Waterfront Infrastructure and Access to Open Space

NYMTC Presentation

Acknowledgements

Huge thank you to the NYC Department of City Planning **Urban Design Office**

- Erick Gregory
- Sagi Golan
- Crystal Jane Eksi
- Kenismael Santiago-Pagan
- Kriti Sharma
- John Moody
- Di Le

Special thank you to my mentor: Ryan Jacobson

Research Purpose & Methodology

Question: How does transportation infrastructure impact public access to New York City's waterfront open space, and how can connections over, under, and across infrastructure be improved for pedestrians and cyclists?

How:

Citywide mapping

Field work & documentation

Stakeholder meetings

DCP Borough Offices
DCP Transportation Division
NYCDOT Greenways
NYCDOT Bridges

NYC's waterfront is one of city's greatest assets

NYC's waterfront continues to evolve

Preliminary concepts, subject to change

Brooklyn Marine Terminal

Source: Publicly Owned Waterfront, NYC Department of City Planning

Ongoing Projects near the Waterfront

EDC

- 2 Coney Island Creek Resiliency Project
- 5 Staten Island North Shore Action Plan
- 7 Ferry Expansion: MADE-Bush Terminal, Sunset Park
- 8 Brooklyn Marine Terminal
- 10 Lower Manhattan Coastal Resiliency
- 11 Brooklyn Bridge Esplanade
- 12 East Midtown Waterfront
- 15 East River Esplanade Reconstruction (with NYC Parks)
- 18 Ferry Expansion: 125th Street, East Harlem
- 17 Manhattan Greenway Harlem River
- 18 Academy Street and North Cove Waterfront Parks
- 21 Willets Point

NYC DOT

- 1 Jamaica Bay Greenway
- 3 Calvert Vaux Pedestrian Bridge
- 4 17th Avenue Bridge
- 6 Brooklyn Waterfront Greenway
- 9 BQE (Central, North, and South)
- 12 East River Waterfront Esplanade
- 13 South Outer Roadway
- 19 Harlem River Greenway
- 22 Queens Waterfront Greenway

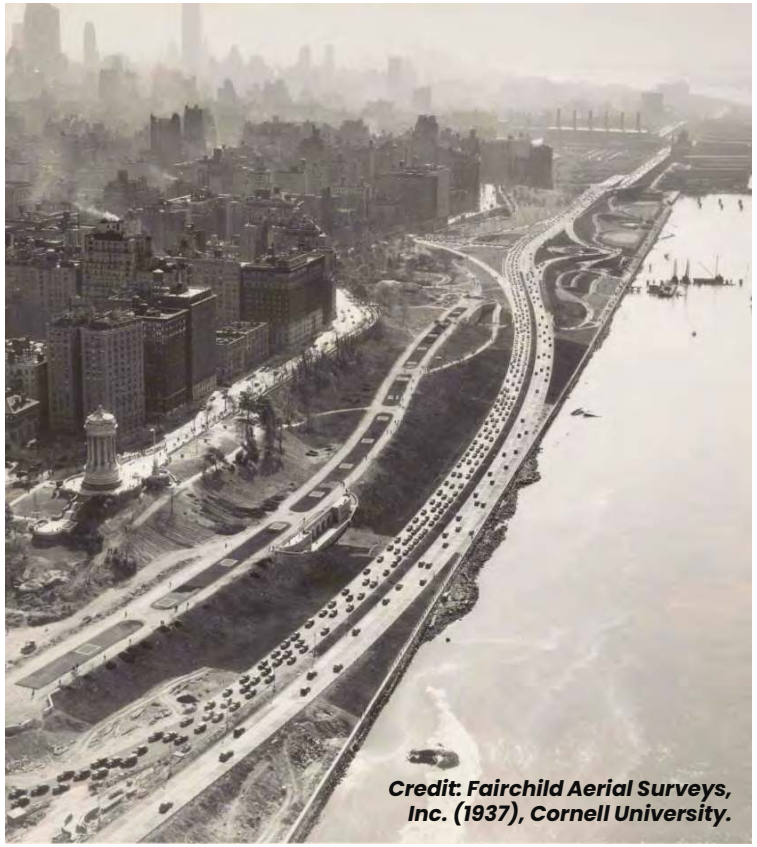
NYS DOT

- 20 Cross Bronx Five Bridges Project

DCP

- 14 OneLIC Neighborhood Plan (POA)

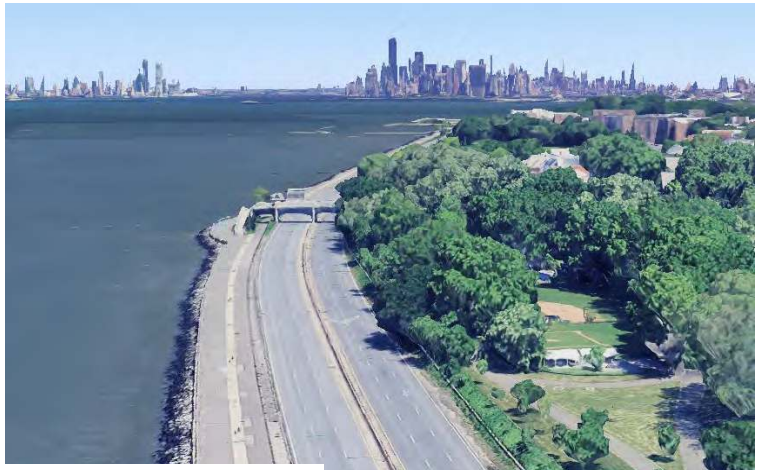
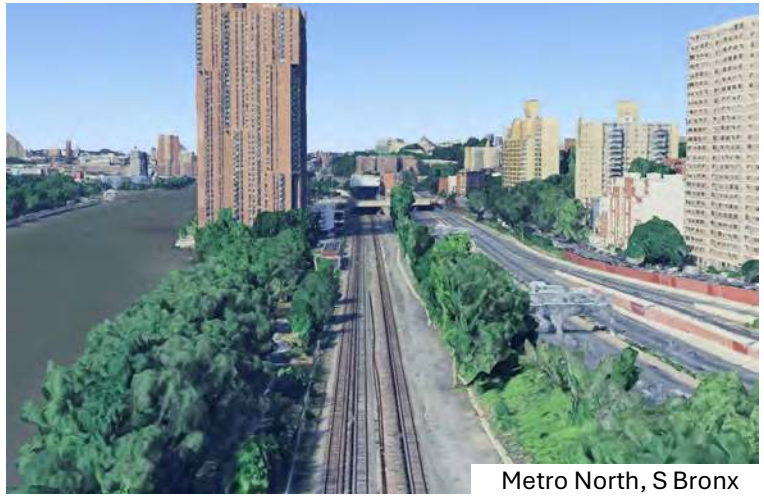
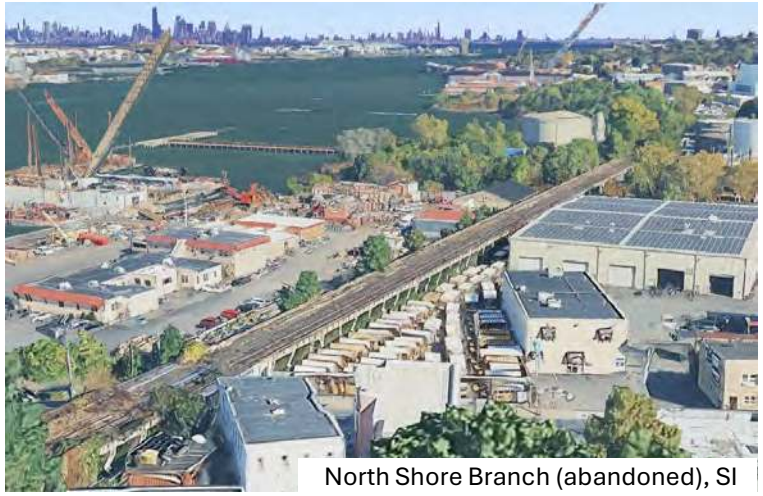
Transportation infrastructure built in the 20th century limit access



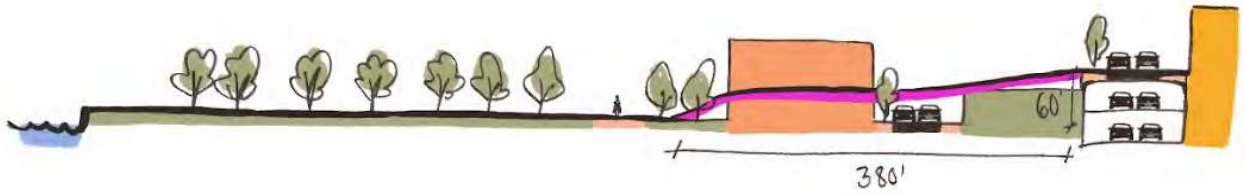
Credit: Fairchild Aerial Surveys, Inc. (1937), Cornell University.

Source: LION, NYC Department of City Planning

Types of infrastructure that impede waterfront access

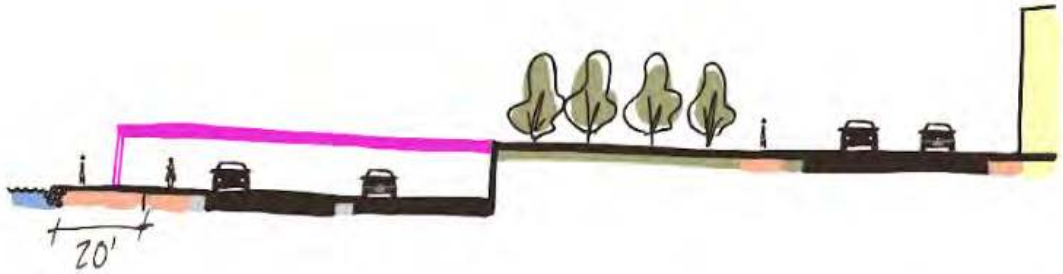
	Highway	Rail
At-Grade	 Belt Pkwy, SW Brooklyn	 Metro North, S Bronx
Elevated	Gowanus Expwy, W Brooklyn	 North Shore Branch (abandoned), SI

Different relationships between open space and infrastructure



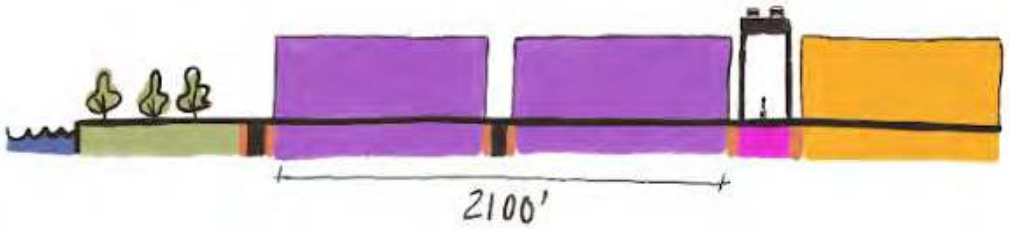
Brooklyn Bridge Park (intentional design)

grade change + buffering from hwy



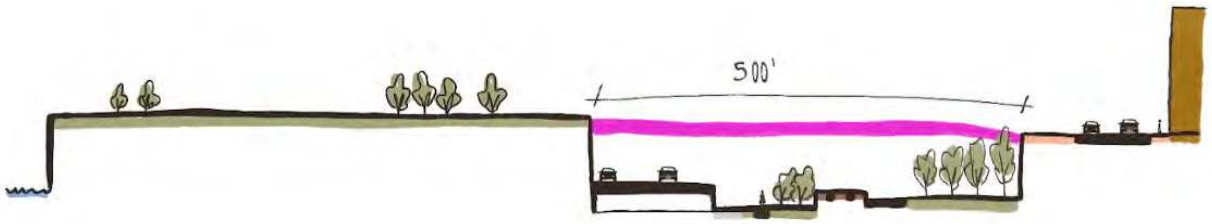
Bay Ridge (bare bones access)

type/configuration of open space



Sunset Park / Bush Terminal (challenging transition)

distance and experience to waterfront



Riverbank State Park (functional access)

length of overpass

Reimagining aging infrastructure

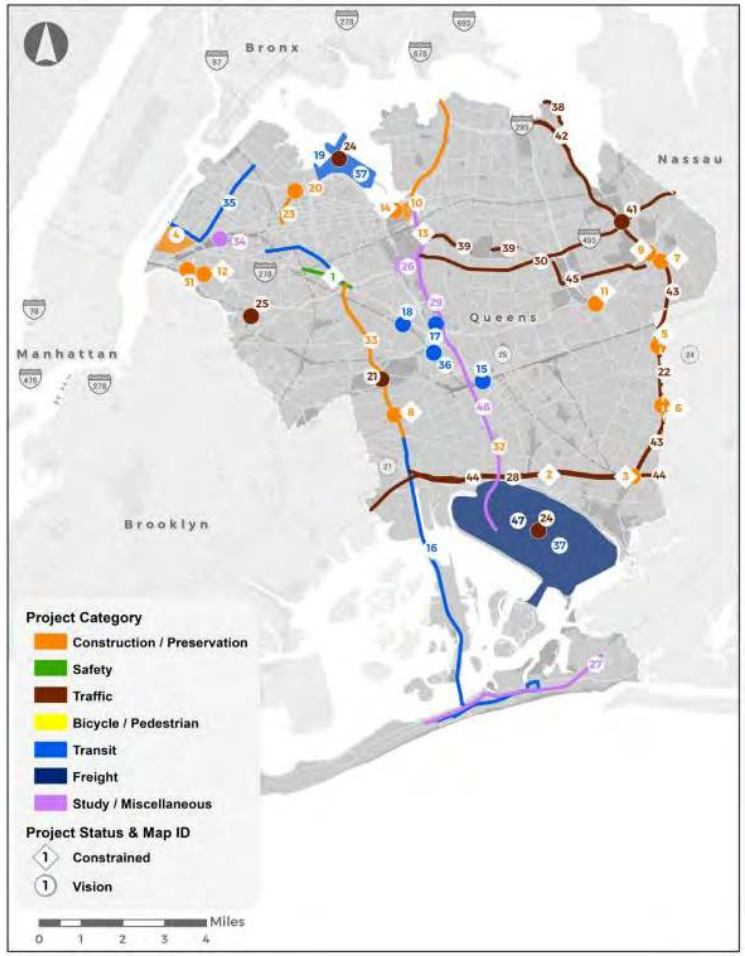
Credit: Jonathan Portee, amNewYork

Cross Bronx 5 Bridges Project

Credit: Susan De Vries, Brooklyn Paper

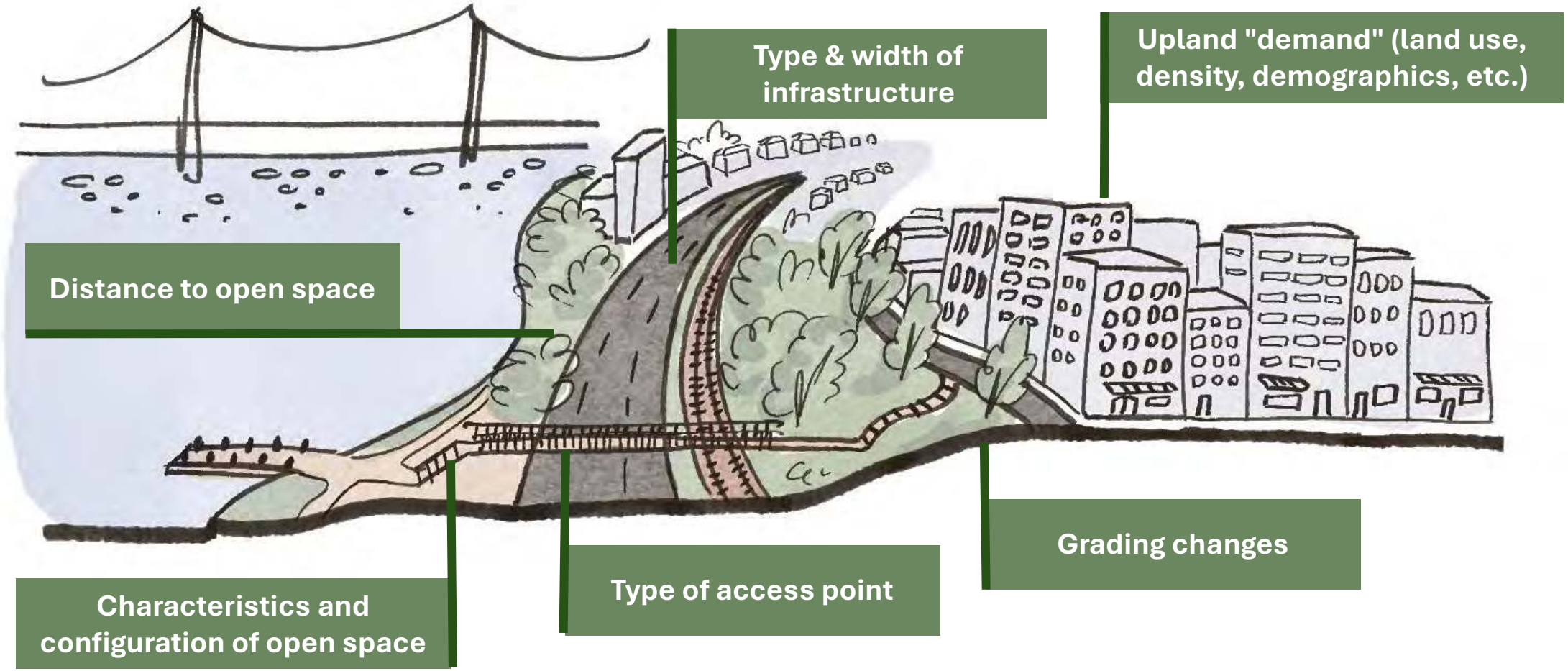
Brooklyn-Queens Expressway

NYMTC's Moving Forward 2055 Plan

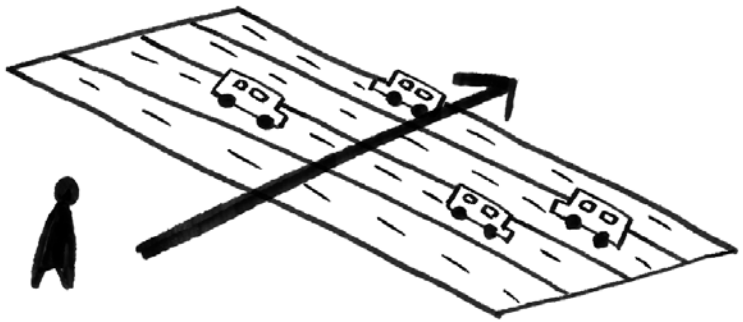


MAP ID	PIN	Plan No.	Work Type / Category	Project Name / Project Description	Sponsor	Estimated Completion Date	Estimated Costs in Plan (Millions YOE $)	Air Quality Status
unmapped		NYCMB5430C	Transit / System Preservation	New Fare Payment System and Support: Support the roll out of the OMNY fare payment system in an effort to improve customer service and experience	MTA NYCT	2026	$87.60	Exempt
unmapped		NYCMB5429C	Transit / System Preservation	Advanced Technology on Buses: Automatic passenger counter retrofits and digital screen technology to improve customer service	MTA NYCT	2026	$12.00	Exempt
3		NYCMB5605C	Transit / System Enhancement	Signal Modernization on 8th Avenue, Queens Boulevard East, Queens Blvd West, 63rd Street, Astoria, Crosstown, Fulton, Lexington; Related Interlockings	MTA NYCT	2026	$5,465.60	Exempt
4		NYCMB1572C	Ped-Bike / System Enhancement	Jamaica Bay Greenway Non-Motorized and Multimodal Improvements	NYC DOT	2027	$2.5	Exempt
5	X77302	NYCMB5323C	Transit / System Enhancement	South Bronx Select Bus Service	NYC DOT	2026	$48.50	Non-exempt

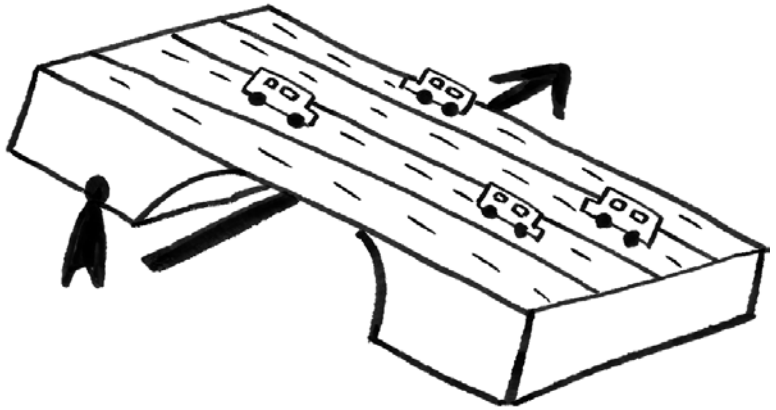
Factors that often affect waterfront access



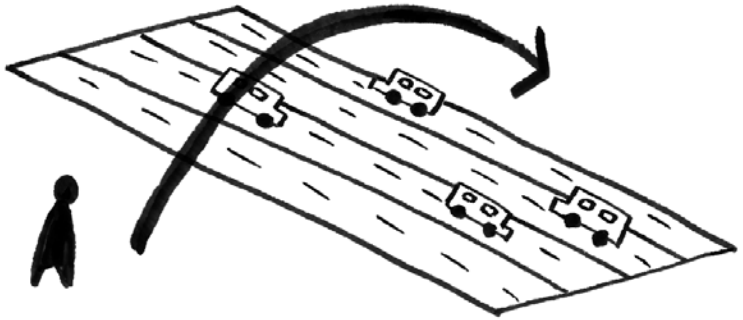
Different crossing types create different levels of physical and psychological barriers



At-Grade

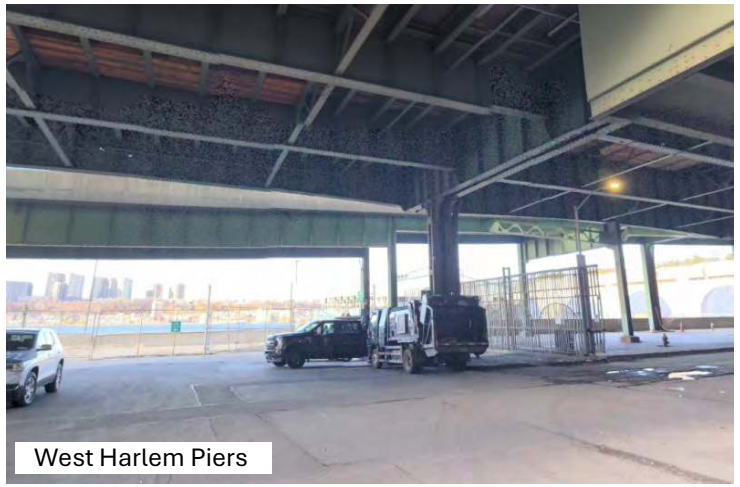


Underpass



Overpass

Quality of crossings vary across NYC

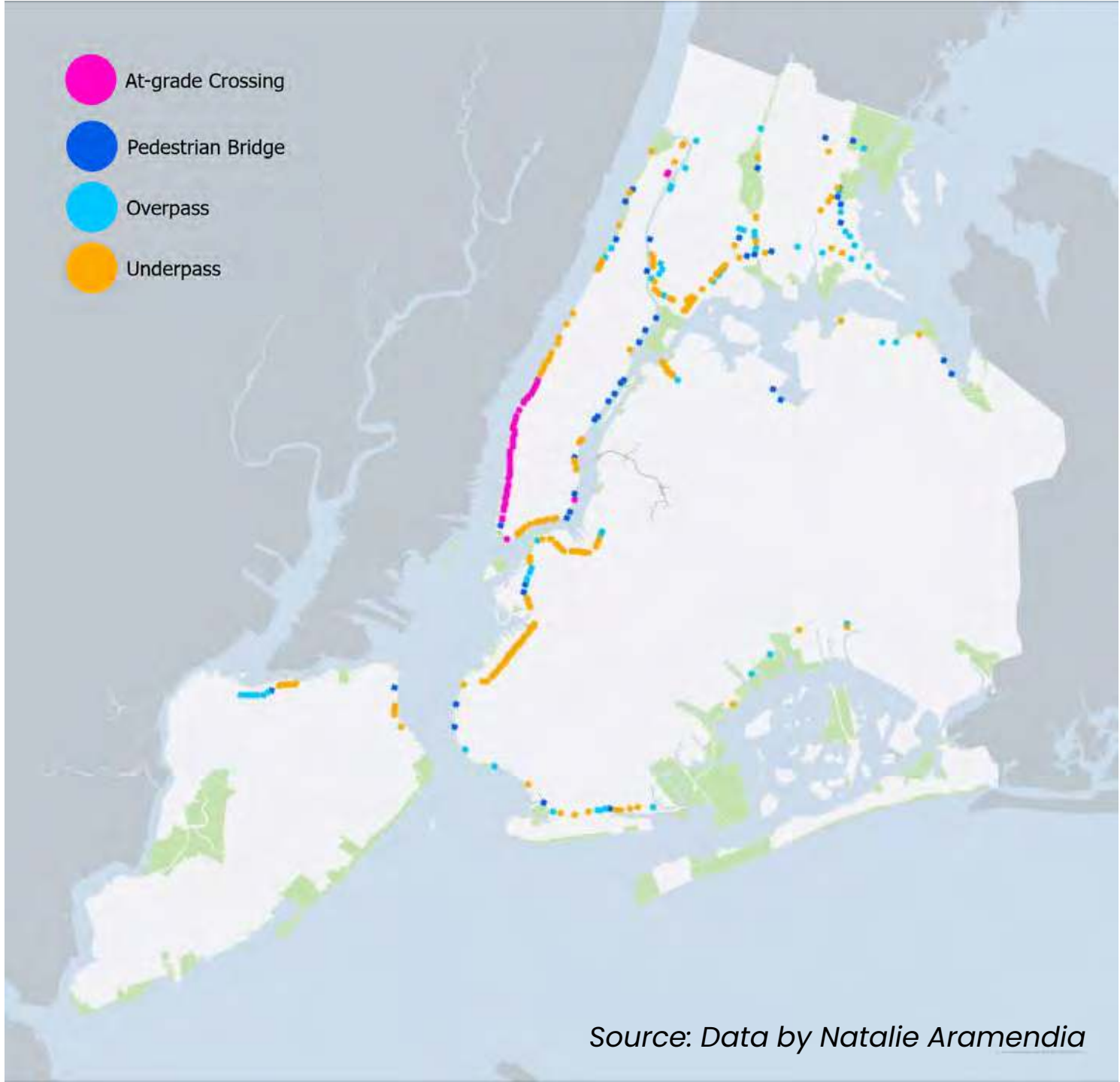


At-Grade

Underpass

Overpass

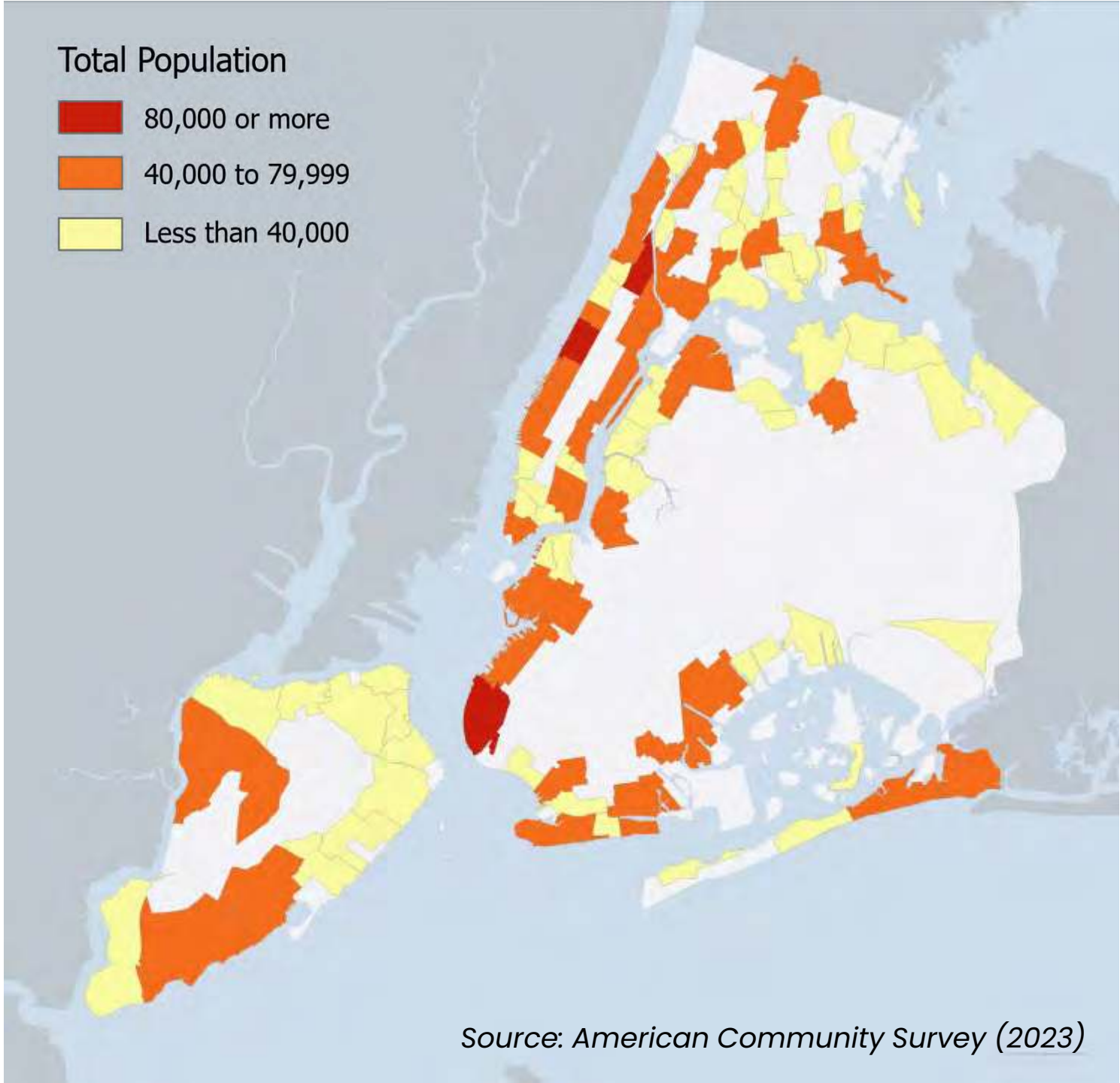
Access opportunities are unevenly distributed



Source: Data by Natalie Aramendia

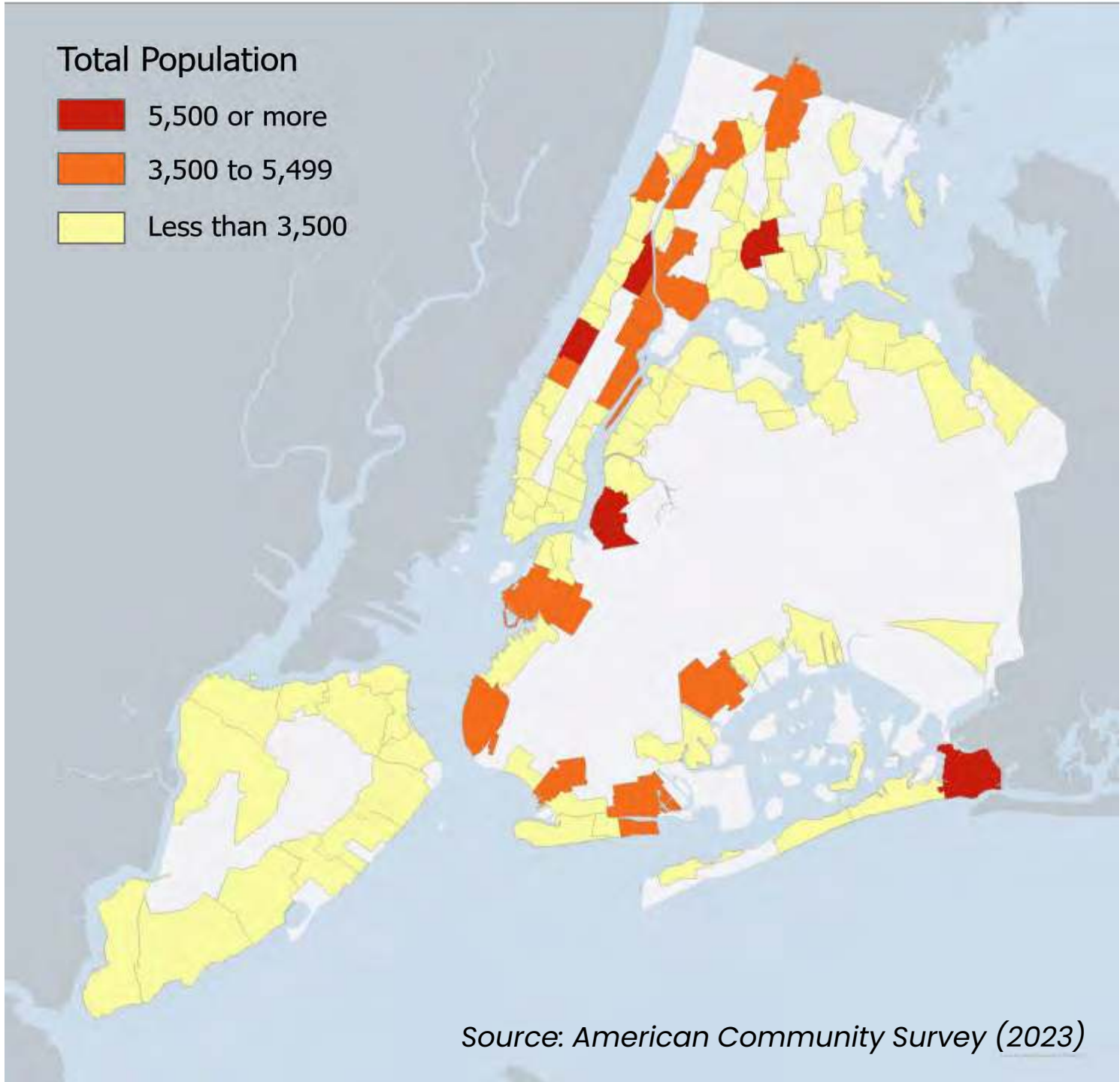
Access opportunities are unevenly distributed

Waterfront Open Space Demand



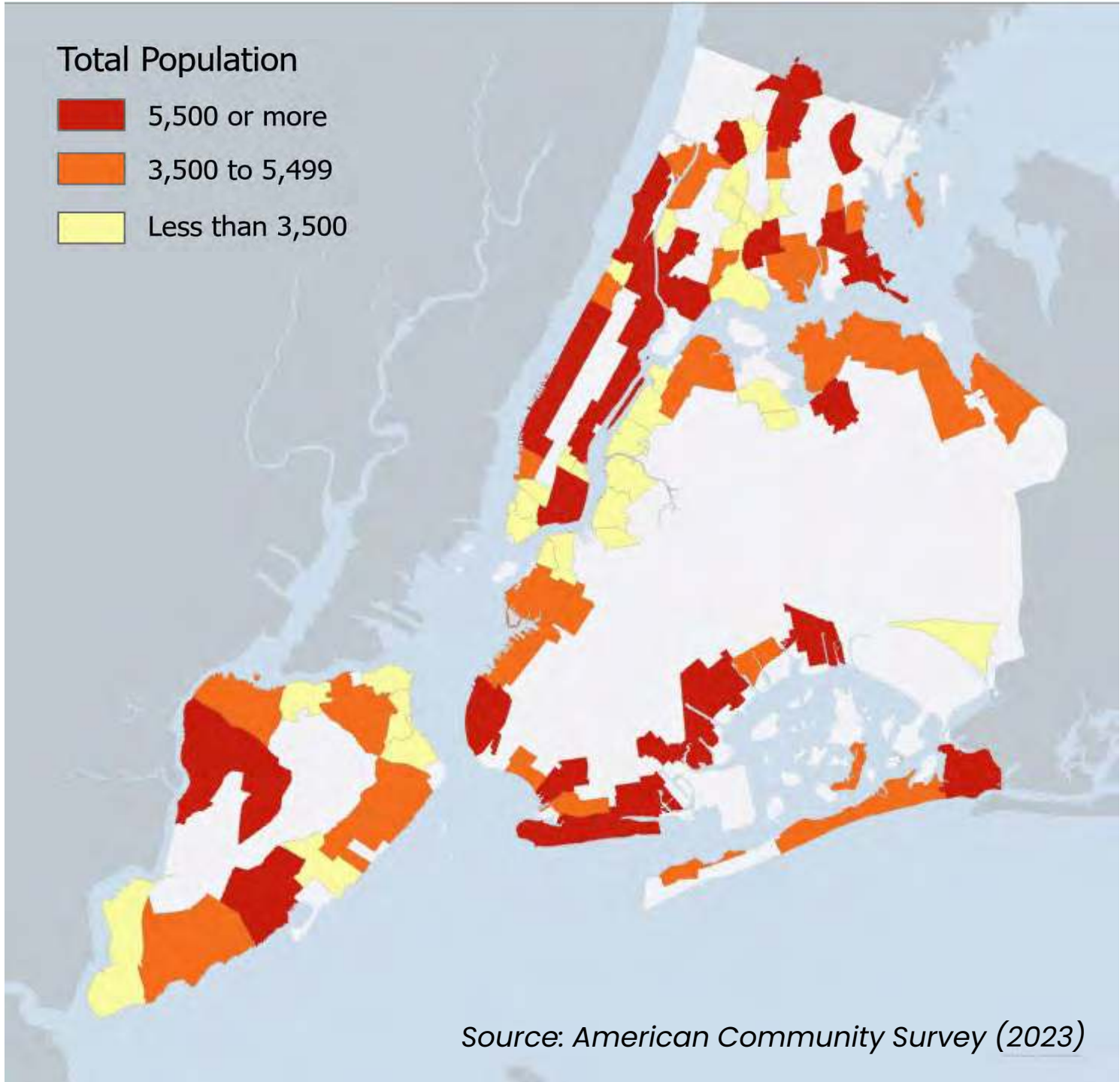
Source: American Community Survey (2023)

Households with children under 6 years



Source: American Community Survey (2023)

Households with one or more people age 65+

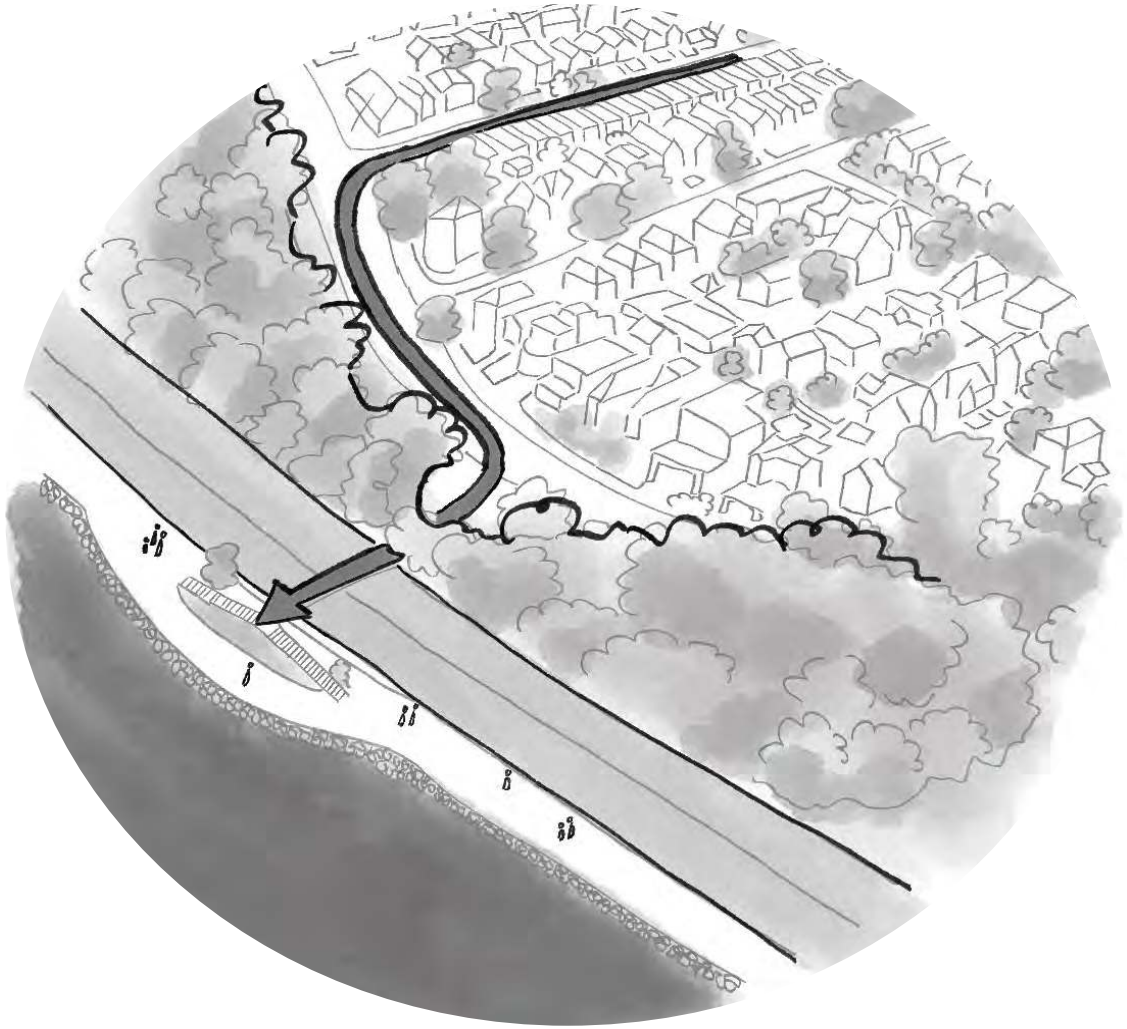


Source: American Community Survey (2023)

1 in 3 pedestrian bridges are not ADA compliant

Source: Data by Natalie Aramendia

Reaching the waterfront is also knowing where it is



Bay Ridge, Brooklyn

Reaching the waterfront is also knowing where it is

Bay Ridge, Brooklyn

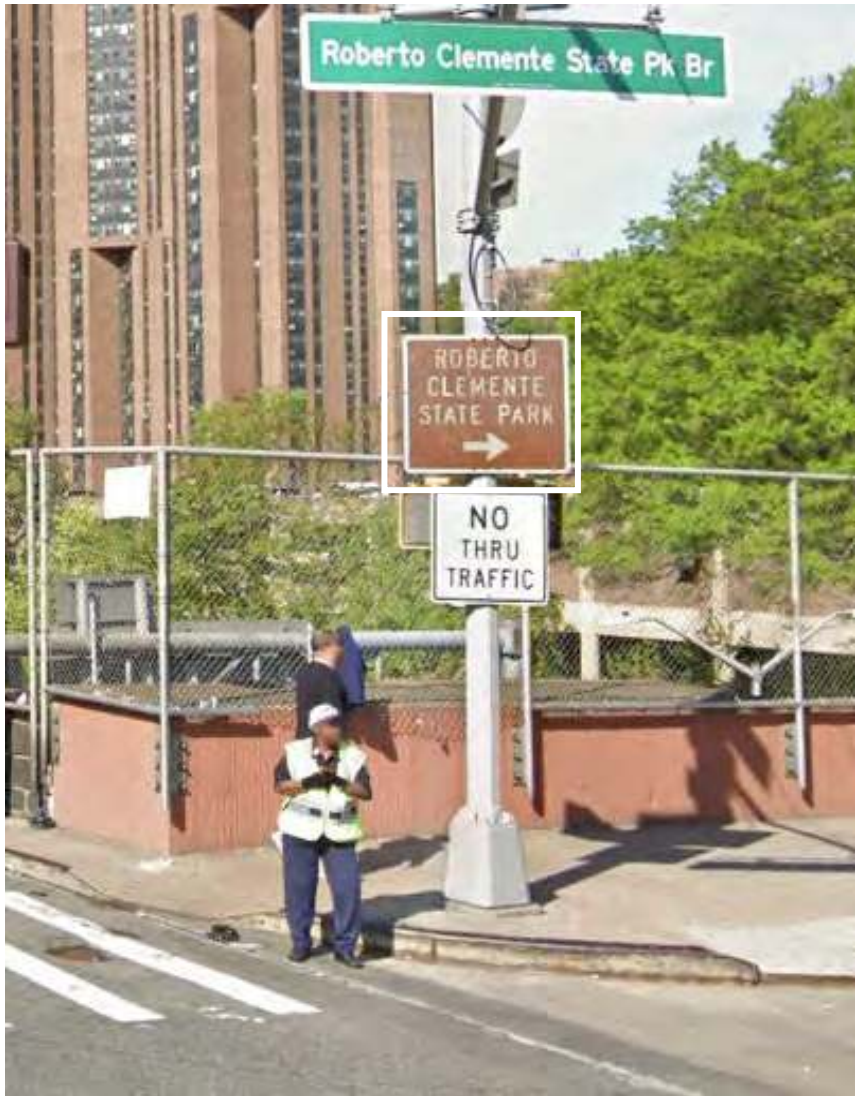
Credit: Google Streetview

Preserve sightlines at crossings

Bay Ridge, Brooklyn

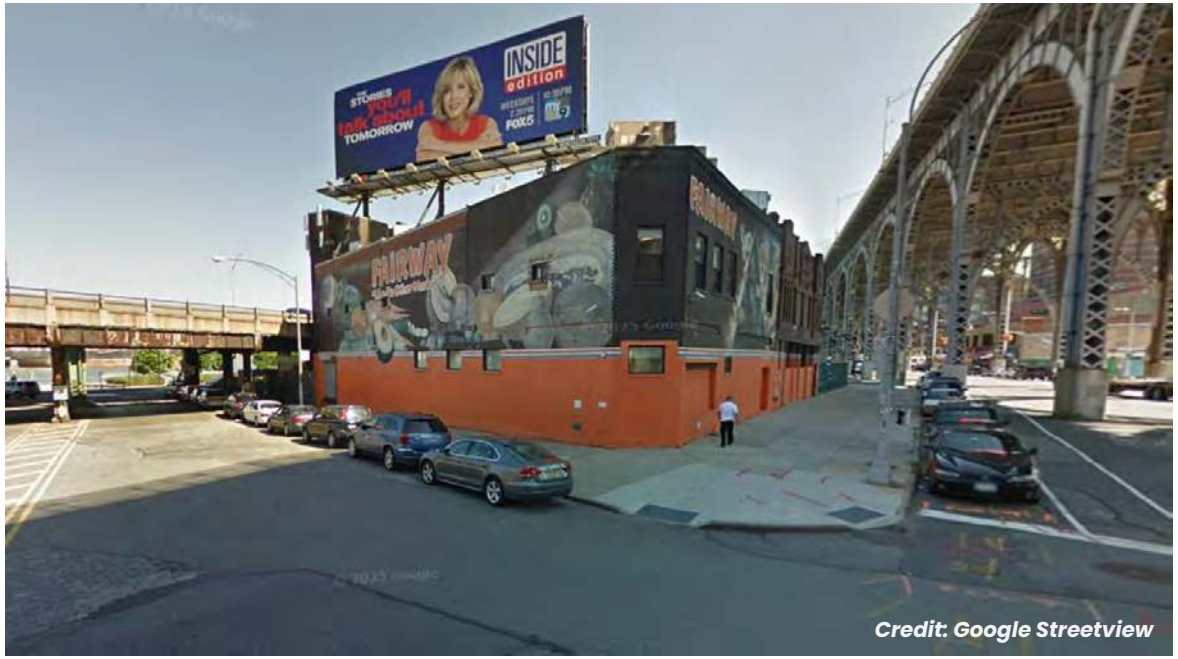
Credit: Google Streetview

Expand wayfinding at both the crossing and inland decision points



Create inland public spaces to signify proximity to the waterfront

Before



Credit: Google Streetview

After

Credit: Google Streetview

West 125th Street Improvements

Access Point Design

Qualitative Assessment
Considerations for At-grade Crossings

Unobstructed views of the water

Pedestrian signals

Planted medians

Refuge islands

West Side Hwy

Qualitative Assessment
Considerations for Underpasses

Qualitative Assessment
Considerations for Overpasses

Qualitative Assessment
Considerations for Ped Bridges

Qualitative Assessment
Design Opportunities

Enabling **fairly-distributed** and **safe access** for all ages, abilities, and modes of travel

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Making the waterfront destination **visible** and the route **intuitive** from a distance

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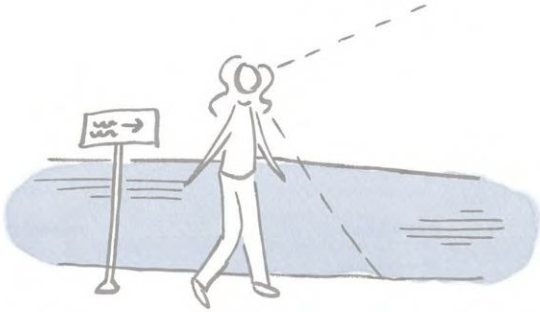
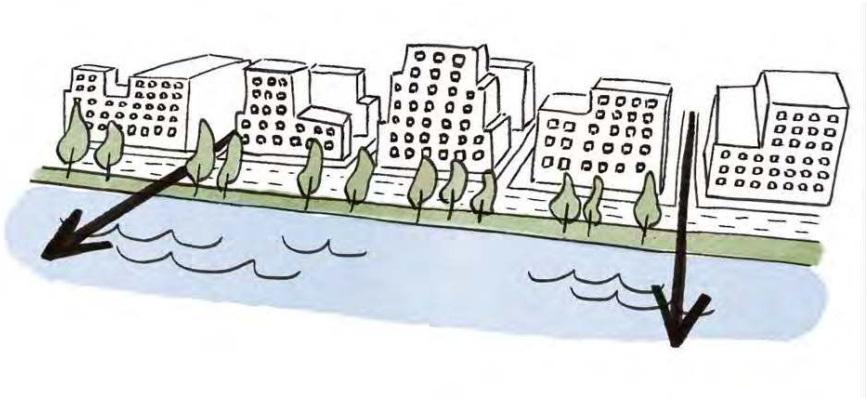


Create a pleasant, **human-scaled journey** to the waterfront

Conclusion

- **Crossing gaps** are especially common along **linear waterfront parks** and areas where ped bridges are the most common form of access



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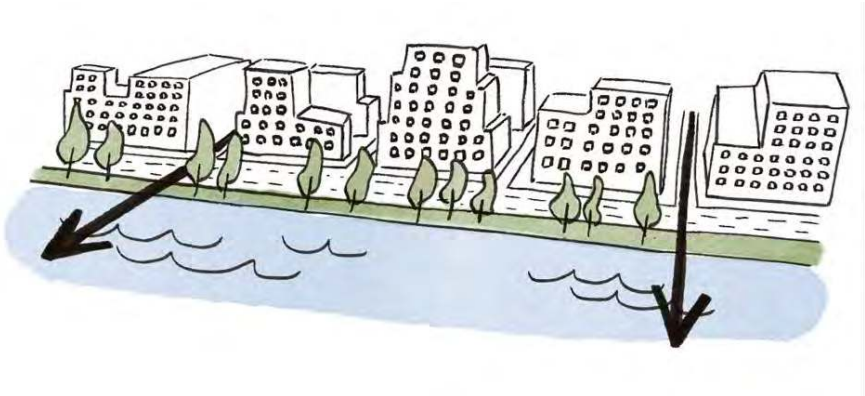
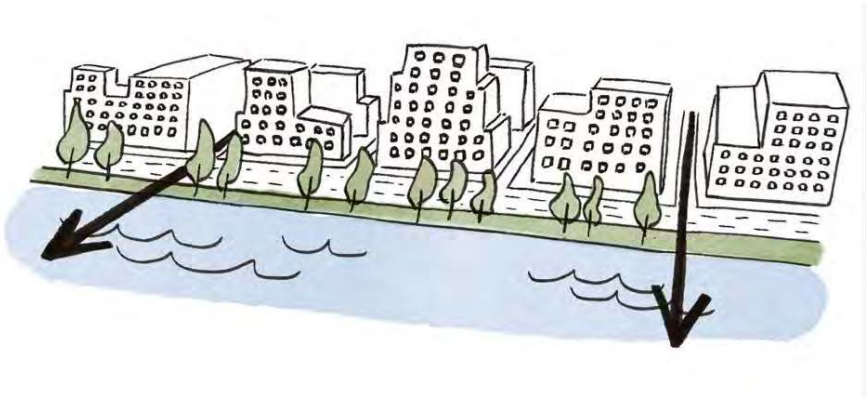
- **Crossing gaps** are especially common along **linear waterfront parks** and areas where ped bridges are the most common form of access
- West Side Highway **conversion from an elevated to an at-grade highway** dramatically improved connection to waterfront



Conclusion

- **Crossing gaps** are especially common along **linear waterfront parks** and areas where ped bridges are the most common form of access
- West Side Highway **conversion from an elevated to an at-grade highway** dramatically improved connection to waterfront
- Residential neighborhoods with vulnerable users (i.e. seniors, caregivers, and children) often fall short of providing **safe crossings**



Thank you :)

Vision Zero Initiatives

NYMTC September 11 Memorial Fellowship

Snigdha Anantharaju

September 2026

NEW YORK CITY DOT

About me

I am Snigdha Anantharaju (she/her) and I recently received my Master's degree in Urban Data Science from NYU Tandon School of Engineering, where I focused on using data science and machine learning to study road safety and road users' behavior along with other urban-science applications. My work as a part of the 9/11 Memorial Transportation Research Fellowship was based on Vision Zero Initiatives at the Office of Research, Implementation and Safety (RIS), New York City Department of Transportation.

Acknowledgements

I am deeply grateful to my advisors - Chris Brunson, Ben Schwed, Colin Anderson, and Seth Hostetter. I am also grateful to Alicia Posner, AnnMarie Doherty, and my colleagues - Nathan Albert, Rachael Metz, Maggie Loesch, Matt Sieracki and, Olivia Kulasa at Safety Projects and Programs for supporting and guiding me throughout this fellowship period.

I also extend my gratitude to folks at NYU Center for Urban Science + Progress – Peter Huu Tran, Anton Rozhkov, Manny Patole, and Abhishek Kumar for their support.

Projects

- Data Processing and analysis
  - Scripts for Traffic counts , bikes and pedestrian counts processing
- Street Improvement Project
  - Marcus Garvey and Throop
- Research Project
  - Street Safety Around New York City Housing Authority **(NYCHA) Campuses** in Brooklyn

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Data Processing

1

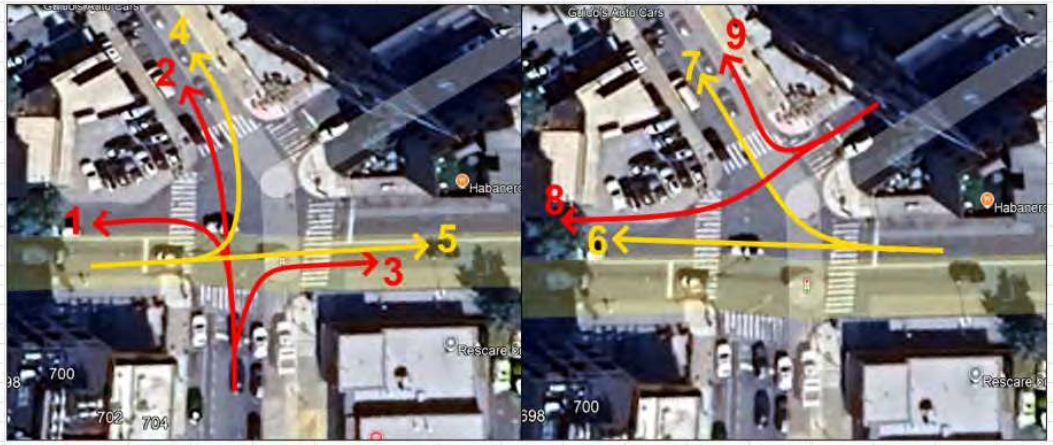
Processing Raw counts using Python scripts

Important to understand the peak hour traffic volume and install/implement appropriate safety treatment.

'ersion:	1
:ount Type:	Turning Movement
lode ID:	
ocation 1 (N/S):	Throop Ave/Thornton St
ocation 2 (E/W):	Flushing Ave
lorough Code:	3
'ollect Date:	9/16/2025
'eriod:	
nterval (min):	15 MIN
tart Time:	7:00 AM
nd Time:	7:00 PM

Vehicle Type	Heavy Vehicle
Auto	Y
Bus	Y
Truck	Y
Bike	Y
	N
	N
	N
	N
	N
	N
	N
	N
	N

Sketch



From	To	DIR	1	2	3	4	5	6	7	8	9
		Class	0	0	0	0	0	0	0	0	0
AM 7:00:00	AM 7:15:00	Auto									
		Bus									
		Truck									
		Bike									
AM 7:15:00	AM 7:30:00	Auto									
		Bus									
		Truck									
		Bike									
AM 7:30:00	AM 7:45:00	Auto									

Hourly raw vehicle counts at each intersection

Processing Raw counts using Python scripts

Hourly raw vehicle counts at each intersection

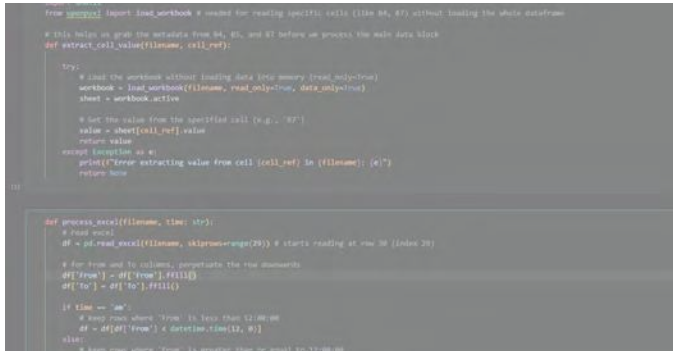
```python
from openpyxl import load_workbook # needed for reading specific cells (like B4, B7) without loading the whole dataframe

# this helps us grab the metadata from B4, B5, and B7 before we process the main data block
def extract_cell_value(filename, cell_ref):

    try:
        # Load the workbook without loading data into memory (read_only=True)
        workbook = load_workbook(filename, read_only=True, data_only=True)
        sheet = workbook.active

        # Get the value from the specified cell (e.g., 'B7')
        value = sheet[cell_ref].value
        return value
    except Exception as e:
        print(f"Error extracting value from cell {cell_ref} in {filename}: {e}")
        return None
```

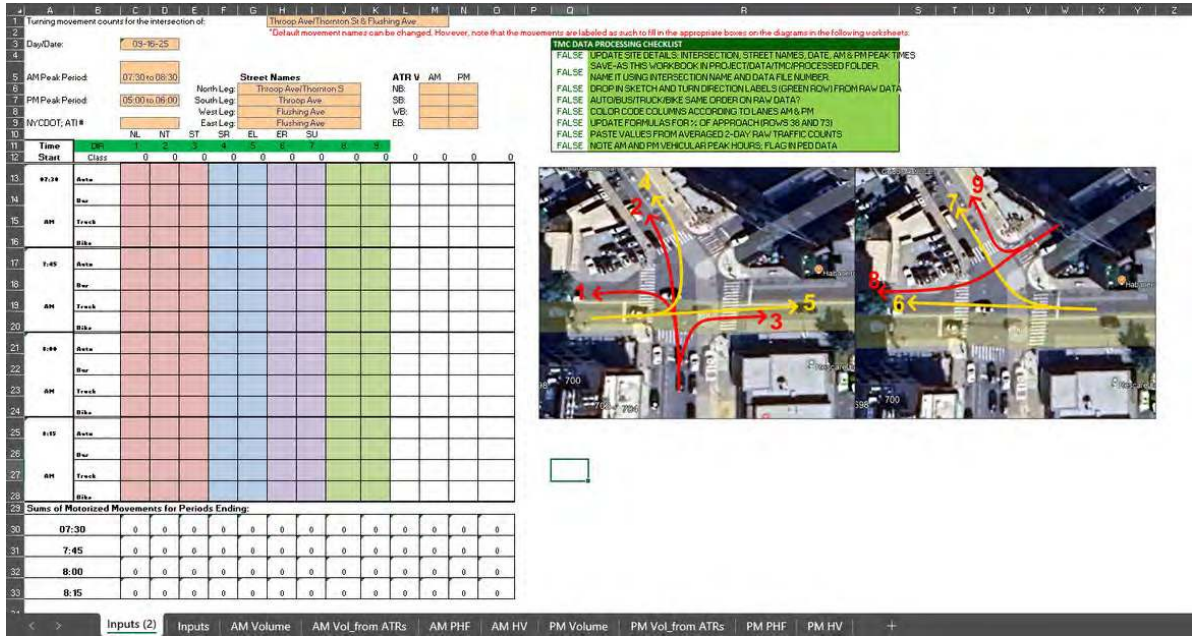
[1]

```python
def process_excel(filename, time: str):
    # read excel
    df = pd.read_excel(filename, skiprows=range(29)) # starts reading at row 30 (index 29)

    # for From and To columns, perpetuate the row downwards
    df['From'] = df['From'].ffill()
    df['To'] = df['To'].ffill()

    if time == 'am':
        # keep rows where 'From' is less than 12:00:00
        df = df[df['From'] < datetime.time(12, 0)]
    else:
        # keep rows where 'From' is greater than or equal to 12:00:00
```

Processing Raw counts using Python scripts

Hourly raw vehicle counts at each intersection





Processed hourly peak volume

The raw data is processed and gives out peak hour volumes (in 15-minute intervals) which can be used to understand the traffic movements and help determine what the best safety treatment would be in the respective scenario.

Street Improvement Project

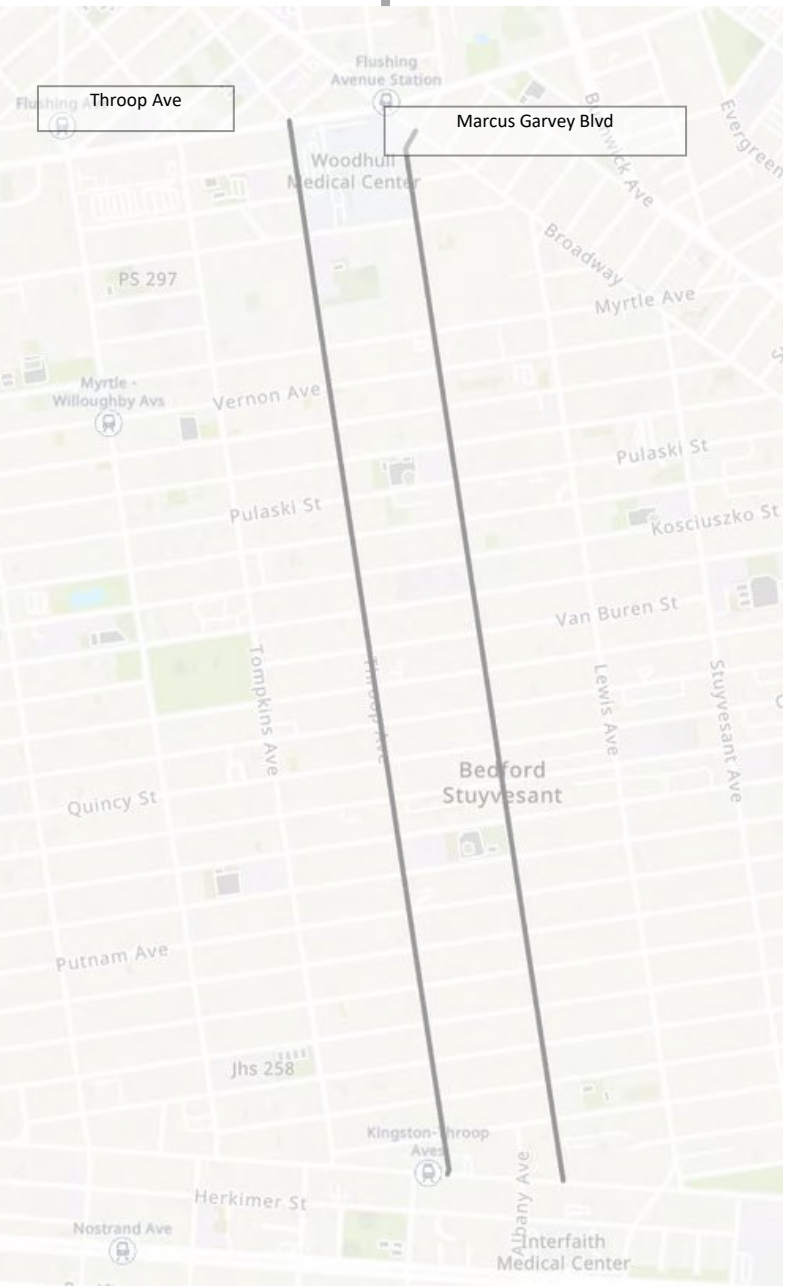
Marcus Garvey Blvd and Throop Av –
Existing Conditions

2

Overview of Project Scope

Marcus Garvey Blvd and Throop Av (Fulton St to Flushing Av)

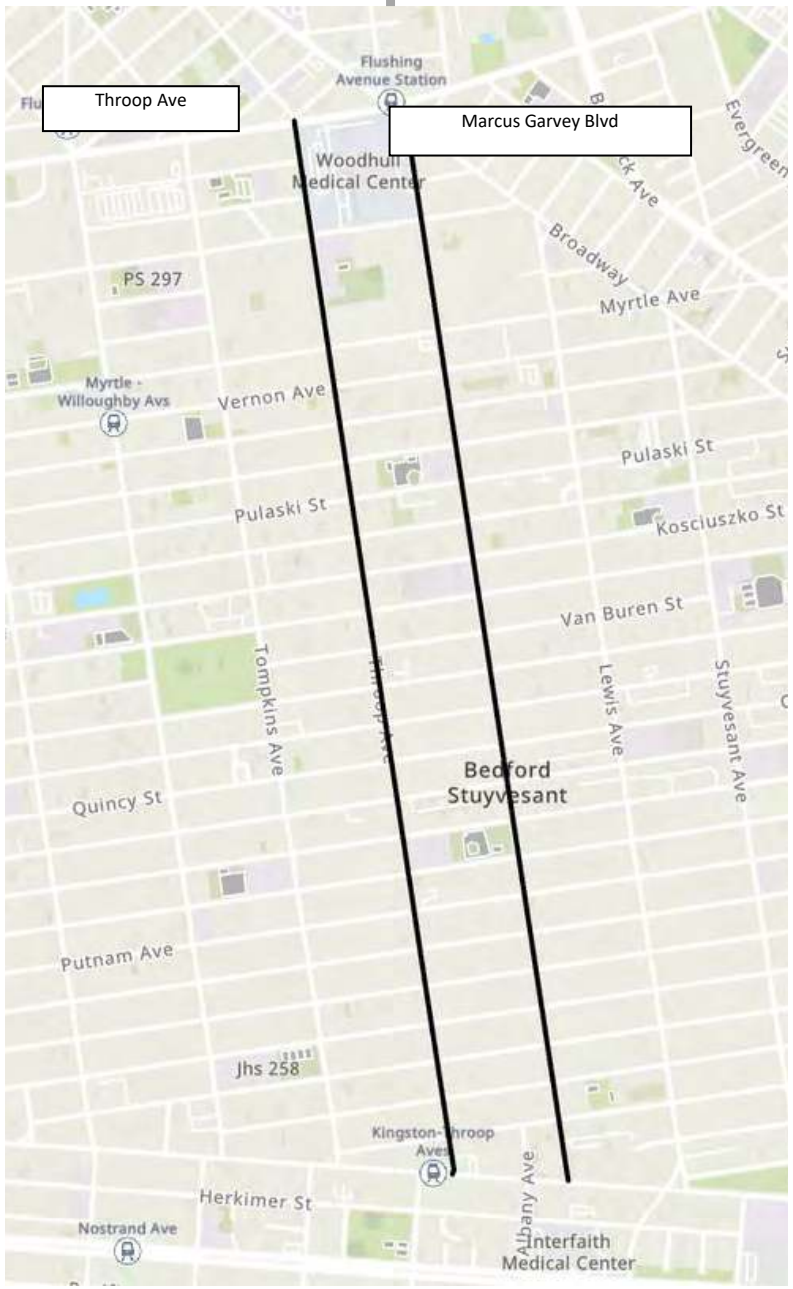
- 4.35 miles through **Bedford-Stuyvesant, Brooklyn.**



Overview of Project Scope

Marcus Garvey Blvd and Throop Av (Fulton St to Flushing Av)

- 4.35 miles through **Bedford-Stuyvesant, Brooklyn.**
- Both Marcus Garvey Blvd and Throop Ave are designated **Vision Zero Priority Corridors** due to a high frequency of severe injuries.



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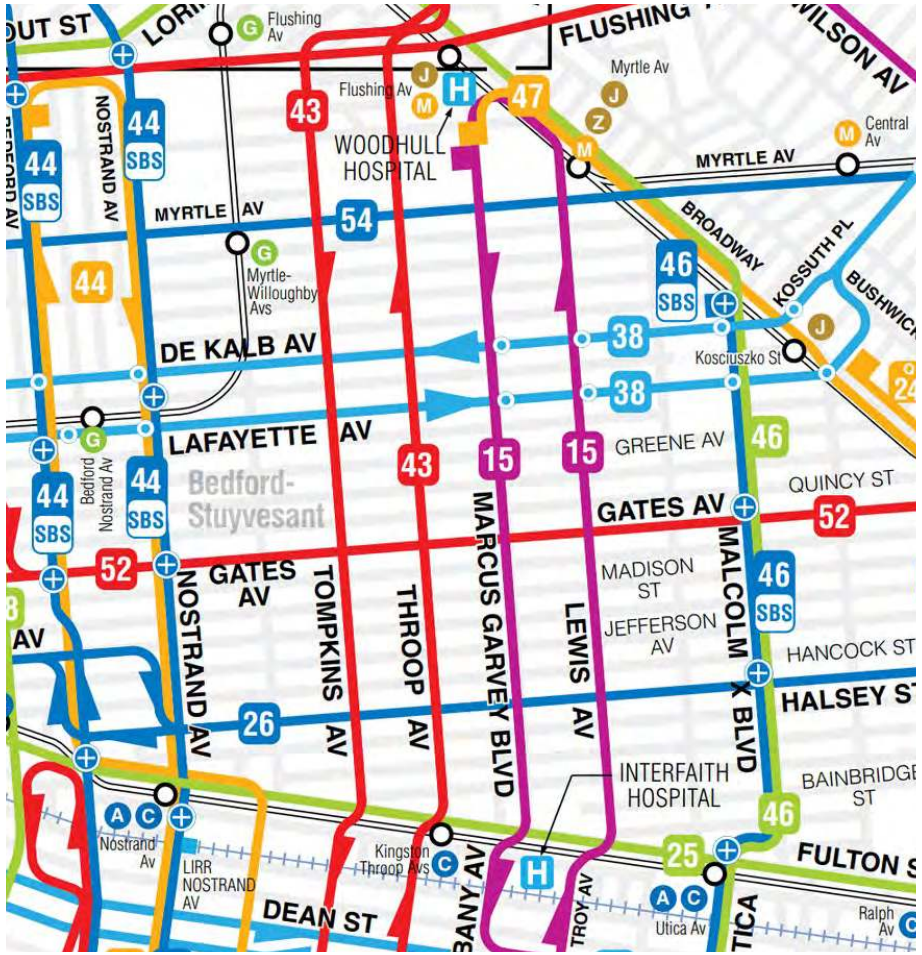
- 4.35 miles through **Bedford-Stuyvesant, Brooklyn.**
- Both Marcus Garvey Blvd and Throop Ave are designated **Vision Zero Priority Corridors** due to a high frequency of severe crashes.
- The corridors serve as critical north-south connectors for local transit (B15, B43 buses) and regional traffic.

Existing Bus Network



B15 passes through Marcus Garvey Blvd and B43 through Throop Avenue; Other routes include B38, B52 B54, B25, B26, B46 and B57 LTD

Current peak time frequency of B15 and B43 is 5 buses per hour and 10 buses per hour respectively

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Brooklyn Bus Network Redesign

A major change is both B15 and B43 will pass through Marcus Garvey Blvd (southbound) and Throop Avenue (northbound); Other nearby routes include B38, B52, B25, B46, B47, B53 and B54

Overview of Project Scope

Marcus Garvey Blvd and Throop Av (Fulton St to Flushing Av)

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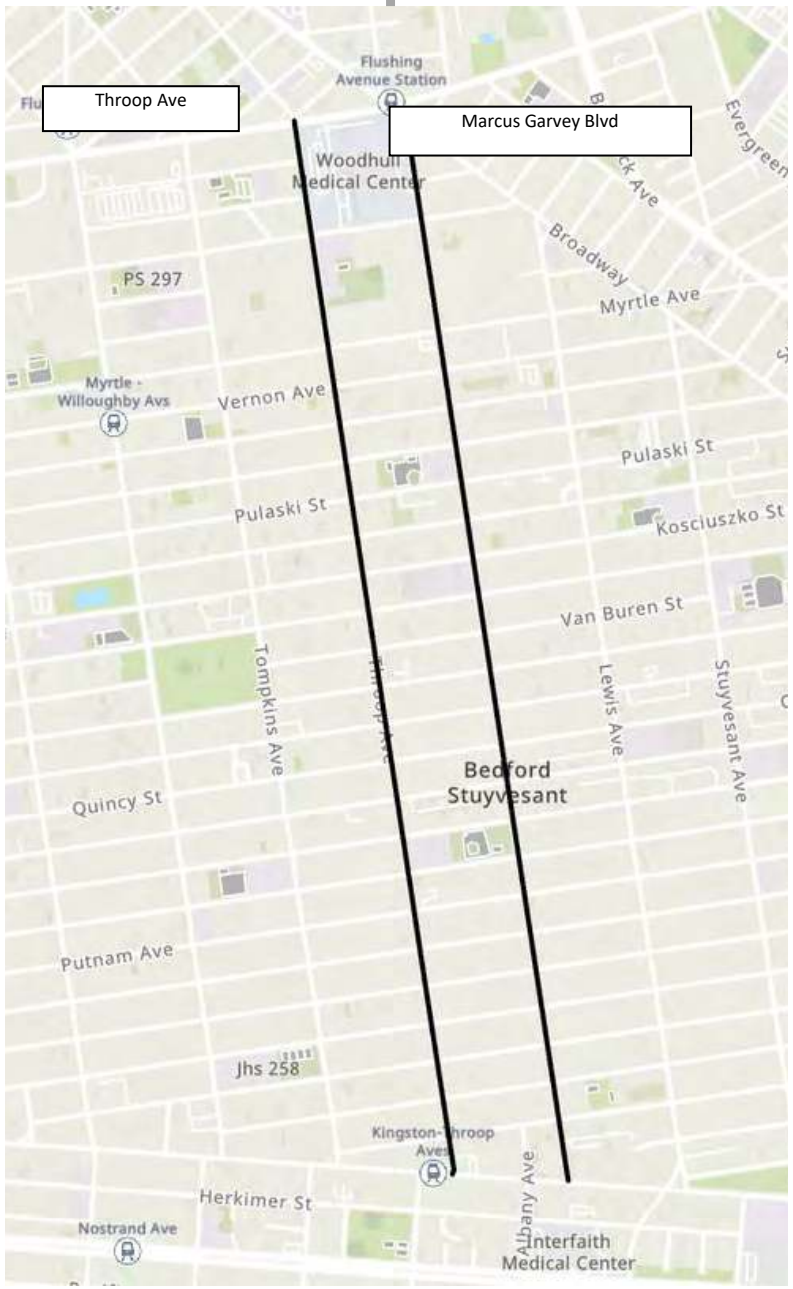
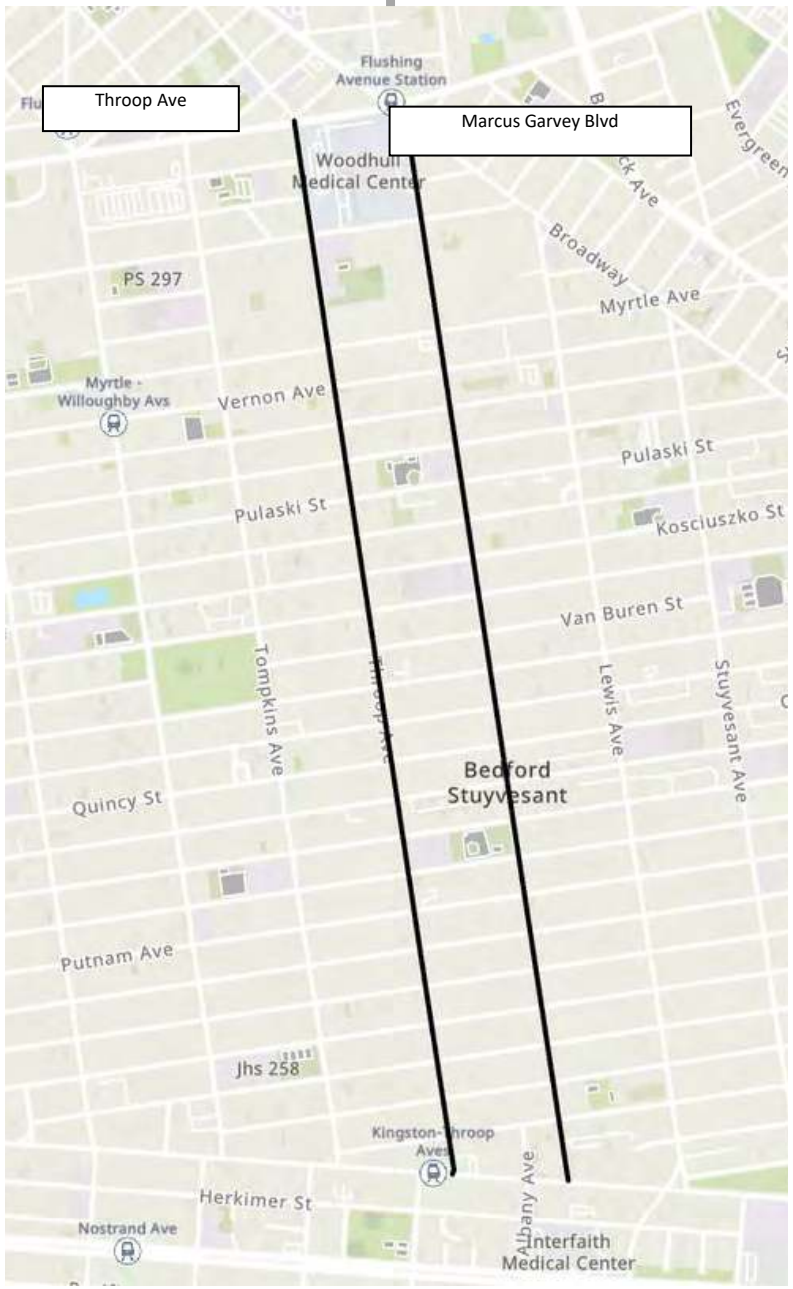
- The corridors serve as critical north-south connectors for local transit (B15, B43 buses) and regional traffic.
- This project will address issues related to speeding, double parking, and pedestrian safety.



Overview of Project Scope

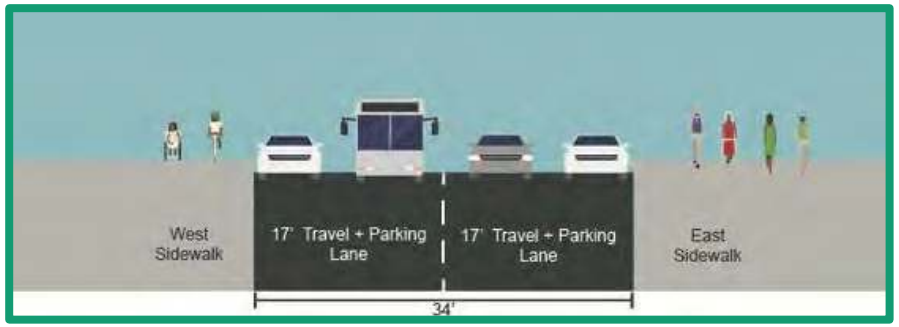
Marcus Garvey Blvd and Throop Av (Fulton St to Flushing Av)

- 4.35 miles through **Bedford-Stuyvesant, Brooklyn.**
- Both Marcus Garvey Blvd and Throop Ave are designated **Vision Zero Priority Corridors** due to a high frequency of severe crashes.
- The corridors serve as critical north-south connectors for local transit (B15, B43 buses) and regional traffic.
- This project addresses issues about speeding, double parking, and pedestrian safety.
- The KSI (killed or severely injured) rate is one of the highest in Brooklyn in both the corridors **(Top 10% in Brooklyn)**.

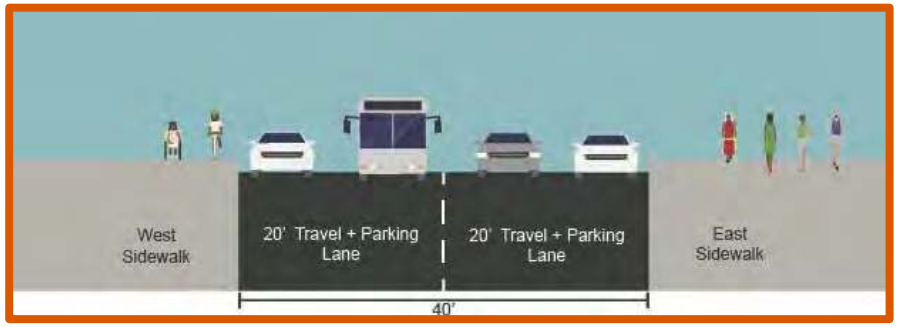


Changes in Road Geometry

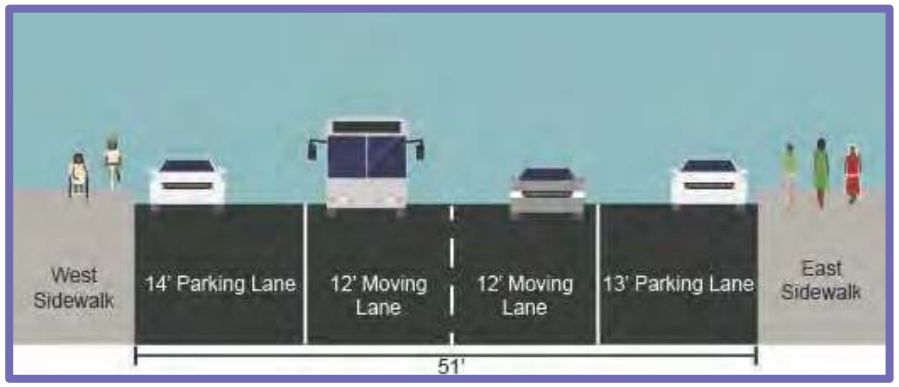
34 feet wide



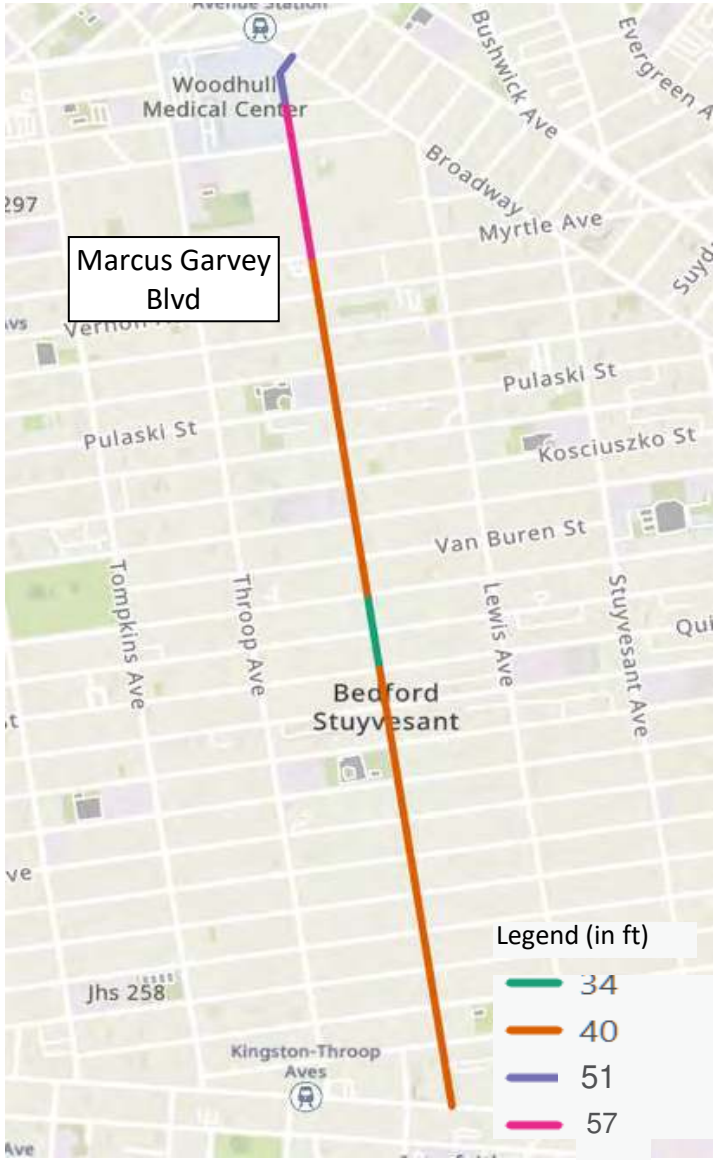
40 feet wide



51 feet wide



Marcus Garvey Blvd



Crash Analysis

Marcus Garvey Blvd

Injury Summary (Detailed), 2020-2024 (5 Years)

Type	Total Injuries	Severe Injuries	Fatalities	KSI
Pedestrian	**68**	**9**	**1**	**10**
Traditional Bicycle	**26**	**2**	**0**	**2**
Car	124	2	0	2
Other MVO	29	1	0	1
SUV	57	4	0	4
Motor Vehicle Total	**210**	**7**	**0**	**7**
E-bike	6	0	0	0
Moped	17	1	1	2
Motorcycle	8	0	1	1
Off Road	0	0	0	0
Other Motorized	0	0	0	0
Stand-up Scooter	9	0	0	0
Motorized Two-Wheelers Total	**40**	**1**	**2**	**3**
Total	**344**	**19**	**3**	**22**

Pedestrian Injuries by Control and Pedestrian Action, 2020-2024 (5 Years)

	Number of injuries	Percent of Known Injuries	Percent of Known Injuries (Boro)
Signalized Intersection: Crossing With Signal	36	57.1%	41.7%
Signalized Intersection: Crossing Against Signal	4	6.3%	4.8%
Stop-Controlled Intersection / Crosswalk	1	1.6%	4.8%
Stop-Controlled Intersection / No Crosswalk	1	1.6%	0.9%
Other Actions/Uncontrolled Intersection	6	9.5%	12.8%
Midblock	15	23.8%	34.5%
Other Control Types	0	0.0%	0.5%
Total Known	63	N/A	100%
Unknown/Indeterminate	5	N/A	N/A
Total	68	N/A	100%

Research Project

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn

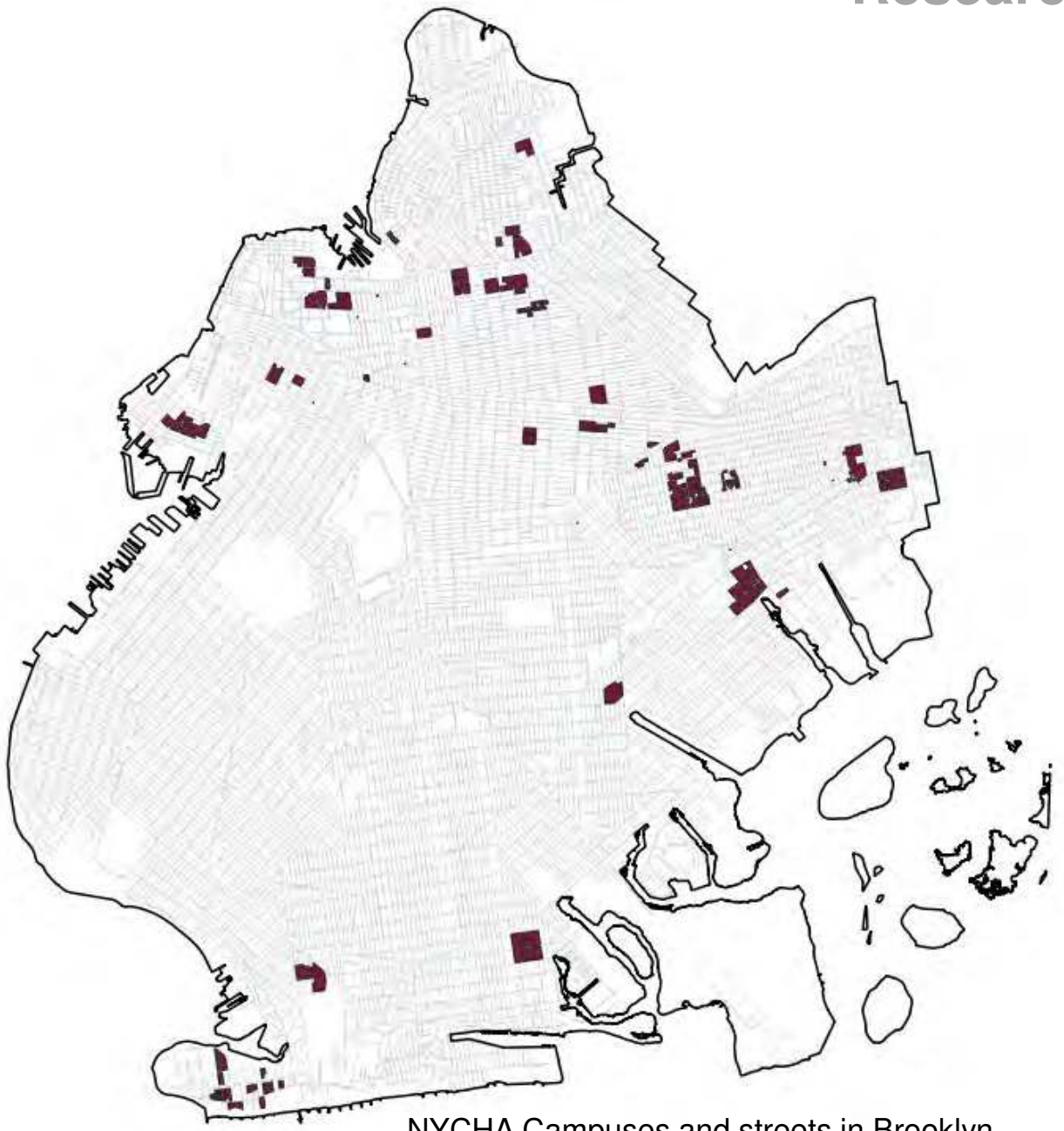
3

Overview

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn

Overview

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn



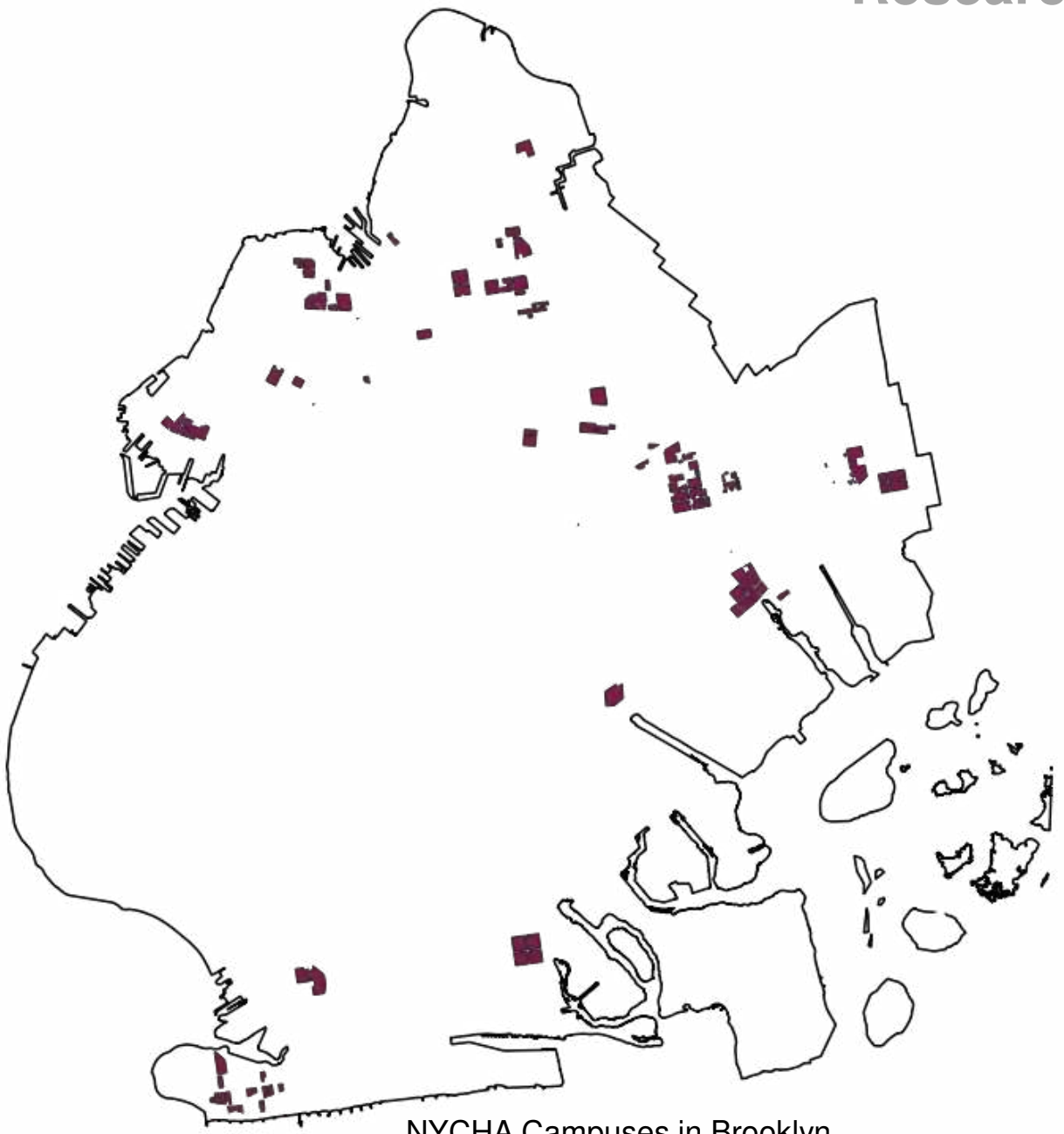
NYCHA Campuses and streets in Brooklyn

Overview

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn

88

public housing developments managed by NYCHA



NYCHA Campuses in Brooklyn

Overview

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn

88

public housing developments managed by NYCHA

1766

miles of streets in Brooklyn

Streets in Brooklyn

Overview

Street Safety Around New York City Housing Authority (NYCHA) Campuses in Brooklyn

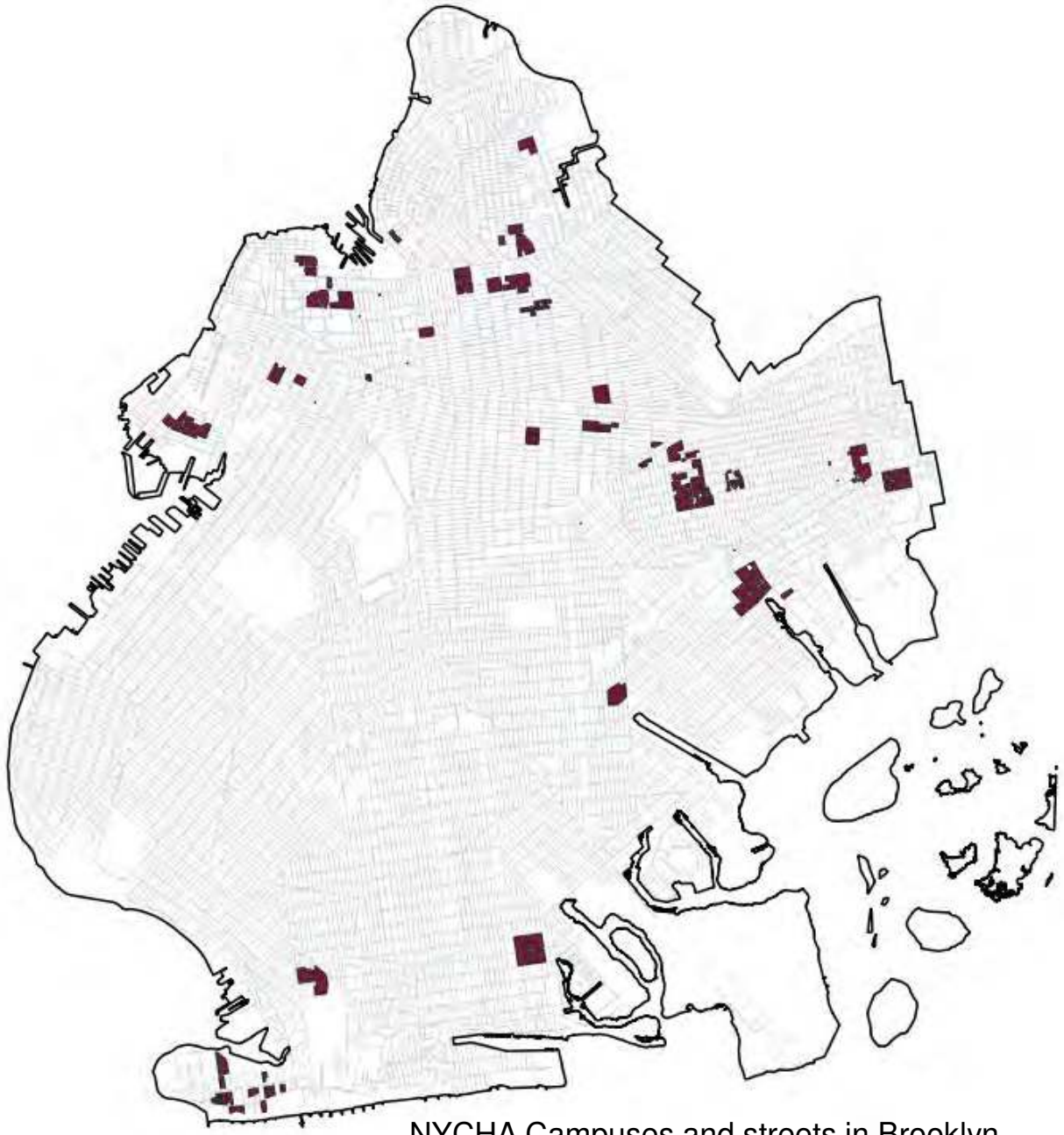
88

public housing developments managed by NYCHA

1766

miles of streets in Brooklyn

This project is about assessing crashes and street width around these NYCHA campuses and if they are all interrelated.



NYCHA Campuses and streets in Brooklyn

Injuries are not evenly distributed

Identified places for closer investigation and is not a causal NYCHA effect.

the line widths in this map are proportional to the number of injuries per mile in that segment

Injuries in Brooklyn by road segment

Hypotheses

1 Crash rates are higher around NYCHA campuses.

Hypotheses

1 Crash rates are higher around NYCHA campuses.

2 Streets are wider around NYCHA campuses.

Road Width, **Injury Burden**, and Proximity

27658

road segments

2097

corridors in Brooklyn

VARIABLES

Road width

Sets the street context for exposure

Injuries per mile

Measured as injuries per mile

Proximity

Adjacent, within one mile, beyond one mile

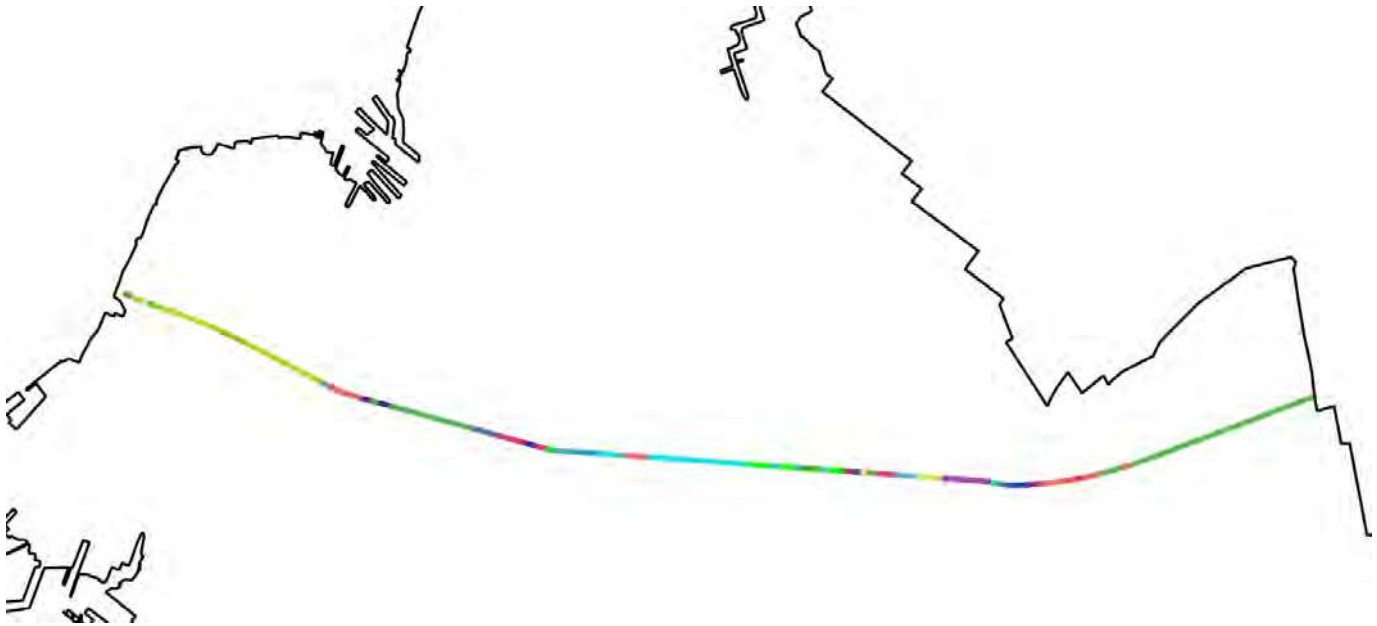
About the dataset

Road width
Injuries
Injuries per mile

Source: LION dataset, NYCDCP

About the dataset

- Each corridor is divided into several groups.
- The group is changed wherever the street width changes significantly.
- And, the total injuries in that group or segments divided by mileage of the group is **injuries per mile**.

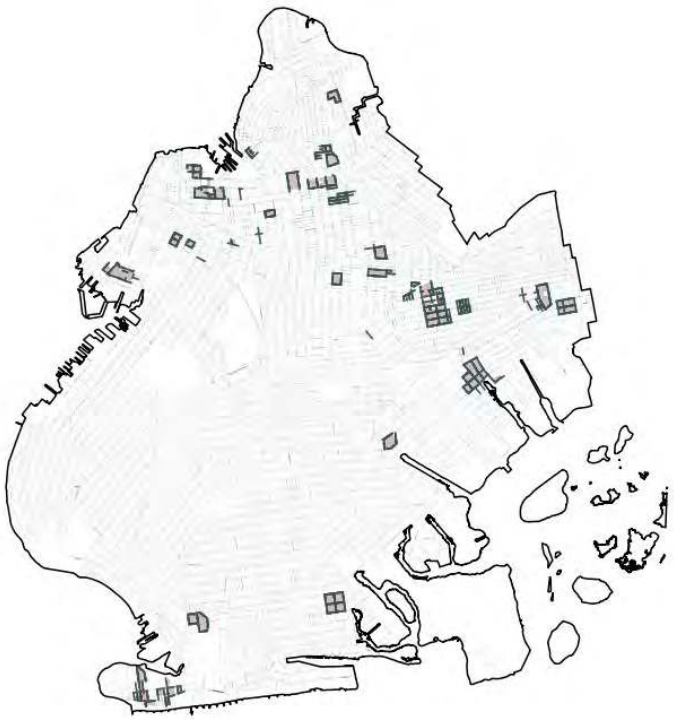


Example of groups on Atlantic Avenue

Proximity

Three categories

1. Adjacent to NYCHA campuses



Proximity

Three categories

1.Adjacent to NYCHA campuses

2. One mile from NYCHA campuses

Proximity

Three categories

N

1.Adjacent to NYCHA campuses

2. One mile from NYCHA campuses

3. Beyond one-mile of NYCHA campuses

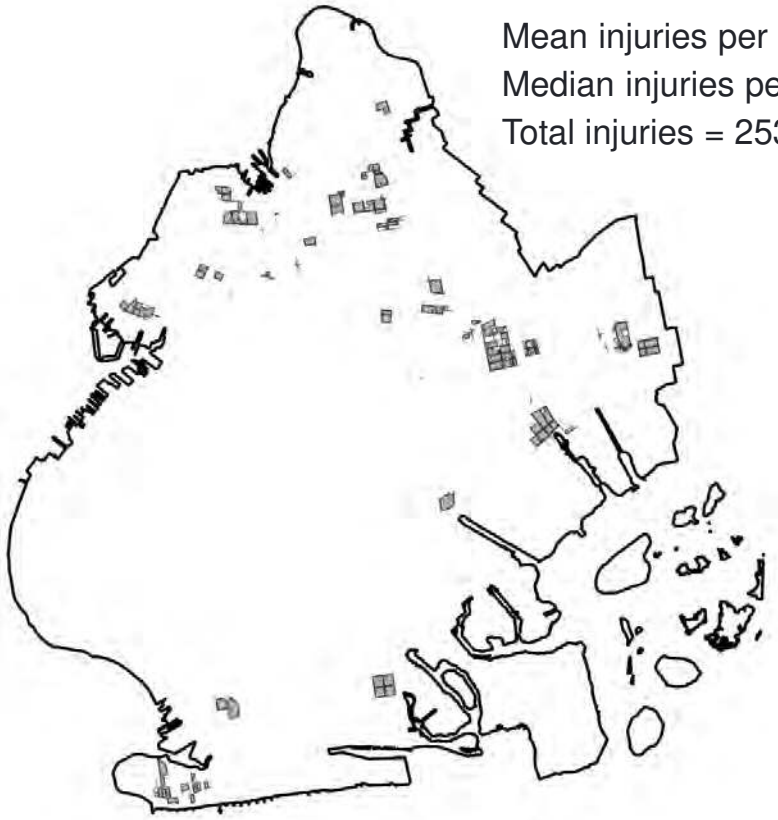
Analysis

Analysis

The Immediate-Adjacent Comparison Is **Mixed**

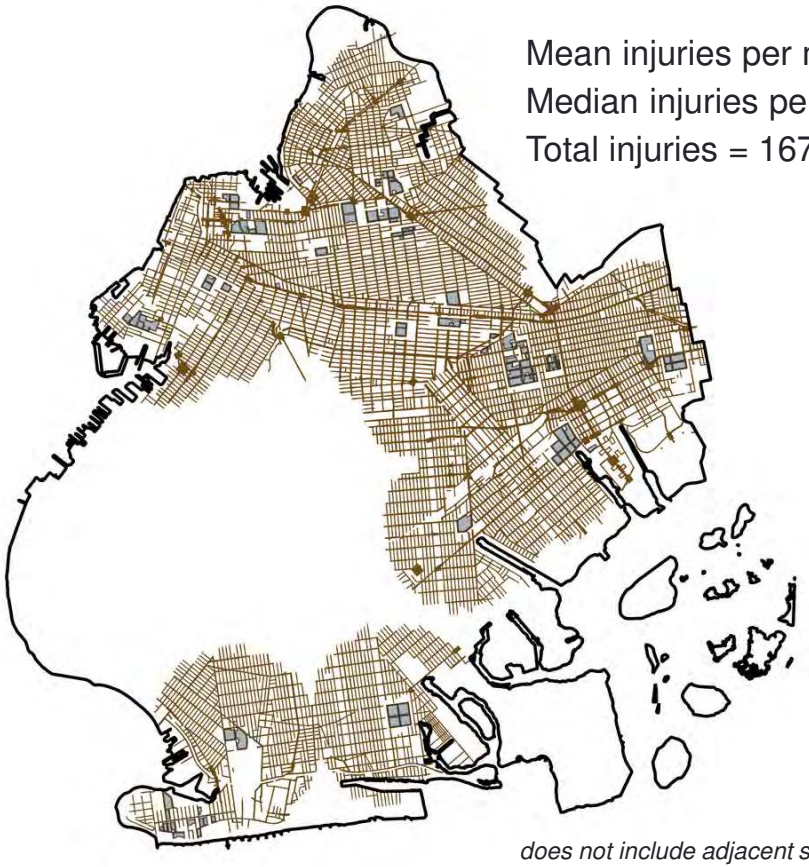
N

Adjacent



Mean injuries per mile **131.4**
Median injuries per mile **106.0**
Total injuries = 2534

One-mile radius



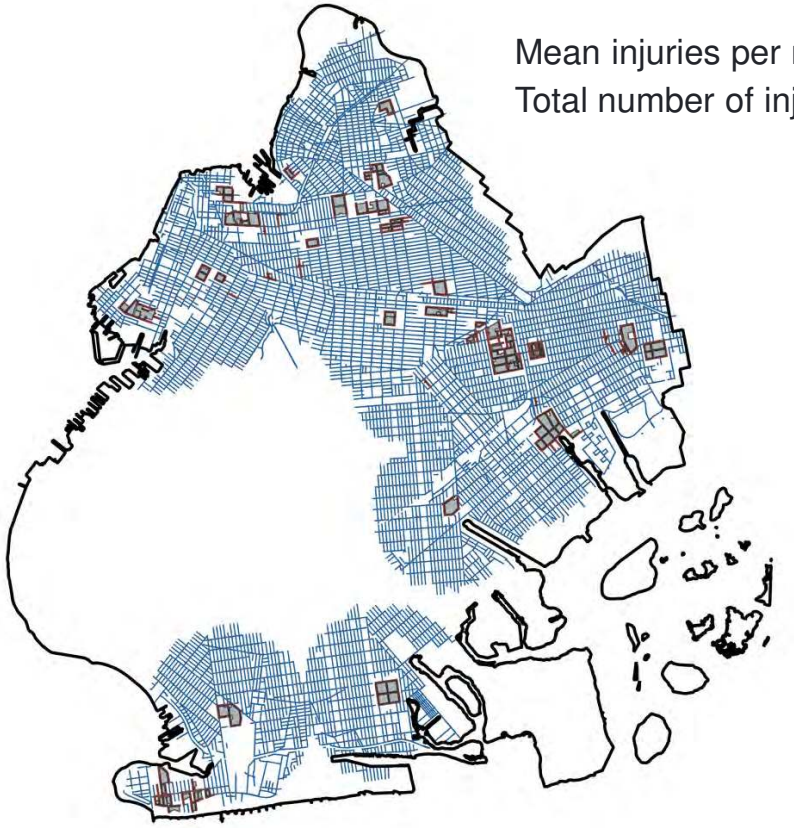
Mean injuries per mile = **141.4**
Median injuries per mile = **90.8**
Total injuries = 16746

does not include adjacent segments

Average Injuries per mile Is Higher Within One Mile

N

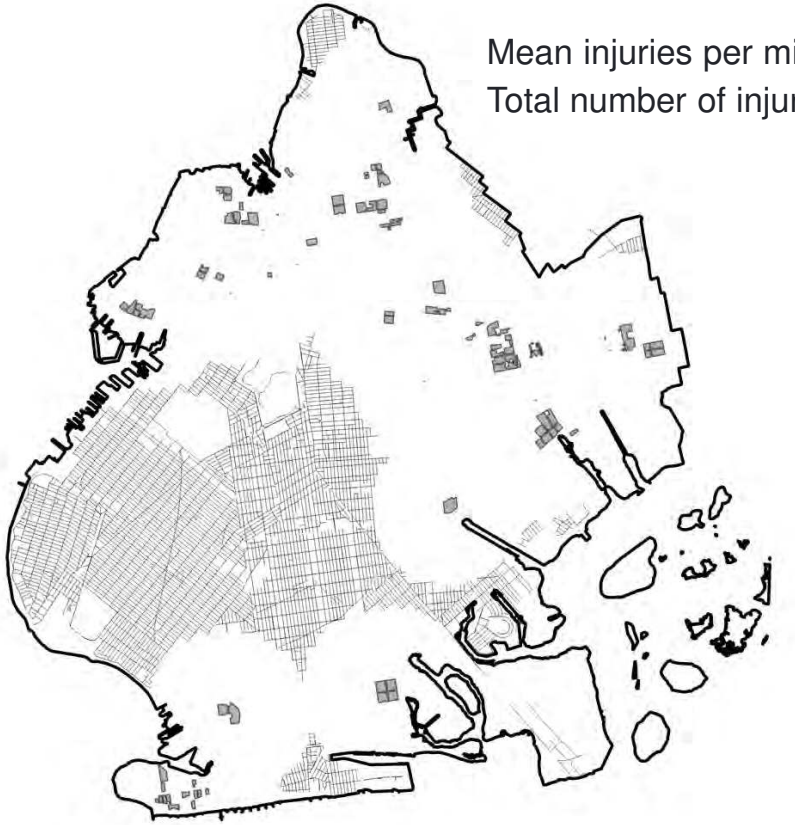
Within one mile



Mean injuries per mile = **140.1**
Total number of injuries = 19280

includes adjacent segments

Beyond one mile

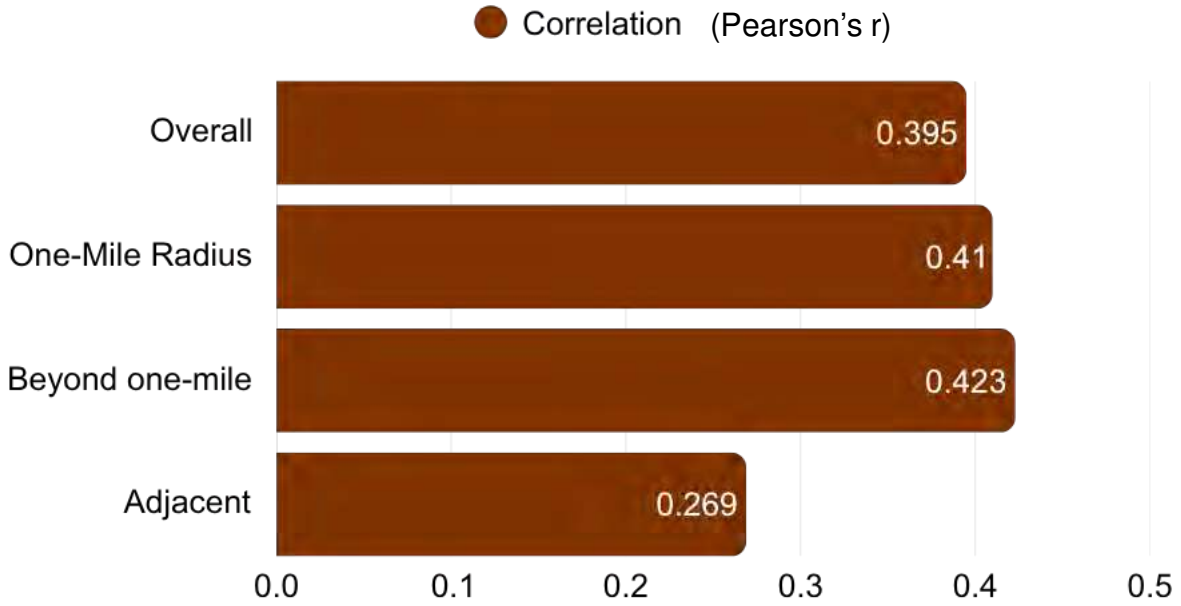


Mean injuries per mile = **99.1**
Total number of injuries = 8378

Do wider segments tend to have higher injury rates?

Correlation between width and injuries per mile

Across the dataset, the relationship between road width and injuries per mile is positive in every group -- but not equally strong!



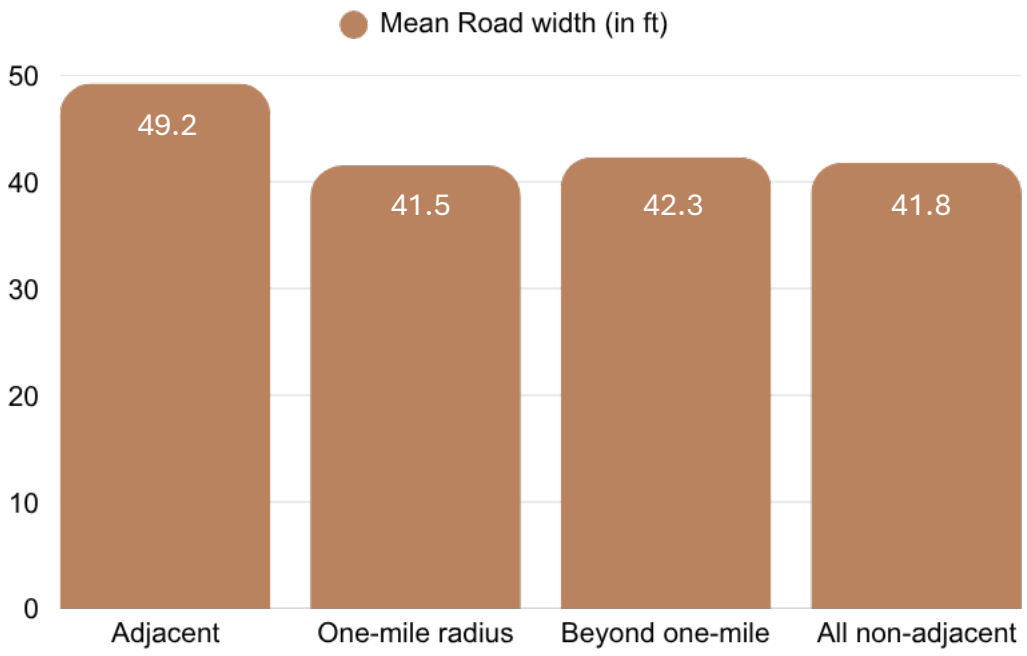
Adjacent segments show the weakest correlation at r = **0.269**.

The positive relationship appears in **every group**, but the strength varies.

This is a descriptive relationship, not evidence of causation.
Road width and injuries per mile may both reflect traffic volume, roadway classification, or land use.

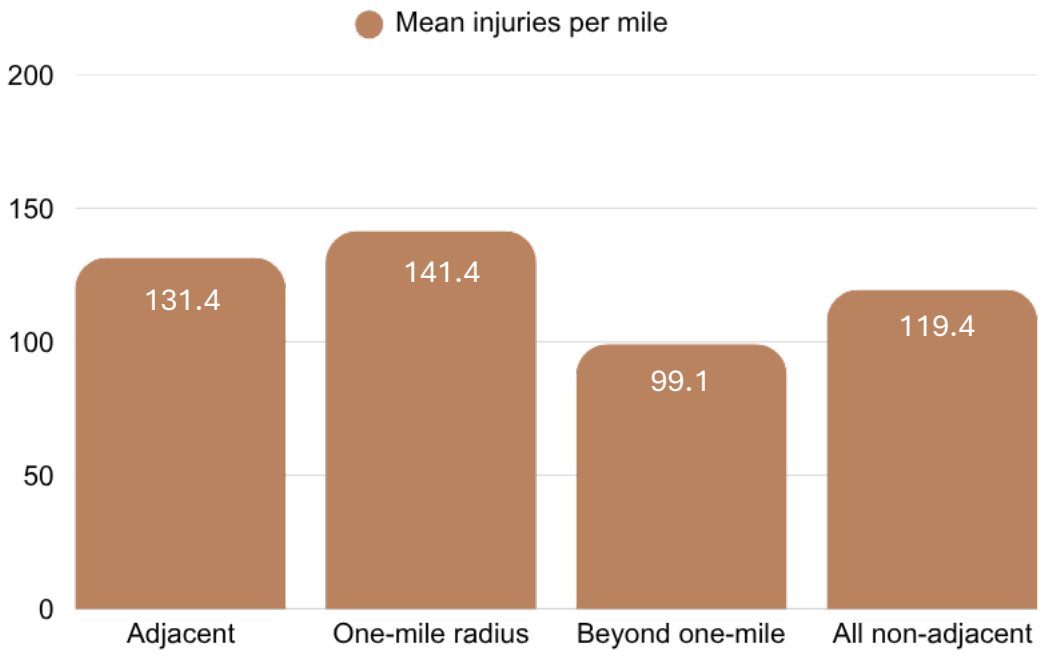
Road width around NYCHA

- Adjacent NYCHA segments are **wider on average** than nearby and non-adjacent comparison segments.
- On an average, road segments adjacent to NYCHA are the widest with mean road width **49.24 feet.**
- That puts adjacent segments notably above the one-mile radius, beyond-one-mile, and all non-adjacent comparison groups.



Injuries per mile average

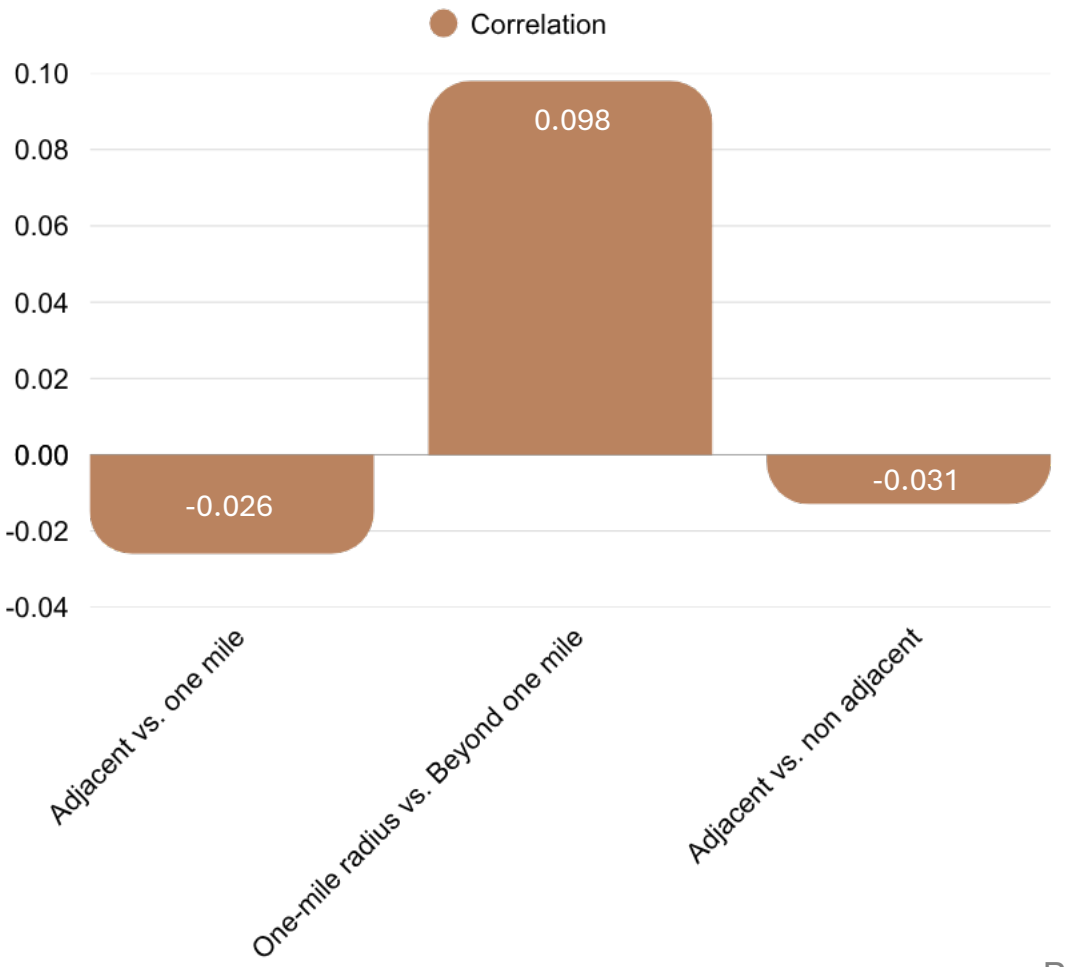
- The highest rate of injuries per mile is for the segments that are within a one-mile radius of NYCHA campuses at 141.4 injuries per mile.



Correlation between injuries and proximity to NYCHA

Correlation between

- Segments adjacent to NYCHA and within one mile radius is -0.026
- Segments within one mile radius and beyond one mile is 0.098
- Segments adjacent to NYCHA and not adjacent to NYCHA is -0.013



Correlation between injuries and proximity to NYCHA

Correlation between

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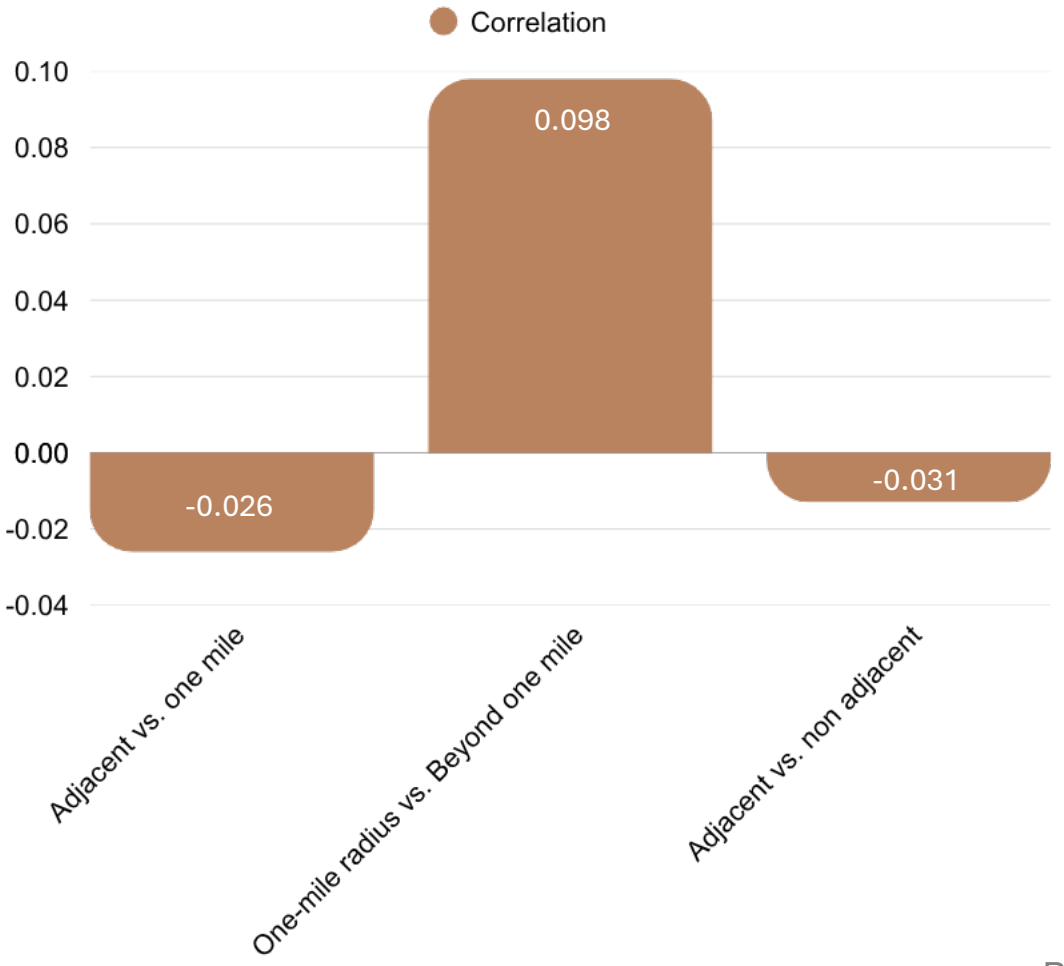
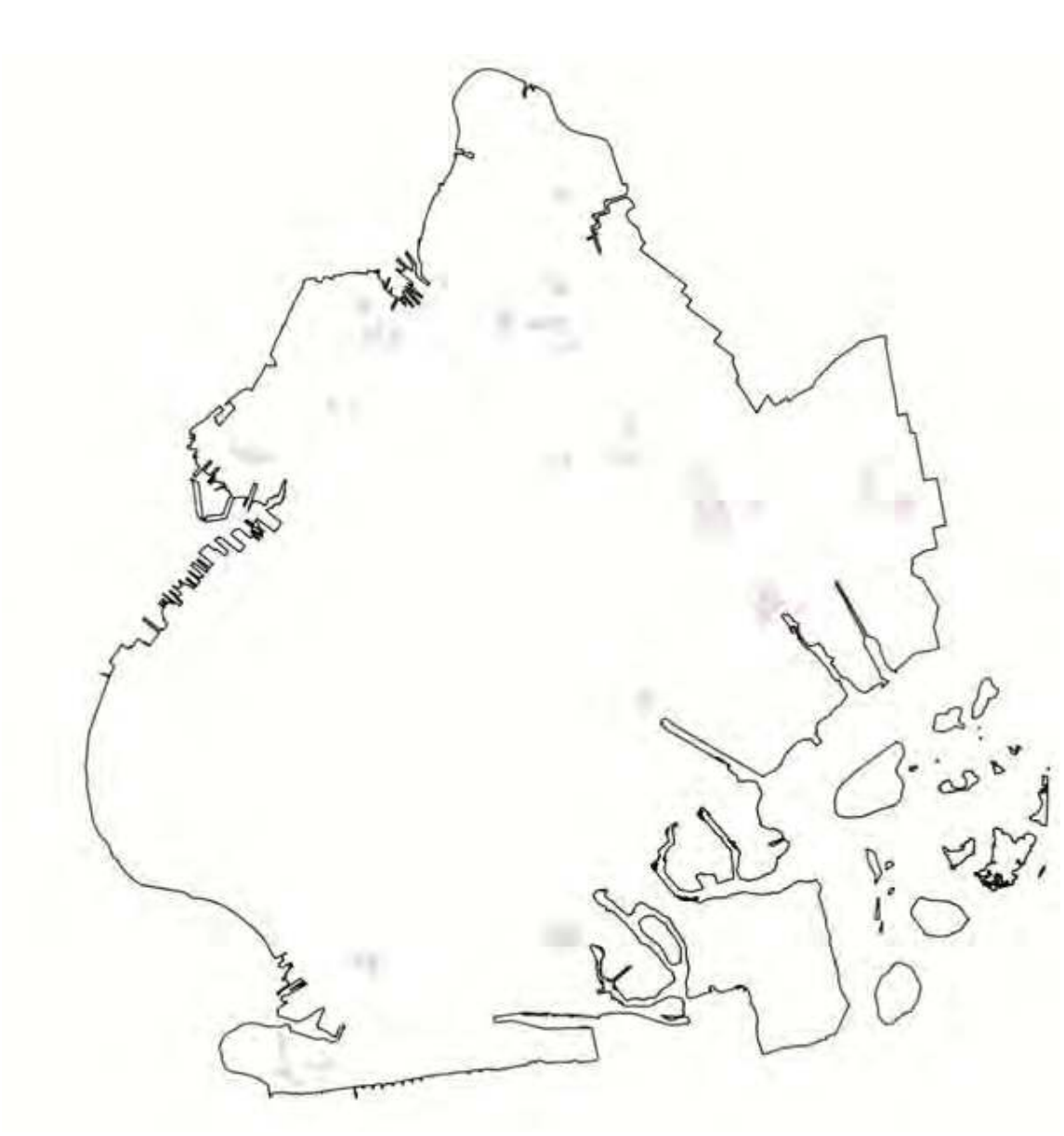
- Segments adjacent to NYCHA and not adjacent to NYCHA is -0.013

In this case, we fail to reject the null hypothesis that injuries and proximity to NYCHA are correlated.



Adjacent segments extended to 1 mile



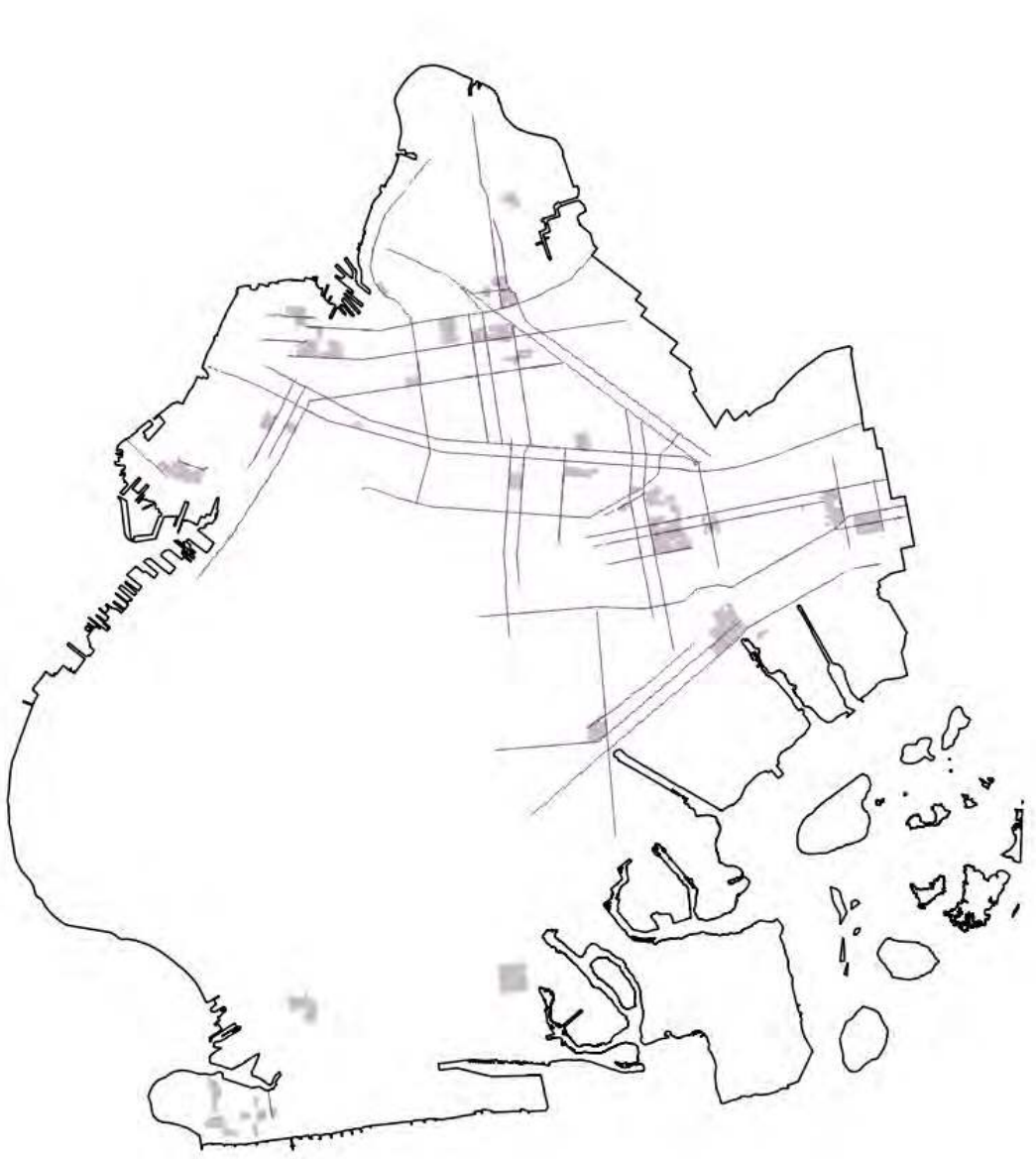
Adjacent segments extended to 1 mile

Mean injuries per mile **301**
Median **176.64**
Mean road width **52.87 ft**

Adjacent segments extended to 1 mile by percentile by segment

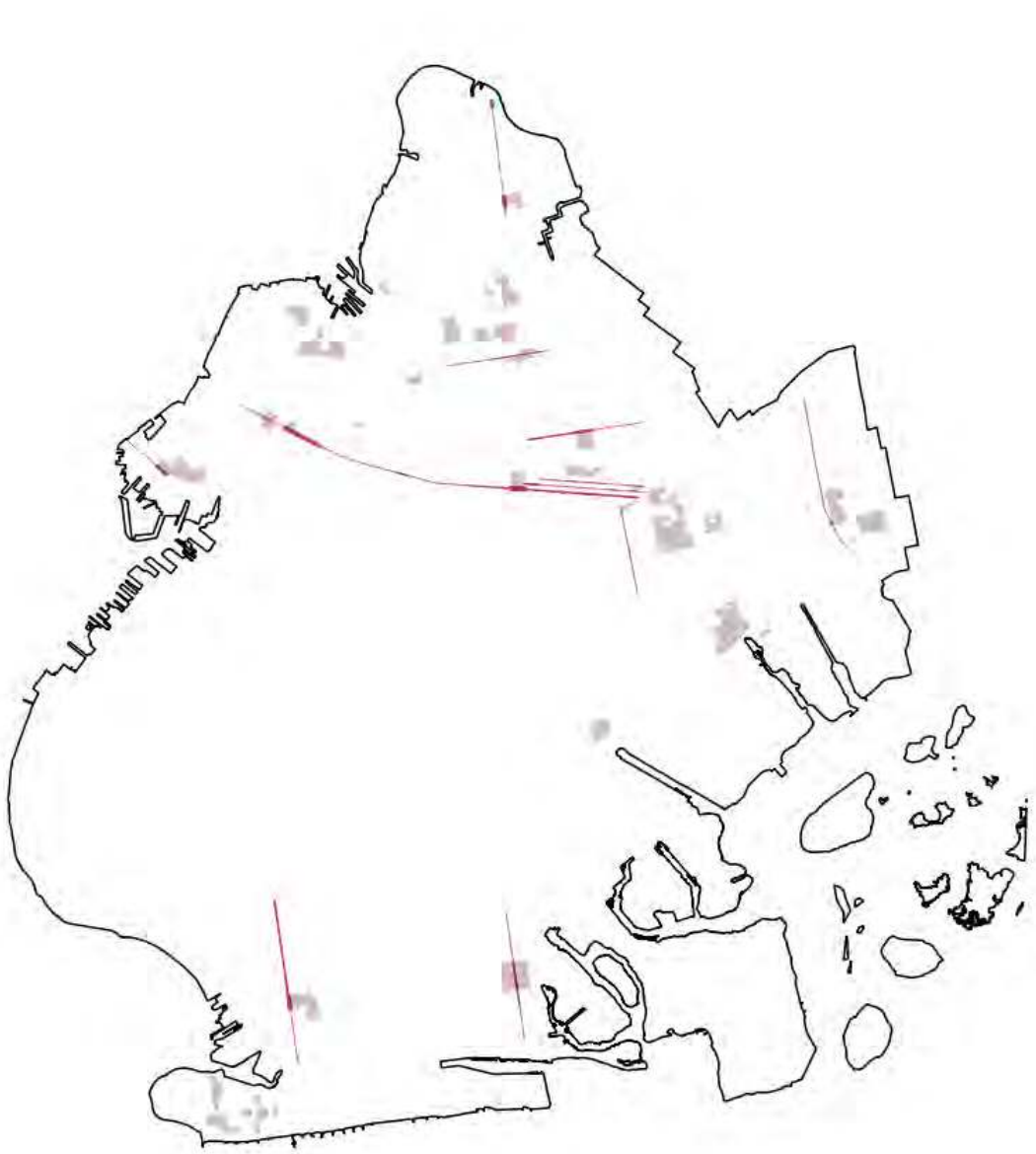
Adjacent segments extended to 1 mile by percentile by corridor

Top 20 percentile corridors based on injury rates



Adjacent segments extended to 1 mile by percentile

Corridors that have the most risk around NYCHA campuses and need to be focused on for future interventions



Conclusion

Adjacent Segments Are Wider

NYCHA-adjacent street segments are wider than nearby and non-adjacent comparison segments.

Injury Burden Varies by Zone

Higher within one mile than beyond; the immediate-adjacent comparison is mixed and distribution-sensitive.

Potential next steps would be to look at other factors like road density, traffic volumes on the corridors with highest injury rates and focus on the corridors that are within a one-mile radius of NYCHA campuses.

Quick recap and what I learned

- Built a reproducible workflow on Python that converts raw traffic volumes counts into processed 15-minute intervals to understand each corridor in a project.
- Learned how to look at corridors from a road safety perspective and identified the key factors for improving road safety like road width, traffic exposure, existing injury rates and types of injuries.
- Learned that data preparation choices shape what can be tested and how the results could be interpreted.
- A rejected hypothesis is still informative as it rules out one expected relationship and points us towards other factors.
- Everything is spatial and most questions can be answered by examining the data available.

Thank you!

NYC DOT | NYC DOT | nyc_dot | NYC DOT

Turning NYC Camera Views into Reliable Citywide Traffic Counts

From fragmented video to a repeatable, auditable workflow that can scale across camera locations

August 11, 2026

NEW YORK CITY DOT

Acknowledgment

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Master's Student

City College of New York

Traffic counting already spans multiple programs

Traffic counting is already a multi-program operation — vehicle classification is one part of a larger count ecosystem.

ATR Automated Traffic Recorders

VCC Vehicle Classification Counts

BIKE Bicycle & Micro mobility Counts

PED Pedestrian Counts

SPEED Spot Speed Counts

TMC Turning Movement Counts

WIM Weigh in Motion

CONT Continuous Counts

PARTNERS Data from Partners

The vehicle-classification workflow must fit into a broader, already-established count program.

From a working algorithm to an operational workflow

Operational scale requires three layers to work together — not just one successful computer-vision model.

Data Infrastructure

organize video, ground truth, metadata, and outputs

→

Compute Infrastructure

process large video volumes reliably and efficiently

→

Operational Scale

repeat the workflow across locations, time periods, and users

Scaling the demo means solving data structure, compute, and operations as one connected system.

Vehicle classification is a clear near-term automation opportunity

The scale of manual video review makes efficiency, consistency, and repeatability operational priorities.

~$1,000,000

Estimated annual program cost

total vehicle classification count program

~$800,000

Manual video review

80% of total — the primary automation target

~$3,000 / site

Cost per location

200–400 annual locations

The automation opportunity is not abstract: most program cost is tied directly to manual video review.

DOT already has a strong data foundation for testing at scale

Existing videos and validated counts create an unusually strong base for building and testing a scalable workflow.

2,000+

VCC counts — last 5 years

each with ≥24 hrs of video + validated classification counts

~10,000

All count types

VCC + PED + BIKE + TMC video-count pairs across the full count program

A scalable system can build on years of paired video and count records rather than starting from zero.

The prototype shows the concept works in one camera view

The prototype brings the main operational signals together so results can be seen and checked directly.

01 Vehicle labels

02 Counting line

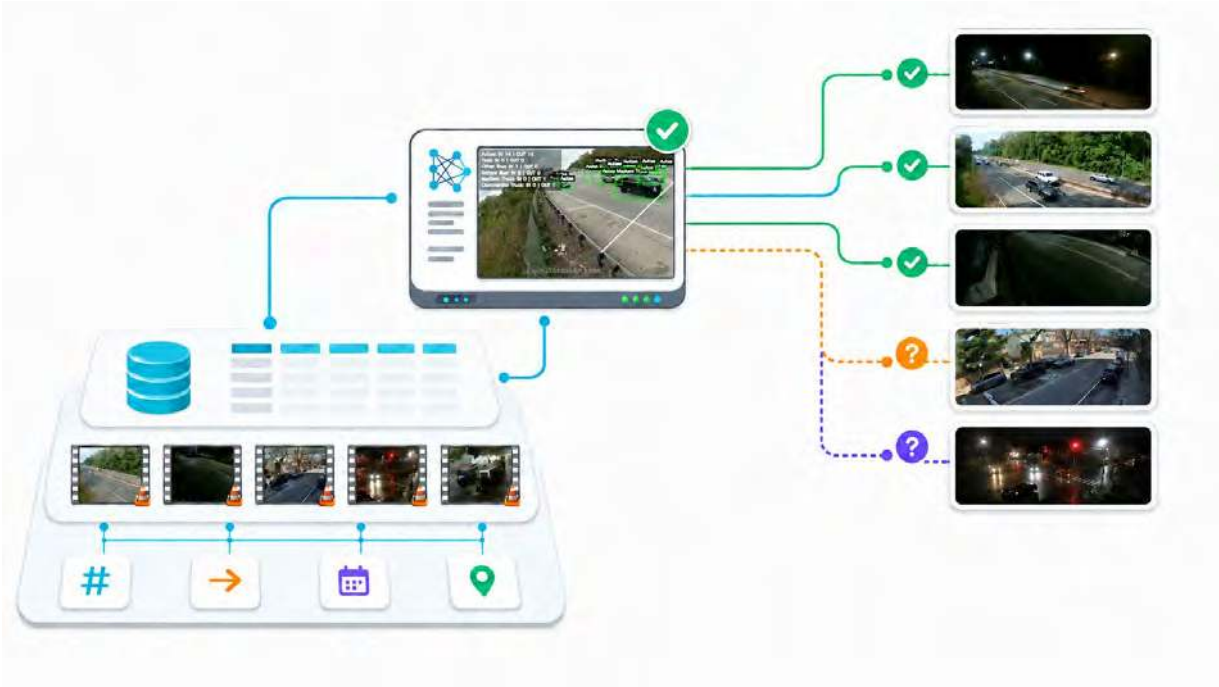
03 Class totals

04 IN / OUT totals

The next challenge is not simply detecting vehicles — it is turning the demo into a repeatable agency workflow.

The foundation is in place

The data, ground truth structure, and a working prototype exist. The remaining challenge is reliability across many different camera views.



What Part I has established:

- **Data foundation**

  linked videos, metadata, and validated count records

- **Working prototype**

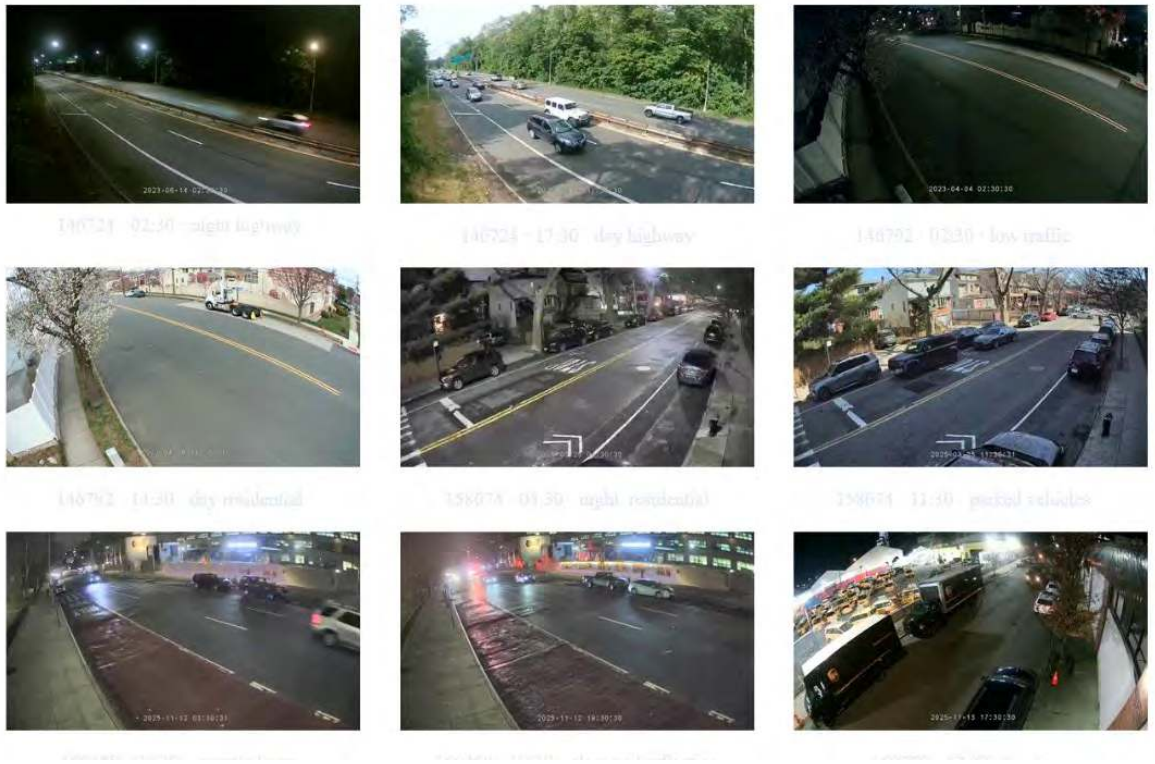
  automated classification counting can be demonstrated and reviewed

- **Scale requirement**

  the workflow must adapt across camera views without repeated setup

Challenge 1: every camera is a different counting environment

Citywide deployment must handle changing geometry, visibility, traffic mix, and ground-truth alignment.



01 **Viewpoint changes**

height, angle, distance from road, lane geometry

02 **Visibility changes**

trees, glare, night, rain, shadows, occlusion

03 **Traffic behavior changes**

turns, queues, buses, trucks, taxis, mixed flows

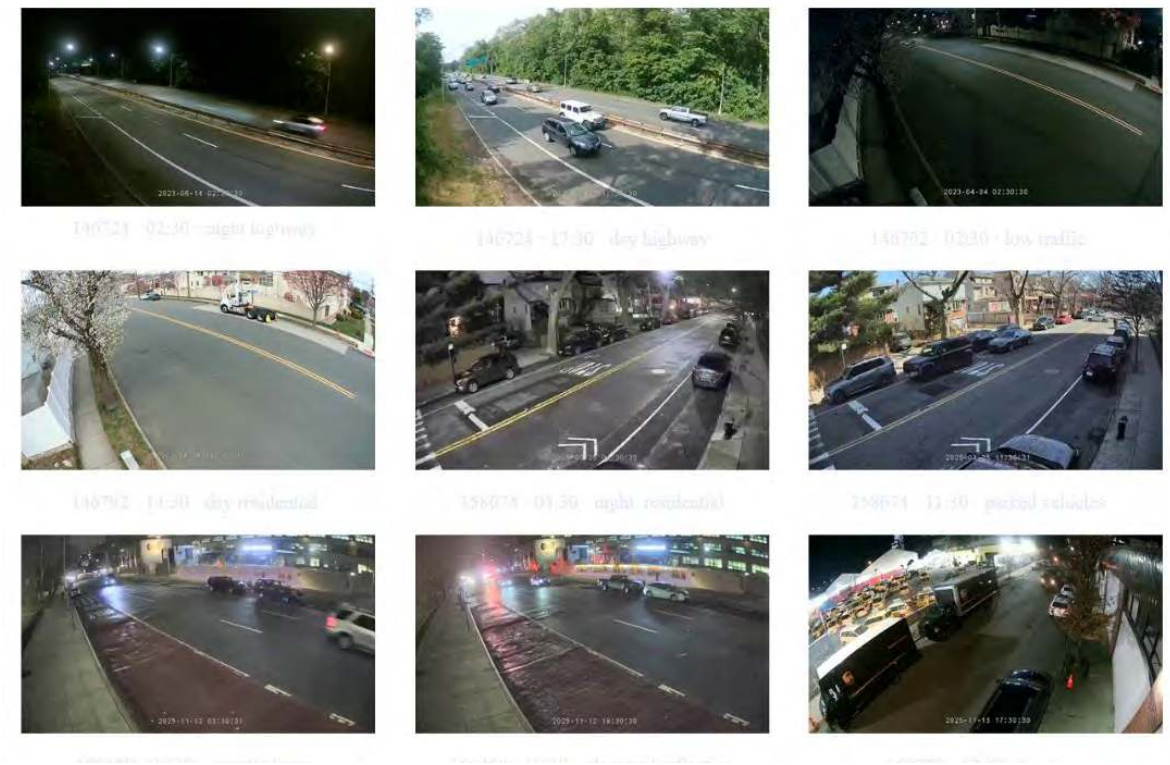
04 **Ground-truth alignment changes**

location, time interval, direction, and class mapping

The workflow has to adapt to the camera view before the counts can scale across the city.

App response: adapt to real city conditions

It adapts to conditions that change from one camera to another and from one time period to another.



Camera angle — count zone is calibrated per view

Visibility — candidate zones are screened for occlusion risk

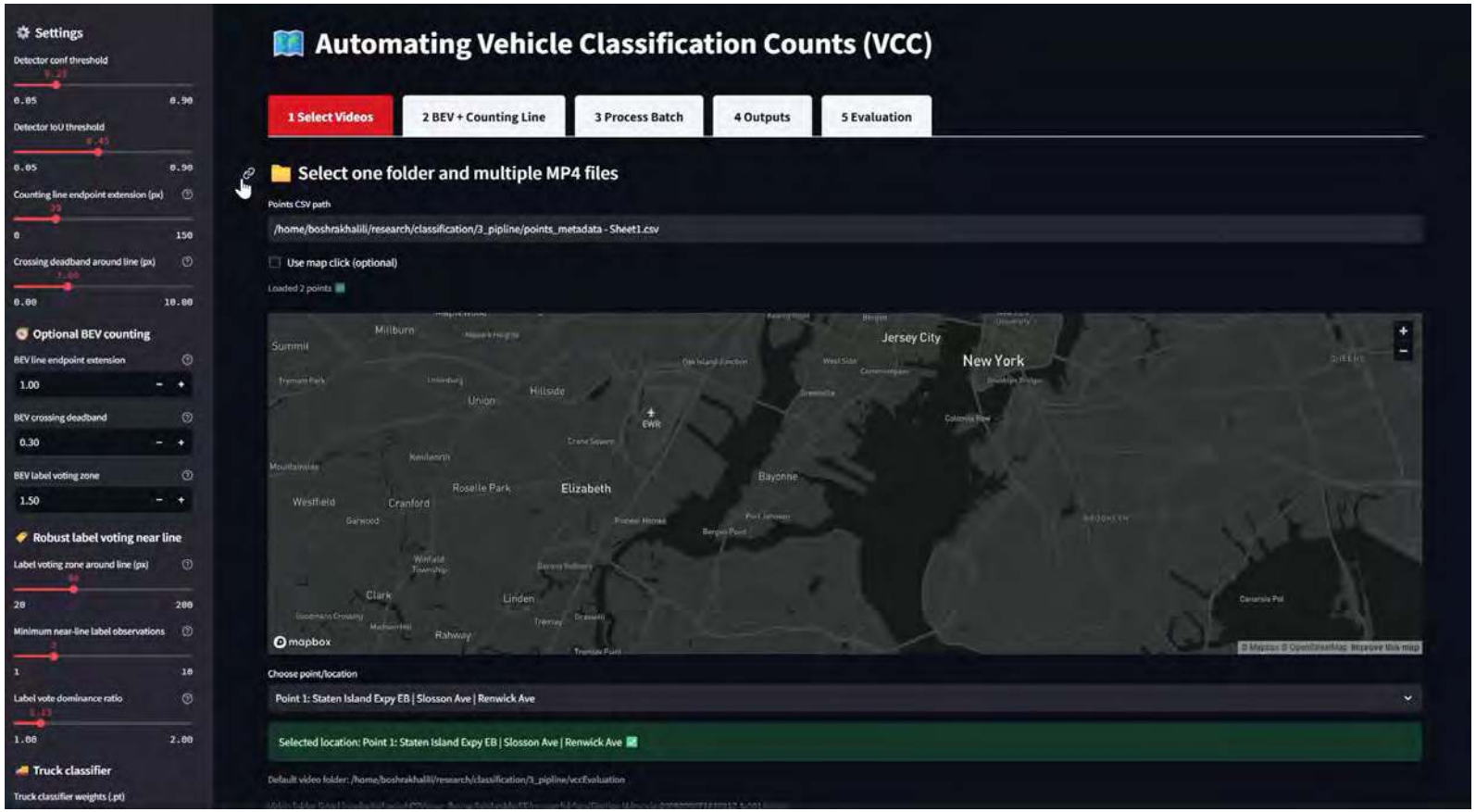
Vehicle mix — report classes support cars, taxis, buses, and trucks

Time variation — same setup can process different clips from one camera

Scale comes from a repeatable process that adjusts to local camera conditions.

App tool — Select the location and batch

Group clips from one camera view so they share one calibration.



App response: choose the most countable zone

The workflow recommends a reliable zone from the evidence available in that specific scene.

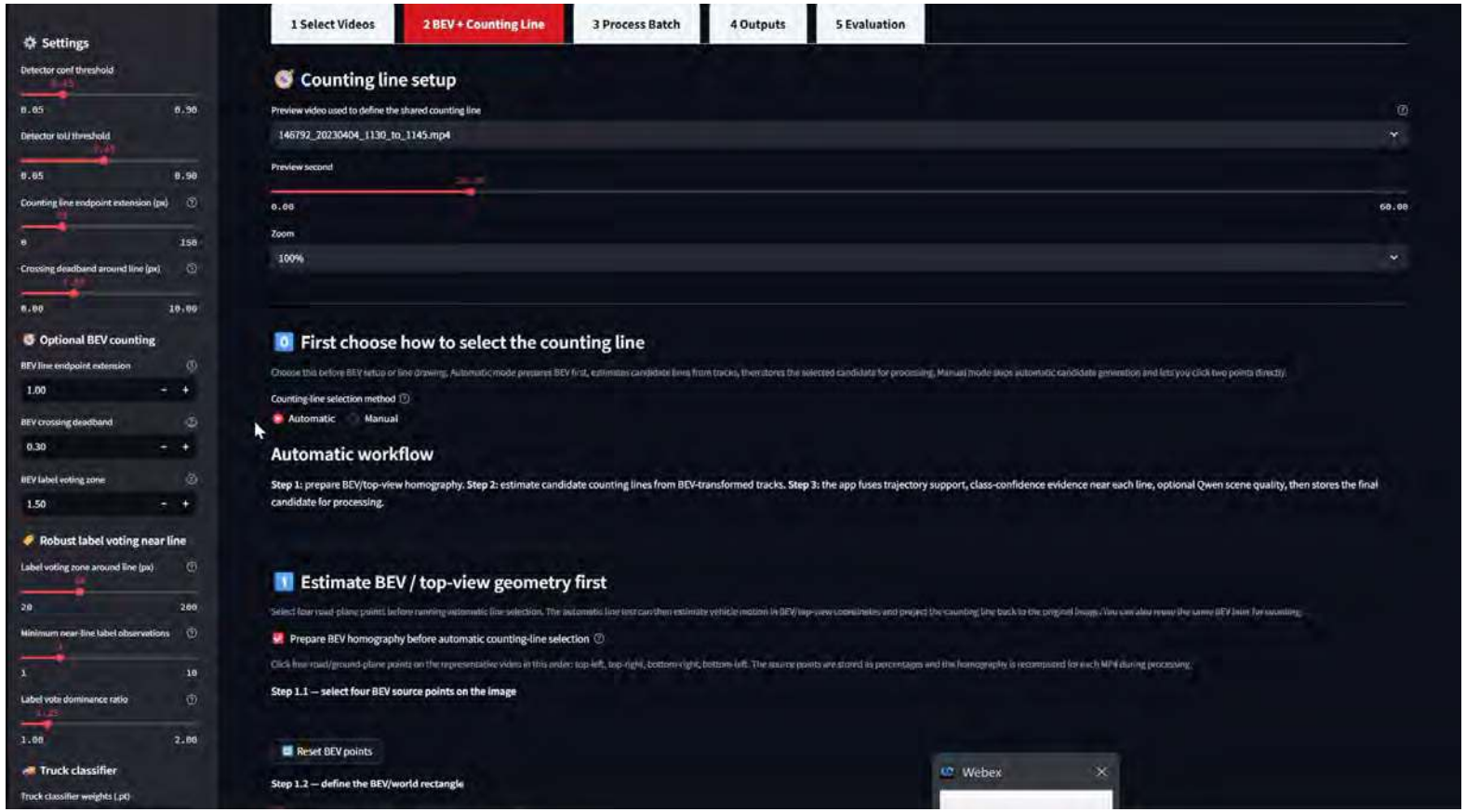
A strong counting zone should have:

- **Clear crossings**
  vehicles move through the zone instead of skimming the edge
- **Good visibility**
  less tree cover, glare, shadows, or parked-vehicle blockage
- **Stable class evidence**
  labels are consistent near the crossing zone
- **Reusable geometry**
  the saved zone applies to repeated clips from that camera

The output is a reusable camera calibration — not just an automatically drawn line.

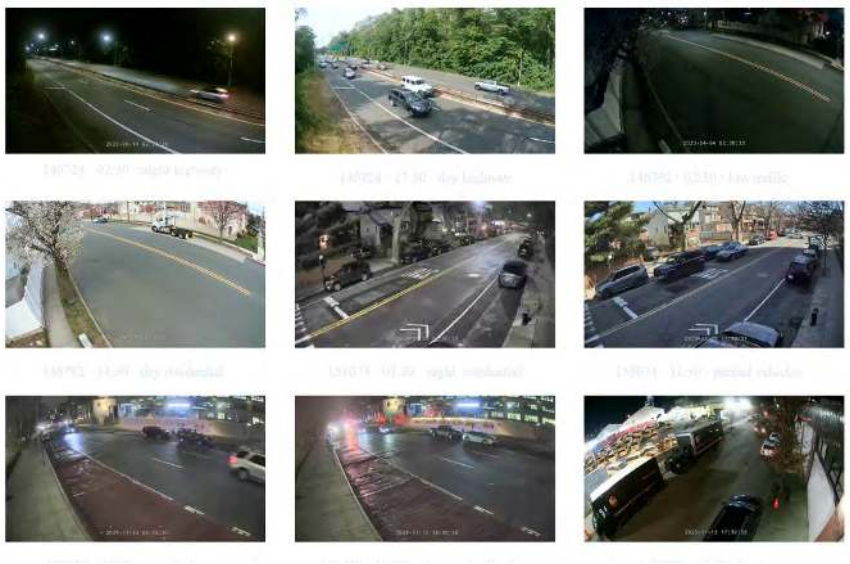
App tool — Calibrate the counting zone

Define or confirm one reusable counting zone for the camera view.



Challenge 2: repeated setup creates scaling risk

When every view requires new manual choices, small setup differences become operational inconsistency.



If setup is repeated manually:

line placement changes

class labels become unstable

review burden grows

Different camera views

Repeated manual choices

Inconsistent counts

Citywide scaling means reducing repeated decisions, not simply running the model faster.

App response: calibrate once, then process many clips

Treat camera setup as a reusable location asset rather than a per-video task.

1

Select location

group clips from the same camera view

2

Calibrate view

choose a reliable counting zone

3

Process batch

run all clips with the same setup

4

Review evidence

inspect videos, errors, and debug files

5

Export package

counts, summaries, metadata, ZIP

Operational model: one camera-specific calibration supports many time periods.

App response: turn repeated clips into comparable counts

After a camera is calibrated, each clip is processed independently while sharing the same counting setup.

Finished 146792_20230404_1145_to_1200.mp4

	geometry	class	IN	OUT	crossings
0	IMAGE	Autos	77	73	150
1	IMAGE	Taxi	0	0	0
2	IMAGE	Other Bus	1	0	1
3	IMAGE	School Bus	0	0	0
4	IMAGE	Medium Truck	3	4	7
5	IMAGE	Commercial Truck	1	3	4

Batch processing status

	status	video_file	error
0	done	146792_20230404_1130_to_1145.mp4	
1	done	146792_20230404_1145_to_1200.mp4	

Batch count totals from processed CSVs

	video_file	class_name	IN	OUT	total_crossings
2	146792_20230404_1130_to_1145.mp4	Other Bus	1	0	1
3	146792_20230404_1130_to_1145.mp4	School Bus	0	0	0
4	146792_20230404_1130_to_1145.mp4	Medium Truck	1	4	5
5	146792_20230404_1130_to_1145.mp4	Commercial Truck	1	3	4
6	146792_20230404_1145_to_1200.mp4	Autos	77	73	150
7	146792_20230404_1145_to_1200.mp4	Taxi	0	0	0
8	146792_20230404_1145_to_1200.mp4	Other Bus	1	0	1
9	146792_20230404_1145_to_1200.mp4	School Bus	0	0	0
10	146792_20230404_1145_to_1200.mp4	Medium Truck	3	4	7
11	146792_20230404_1145_to_1200.mp4	Commercial Truck	1	3	4

What becomes easier:

- **Same geometry**
  all clips from one view use the same calibrated zone
- **Separate outputs**
  each video gets its own count, video, and evaluation files
- **Combined summary**
  multiple clips can be reviewed in one package
- **Time comparisons**
  morning, afternoon, and different dates become comparable

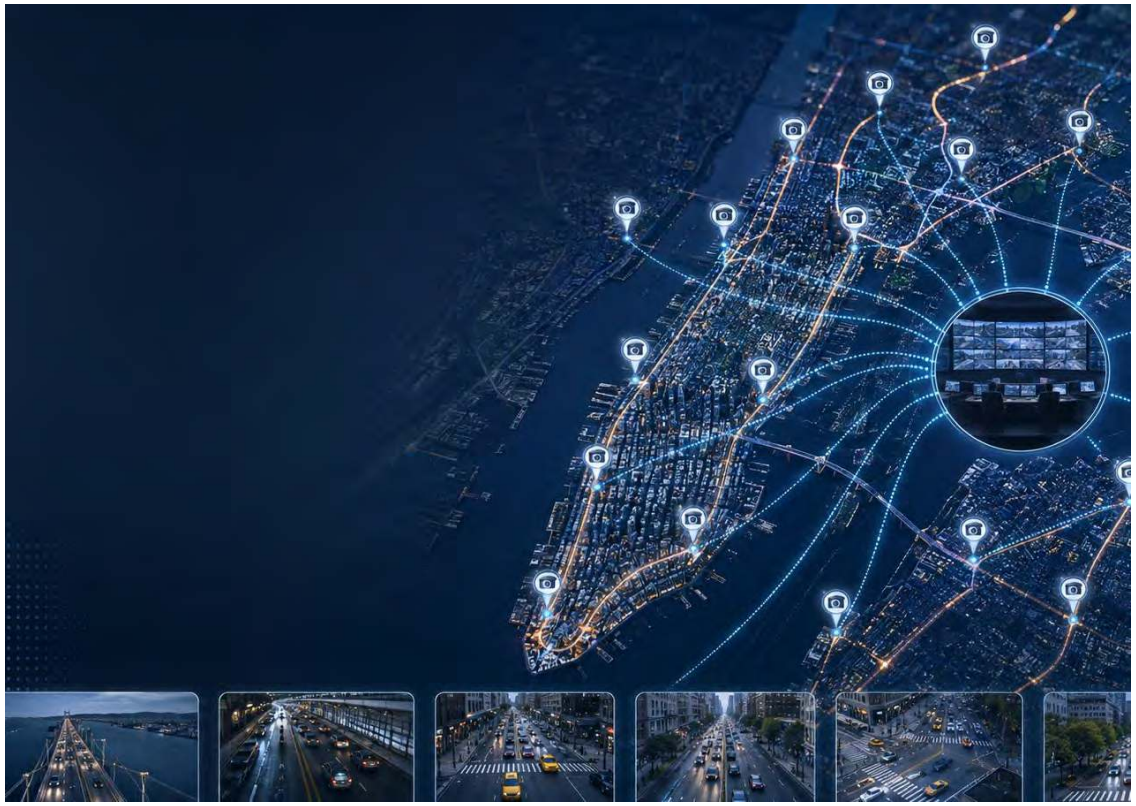
The city-scale benefit is consistency over time, not automation for one clip.

App tool — Process the batch

Run every selected clip with the same geometry and class logic.

Challenge 3: every count needs traceable evidence

When a count looks high, low, or different from ground truth, reviewers should be able to trace exactly where it came from.



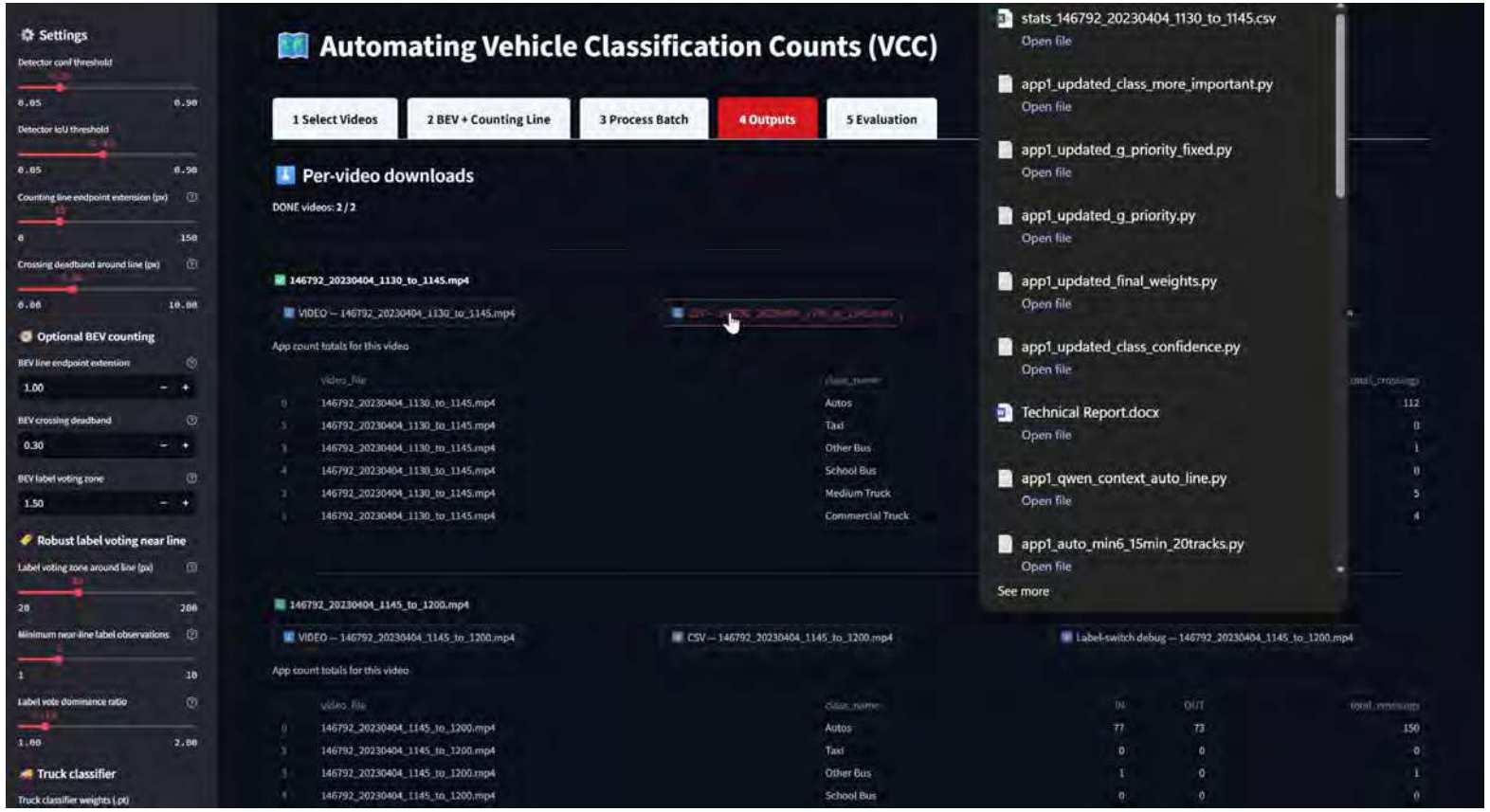
Annotated video	see detections, tracks, zone, and crossings
Prediction CSVs	counts by class, direction, and interval
Evaluation files	compare predictions with ground truth
Debug artifacts	line scores, direction assignment, label switching, metadata

This makes the output auditable and easier to improve.

A defensible workflow explains both the number and the evidence behind it.

App tool — Review and export outputs

Package annotated videos, counts, debug files, and summaries.



App tool — Review and export outputs

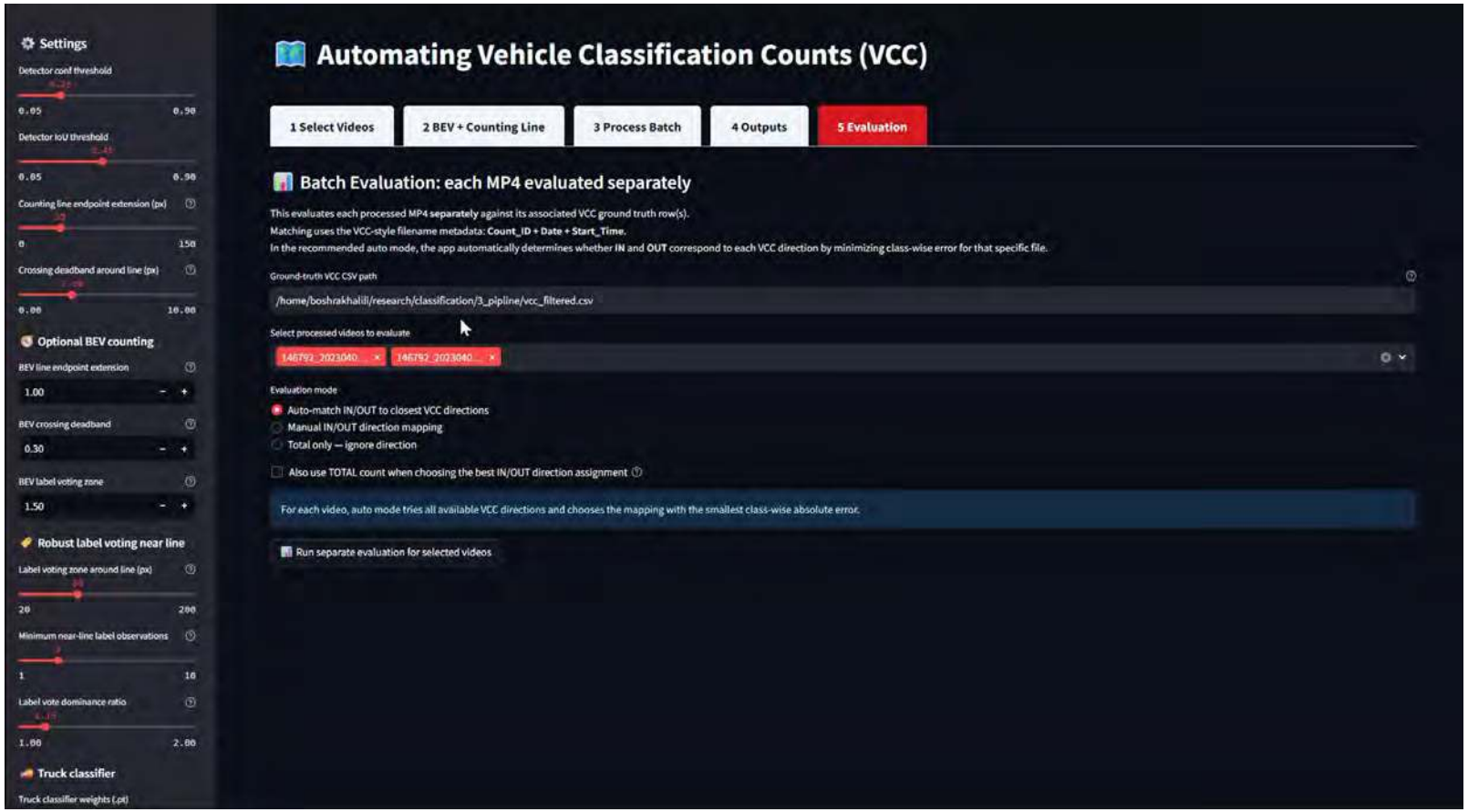
Package annotated videos, counts, debug files, and summaries.

video_file	segment_i	fps	interval_s	interval_ir	interval_s	interval_e	line_start_	line_start_	line_end_	line_end_	counting_	use_bev_c	line_start_	line_start_	line_end_	line_end_	class_nam	in_count	out_count	total_crossings
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Autos	21	16	37
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Taxi	0	0	0
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Other Bus	0	0	0
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	School Bu	0	0	0
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Medium T	0	3	3
146792_2	146792_2	30	300	0	0	300	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Commerci	0	0	0
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Autos	19	14	33
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Taxi	0	0	0
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Other Bus	1	0	1
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	School Bu	0	0	0
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Medium T	0	0	0
146792_2	146792_2	30	300	1	300	600	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Commerci	1	1	2
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Autos	20	22	42
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Taxi	0	0	0
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Other Bus	0	0	0
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	School Bu	0	0	0
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Medium T	1	1	2
146792_2	146792_2	30	300	2	600	899.9907	1394	1	45	733	IMAGE	FALSE	1394	1	45	733	Commerci	0	2	2

video_file	track_id	counting_	crossing_f	stable_co	near_line	label_unic	label_switch_count	best_vote	second_vote	vote_margin_ratio	label_votes
146792_20230404_1145_to_1200.mp4	36	IMAGE	Autos	Autos	10	2	2	5.245514058	0.413991845	12.67057341	Autos:5.246;Commercial Truck:0.414
146792_20230404_1145_to_1200.mp4	196	IMAGE	Medium T	Autos	10	3	4	3.850308968	0.590218956	6.523526449	Autos:3.850;Commercial Truck:0.590;Medium Truck:0.425
146792_20230404_1145_to_1200.mp4	240	IMAGE	Commerci	Commerci	11	2	3	3.666849701	2.413948727	1.519025512	Commercial Truck:3.667;Autos:2.414
146792_20230404_1145_to_1200.mp4	266	IMAGE	Medium T	Autos	11	2	1	4.105474318	1.202970844	3.412779568	Autos:4.105;Medium Truck:1.203
146792_20230404_1145_to_1200.mp4	369	IMAGE	Commerci	Commerci	10	2	3	3.549814947	2.0244247	1.753493201	Commercial Truck:3.550;Autos:2.024
146792_20230404_1145_to_1200.mp4	386	IMAGE	Autos	Autos	8	2	2	3.695407572	0.775138262	4.767417315	Autos:3.695;Medium Truck:0.775
146792_20230404_1145_to_1200.mp4	405	IMAGE	Commerci	Commerci	6	2	1	3.303759292	0.326868723	10.10729707	Commercial Truck:3.304;Autos:0.327
146792_20230404_1145_to_1200.mp4	461	IMAGE	Medium T	Autos	10	2	1	5.732702233	0.466814564	12.28046996	Autos:5.733;Medium Truck:0.467

App tool — Evaluate against ground truth

Compare by time interval, direction, and vehicle class.



Evaluation setup: varied real-world camera clips

The test set combines multiple camera views and dates, so the workflow is checked beyond a single easy example.

27
Video files

8
Recording dates

Oct 7 - Nov 20, 2025

View diversity different curbside, corridor, and intersection views

Temporal diversity clips span multiple recording dates and conditions

Evaluation alignment counts are compared by class, interval, and direction

The goal is to test repeatability across camera views, not only model performance on one clip.

Early results show strong total-volume agreement

Across matched vehicle classes, total volume is close to ground truth while class-level error highlights where review should focus.

2,259
Matched classes

2,250
Predicted total

0.40%
Overall APE

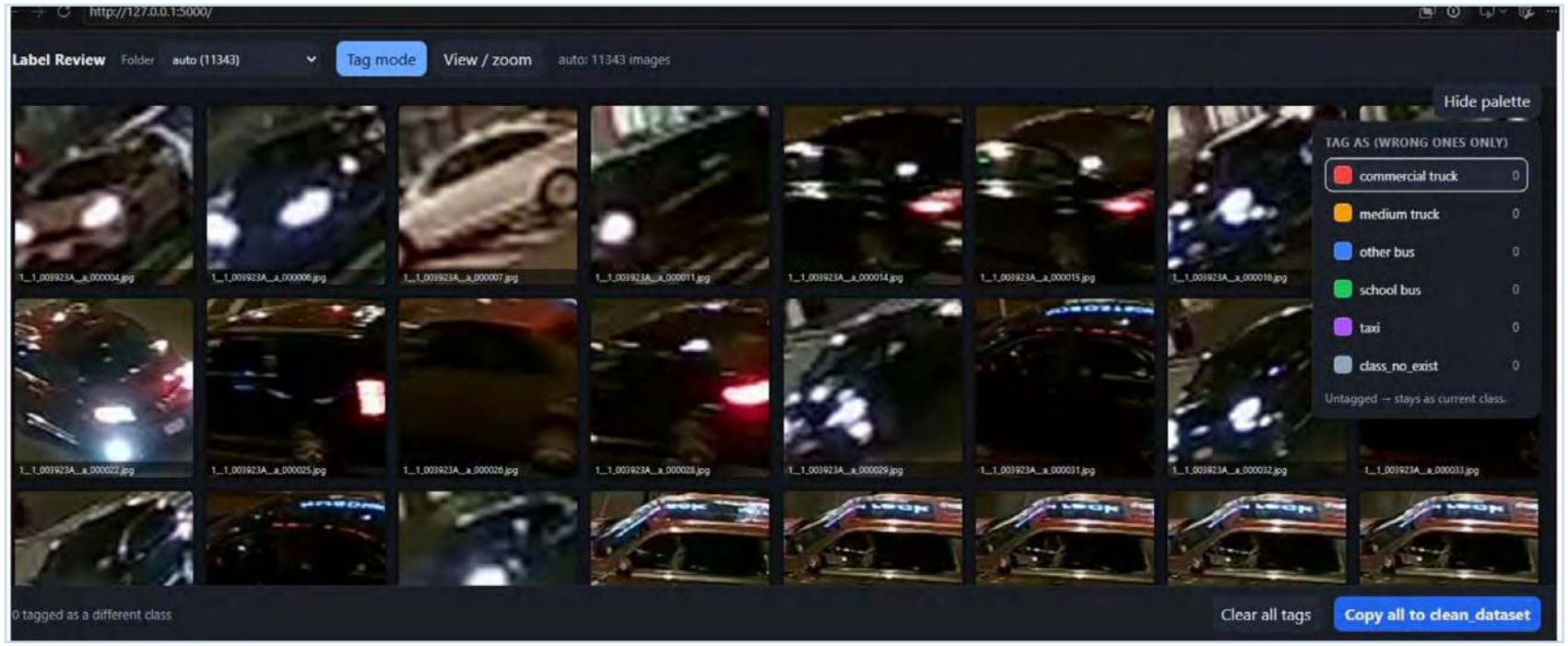
4.21%
Weighted APE

Vehicle class	Actual	Pred.	Error	Weight	Weighted APE
Autos	1,720	1,689	-31	0.7614	1.37%
Taxi	196	175	-21	0.0868	0.93%
Commercial Vehicle	158	166	+8	0.0699	0.35%
Medium + Heavy Truck	104	127	+23	0.0460	1.02%
School Bus	16	23	+7	0.0071	0.31%
Other Bus	65	70	+5	0.0288	0.22%
All vehicles	**2,259**	**2,250**	**-9**	**1.0000**	**4.21%**

Strong total-volume agreement; class-level review should target trucks, buses, and label ambiguity.

Ongoing work: faster review and cleaner class labels

A lightweight labeling tool supports human review of uncertain crops and feeds corrections back into the classification workflow.



1 **Review uncertain crops**

focus human time where class evidence is weak

2 **Tag only wrong labels**
correct commercial truck, bus, taxi, and no-class cases

3 **Improve next runs**
use reviewed crops to strengthen class consistency

The workflow improves over time when errors become structured review data instead of one-off fixes.

From working prototype to repeatable citywide workflow.

Three takeaways from moving automated traffic counting toward agency use

01 BUILD THE FOUNDATION

Standardize the data before scaling the AI.

Connect video, ground truth, time, direction, classes, and metadata in one repeatable structure.

02 DESIGN FOR VARIABILITY

Calibrate once Process many.

Adapt the counting setup to each camera view, then reuse it consistently across clips and time periods.

03 BUILD FOR TRUST

Every count should be measurable and traceable.

Keep predictions connected to annotated evidence, ground truth, evaluation results, and reviewable outputs.

NEXT MOVE
Establish the system in-house

Thank You!

Questions?

NEW YORK CITY DOT

nyc.gov/DOT

nyc_dot

nyc_dot

NYCDOT

NYCDOT

curb enthusiasm

An NYC DOT Podcast

Streets -to- Health

Reimagining city streets:
Street Project → Health

NYMTC Brown Bag
September 9, 2026

Sabah Usmani
PhD (Environmental Health Sciences)
Columbia University Mailman School of Public Health
NYMTC 9/11 Fellow (NYC DOT)
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Associate Professor | Biostatistics, Computer Science & Engineering | NYU

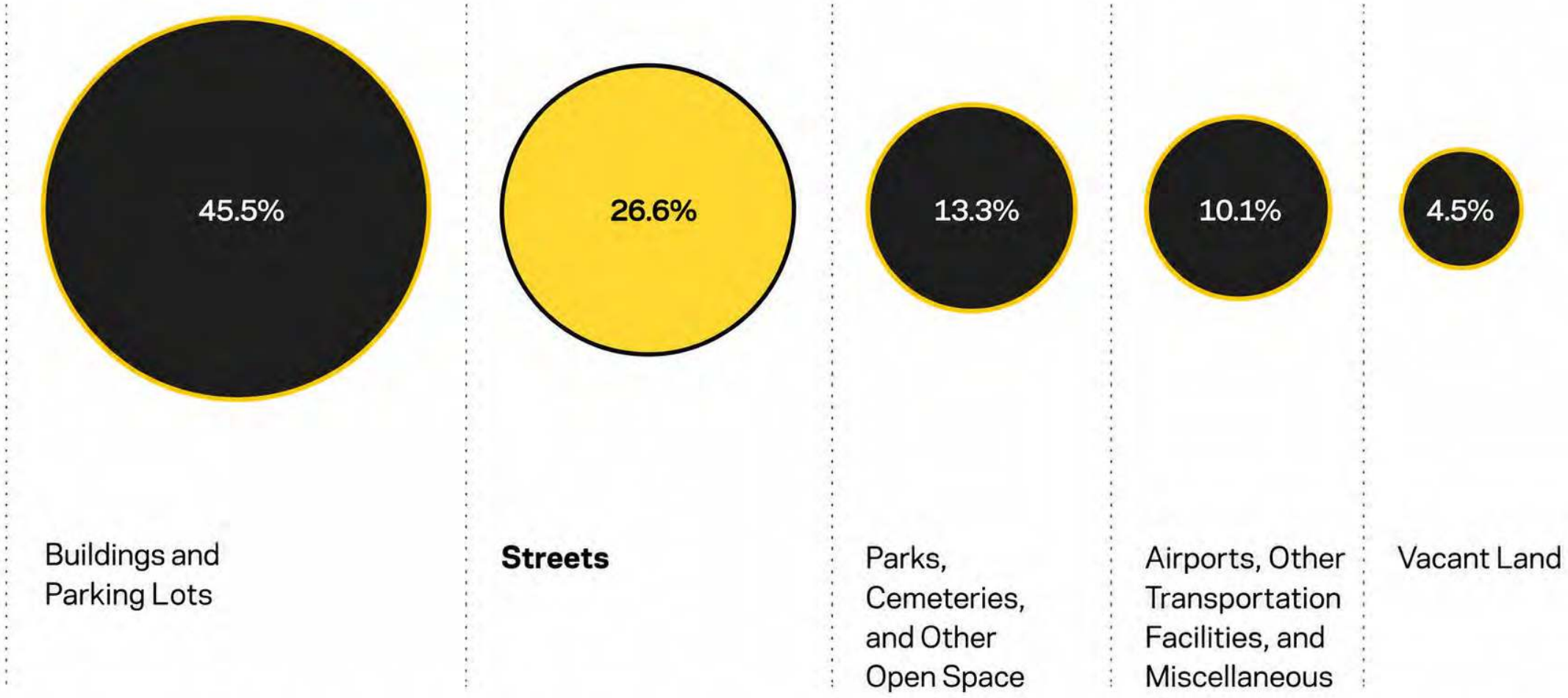
Samantha Lake
Graduate Researcher | Biostatistics| NYU

SEPTEMBER 11TH MEMORIAL PROGRAM
NYMTC
FOR REGIONAL TRANSPORTATION PLANNING

20TH ANNIVERSARY

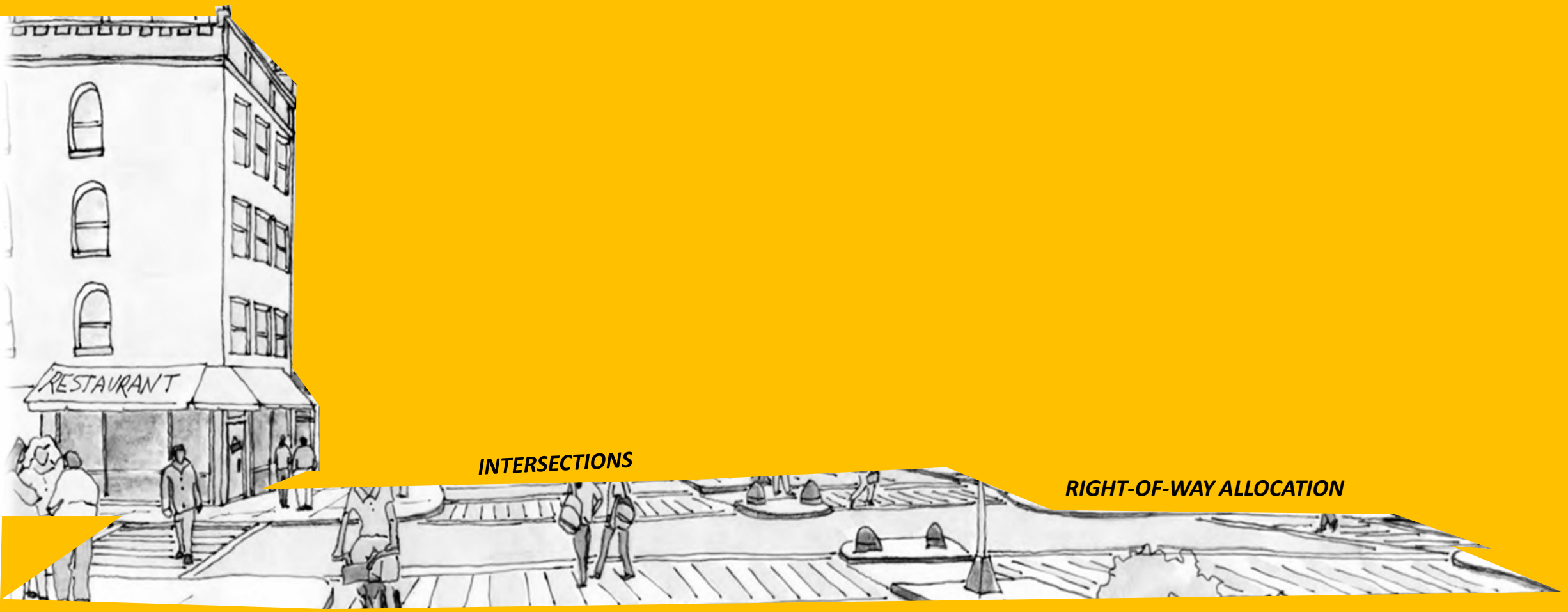
IN MEMORY OF
IGNATIUS ADANGA
CHARLES LESPERANCE
SEE WONG SHUM

Streets make more than 25% of the city's land Area



Streets make up over 25% of the city's land area. (Source: PlaNYC Sustainable Stormwater Management Plan, 2008)

SIDE WALK/PEDESTRIAN ENVIRONMENT



INTERSECTIONS

RIGHT-OF-WAY ALLOCATION

BIKE LANE/ SHARED LANE

STREET TREES

TRAFFIC CALMING MEASURES/VISION ZERO INITIATIVE

RESTAURANT
SHOP
SHOP
STREET CLOSURES/OPEN STREETS
PLAZA

How Street Matter for Health

Pollutionwatch
Cities

Why health and wellbeing should be at centre of urban planning

Scientists are examining how building and use of infrastructure relates to the burden of illness

Gary Fuller
@drgaryfuller
Fri 20 Oct 2023 07.00 CEST

This makes streets one of the most modifiable public spaces in the city

NYC DOT street projects can influence :

- Environmental Exposure
- Mode choice
- Perceived and actual safety
- Traffic volume and speed
- Access to public space along streets

Summary of Projects

1. **Streets-to-Health Framework**
   Connecting street design and transportation interventions to health outcomes

2. Open Streets: Schools & Children's Health (Lead: Mount Sinai)
Evaluating impacts on children's health and well-being

3. E-Bike Use, Physical Activity & Cardiovascular Health (Lead: NYU)
Examining how e-bike use relates to physical activity and cardiovascular health

1. Developing the streets-to-health framework for NYC DOT

STREET PROJECTS → HEALTH FRAMEWORK

A STREET PROJECTS

- Street network
- Right-of-way allocation
- Bikeability
- Walkability
- Parking/Curb Use
- Traffic calming & Speed Management (E.g., vision zero)
- Plazas
- Open Streets
- Transit Infrastructure (E.g. Bus Lanes)
- …

B STREET USE/TRAFFIC

C PATHWAYS

D HEALTH OUTCOMES

Upstream ⟷ *Downstream*

Adapted from Nieuwenhuijsen, 2020

STREET PROJECTS → HEALTH FRAMEWORK

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- **Open Streets**
- **Transit Infrastructure (E.g. Bus Lanes)**
- **…**

B STREET USE/TRAFFIC

- Walking
- Cycling
- Car Use
- Public Transportation
- Time spent on the Street/Outdoors

- Traffic Conditions

Volume, Speed, Vehicle Mix, Temporal Intensity/Congestion

C PATHWAYS

[redacted]

D HEALTH OUTCOMES

[redacted]

Upstream ⟵ ⟶ *Downstream*

Adapted from Nieuwenhuijsen, 2020

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Volume, Speed, Vehicle Mix, Temporal Intensity/Congestion

C PATHWAYS

Environmental

- Air Pollution
- Noise
- UV Radiation
- Temperature
- Traffic collision

Behavior/ Psychological

- Physical Activity
- Stress & Perceived Safety
- Social Interaction
- Access to services

D HEALTH OUTCOMES

[redacted]

Upstream ⟵ ⟶ *Downstream*

Adapted from Nieuwenhuijsen, 2020

STREET PROJECTS → HEALTH FRAMEWORK

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- Temperature
- Traffic collision

Behavior/ Psychological

- Physical Activity
- Stress & Perceived Safety
- Social Interaction
- Access to services

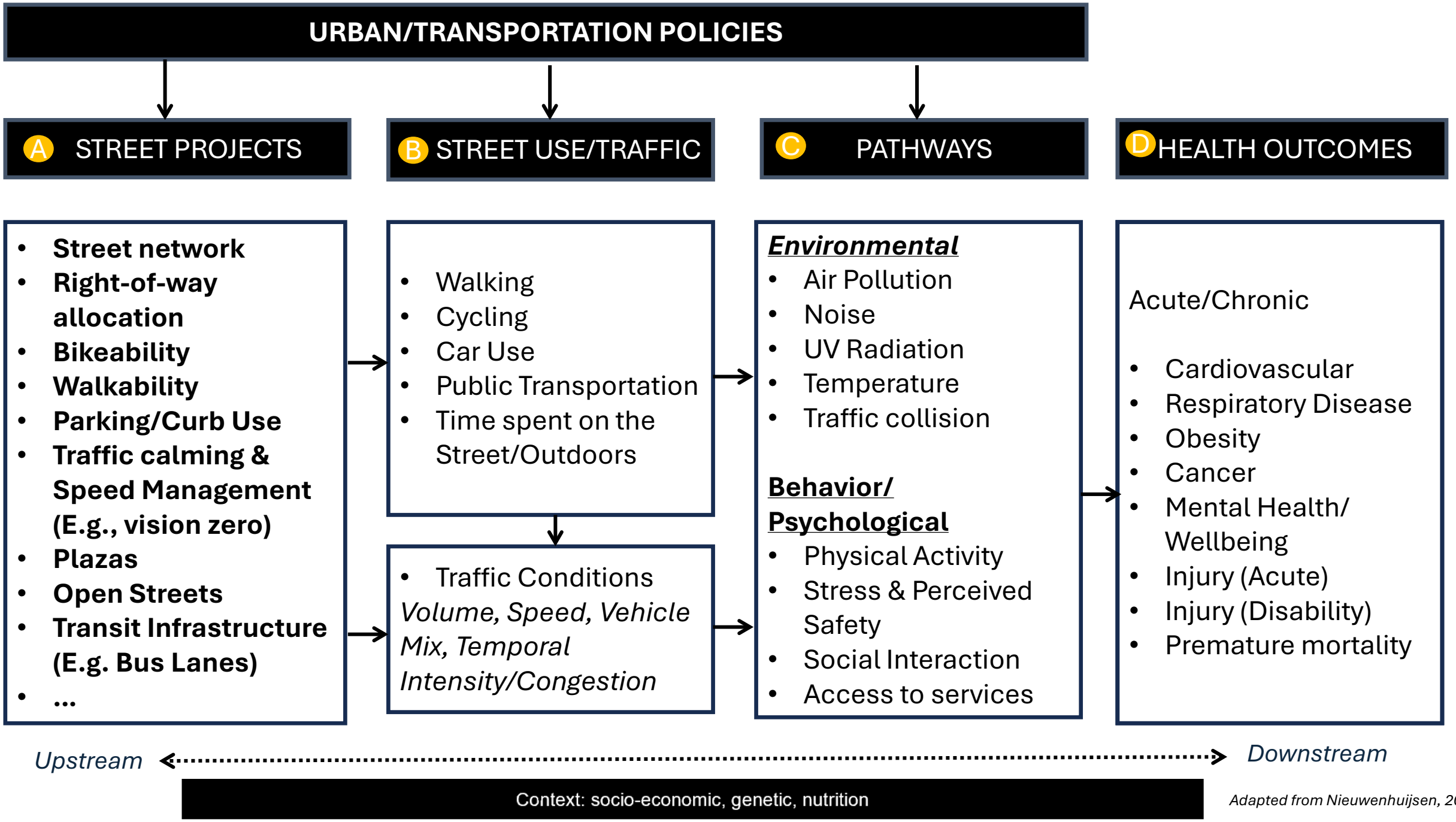
D HEALTH OUTCOMES

Acute/Chronic

- Cardiovascular
- Respiratory Disease
- Obesity
- Cancer
- Mental Health/ Wellbeing
- Injury (Acute)
- Injury (Disability)
- Premature mortality

Upstream ⟷ *Downstream*

Adapted from Nieuwenhuijsen, 2020



Adapted from Nieuwenhuijsen, 2020

2. Streets-to-health Pilot Study 1: Open Streets Schools

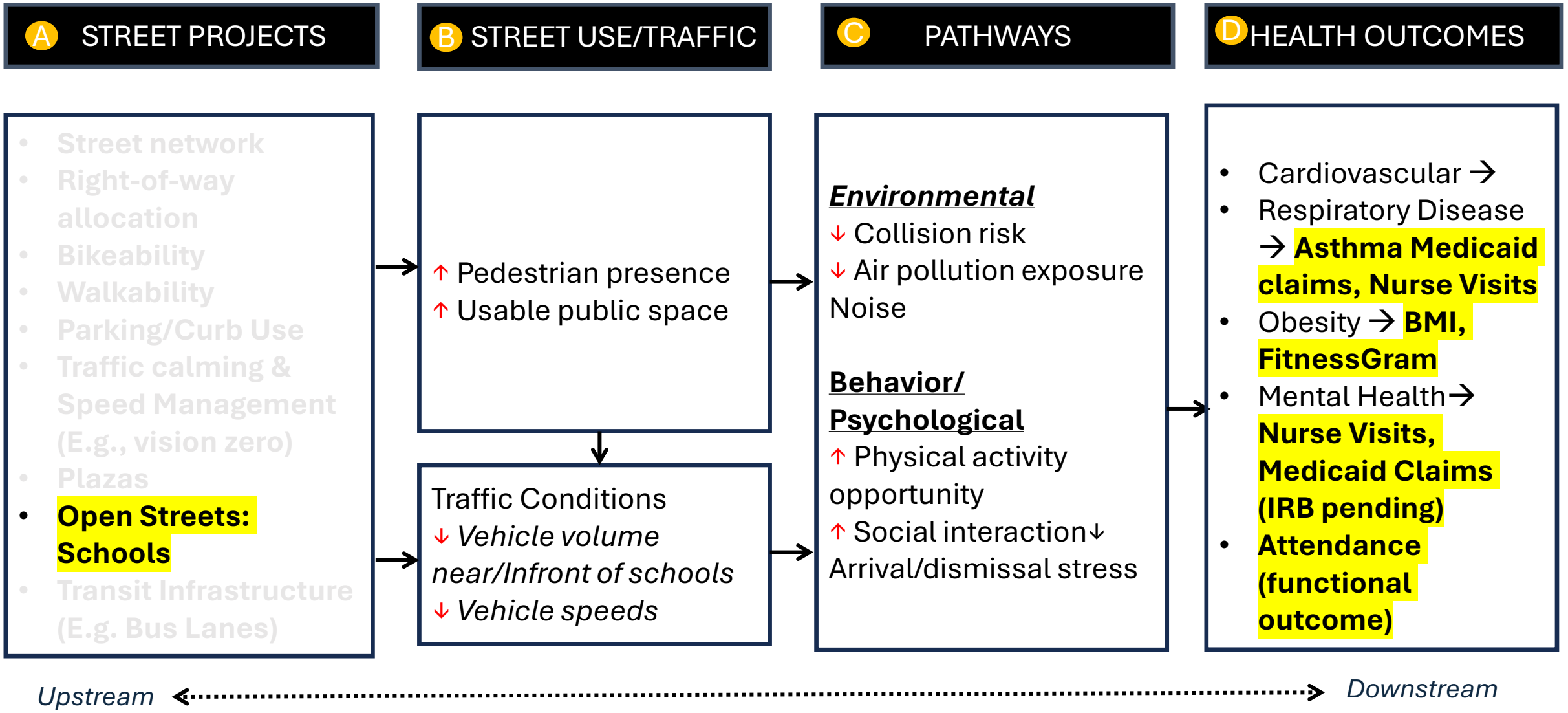
Research Question: How does Open Streets: Schools program affect student health and education in NYC?

Team: Michael Cassidy (Mount Sinai, lead), Josef Szende, Debbie Sheintoch ,Sabah Usmani

PS59

Applying the STREETS → HEALTH Framework:

Open Streets – Schools → Student Health



Adapted from Nieuwenhuijsen, 2020

Global Evidence on Open Streets & Health Pathways

- Research has suggested health-relevant impacts of Open Streets programs on:
  - *Physical/pedestrian activity (Rong & Freeman, 2024; Zieff et. al., 2016)*
  - *Noise (Benavides et al., 2023)*
  - *Local traffic (Usmani et al., under review; Nello-Deakin, 2022)*
  - *Social Inclusion and Community Interactions (Mejia-Arbelaez et. al., 2021)*
  - *Premature mortality across 15 cities in Latin America (Velázquez-Cortés, 2023)*

NYC Students Face Health Challenges

21%

of NYC elementary and middle schoolers are obese

Argenio et al., 2024

12%

of NYC children aged 13 and under have asthma

NYC Kids, 2019

86%

of NYC high schoolers do not get recommended exercise

2021 YRBS

Conditions are worse in disadvantaged neighborhoods

Health, activity and traffic-safety burdens are concentrated in the same communities.

Cassidy et al., 2025

Analytical Panel

Full sample

1,576
NYC public schools × 7 years (2018–2024) = 11,032 school-years

74
ever-approved Open Streets schools (treatment)

1,502
never-approved schools (control)

Balanced panel: all schools observed in all years

Applied-ever subsample

92
schools that ever applied to the program

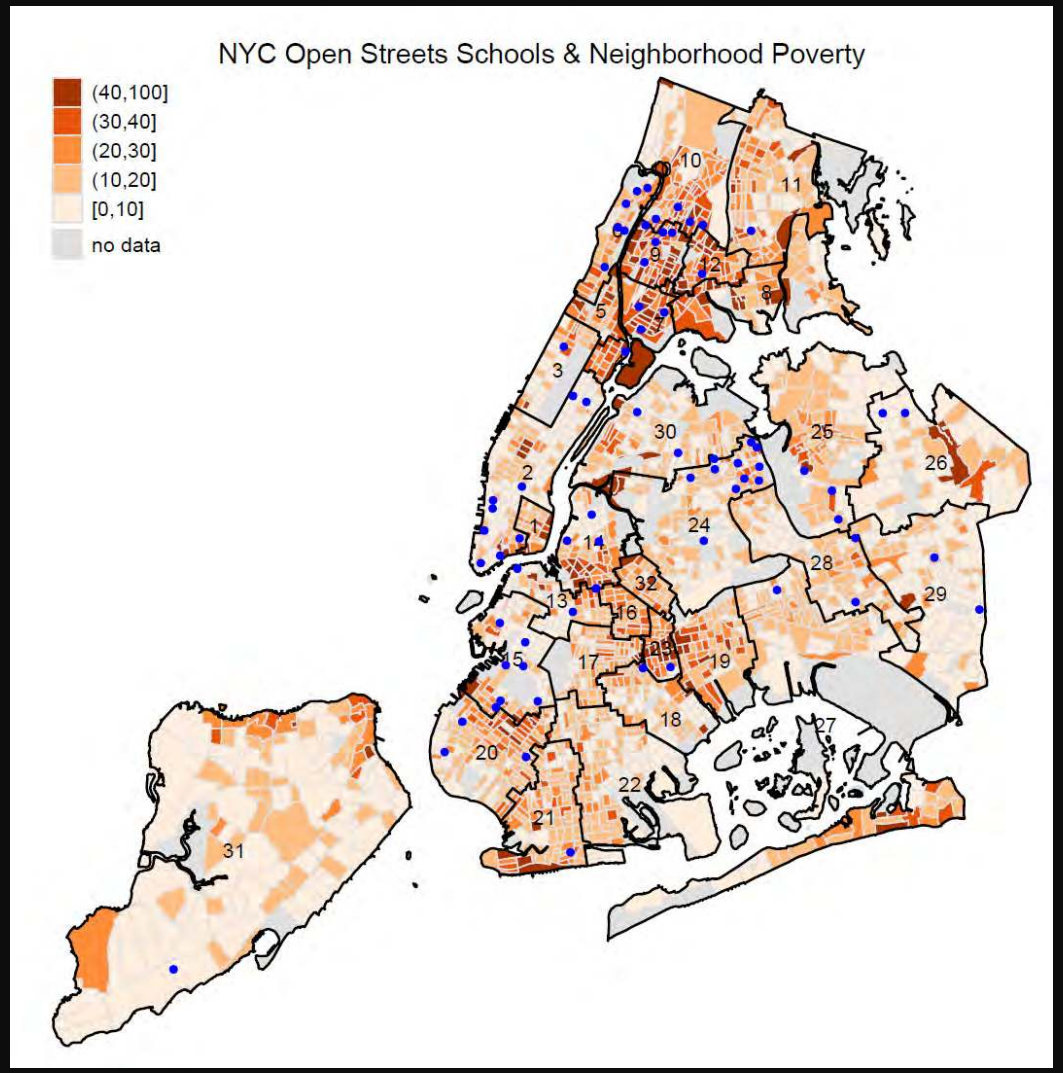
74
approved (treatment)

18
applied but not approved (control)

Tighter comparison: schools that selected into application

Open Streets Schools & Neighborhood Poverty

Poverty rate by census tract

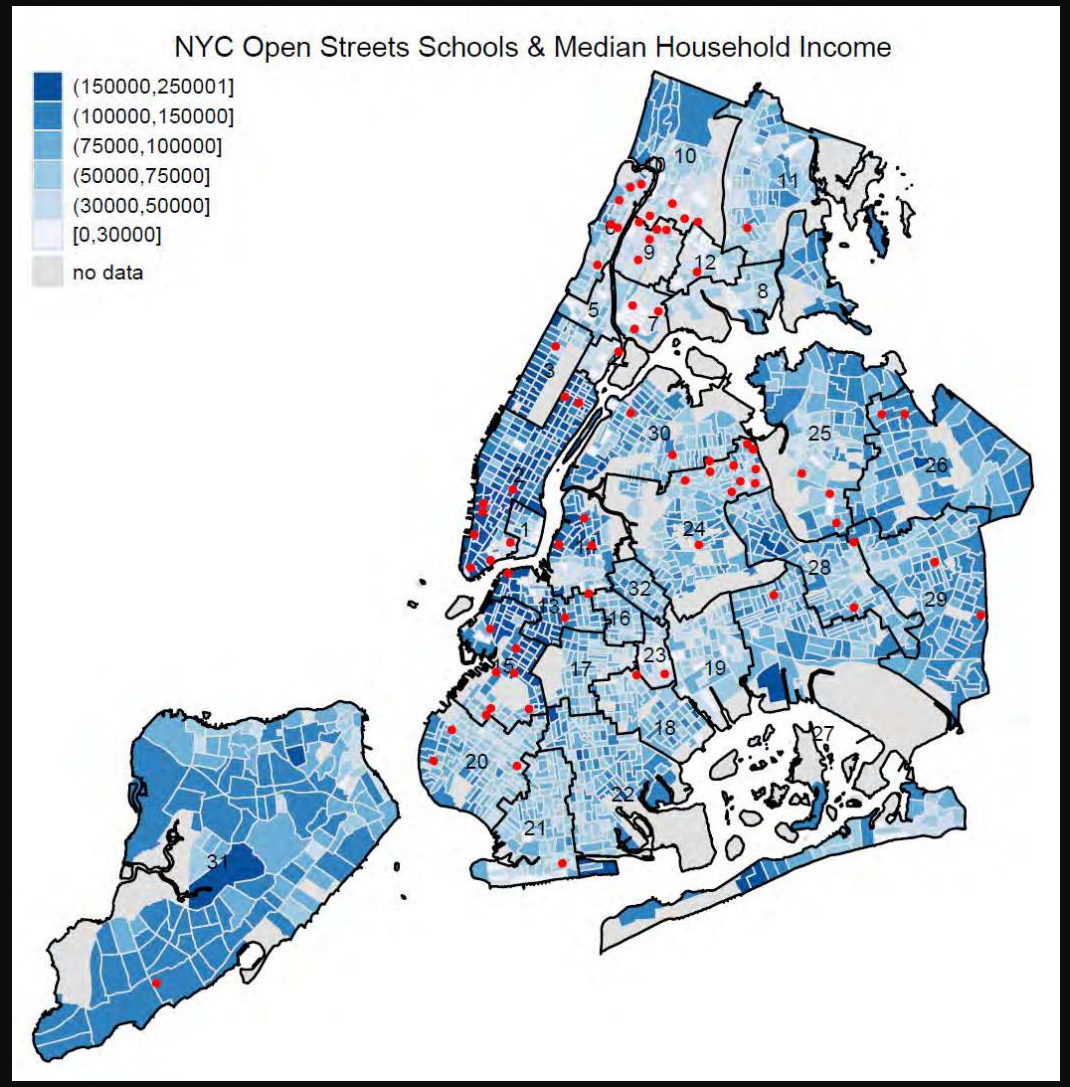


Open Streets schools (blue dots) are spread across all five boroughs, with dense clusters in Manhattan and northwest Brooklyn.

Darker tracts have higher poverty rates. Gray tracts have no data.

Open Streets Schools & Median Household Income

Median household income by census tract

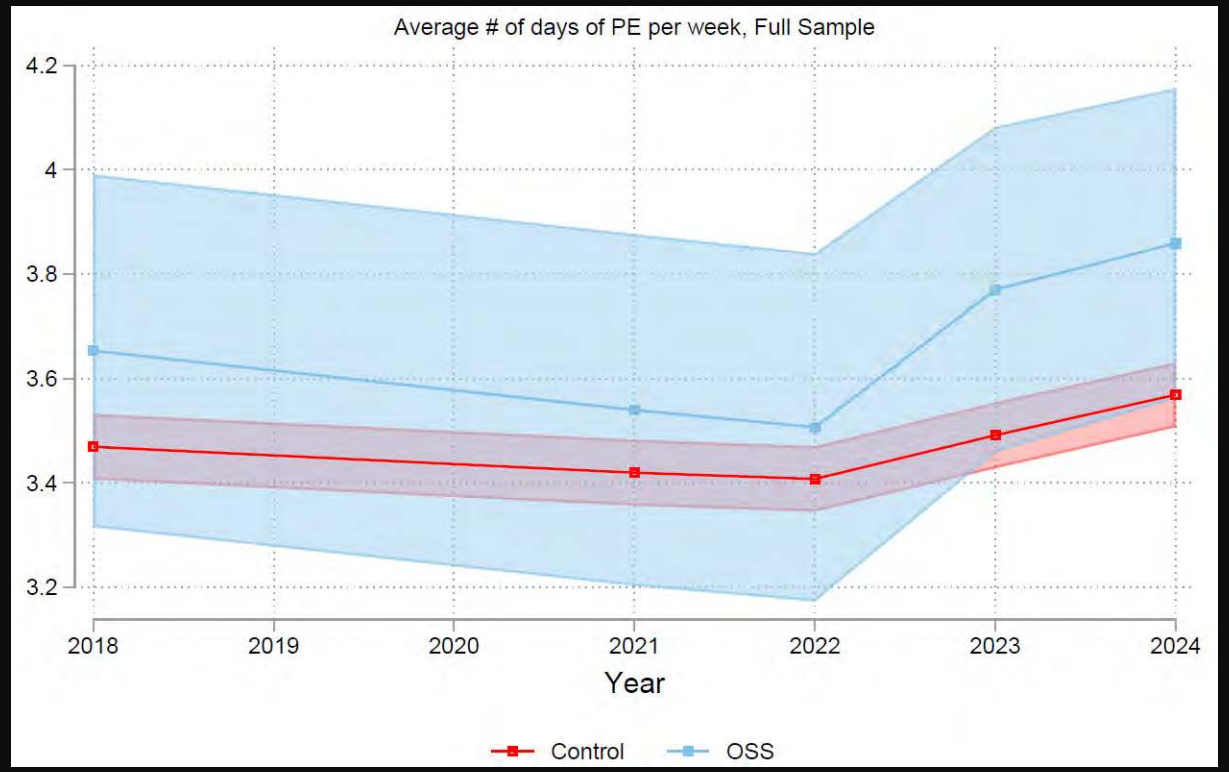


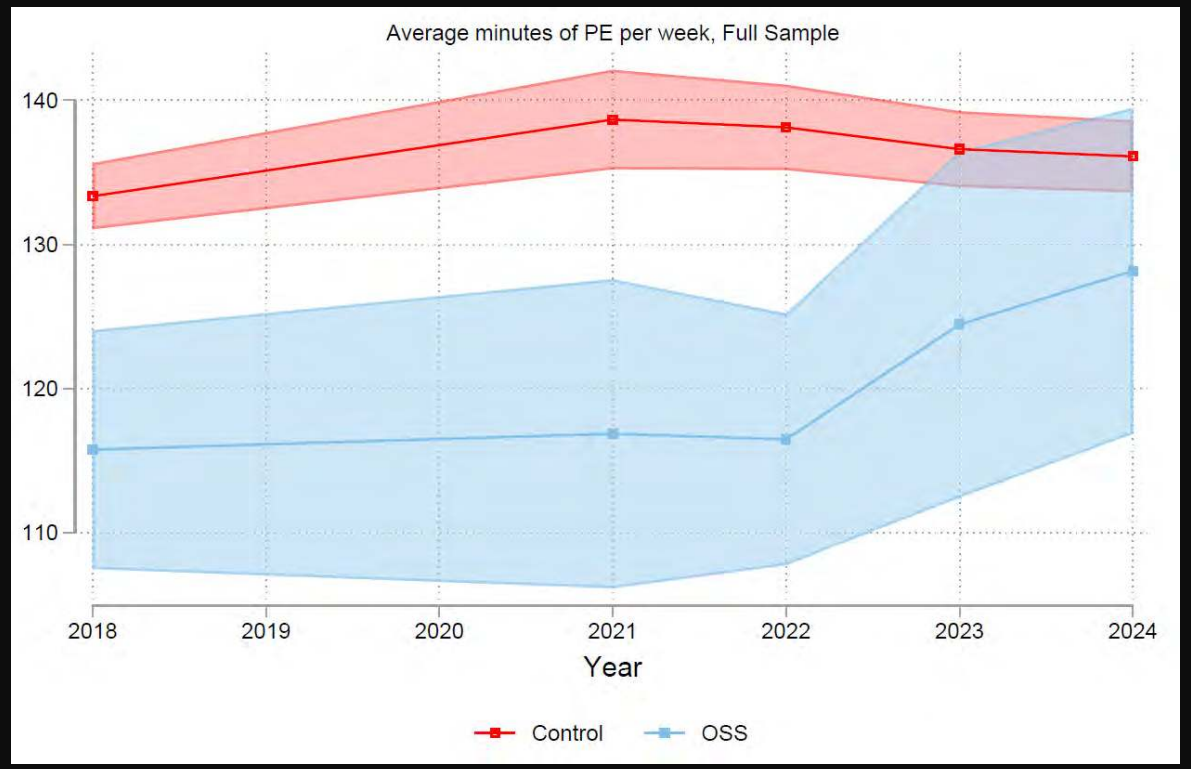
Participation is thinnest in Staten Island and in the highest-poverty stretches of the South Bronx and central Brooklyn.

Darker tracts have higher median household income. Gray tracts have no data.

Physical Education results (Full Sample)

Open Streets schools vs. all never-approved NYC public schools





Michael Cassidy (Mount Sinai)

3. Streets-to-health Pilot Study 2: Ebikes and Health in NYC

Research Questions:

Q1: *How is e-bike use associated with physical activity and cardiovascular health in NYC?*

Q2: How does DOT cycling infrastructure promote e-bike use in NYC?

NYC E-bike Study Full Team:

NYU

Sr. Project Team

Dr. Rumi Chunara (PI)

Samantha Lake

Project Team

Canaan Woldekidan, Rabia Shafiq, Jessica Salvadore, Loan Tran, Monica Lall, Laibah Ashfaq

NYC DOT

Josef Szende

Sabah Usmani

Debbie Sheintoch

Mojdeh Azad

Applying the STREETS→HEALTH Framework: E-bikes/Bike Infra→ Cardiovascular Health

A STREET PROJECTS

- Street network
- Right-of-way allocation
- **Bike Infrastructure (e.g., Protected Bike lanes, Citi Bike dock access)**
- Walkability
- Parking/Curb Use
- Traffic calming & Speed Management (E.g., vision zero)
- Plazas
- …

B STREET USE/TRAFFIC

↑/ ↓ Walking
↑ **Cycling (e-bike use)**
↑ Cycling (bicycle use)
- Car Use

↓ Sedentary Travel
↑ Time spent on the Street/Outdoors

- Traffic Conditions

Volume, Speed, Vehicle Mix, Temporal Intensity/Congestion

C PATHWAYS

Environmental (not directly measured)

Behavior/ Psychological
↑ **Physical Activity (via E-bike use, MET-min/week, Heart Rate)**
↓ Stress (related to traffic)
↑ Perceived Safety
↓ Perceived barriers to cycling
↑ Access to services
↑/ ↓ Social Interaction

D HEALTH OUTCOMES

Cardiovascular (MET-minutes, activity thresholds, Heart Rate)
Respiratory Disease
Obesity
Cancer
Mental Health/ Wellbeing
Injury (Acute)
Injury (Disability)
Premature mortality

Upstream ⟵⟶ *Downstream*

Adapted from Nieuwenhuijsen, 2020

Study Overview

Mixed-methods observational design across three instruments

1 Survey (recall) (In progress)

- Baseline e-biking behavior & cardiovascular health
- Identify incentives & barriers to e-biking
- Recruit for focus groups & Wearable study

2 Focus Groups (In progress)

- Three focus groups: frequent, infrequent & never riders
- Opportunity to ask for narratives, uncover the trends that we find

3 Wearable Study (Planned)

- Collect cardiovascular health metrics, popular corridors, biking frequency to spatially join with existing data

Study Design

- Mixed-methods observational approach.
- Tools: Wearables, surveys, focus groups + existing DOT mobility data.

Study Population

- Adults living or working in NYC.
- Stratified by mobility mode, frequency, location, and demographics.
- Exclusions: Delivery/courier workers and non-NYC residents. Throttle e-bikes.

Research Questions

RQ1 (Health): What is the effect of e-bike use on cardiovascular health in New York City?

RQ2 (Infrastructure): How does DOT cycling infrastructure promote e-bike use in NYC?

409 Delivery Workers

2,363 Commuters

Confirmed Eligibility

Removed Duplicates & Speeders

Full Analytic Sample

355

1,664

RQ1: Total MET-Calculation Sample

E-Bike Trip Frequency + General Health Scale + Trip Related Exertion, Duration, E-Bike Type + Counterfactual | Filtered E-Bike Throttle Owners

94

740

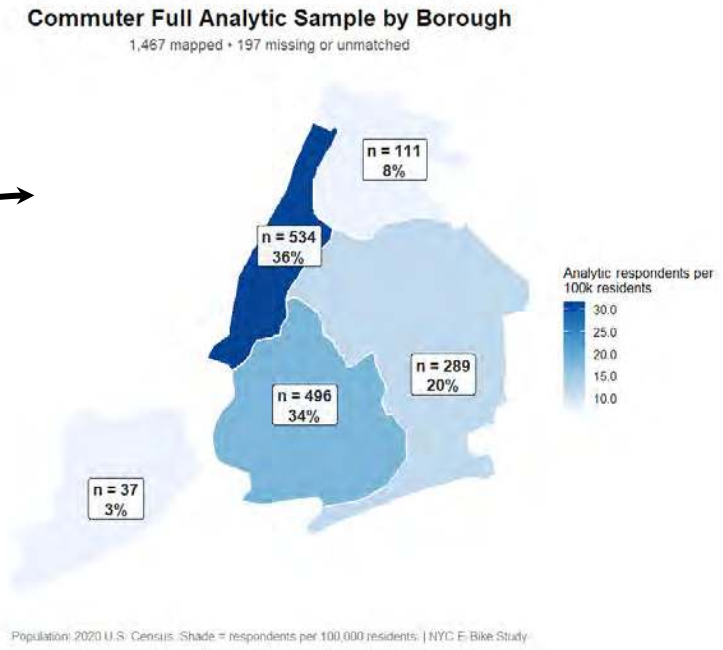
RQ2: Total Infrastructure Influence Sample

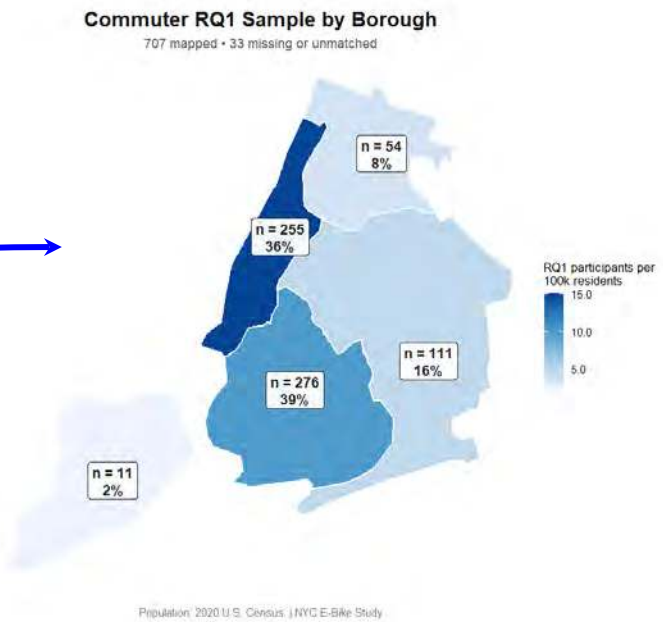
E-Bike Trip Frequency + Barrier Scale + Residency

222

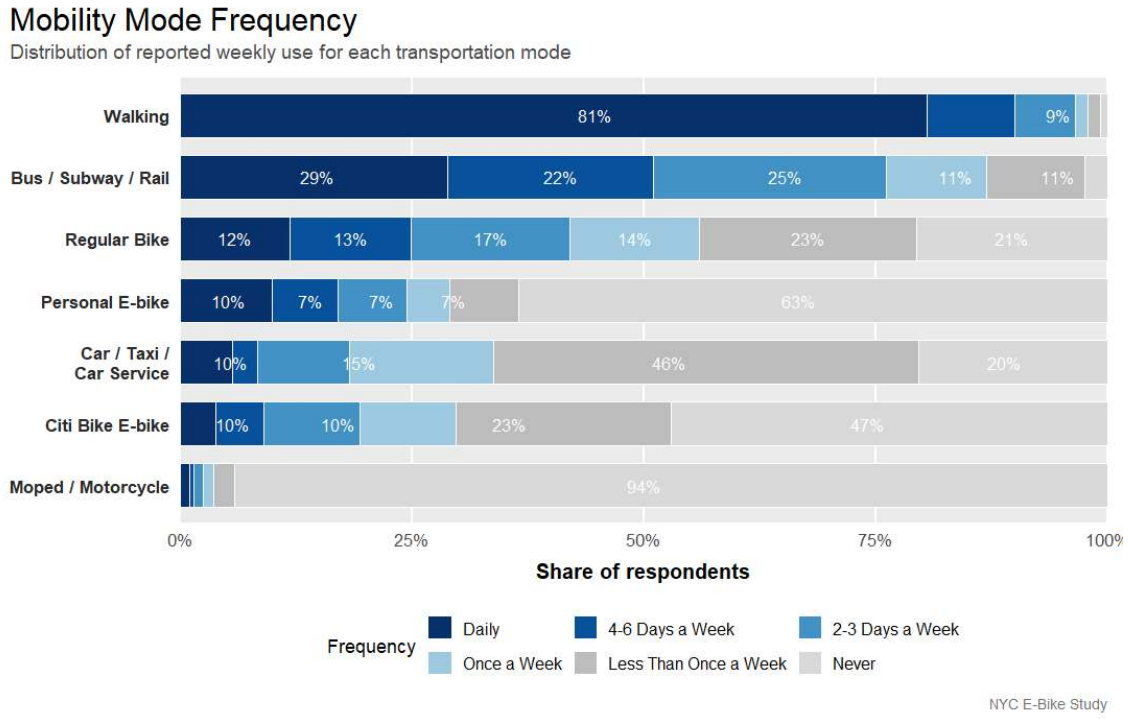
1,454

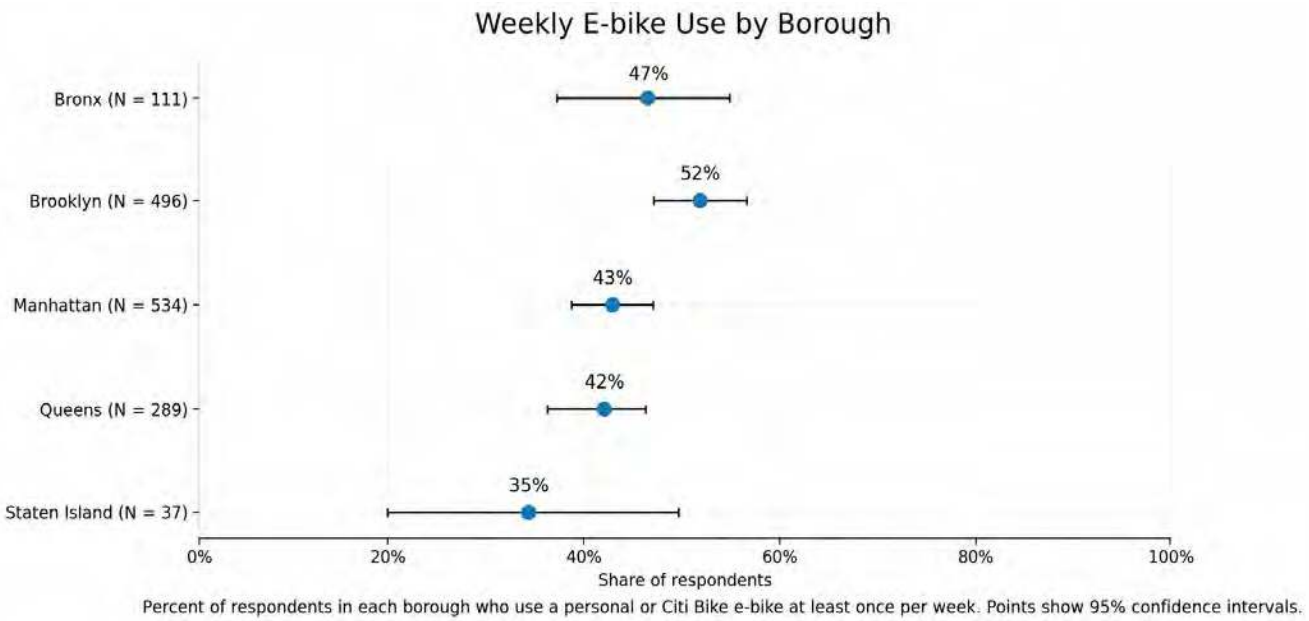
Similar distribution across samples



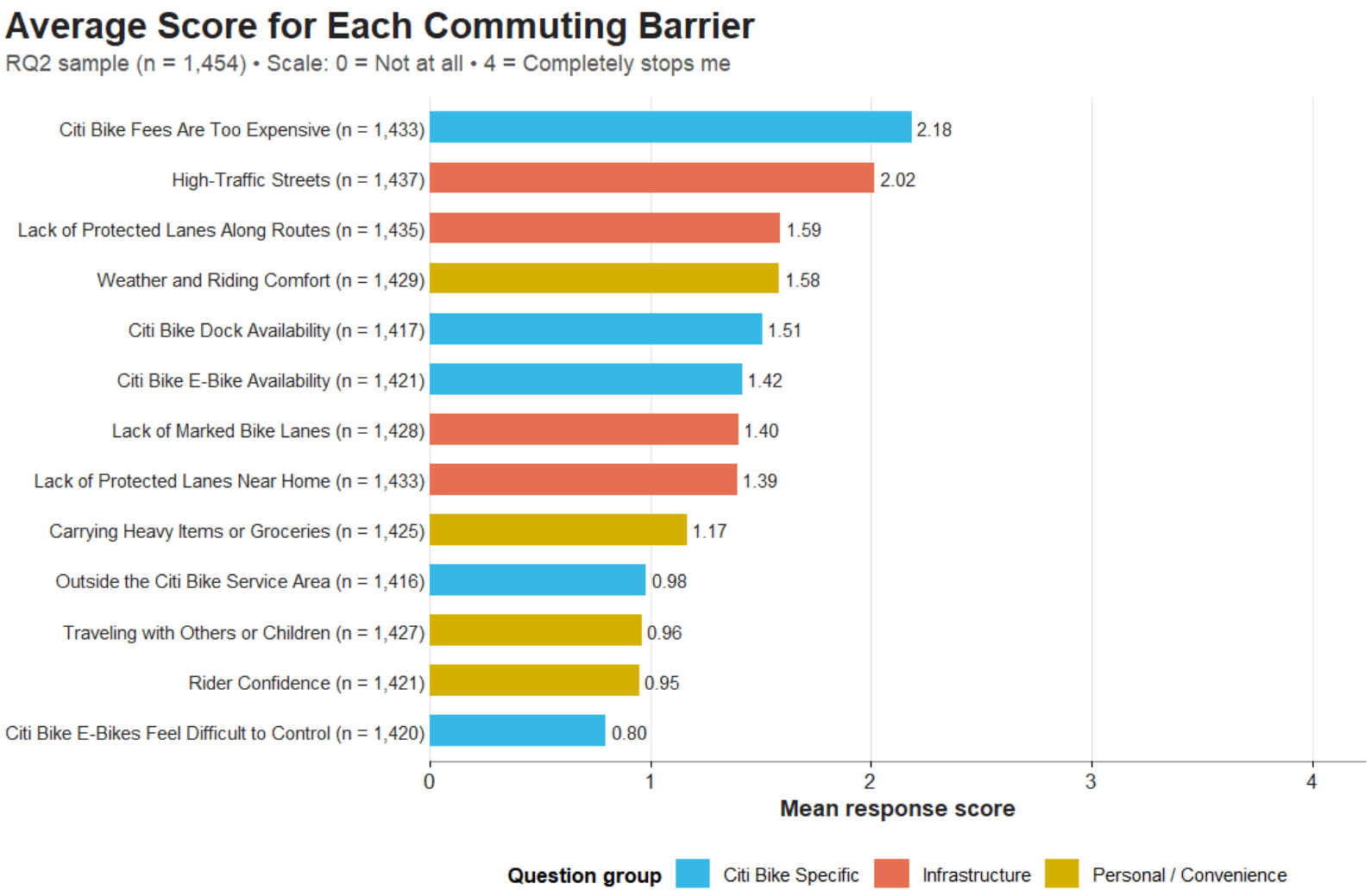


Among Commuters: Out of all of your trips in a typical week, how often do you…





How much does the following currently prevent you from e-biking more often or at all?



What we heard

1. Infrastructure Needs

Participants mentioned inadequate infrastructure for bikes or e-bikes in NYC (protected bike lanes, bad roads).

E.g.: a Brooklyn and Bronx resident discussed the differences in bike lanes types in their neighborhoods, and why they would rather ride in Brooklyn than the Bronx. Lights on the street would help people bike.

2. Safety Concerns

Participants mentioned concerns about e-bike safety (speeding, danger to pedestrians, road rules).

E.g.: some respondents mentioned that e-bikers and delivery workers do not follow the road rules, and that the law should be enforced.

3. Affordability

Participants mentioned concerns about affording the CitiBike Rates or purchasing a personal e-bike.

E.g.: a Bronx resident described building an e-bike after being charged $80 for traveling across boroughs on a citi e-bike. He convinced his friends to do the same.

E-Bike Incentives

While less common, some e-bikers described incentives to e-biking in NYC.

E.g.: not getting sweaty when on the move or being able to reach a subway station more quickly, more fast than traffic.

Applying the STREETS→HEALTH Framework

A STREET PROJECTS

- Street network
- Right-of-way allocation
- **Bike Infrastructure (e.g., Protected Bike lanes, Citi Bike dock access)**
- Walkability
- Parking/Curb Use
- Traffic calming & Speed Management (E.g., vision zero)
- Plazas
- …

B STREET USE/TRAFFIC

↑/ ↓ Walking

↑ **Cycling (e-bike use)**

↑ Cycling (bicycle use)

- Car Use

↓ Sedentary Travel

↑ Time spent on the Street/Outdoors

- Traffic Conditions

Volume, Speed, Vehicle Mix, Temporal Intensity/Congestion

C PATHWAYS

Environmental (not directly measured)

Behavior/ Psychological

↑ **Physical Activity (via E-bike use, MET-min/week, Heart Rate)**

↓ Stress (related to traffic)

↑ Perceived Safety

↓ Perceived barriers to cycling

↑ Access to services

↑/ ↓ Social Interaction

D HEALTH OUTCOMES

Cardiovascular (MET-minutes, activity thresholds, Heart Rate)

Respiratory Disease

Obesity

Cancer

Mental Health/ Wellbeing

Injury (Acute)

Injury (Disability)

Premature mortality

Upstream ⟵⟶ *Downstream*

Adapted from Nieuwenhuijsen, 2020

Conclusion

1. **Street projects can influence health through multiple pathways**
   The framework provides a structured way to connect changes in the street environment to exposures, behaviors, and health outcomes.

2. **The framework can guide real-world evaluation**
   The **Open Streets: Schools** and **e-bike** pilots demonstrate how it can be applied to different transportation interventions, populations, and health outcomes.

3. **The goal is a transferable health lens for transportation planning**
   The framework can help identify relevant health outcomes, guide data collection and evaluation, and support application to other street projects and transportation agencies.

Streets -to- Health

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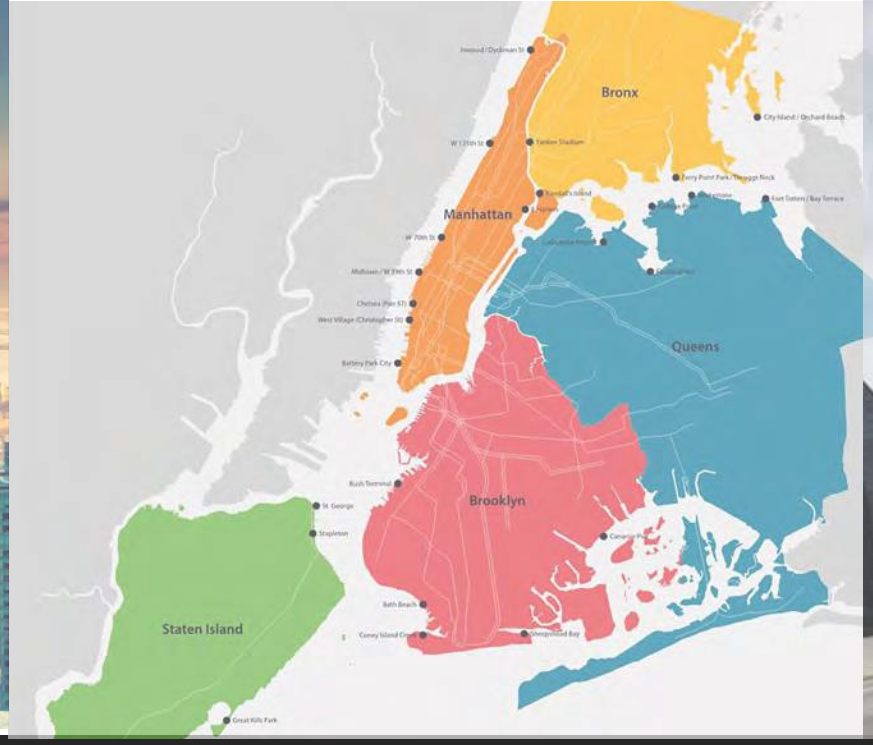


A Strategic Freight Policy Model for New York City

Integrating Demand, Trip Assignment, Emission Modeling and Policy Analysis

NEW YORK CITY DOT

Introduction

Megh KC
Ph.D. candidate, University at Buffalo, SUNY
September 11th Memorial Program Research Fellow 2025-2026

Advisor: Dr. Ziqi Song, University at Buffalo
Mentor: Catherine Ponte, NYC DOT

My goal is to build a transparent, strategic FREIGHT POLICY TOOL that allows policymakers to test the impacts of pricing, routing and clean technologies.

Contents

- Introduction
- Problem Identification
- Methodological Framework
- Policy Scenarios
- Results and Discussion
- Limitations and Future Work

The Dual Nature of Freight

Challenge:

- Trucks are lifeblood of NYC economy and are also primary drivers of localized congestion and air pollution
- Presents uniquely constrained freight environment
- Aggregate passenger models insufficient to capture receiver constraints
- Freight data is complex, fragmented and incomplete
- Understanding impacts of supply-chain routing, infrastructure bottlenecks, tolls and vulnerable neighborhoods

Goal:

Utilize complex, fragmented freight data into a strategic modeling tool quantifying tangible and intangible metrics

Datasets

Geospatial Dataset

Dataset	Description	Source
Traffic Analysis Zones (TAZ)	2212 TAZs over 5 boroughs	NYC DOT
County Boundary	5 Boroughs	NYC DOT
Congestion Relief Zone (CRZ) Boundary	CRZ boundary polygon	GIS Digitization (self)
Truck Route Network	NYC designated truck routes	NYC DOT
Industrial Business Zones	NYC IBZs	NYC Planning Office

Socio-Economic Dataset

Dataset	Description	Source
Population data	Total population (2010-2055)	NYMTC
Industrial employment data	Derived from office employment data	NYMTC and Bureau of Labor Statistics (BLS)
Wholesale employment	Derived from residual employment	NYMTC and BLS
Retail employment	Retail employment (2010-2055)	NYMTC
Warehouse employment	Derived from total employment	NYMTC and BLS

Methodological Framework

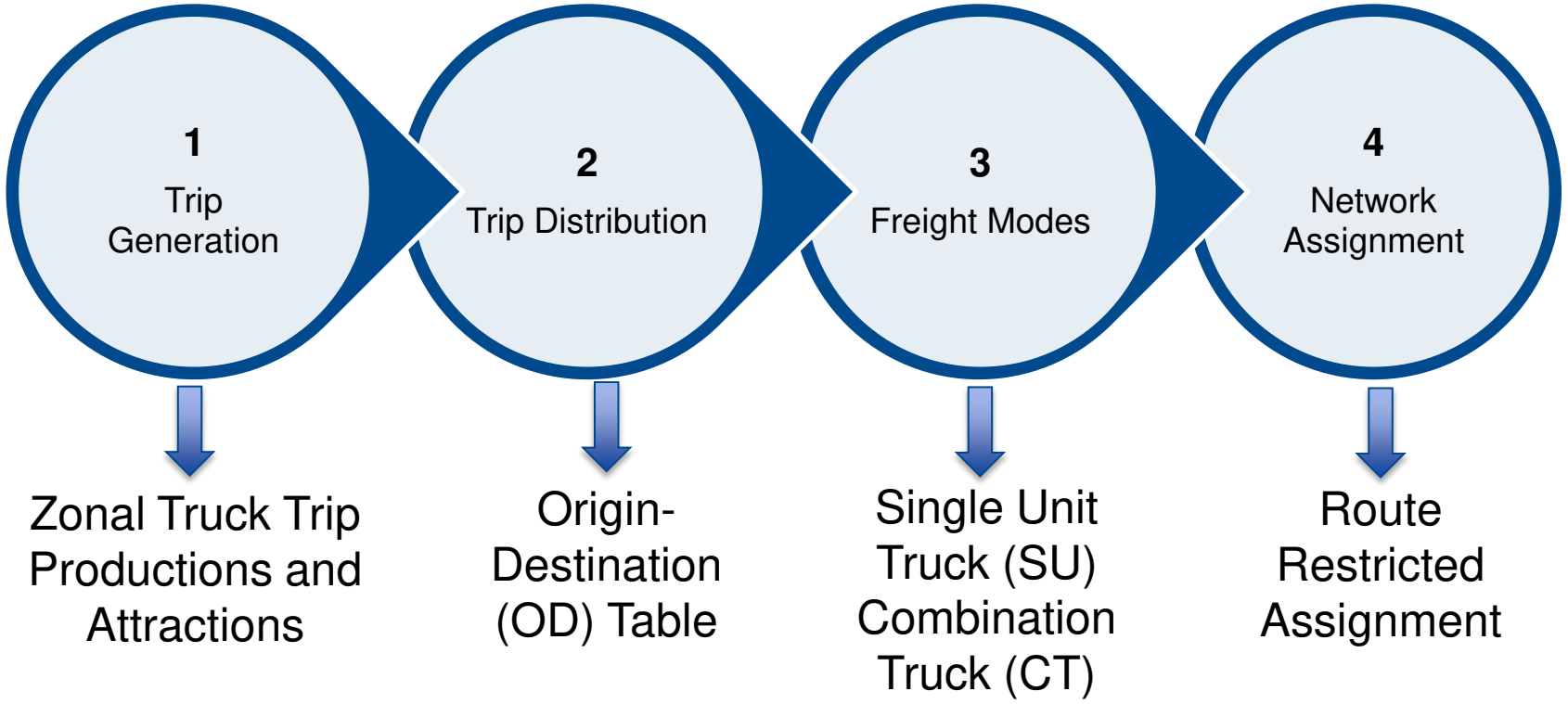
Bridging Planning and Operations

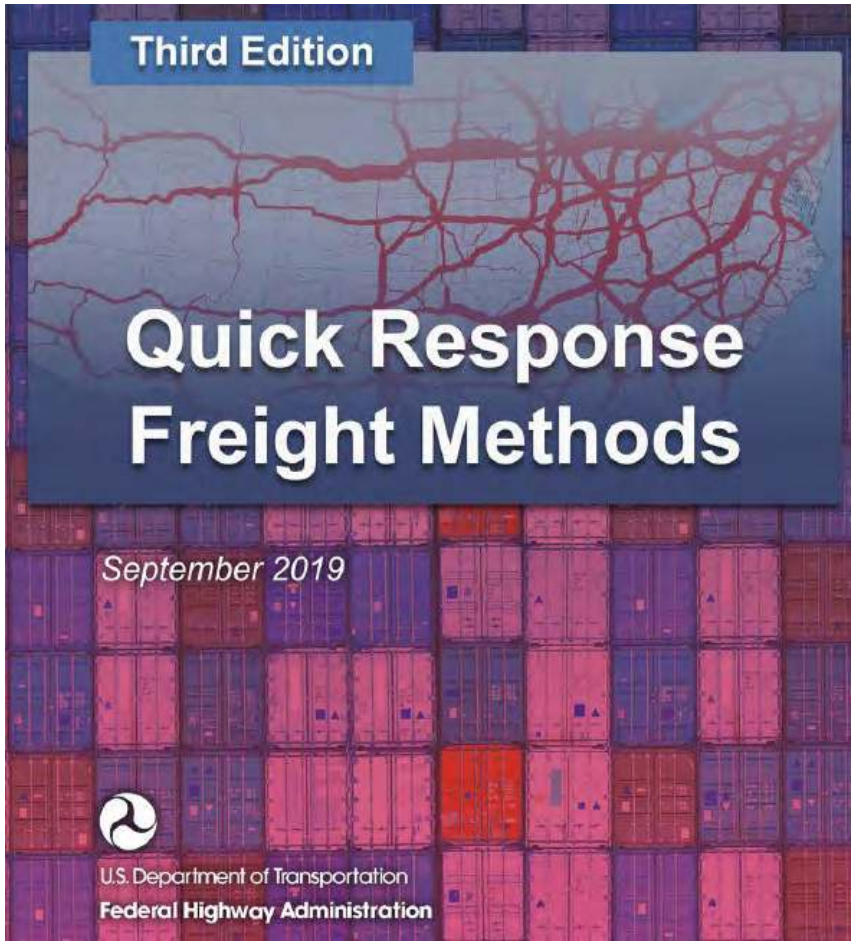
The New York City Freight Truck Model is a **four-step freight demand model** designed to estimate **daily truck trip** patterns, vehicle miles traveled (**VMT**), **emission** modeling, and **policy scenario analysis** for New York City

1. 4-Step Freight Demand Model
2. Truck VMT Assessment and Toll Analysis
3. Emission Modeling
4. Policy Scenario Analysis

Freight Demand Model

4-Step Travel Demand Model





Module 1

Addressing the Gap in Aggregate Land Use Data

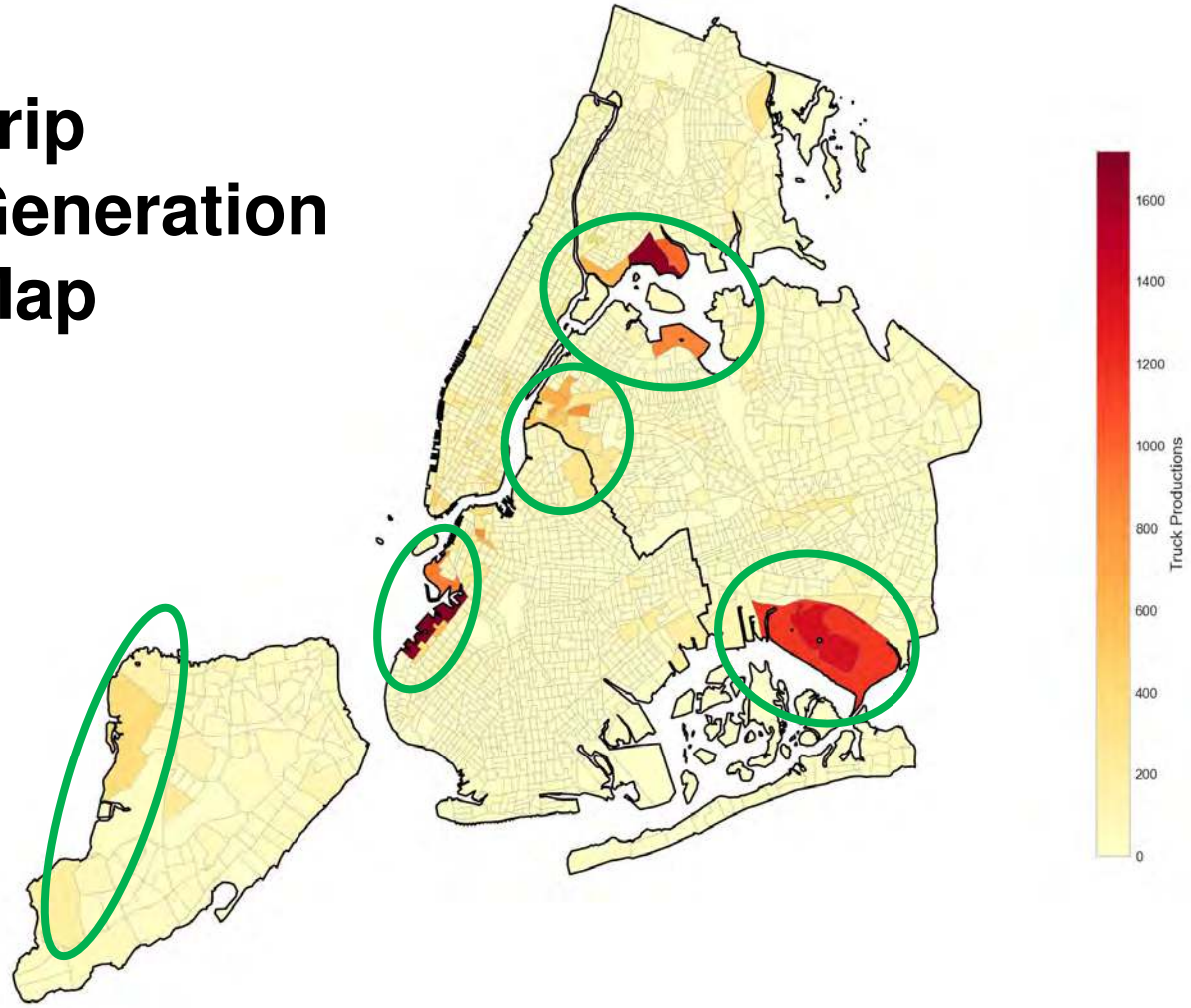
Industrial Business Zones (IBZs): We apply specialized multipliers to designated IBZs to capture true supply-chain clustering effects

Spatial Correction: Major logistics hubs (Hunts Point, JFK Airport, Red Hook) receive targeted intensity adjustments

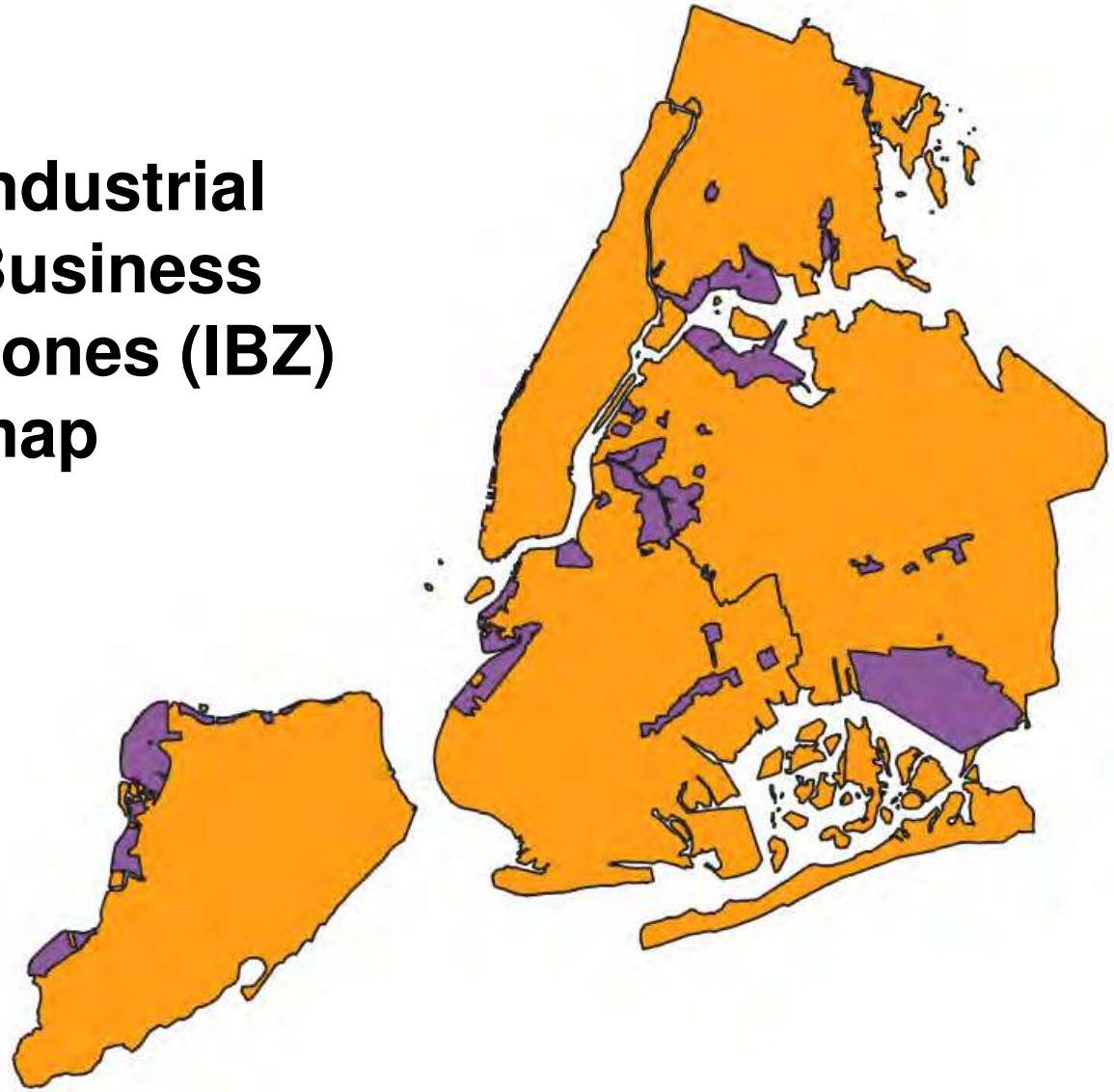
Differentiated Vehicle Classes: Production and attraction rates are explicitly split between Single-Unit (SU) and Combination Trucks (CT) to accurately model physical routing requirements

Land Use/Spatial Correction and IBZ Inclusion Effect on Trip Generation

Trip Generation Map



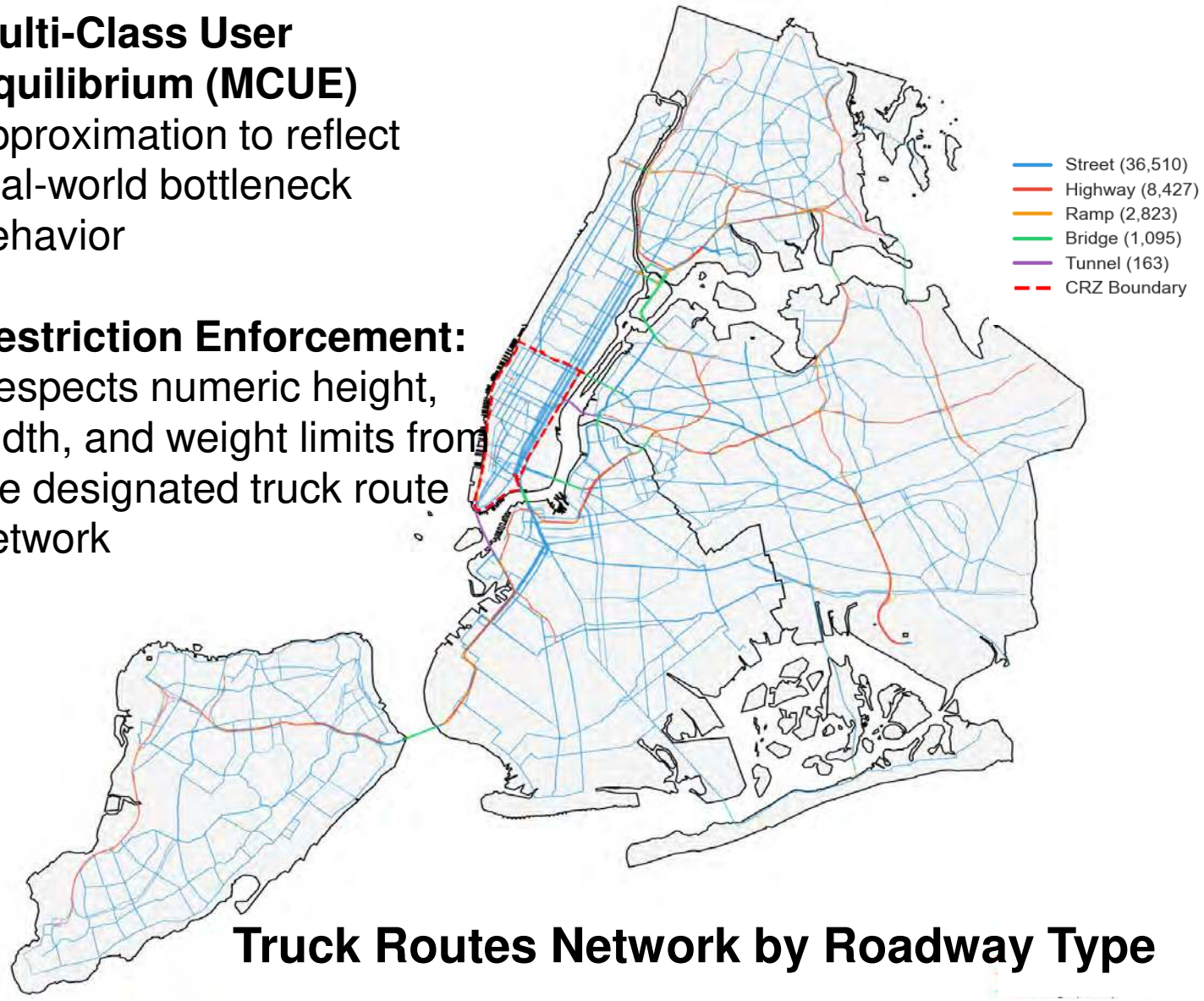
Industrial Business Zones (IBZ) map



Network Assignment

Multi-Class User Equilibrium (MCUE) approximation to reflect real-world bottleneck behavior

Restriction Enforcement: Respects numeric height, width, and weight limits from the designated truck route network



Truck Routes Network by Roadway Type

Crossing Entry Point Calibration Results:

1) Congestion Relief Zone crossings:

MTA count data:	**23,156** per day
Our model:	**24,112** per day

2)

Borough	Model	MTA
Brooklyn	34.1%	31.7%
Queens	26.0%	29.3%
Manhattan	11.2%	14.2%
Staten Island	5.8%	20.8%

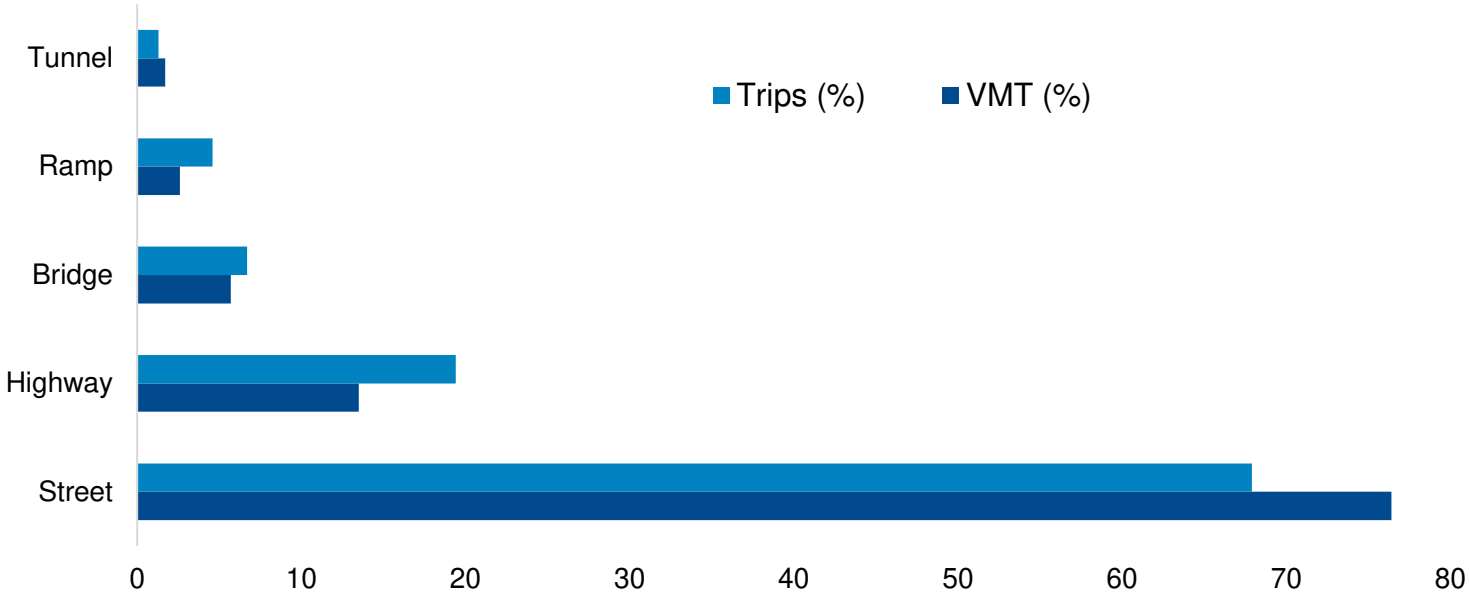
DISCREPANCY in Staten Island is because of New Jersey Truck trips

- Handled via model calibration

Results

Borough-to-Borough Trip Matrix

Trip and VMT distribution by Roadway Type



- Street captures 67% trips but more VMT share
- Situation reverses for highway, bridge and ramp

- Trip distribution highlights heavy intra-borough circulation
- Brooklyn and Queens consistently demonstrate highest internal and cross borough interaction volumes, dominating city's overall freight production footprint

Module 2

Emissions Methodology: Linking Network Dynamics to MOVES

MOVES: Motor Vehicle Emission Simulator

Our project-scale vehicle emissions are quantified using the U.S. EPA's MOVES modeling system to evaluate local environmental impacts [CO2, NOx, and PM2.5]

Mechanical Linkage: Emissions module directly consumes the class-specific, congested link volumes generated by the MSA assignment

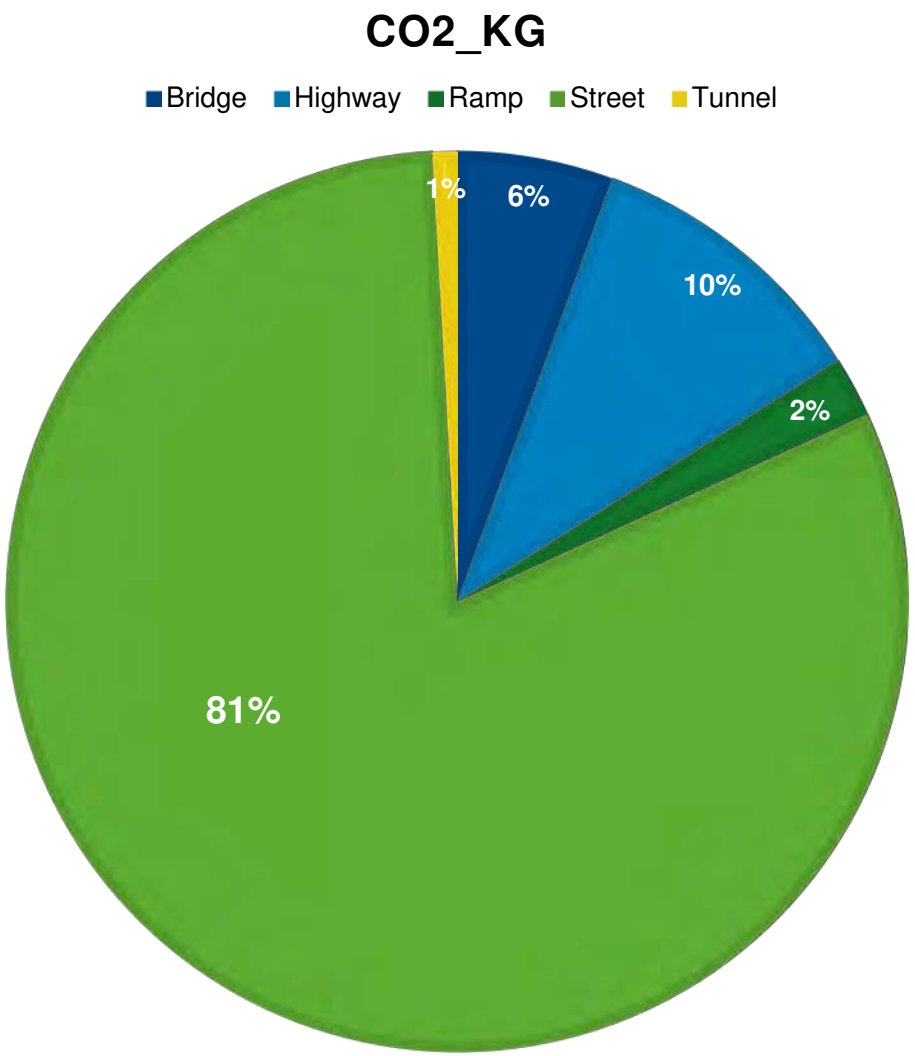
Speed-Dependent Rates: Utilizes EPA MOVES-style emission profiles mapped specifically to congested speeds on diverse roadway classifications (Streets, Highways, Bridges, Tunnels)

Temporal Granularity: Calculates distinct CO2, NOx, and PM2.5 outputs based on precise peak vs. off-peak volume shares, enabling robust testing of delivery-timing policies

Results

The Disparity: Streets Carry 73% of VMT, but 81% of Emissions

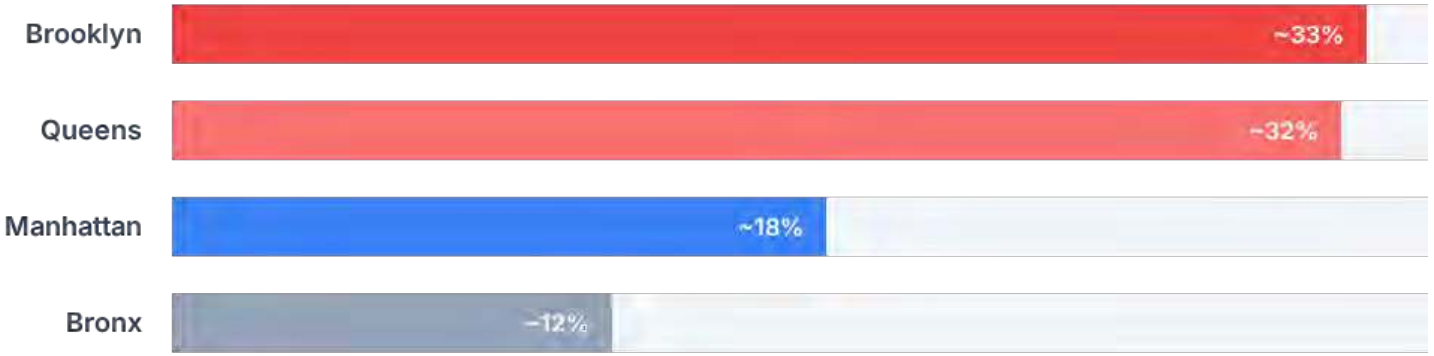
Due to lower free-flow speeds and persistent congestion penalties, the street network disproportionately magnifies the local air quality burden compared to high-capacity throughways



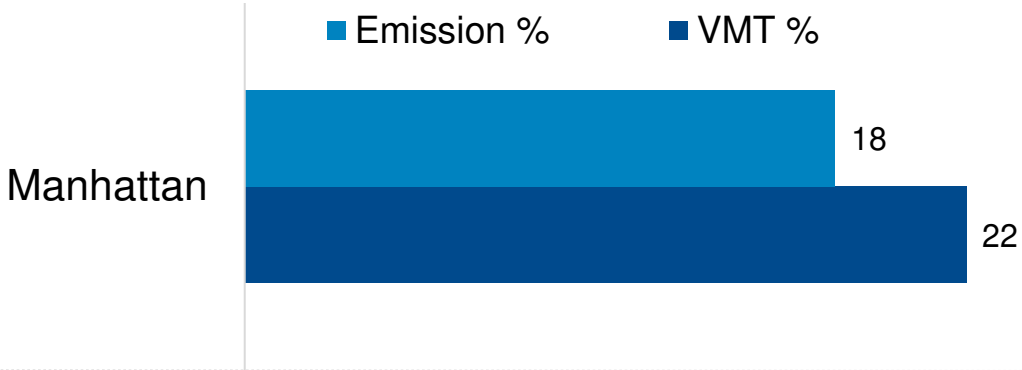
Results

Emissions Generation is Concentrated in Outer Boroughs

Brooklyn and Queens shares the most emission shares among five boroughs, Manhattan being in third



Manhattan has interesting result



Examined Three Policy Scenarios

Off-Peak Shift

Moving 10, 20, 30% of PEAK deliveries to OFF-PEAK hours

Full and Near Zero Electrification

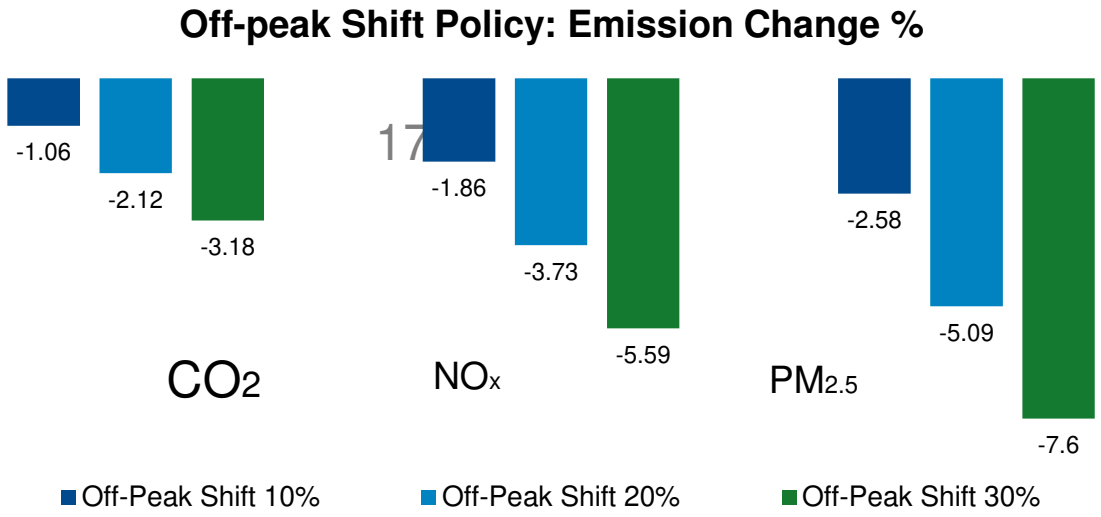
Adopting zero-tailpipe emission vehicles (EVs): 10, 20, 50% EV Trucks

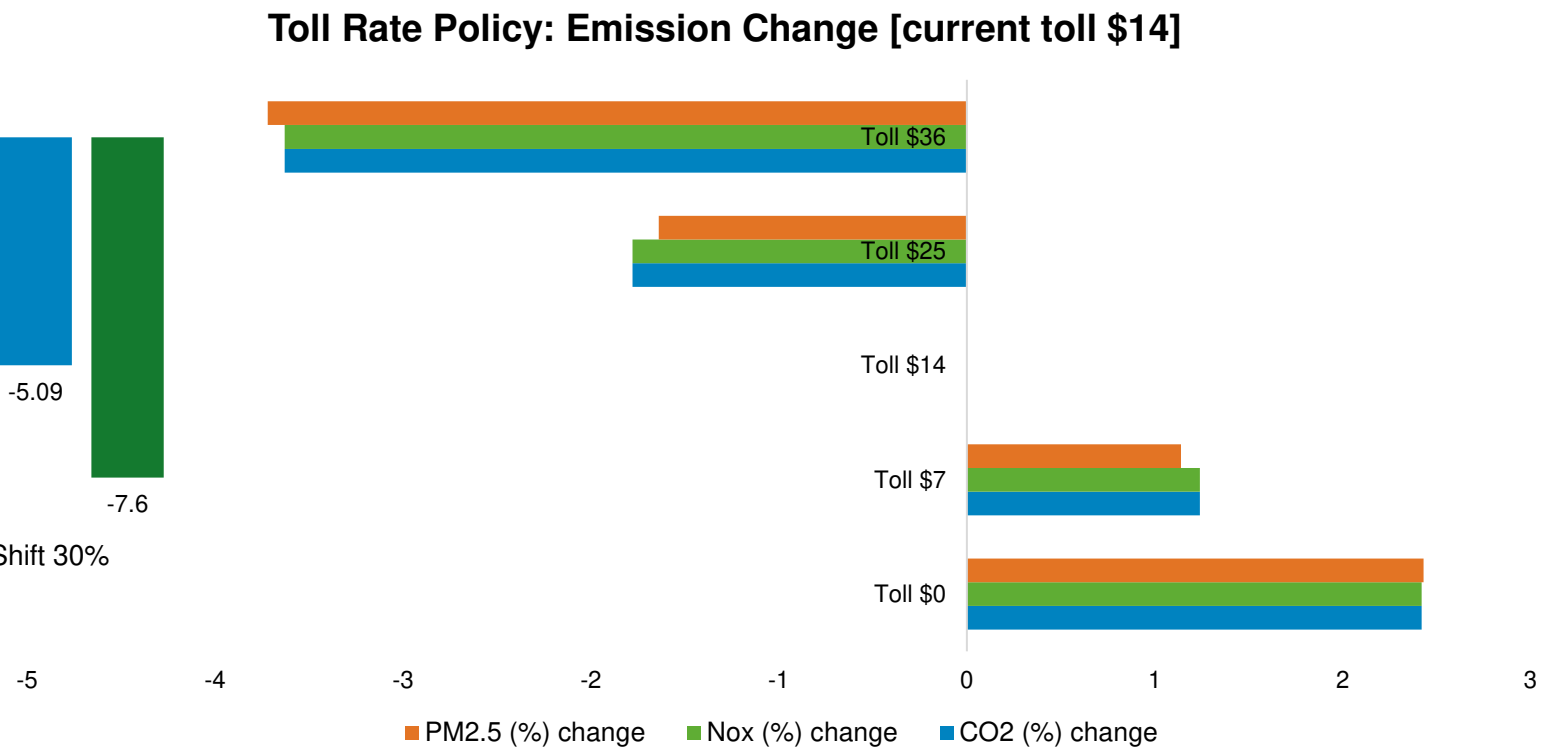
Tolling Sensitivity

Flat increase in current toll prices [$0, 7, 14, 25, 36]

Current toll

Policy Results

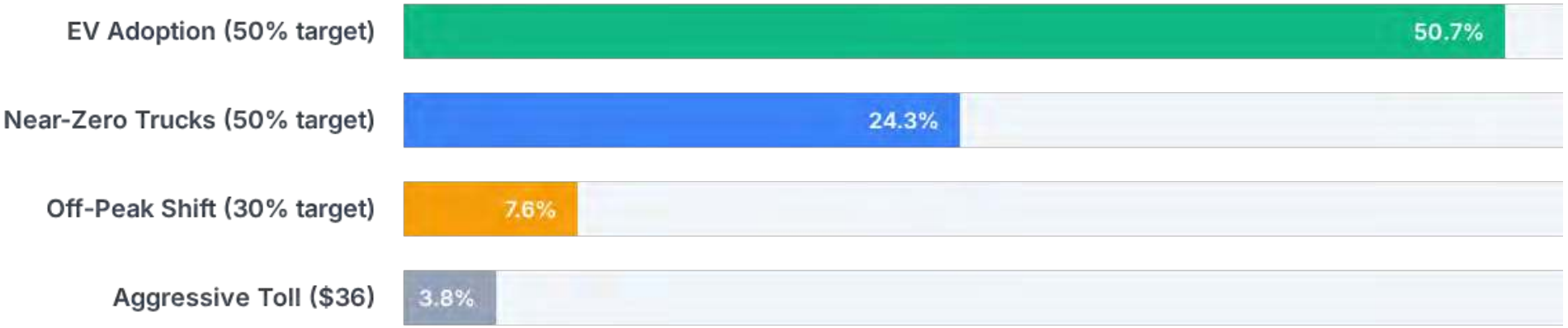




Scenario	CO_2 Change	NO_x Change	$PM_{2.5}$ Change
EV Adoption 10%	-10.13%	-10.14%	-10.14%
EV Adoption 25%	-25.34%	-25.34%	-25.34%
EV Adoption 50%	-50.67%	-50.69%	-50.69%

Conclusions

Policy and Emission Effects



- While pricing is necessary for revenue generation, the model dictates that true environmental progress requires aggressive, parallel investments in vehicle technology and operational timing
- Toll revenue could be connected to fleet transitions investment

This is occurring already:

- New York State is utilizing $15M in CRZ revenues to replace highly polluting diesel Transport Refrigeration Units (TRUs) at the Hunts Point Produce Market
- Replacing just 20 units avoids particulate matter emissions equivalent to removing 6,600 truck trips a day from the Cross Bronx Expressway, perfectly validating the model's portfolio logic

Conclusions

The Power of Policy Bundling

Finance and Access

Cordon pricing serves as the crucial **funding mechanism** and border access control, generating necessary capital despite modest demand suppression

Operations

Off-hour delivery programs and curbside management alleviate daytime capacity constraints, yielding direct, immediate **local air-quality improvements**

Decarbonization

Reinvesting toll revenues into **EV/Near-Zero fleet** subsidies provides the massive, **long-term environmental payoffs** that pricing alone cannot achieve

Limitations and Pathways Forward

- **Integrate New Jersey:** Expand the model's boundaries to fully capture the massive influx of **external NJ trips**
- **Micro-Mobility:** Begin modeling the **shift from large trucks to cargo bikes** for last-mile deliveries in hyper-dense neighborhoods
- **Blue Highways:** Quantify the emissions impact of **shifting middle mile truck trips to Staten Island/Brooklyn barge transfers**
- **Receiver Behavior:** Add data on warehouse and retail open hours to **better predict off-peak delivery adoption**

Thank You!

NEW YORK CITY DOT

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curb enthusiasm

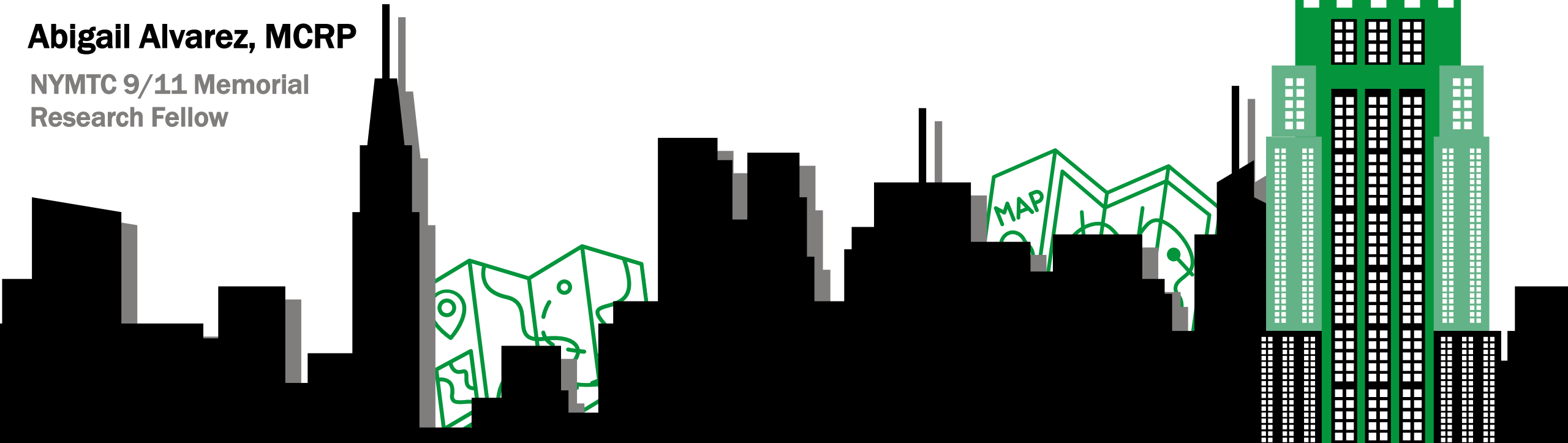
An NYC DOT Podcast

PUBLIC REALM FOR THE PEOPLE:

A Community-Centered Approach for NYC Streets

Abigail Alvarez, MCRP

NYMTC 9/11 Memorial Research Fellow



ACKNOWLEDGEMENTS

Thank you to everyone involved in my fellowship…

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Associate Professor of Urban Planning, Rutgers University

Adam Levine
NYMTC Executive Director

Mike Flynn
NYC DOT Commissioner

NYC DOT Public Realm Team

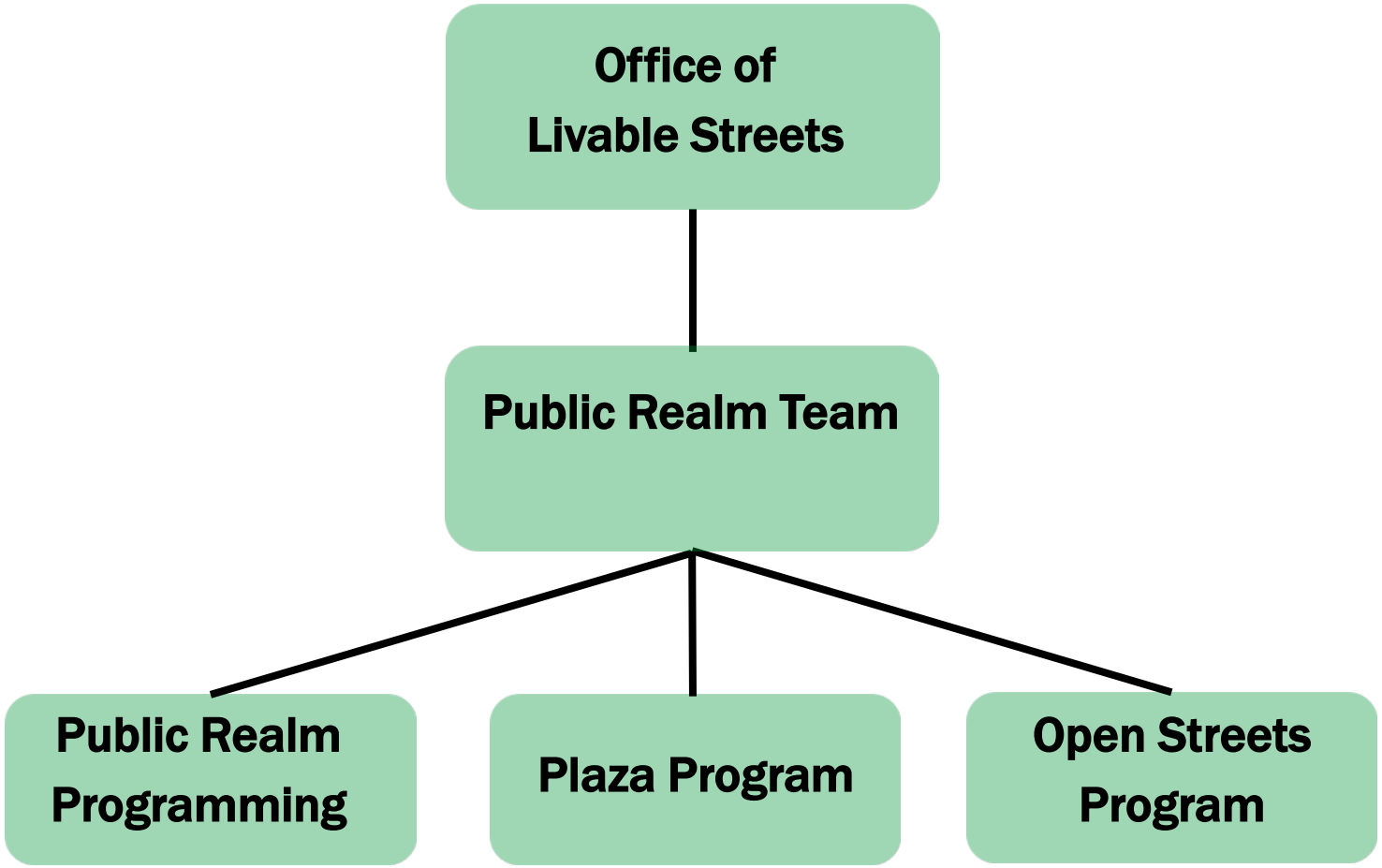
NYMTC Staff & Fellows

CONTEXT

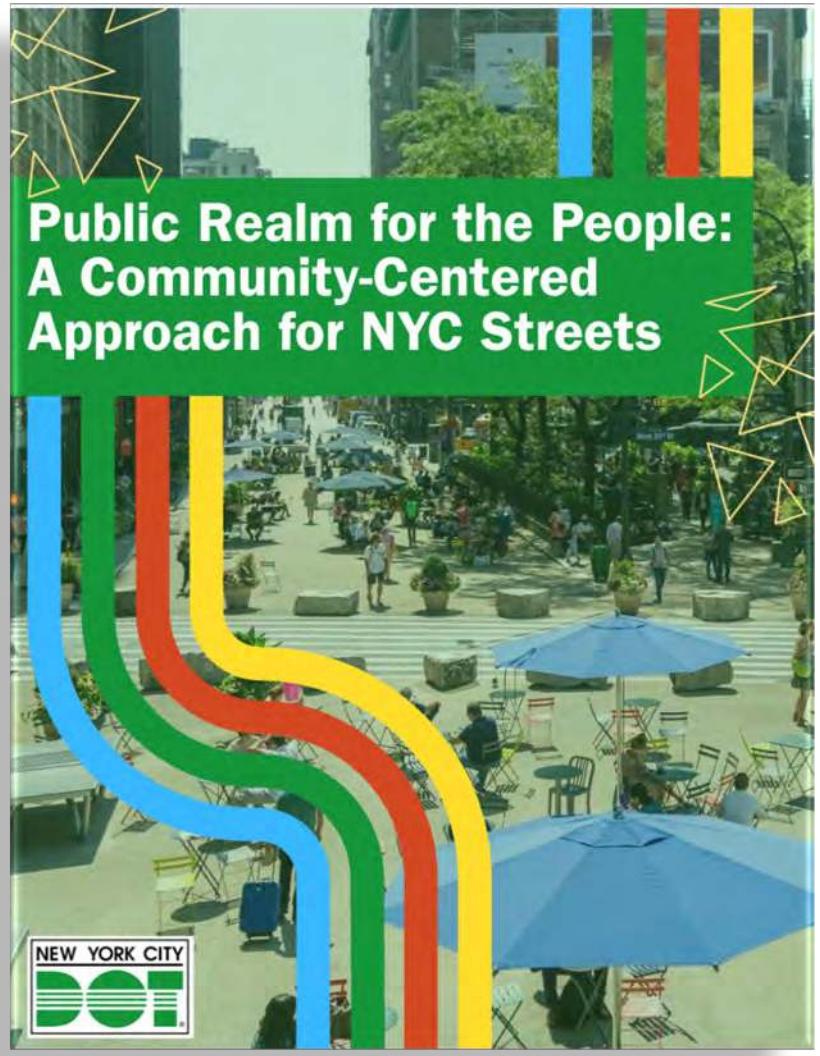
Public Realm Mission

“The NYC DOT partners with communities citywide to **reimagine our streets as public space**.

The work **enhances safety, access, and walkability** while fostering **community, culture, commerce, resilience, and health** to create an affordable, lifelong city for all.**”**



STRATEGIC REPORT



TYPES OF NYC DOT PUBLIC REALM PARTNERS

Open Streets Partners

Streets transformed into public spaces open to all, empowering communities to become stewards of their streets and reimagine them as valuable local assets.

Plaza Partners

Areas located fully within the public right-of-way designated for pedestrians, reclaiming streets for vibrant, social public spaces for all to enjoy.

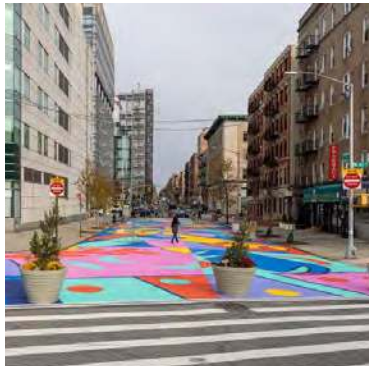
Programming Partners

An initiative that connects public spaces such as Plazas and Open Streets with local organizations to offer a wide range of positive, enriching activities.

BACKGROUND

PUBLIC REALM

Among cities, **public space plays a crucial yet overlooked role** in the quality of life, indicating an area of opportunity for practitioners to optimize it (Duivenvoorden et al., 2021).



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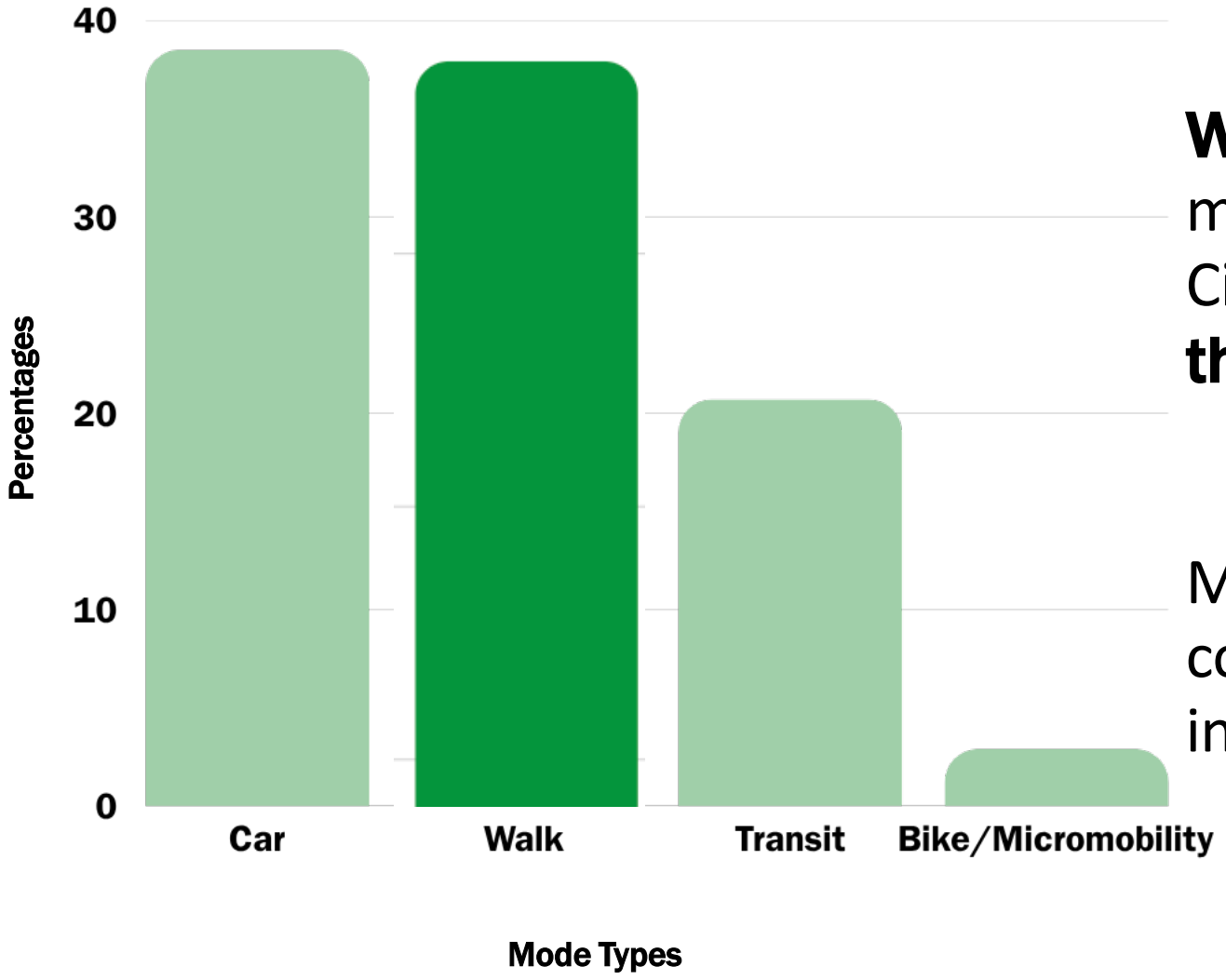
The public realm exists at the **intersection of public space and public life**, a **socio-spatial amalgamation** of urban design and culture (Aelbrecht & Sezer, 2025).

BACKGROUND

MOBILITY, CONNECTIVITY, & COMMUNITY



Walking is the **second-highest** mode of transportation in New York City, accounting for nearly **40% of the citywide mode share**

Most of the **first- and last-mile** connections to other modes involve walking

New York City Mobility Report, 2024

BACKGROUND

MOBILITY, CONNECTIVITY, & COMMUNITY

Social/recreation emerged as the **top purpose** for trips citywide (New York City Mobility Report, 2024).

The perceived quality of neighborhood public spaces is significantly and positively associated with a **sense of community** (Francis et al., 2012).

RESEARCH QUESTION

How do NYC DOT Plaza Partners, Open Streets Partners, and Programming Partners define, implement, and evaluate a community-centered approach in their public realm practices to foster fair access citywide?

METHODS

Research Type

30 qualitative, semi-structured interviews with Open Street, Plaza, & Programming Partners

Data Collection Timeline

6 months: January 2026 – June 2026

Format

Recorded & transcribed **audio/video interviews**

Recruitment

Purposive sampling from publicly available NYC DOT partner lists for **email outreach**

Data Analysis

Thematic analysis & inductive coding in Excel

(bottom-up approach for interpreting qualitative data to transform patterns into themes)

SAMPLE RESEARCH QUESTIONS

Definition

How does your organization define a community-centered approach in the context of Plaza, Open Streets, or Public Realm Programming?

Implementation

What techniques or strategies have you found to be useful in reaching broader audiences?

Evaluation

Are there indicators that you examine to evaluate the sense of belonging in your public space or programming? How are they measured?

INTERVIEWEE OVERVIEW

655 minutes

Cumulative Total Across 30 Interviews

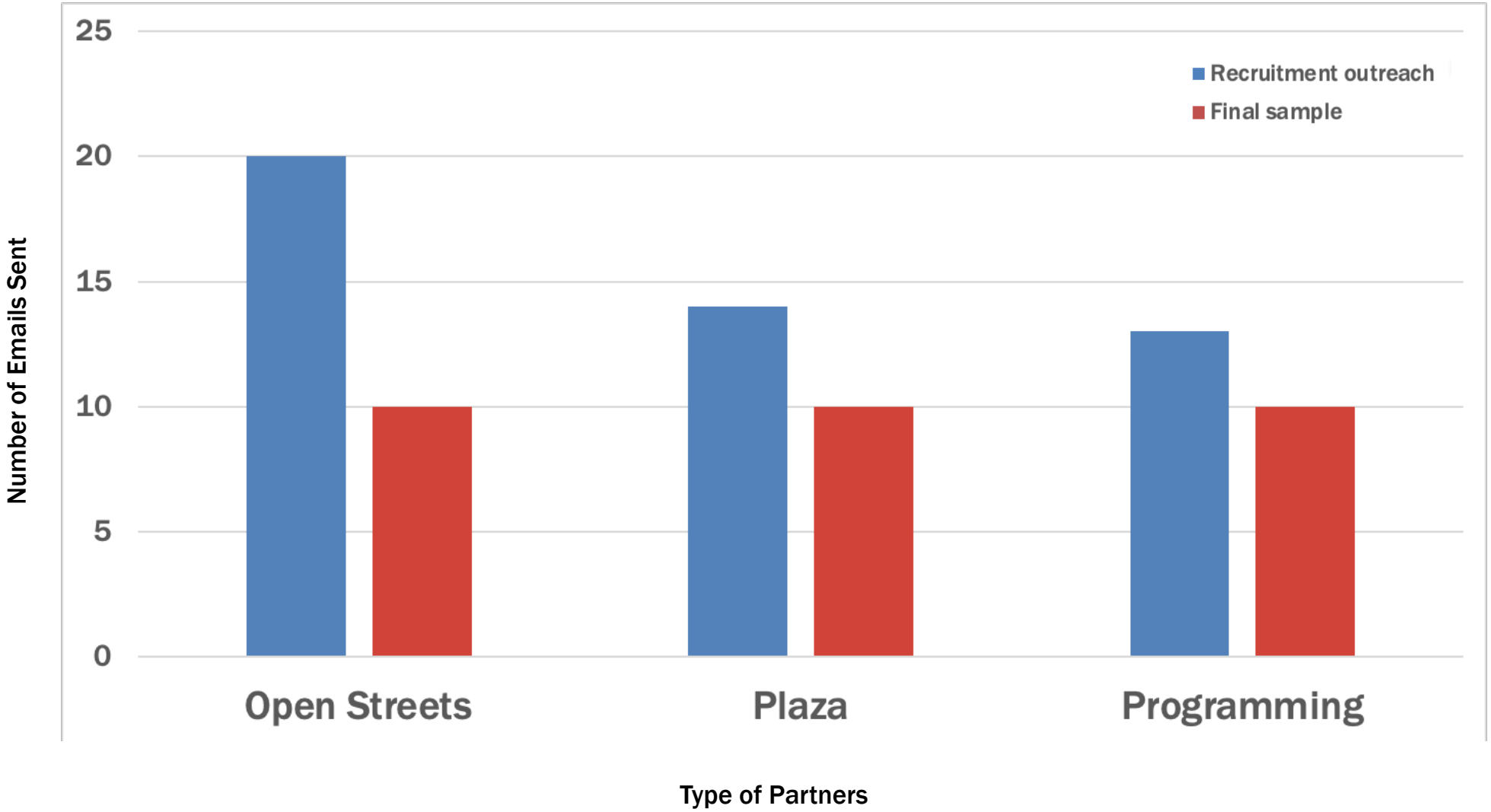
22 minutes

Average Interview Length

90%

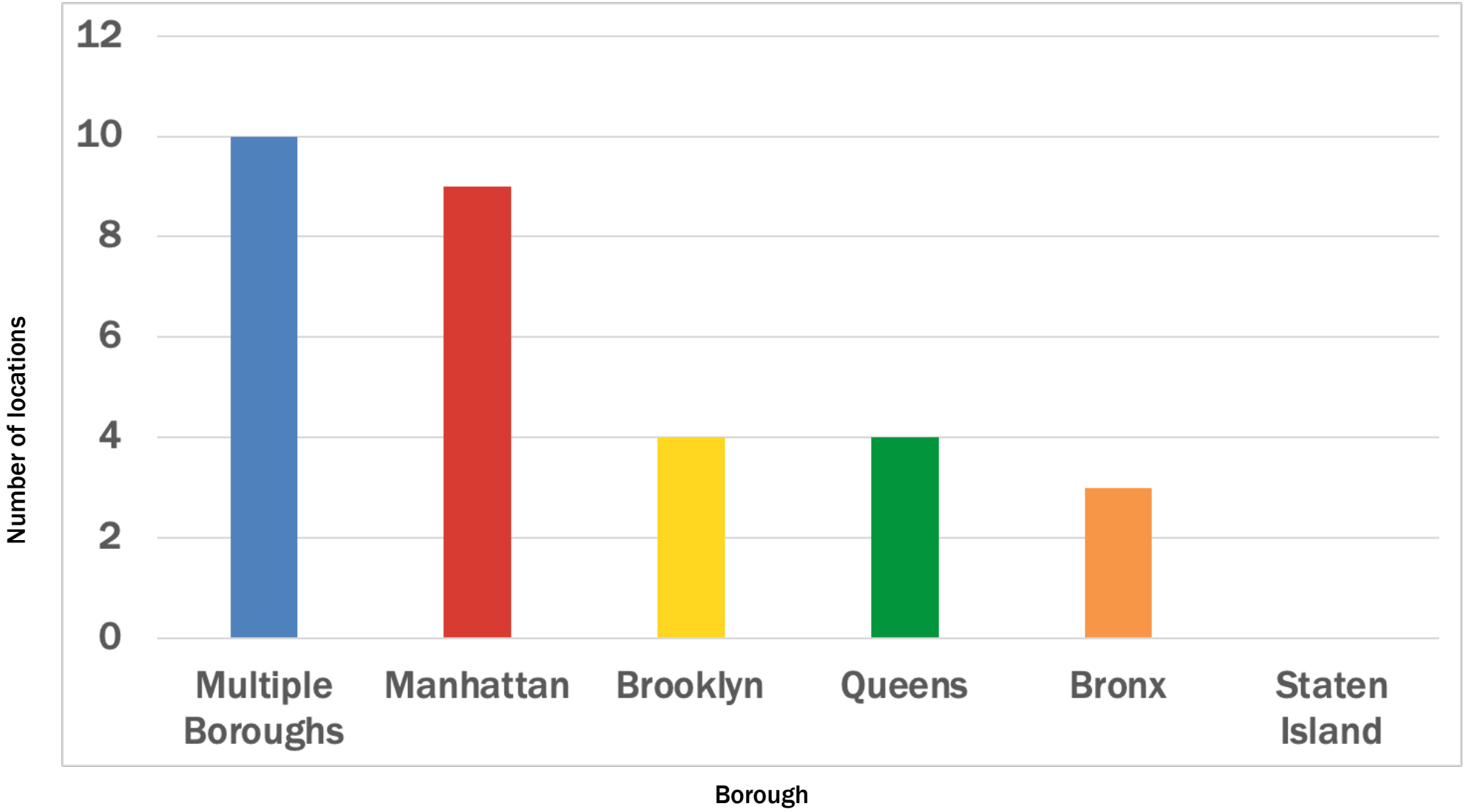
Open Streets & Plaza partner participants activate public space within of ½ mile of public transit

The NYC DOT partner **response rate** to email outreach was **64%**, a higher average than normal.



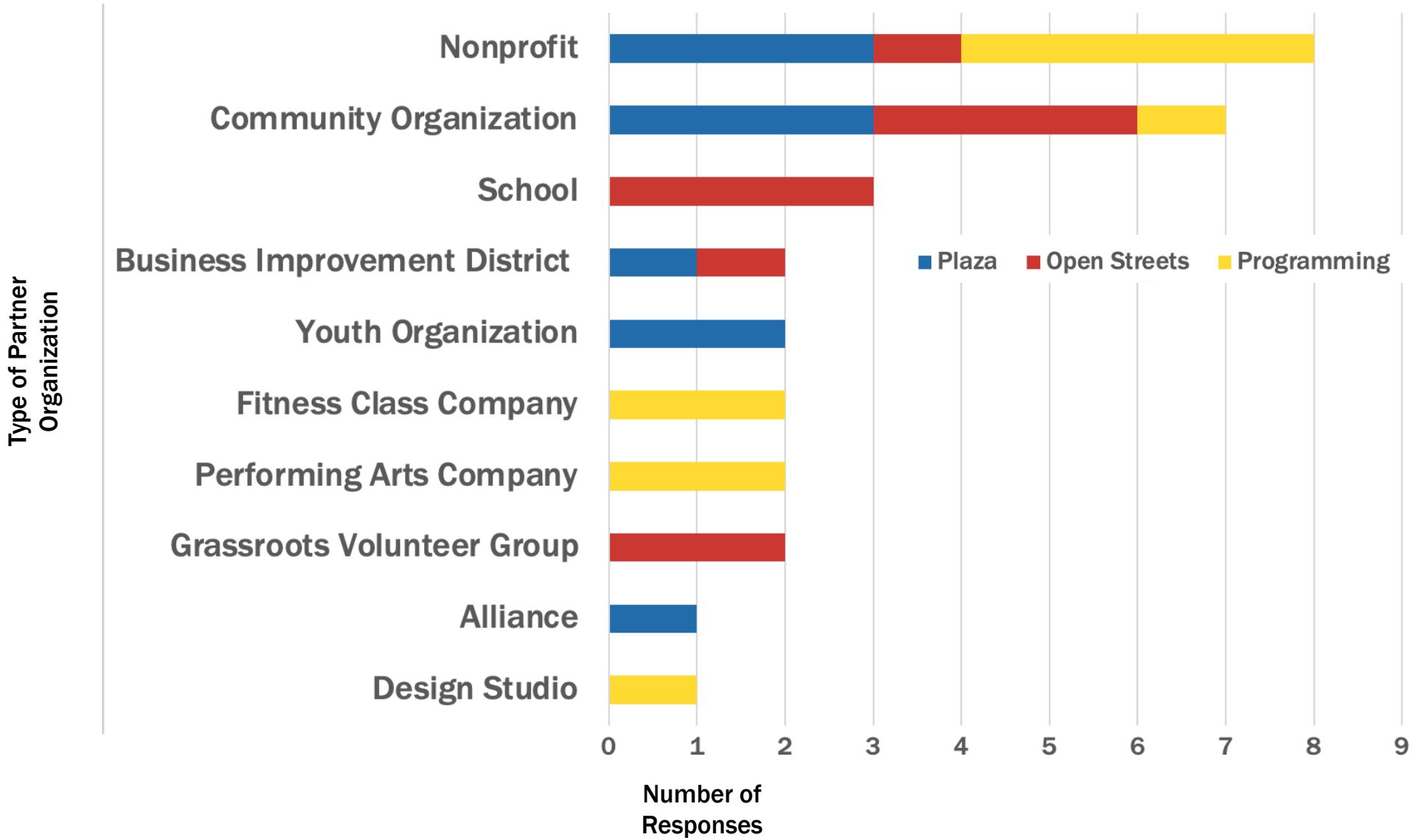
*Email outreach continued until each partner type had 10 participants each; some partners required more outreach than others to reach the goal of 10

The interview sample represents a diverse location distribution across New York City, primarily in **multi-borough work.**



*Staten Island includes a small amount of NYC DOT-operated public space; partners were contacted, but did not respond, leading to no representation in the data

Most NYC DOT Partners in the interviews largely identify as **nonprofits** or **community organizations.**



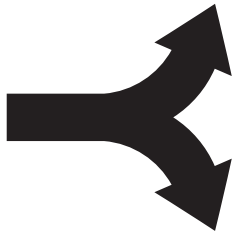
KEY FINDINGS

MOST COMMON WORDS FROM INTERVIEW TRANSCRIPTS

KEY FINDINGS

DEFINITION OF A COMMUNITY-CENTERED PUBLIC REALM

Across all 30 partners, the **dominant definition** of a community-centered public realm emerges as **free, open, and universal access** for everyone.



The concept of **“everyone”** in the public realm varies depending on the characteristics of the community, mainly **neighborhood-specific demographics**.

KEY FINDINGS

IMPLEMENTATION OF A COMMUNITY-CENTERED PUBLIC REALM

Implementing a community-centered approach in the public realm requires a **multi-pronged approach** of **adaptive design, strategic programming, and flexible execution** for every body and every place.

Relationship-building through **consistent community and stakeholder partnership** strengthens the implementation of a community-centered approach.

The implementation of a community-centered approach operates in **two** primary ways: **active mission versus passive openness.**

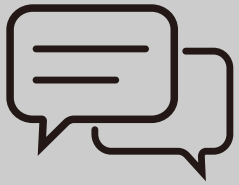
KEY FINDINGS

EVALUATION OF COMMUNITY-CENTERED PUBLIC REALM

Evaluation of a community-centered public realm largely relies upon **informal interactions over formal measurement**.

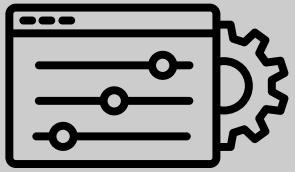
Structural constraints such as **funding, staffing, and bureaucratic processes** may limit community-centered practices.

IMPLICATIONS FOR PRACTICE



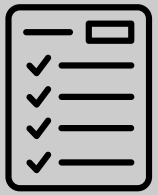
Definition

Standardize the **language and framing** around a “community-centered” approach



Implementation

Provide **clear examples of low-lift and cost-effective** community-centered considerations



Evaluation

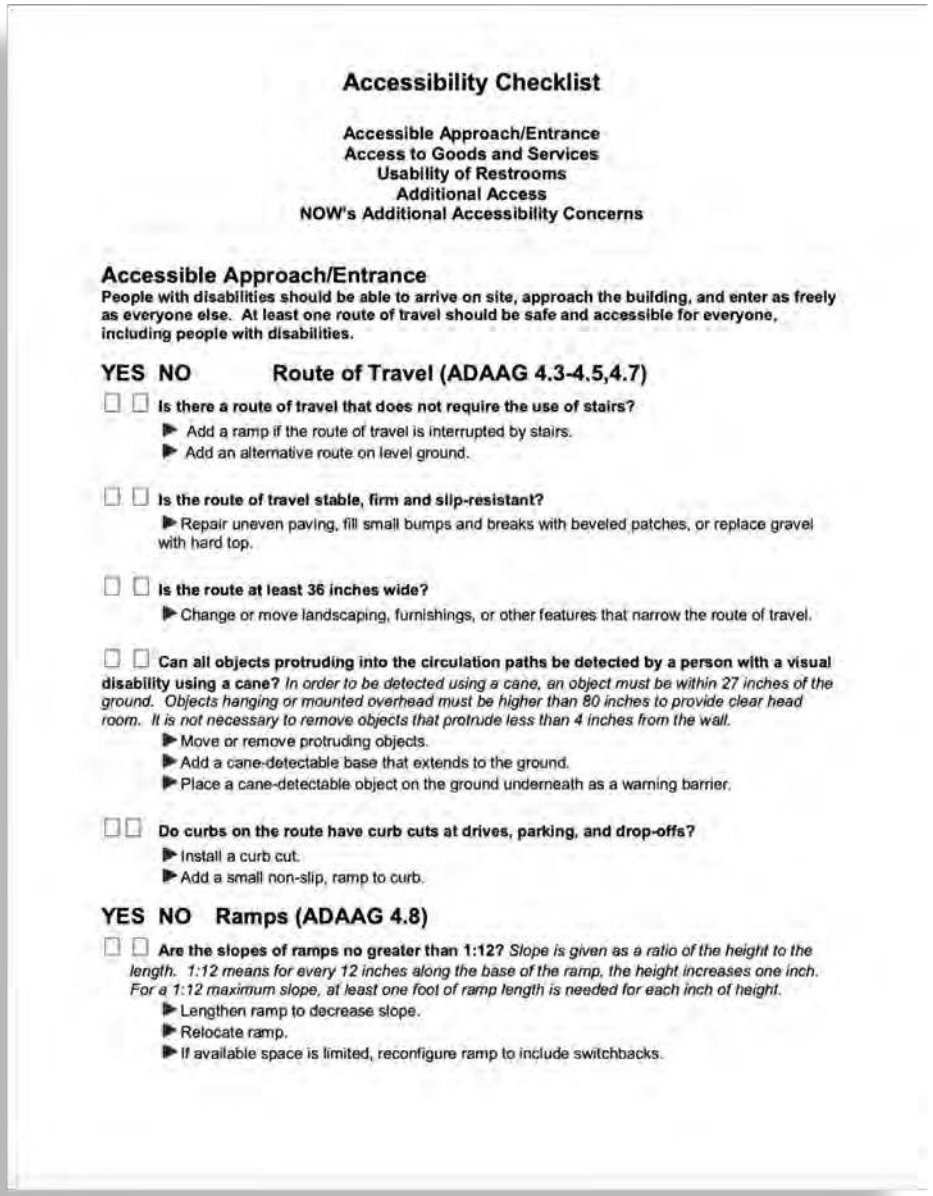
Encourage more robust **data-driven assessment**

RECOMMENDATIONS
SHORT TERM

Design a community-centered checklist for public space and programming considerations

Accessibility Checklist

National Organization for Women



Accessibility Checklist

Accessible Approach/Entrance
Access to Goods and Services
Usability of Restrooms
Additional Access
NOW's Additional Accessibility Concerns

Accessible Approach/Entrance
People with disabilities should be able to arrive on site, approach the building, and enter as freely as everyone else. At least one route of travel should be safe and accessible for everyone, including people with disabilities.

YES NO Route of Travel (ADAAG 4.3-4.5,4.7)

☐ ☐ **Is there a route of travel that does not require the use of stairs?**
- ▶ Add a ramp if the route of travel is interrupted by stairs.
- ▶ Add an alternative route on level ground.

☐ ☐ **Is the route of travel stable, firm and slip-resistant?**
- ▶ Repair uneven paving, fill small bumps and breaks with beveled patches, or replace gravel with hard top.

☐ ☐ **Is the route at least 36 inches wide?**
- ▶ Change or move landscaping, furnishings, or other features that narrow the route of travel.

☐ ☐ **Can all objects protruding into the circulation paths be detected by a person with a visual disability using a cane?** *In order to be detected using a cane, an object must be within 27 inches of the ground. Objects hanging or mounted overhead must be higher than 80 inches to provide clear head room. It is not necessary to remove objects that protrude less than 4 inches from the wall.*
- ▶ Move or remove protruding objects.
- ▶ Add a cane-detectable base that extends to the ground.
- ▶ Place a cane-detectable object on the ground underneath as a warning barrier.

☐ ☐ **Do curbs on the route have curb cuts at drives, parking, and drop-offs?**
- ▶ Install a curb cut.
- ▶ Add a small non-slip, ramp to curb.

YES NO Ramps (ADAAG 4.8)

☐ ☐ **Are the slopes of ramps no greater than 1:12?** *Slope is given as a ratio of the height to the length. 1:12 means for every 12 inches along the base of the ramp, the height increases one inch. For a 1:12 maximum slope, at least one foot of ramp length is needed for each inch of height.*
- ▶ Lengthen ramp to decrease slope.
- ▶ Relocate ramp.
- ▶ If available space is limited, reconfigure ramp to include switchbacks.

RECOMMENDATIONS
SHORT TERM

Organize Public Realm Partner networking events

Public Space Potluck Series

Design Trust for Public Space

PUBLIC SPACE POTLUCK

Public Space Potluck at Socrates Sculpture Park

Thursday, August 15, 2024 @ 5:30 – 7:30 PM

Join Design Trust for Public Space, Municipal Art Society, and Open House New York for a Public Space Potluck at Socrates Sculpture Park.

RECOMMENDATIONS
MEDIUM TERM

Offer community-centered training sessions or workshops

Trainings

Project for Public Spaces

TRAINING

Placemaking: Making it Happen (Online Training)

SEP 15–OCT 1, 2026 ONLINE

Our signature three-week, six-session online training builds on participants' knowledge of placemaking concepts, and provides the tools to implement and manage individual projects. Registration is now open!

TRAINING

Fundraising for Your Public Space: Simple Strategies, Systems, and Structures for the Busy Practitioner

OCT 21–OCT 23, 2026 ONLINE

Keeping public spaces thriving requires reliable funding. This mini-course helps place-based organizations shift from reactive fundraising to a more sustainable, strategic approach. Early registration opens on August 9.

RECOMMENDATIONS
MEDIUM TERM

Create a public realm evaluation tool template

Great Public Spaces Evaluation Tool for Public Space and Public Life

New South Wales Australian Government

Please fill out your evaluation below

N/A Can't answer/not applicable **1** Strongly disagree **2** Disagree **3** Neutral **4** Agree **5** Strongly agree

Divide the total score by the number of answered questions in each of the four themes.
The average score for each theme provides an overview of its performance compared to the other themes.

Am I able to get there?	Score
People find it easy and pleasant to get to the public space, through a network of paths, streets, public transport and signage	N/A
People can easily access the public space through multiple entrances	N/A
People of all ages and abilities can easily and comfortably move around the space	N/A
People walking are protected from all vehicles including cyclists	N/A
People riding bikes are protected from other vehicles	N/A
Average score Total score ÷ number of answered questions	**N/A**

Am I able to play and participate?	Score
There are a range of things to do in the public space including exercise, recreation, games, play and/or learning opportunities	N/A
The public space encourages positive social interactions or individual experiences e.g. talking, casual or planned	N/A
People of all ages and abilities can use the space and have the facilities they need to stay e.g. end of trip facilities or drinking water	N/A
There is a choice of places or features to safely sit, play, thrive and relax	N/A
There are social or cultural activities appropriate to the space e.g. programmed activities or events	N/A
Average score Total score ÷ number of answered questions	**N/A**

Am I able to stay?	Score
People can sit in the shade or in the sun	N/A
There are a range of comfortable places to sit, stay or relax and amenities are provided	N/A
There are enough trees, grass and plants to make the public space shaded and comfortable	N/A
The public space feels safe during the day	N/A
The public space feels safe at night	N/A
The public space is lit at night and has clear sight lines and good visibility	N/A
The public space is clean and well-maintained	N/A
The surrounding buildings scale are not too dominating, allowing people to feel comfortable in the public space	N/A
It is well designed, visually attractive with scenic qualities	N/A
There are features that shelter you from wind, sun, and rain	N/A
You are protected from noise, dust, unpleasant smells, or pollution in the public space	N/A
Average score Total score ÷ number of answered questions	**N/A**

Am I able to connect?	Score
People with a diversity of ages, genders, cultural or ethnic backgrounds are using the public space	N/A
There is an interesting atmosphere and activities e.g. people watching, arts and cultural activations	N/A
You can meet people and socialise, and it is a positive place	N/A
There are shops, cafes, community services or economic activity close by	N/A
People are able to connect with each other in both a commercial and non-commercial settings	N/A
There are local stories of significance (First Peoples, historic, cultural) told and celebrated in the public space	N/A
There are public artworks, heritage or monuments that reflect the unique local character	N/A
There is evidence of volunteerism, community stewardship and/or the space is well-loved and well attended for its function	N/A
There are cultural, performance or musical activations	N/A
The public space feels welcoming with a sense of belonging and you feel encouraged to return	N/A
Average score Total score ÷ number of answered questions	**N/A**

RECOMMENDATIONS
LONG TERM

Identify key stakeholders for more private-public partnerships

NYC DOT Soccer Streets with Chobani at PS 32

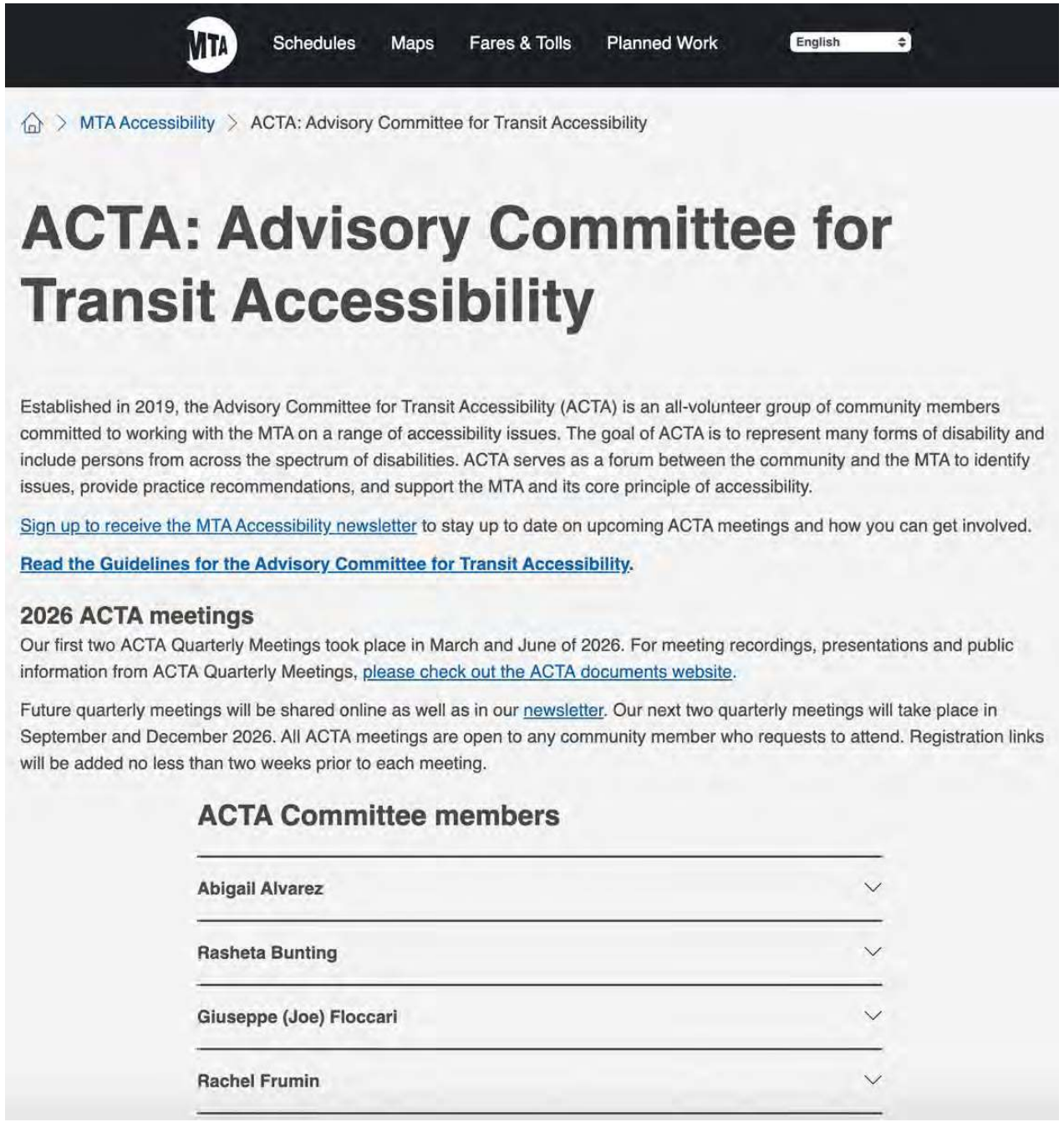
NYC DOT and Street Lab

RECOMMENDATIONS
LONG TERM

Curate a Public Realm Partners Advisory Committee

Advisory Committee for Transit Accessibility

MTA ACTA



Schedules Maps Fares & Tolls Planned Work English

MTA Accessibility > ACTA: Advisory Committee for Transit Accessibility

ACTA: Advisory Committee for Transit Accessibility

Established in 2019, the Advisory Committee for Transit Accessibility (ACTA) is an all-volunteer group of community members committed to working with the MTA on a range of accessibility issues. The goal of ACTA is to represent many forms of disability and include persons from across the spectrum of disabilities. ACTA serves as a forum between the community and the MTA to identify issues, provide practice recommendations, and support the MTA and its core principle of accessibility.

Sign up to receive the MTA Accessibility newsletter to stay up to date on upcoming ACTA meetings and how you can get involved.

Read the Guidelines for the Advisory Committee for Transit Accessibility.

2026 ACTA meetings

Our first two ACTA Quarterly Meetings took place in March and June of 2026. For meeting recordings, presentations and public information from ACTA Quarterly Meetings, please check out the ACTA documents website.

Future quarterly meetings will be shared online as well as in our newsletter. Our next two quarterly meetings will take place in September and December 2026. All ACTA meetings are open to any community member who requests to attend. Registration links will be added no less than two weeks prior to each meeting.

ACTA Committee members

Abigail Alvarez

Rasheta Bunting

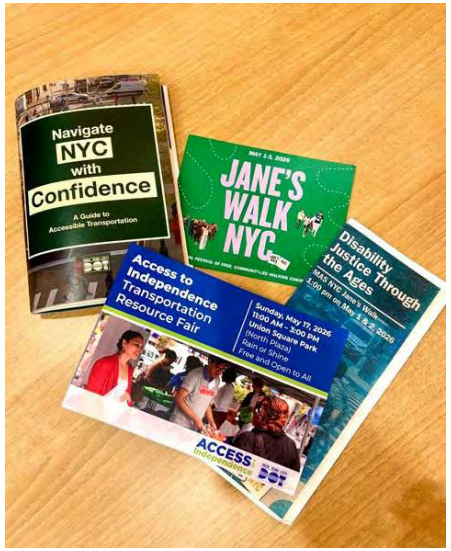
Giuseppe (Joe) Floccari

Rachel Frumin

RESEARCH IN ACTION

ACCESSIBILITY ALONG 14TH STREET

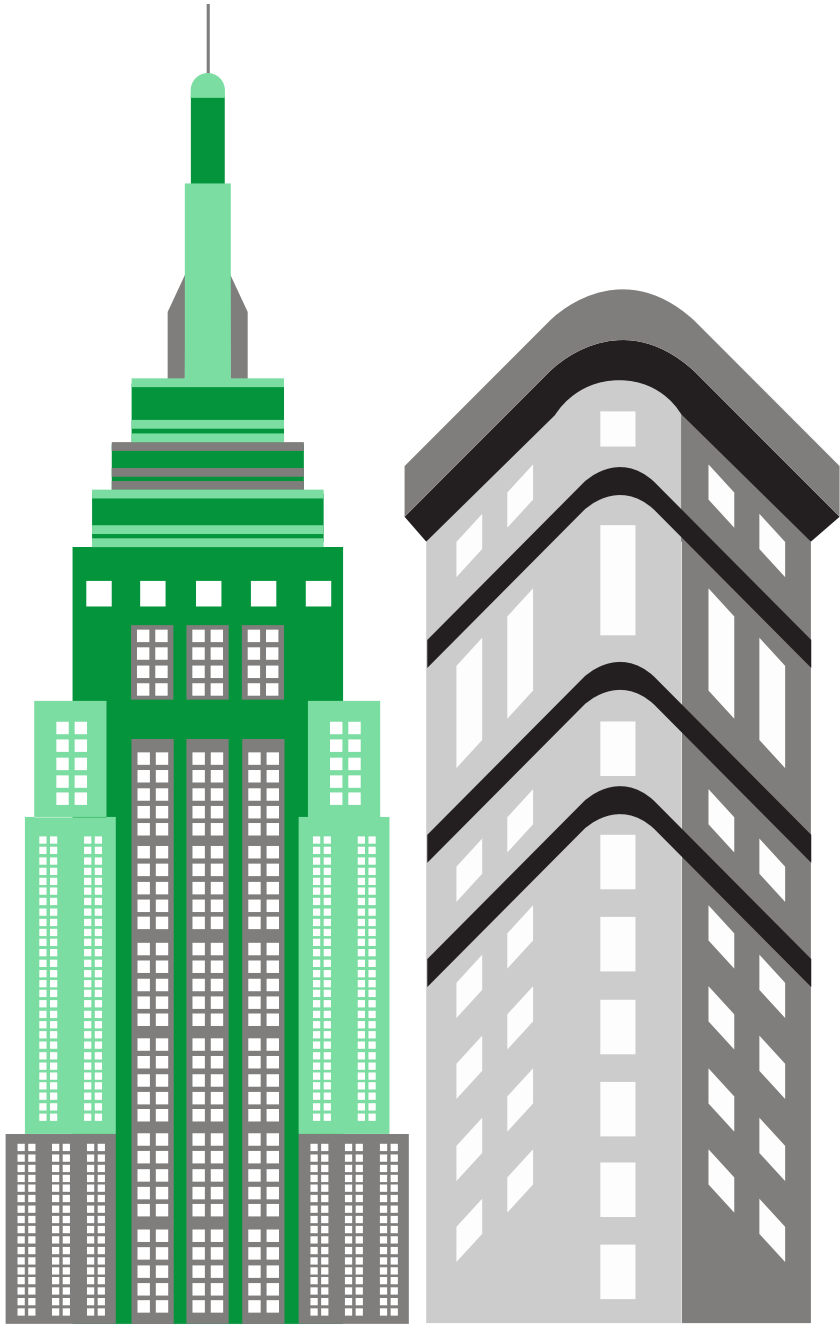
- The only tour focused on **ADA & transit accessibility**
- Nearly **50 attendees** from two tours over two days, including guests from the **Union Square Partnership** and **Elevator Action Group**!
- Offered a **wheelchair accessible** route and **ASL interpretation**
- Shared a tour brochure, NYC Transportation Accessibility guidebook, and flyer for the NYC DOT, **"Access to Independence Transportation Resource Fair"**



The Municipal Art Society of New York
MASNYC

THANK YOU!

LET'S STAY CONNECTED...

abigail.alvarez@rutgers.edu

www.linkedin.com/in/abigail-alvarezzz/