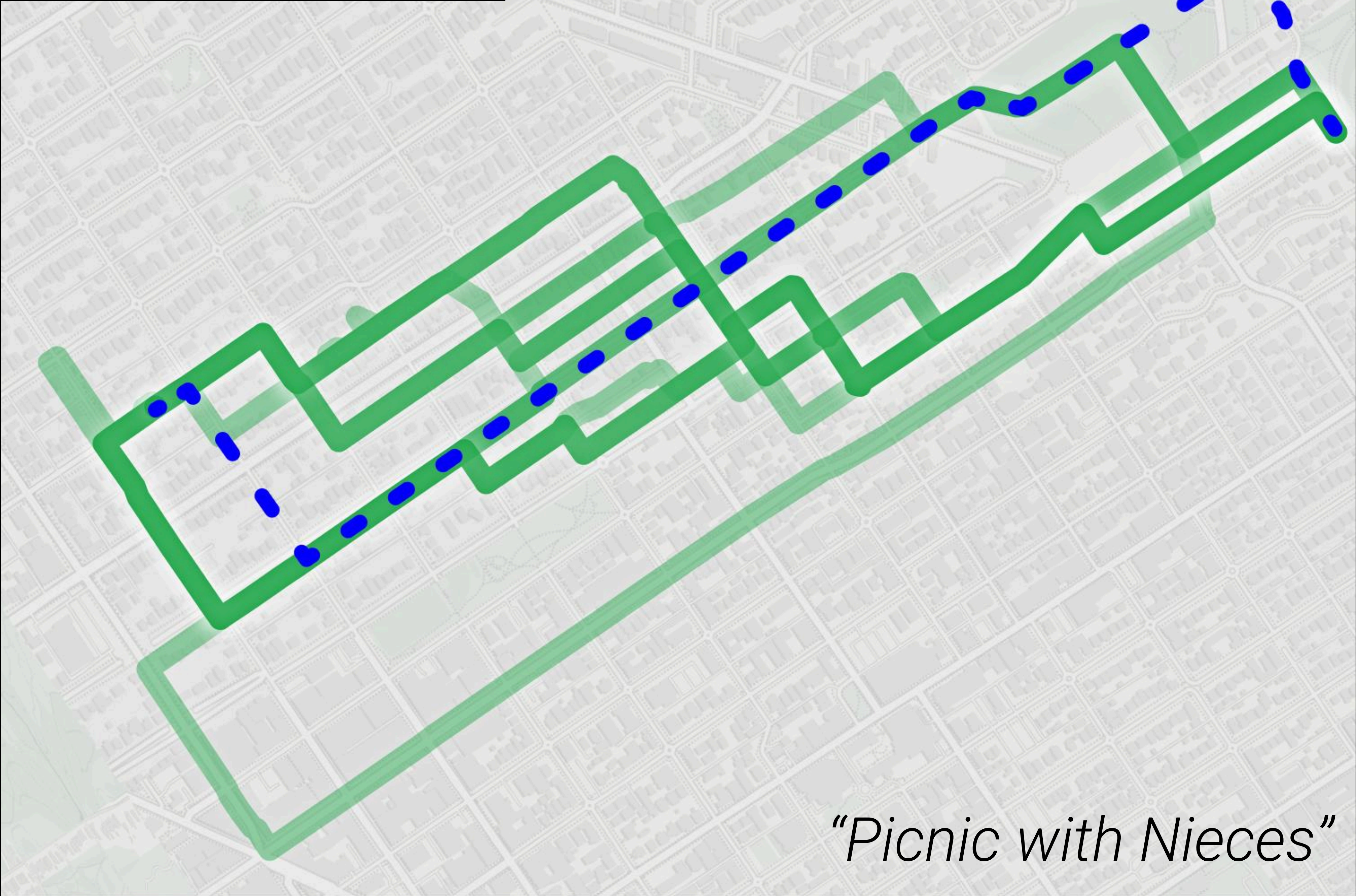
1. *You're rushing to the grocery store*
2. *You're taking your nieces to the park*
3. Free Exploration

BikeButler vs. Google Maps



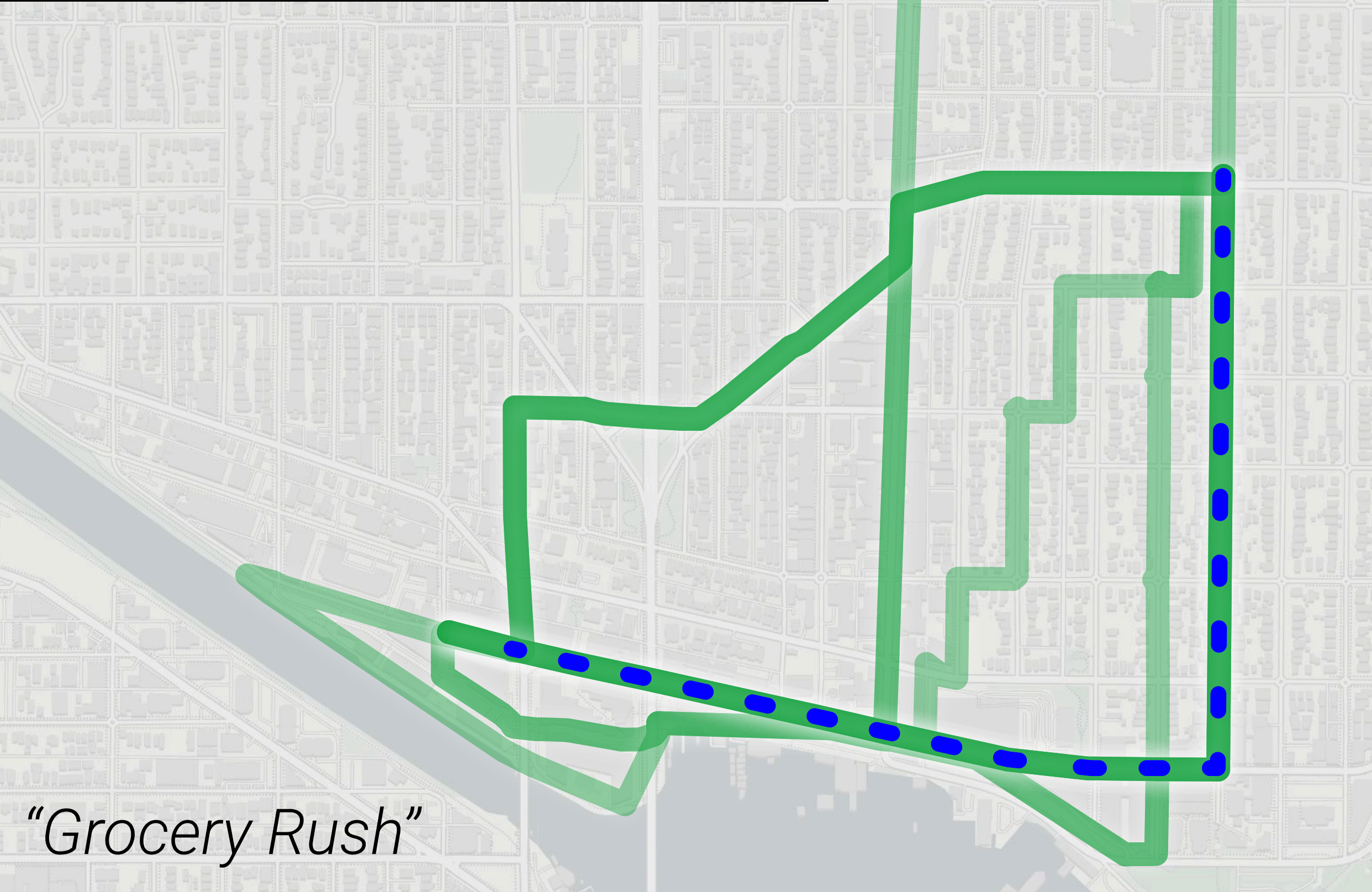
"Picnic with Nieces"

BikeButler vs. Google Maps

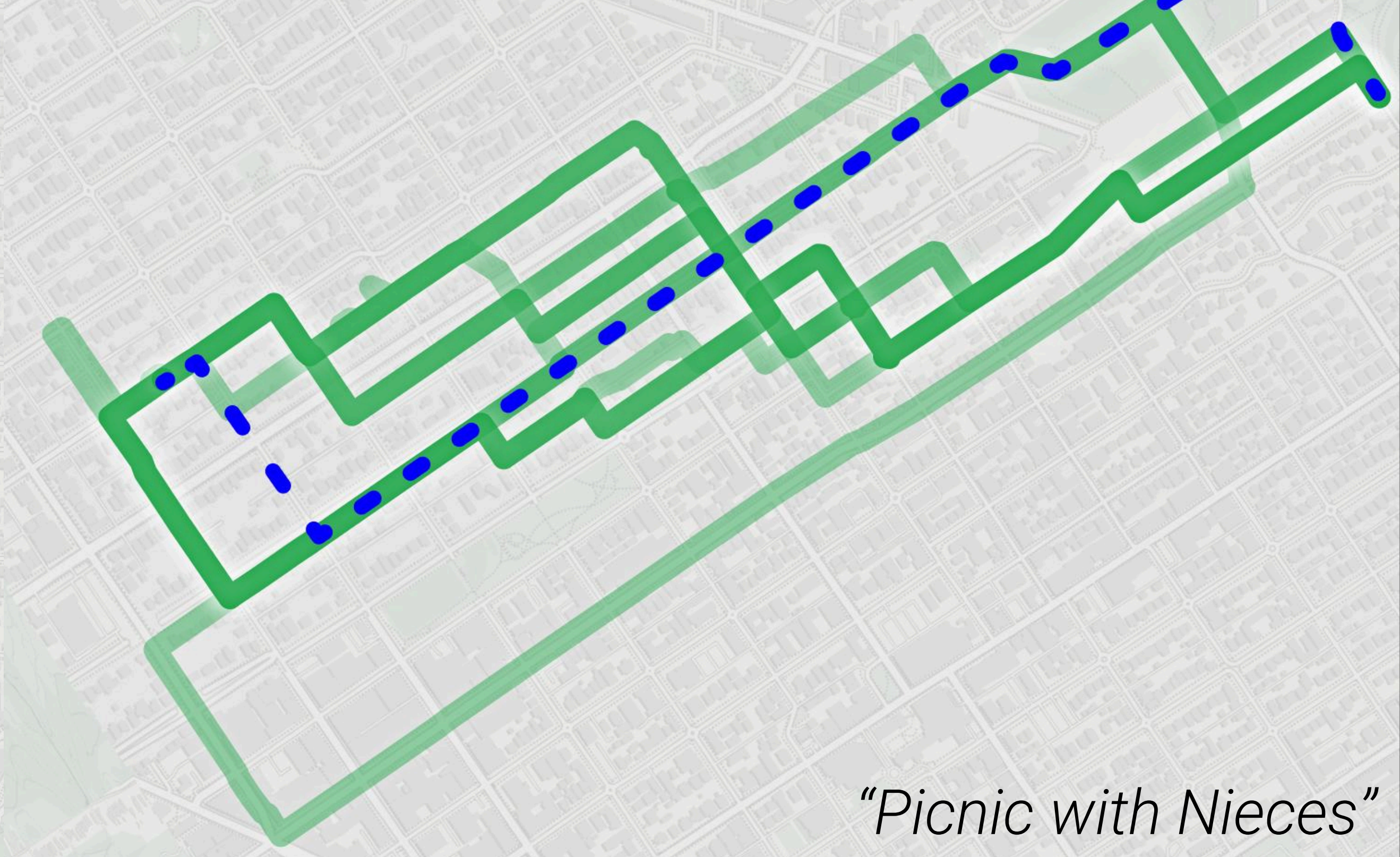


"Picnic with Nieces"

BikeButler vs. Google Maps



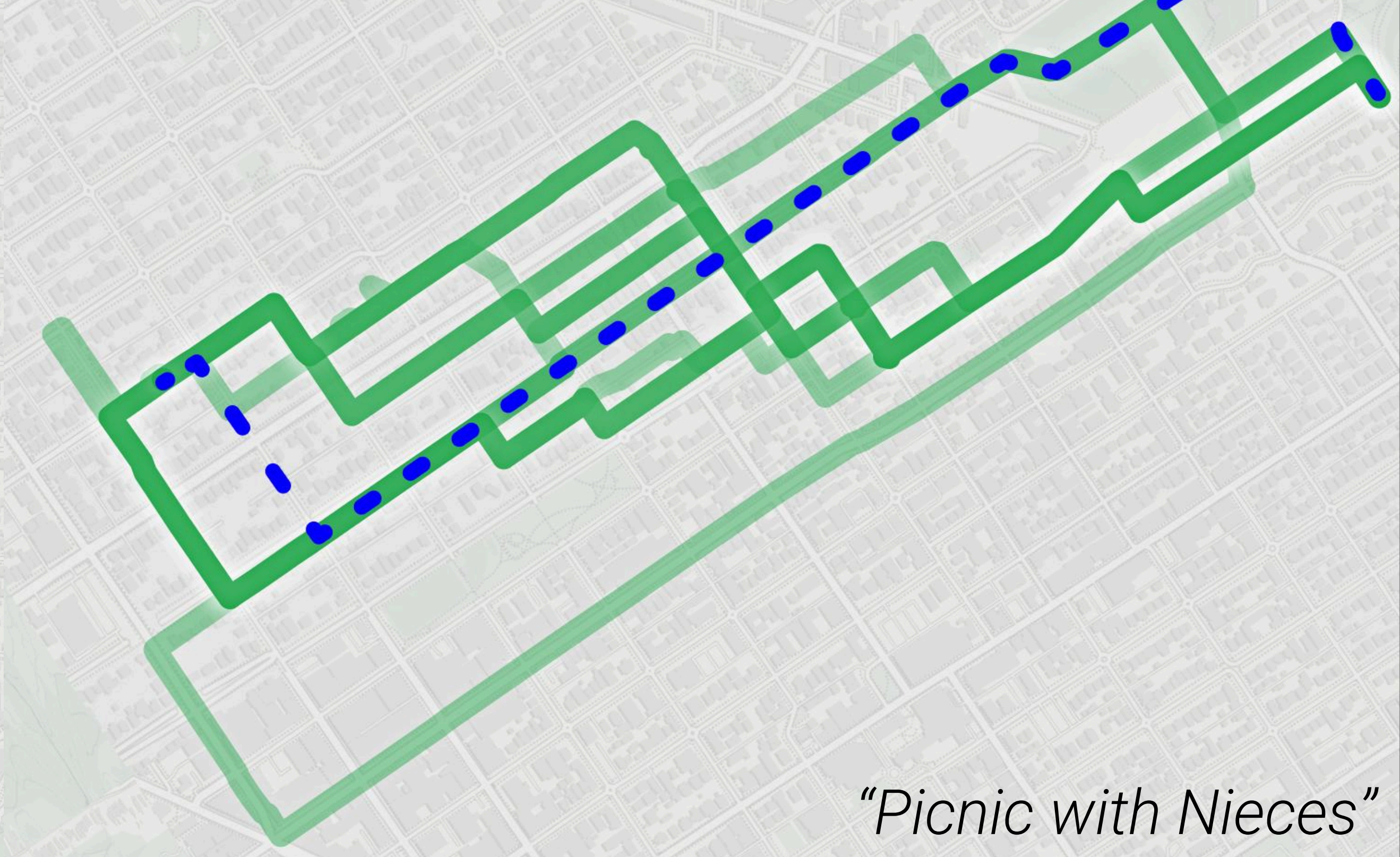
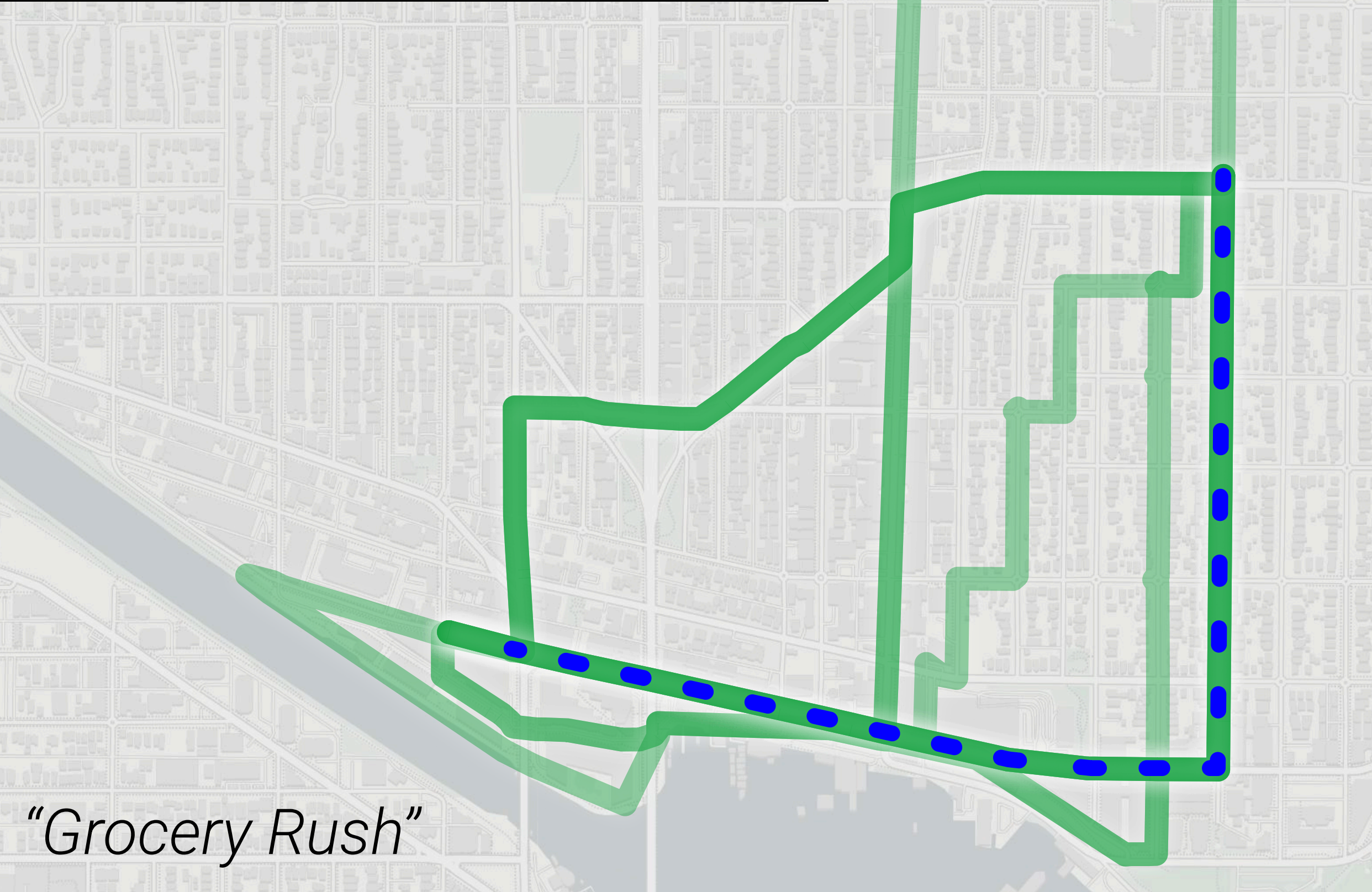
"Grocery Rush"



"Picnic with Nieces"

	Routes	Length	Slope	Bike Lanes	Residential	Speed Limit:	Vegetation:	Surface:
BikeButler	22		↓ 8%		↑ 2x	↓ 20.5%	↑ 5%	↑ 10.5%
Google Maps	4	↓ 7.4%		↑ 69%				

BikeButler vs. Google Maps



	Routes	Length	Slope	Bike Lanes	Residential	Speed Limit:	Vegetation:	Surface:
BikeButler	22		↓ 8%		↑ 2x	↓ 20.5%	↑ 5%	↑ 10.5%
Google Maps	4		↓ 7.4%	↑ 69%				

Overarching themes

Understanding routes

“

Having the street view photos is helpful, it gives you a sense of what to expect

P12

Customizing routes

“

I liked being able to choose different options, and there were factors I hadn't thought about, like sidewalks.

P5

Desired features

- Small alterations; 'dragging'
- More streetscape features
- Mobile integration

anonymized

Bike Butler

Origin
[Redacted]

Destination
[Redacted]

Profile
Scenario 3

Get Bike Route

Profile Manager

All Around Scenario 3

Slow and Safe

Fast and Loose

Scenario 2

Scenario 3

Low speed limits I don't care High speed limits

More bike friendly roads More car friendly roads

Sidewalks No sidewalks

Flat road Hilly road

Smooth pavement Rough pavement

A better route A faster route

New Delete Copy Export Close

"I don't know of another tool that has all of this information in one place."



Segment 1

Segment 2

Segment 3

anonymized

Bike Butler

Origin [Redacted]

Destination [Redacted]

Profile Scenario 3

Get Bike Route

Satellite View



Profile Manager

All Around Scenario 3

Slow and Safe

Fast and loose

Test

Scenario 3

A better route

A faster route

New Delete Copy Export Close

“It’s knowing what to anticipate... when I can’t find enough information on Google I won’t bike”

Segment 1

Segment 2

Segment 3

BikeButler:

Personalized, Context-Sensitive Bike Routing



Jared Hwang
UW CS



John O'Meara
UW CS



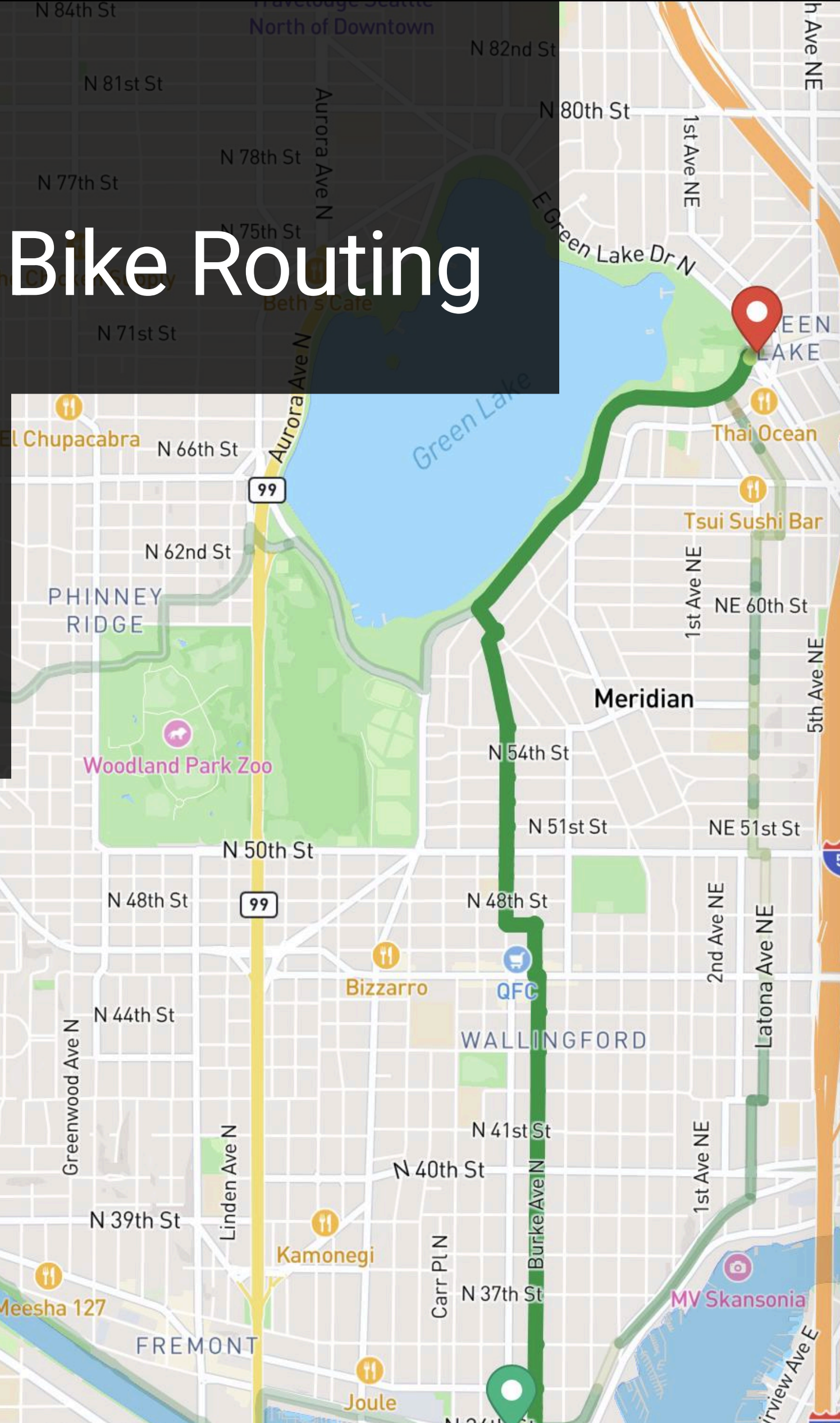
Zeyu Wang
UW Urban Planning



Jasmine Zhang
UW CS



Jon E. Froehlich
UW CS



SLOW AND SAFE V1 SEGMENTS ⓘ



Segment 1



Good: Slope Bad: Vegetation, Street Type



Segment 2



Good: Vegetation, Speed Limit Bad: Slope

See more information!



Looking for Internships!

