

Toward a Safer Future: Innovation in Micromobility Safety



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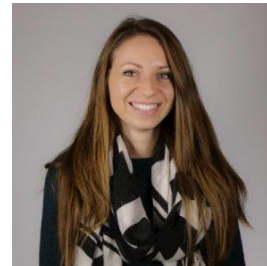
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U.S. Department
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Administration**

Serving All People, All Abilities

Rutgers Micromobility 2.0 Workshop

Session 2 - Towards a Safer Future: Innovations for Micromobility Safety

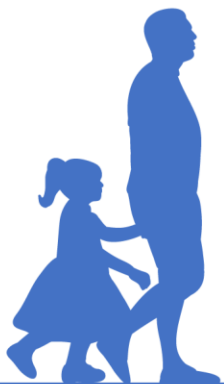
Friday, March 22, 2024

Bronwen Keiner, Office of Human Environment, Federal Highway Administration

Alan Huff, Federal Highway Administration – New Jersey Division

Hannah Younes, PhD, Alan M. Voorhees Transportation Center

Eli Guseman, AICP, City of Jersey City



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U.S. DOT's Micromobility Research



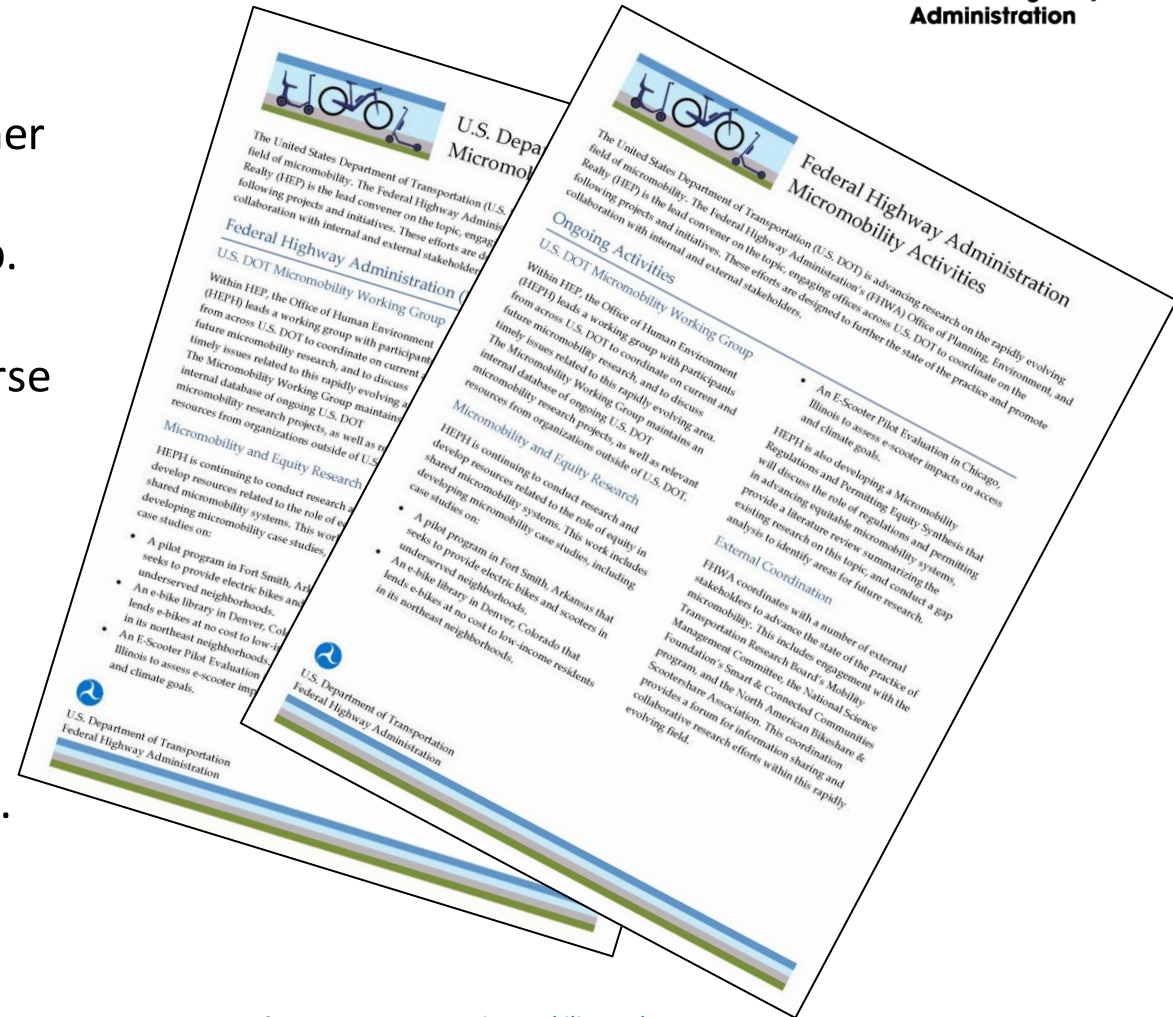
U.S. Department of Transportation
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U.S. DOT is **advancing research** on the rapidly evolving field of micromobility. FHWA's Office of Planning, Environment, and Realty (HEP) is U.S. DOT's lead convener on the topic, coordinating with offices across U.S. DOT through the internal **Micromobility Working Group**.

FHWA's **Micromobility Research Roadmap** charts a course for research we are conducting with our partners.

Our [Micromobility Regulations & Permitting Equity Synthesis](#) was published in October 2023.

Visit our new webpage at <https://www.fhwa.dot.gov/environment/micromobility/>.



Source: [New FHWA Micromobility Webpage](#)



Newsletters



U.S. Department
of Transportation
**Federal Highway
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For more information, subscribe to the following newsletters:

- **FOSTERING MULTIMODAL CONNECTIVITY NEWSLETTER:** This quarterly publication provides real-world examples (case studies) about multimodal transportation investments.
Website: www.fhwa.dot.gov/livability/newsletter/
- **HUMAN ENVIRONMENT DIGEST:** This monthly publication shares the latest information from a range of federal and nonfederal sources, addressing transportation and its relationship to the human environment.
Website: www.fhwa.dot.gov/livability/he_digest/
- **PBIC MESSENGER:** This monthly publication features the latest news, resources, webinars, upcoming events, and more.
Website: www.pedbikeinfo.org/newsroom/newsletters.cfm
- **PEDESTRIAN FORUM NEWSLETTER:** This publication is issued 2-3 times per year by the FHWA Office of Safety.
Website: https://safety.fhwa.dot.gov/ped_bike/pedforum/



Resources



U.S. Department
of Transportation
**Federal Highway
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Additional resources are available here:

- **RESEARCH REVIEW:** This quarterly publication provides information about the most recent research that has been completed by the Office of Human Environment.
Website: www.fhwa.dot.gov/hep/hep_research/newsletter/
- **BICYCLE AND PEDESTRIAN PLANNING, PROGRAM, AND PROJECT DEVELOPMENT GUIDANCE:**
Website: www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/guidance_2023.pdf
- **PROVEN SAFETY COUNTERMEASURES (PSC):** This is a collection of 28 countermeasures and strategies effective in reducing fatalities and serious injuries.
Website: <https://highways.dot.gov/safety/proven-safety-countermeasures>



Questions?



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US Department of Transportation
Federal Highway Administration
Office of Human Environment

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ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

The National Roadway Safety Strategy (NRSS) and the Safe System Approach (SSA)

Alan Huff, Safety Specialist

Federal Highway Administration – New Jersey Division

March 22, 2024



U.S. Department of Transportation
Federal Highway Administration



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The National Road Safety Strategy (NRSS)

www.transportation.gov/NRSS

Our Vision

Zero is the only acceptable number of deaths on our highways, roads, and streets.

The United States Department of Transportation is committed to taking substantial, comprehensive action to significantly reduce serious and fatal injuries on the Nation's roadways.

At USDOT, we support all efforts to achieve **zero**.



Image Credit: NHTSA



Image Credit: NHTSA



Image Credit: FHWA

National Roadway Safety Strategy



U.S. DOT's comprehensive approach to significantly reducing serious injuries and deaths on our Nation's highways, roads, and streets.

- Sets a Department-wide vision and goal
- Adopts the Safe System Approach
- Identifies new priority actions and notable changes to existing practices
- Leverages new funding and policies in the Bipartisan Infrastructure Law to bring this strategy to life
- Advances equity and climate goals
- **Calls others to action**

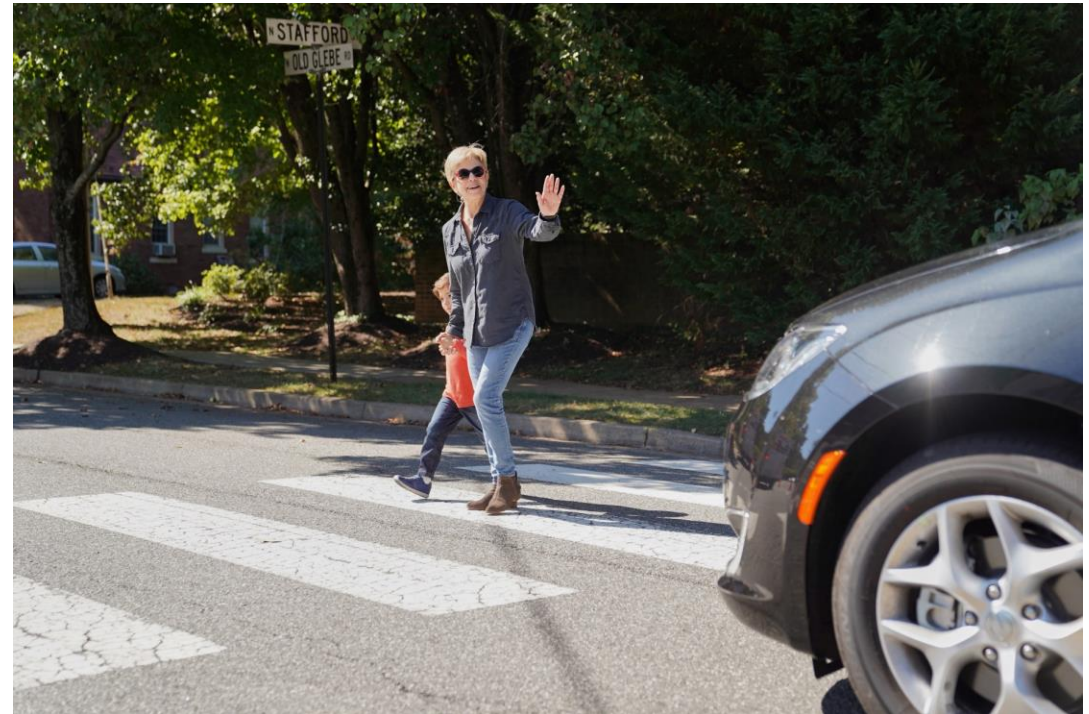
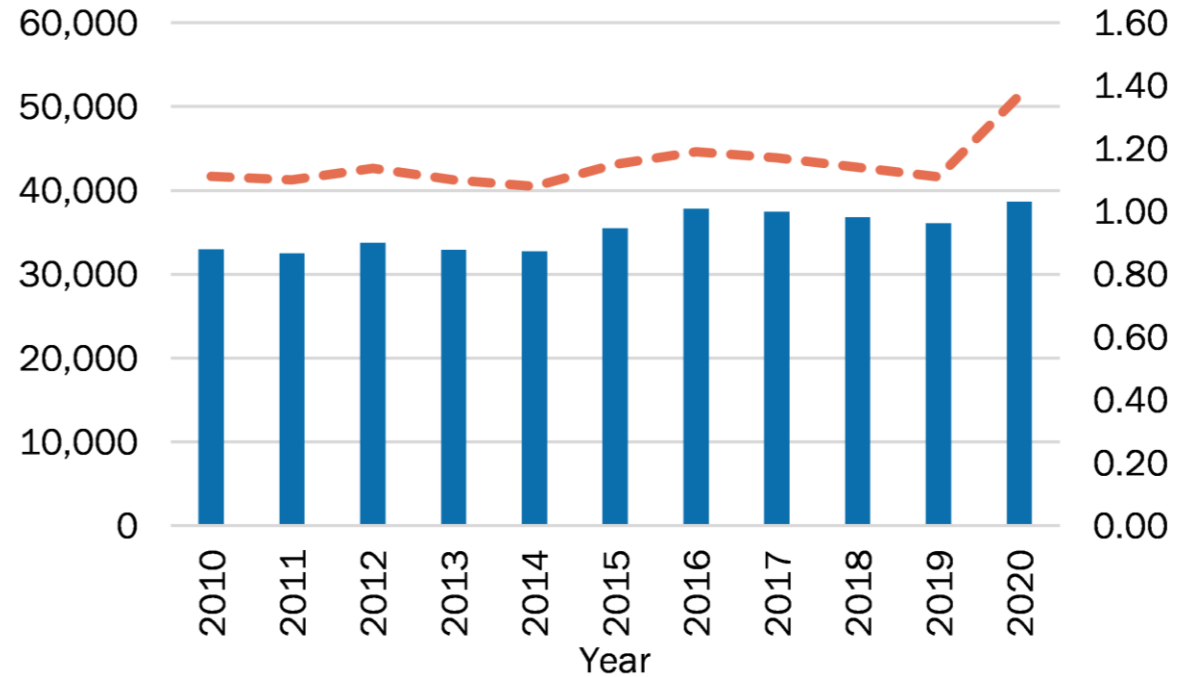
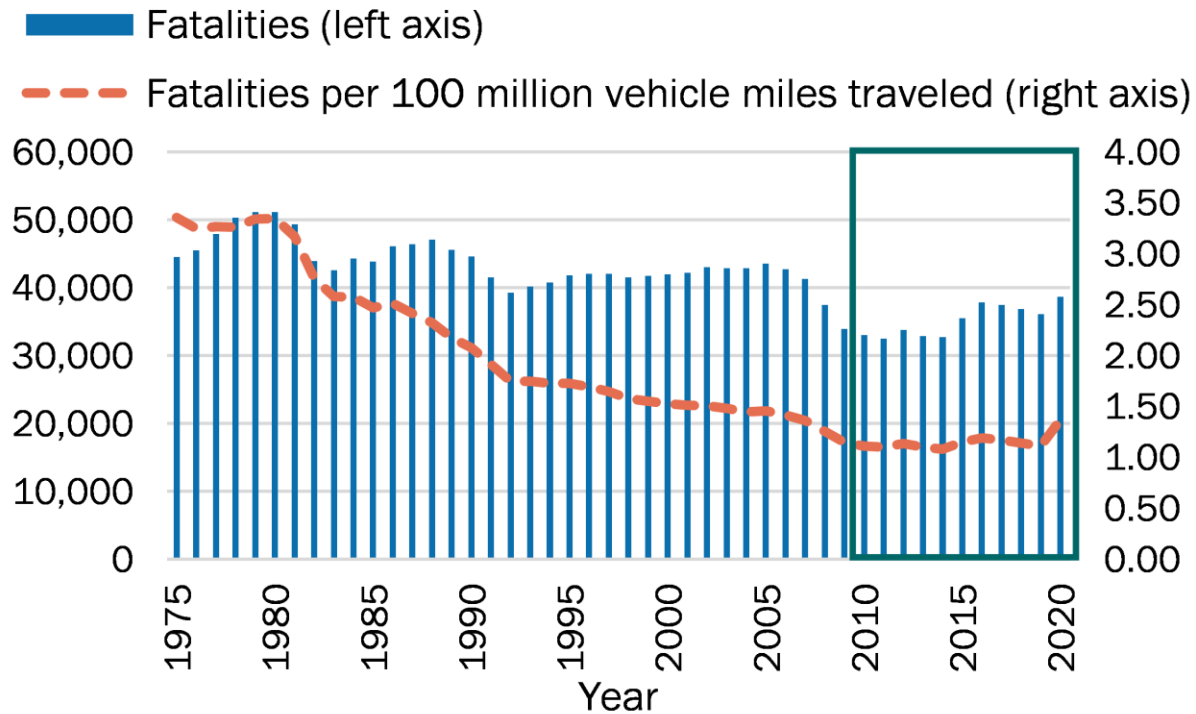


Image Credit: NHTSA

Our National Roadway Safety Problem



Roadway fatalities and the fatality rate declined consistently for 30 years...

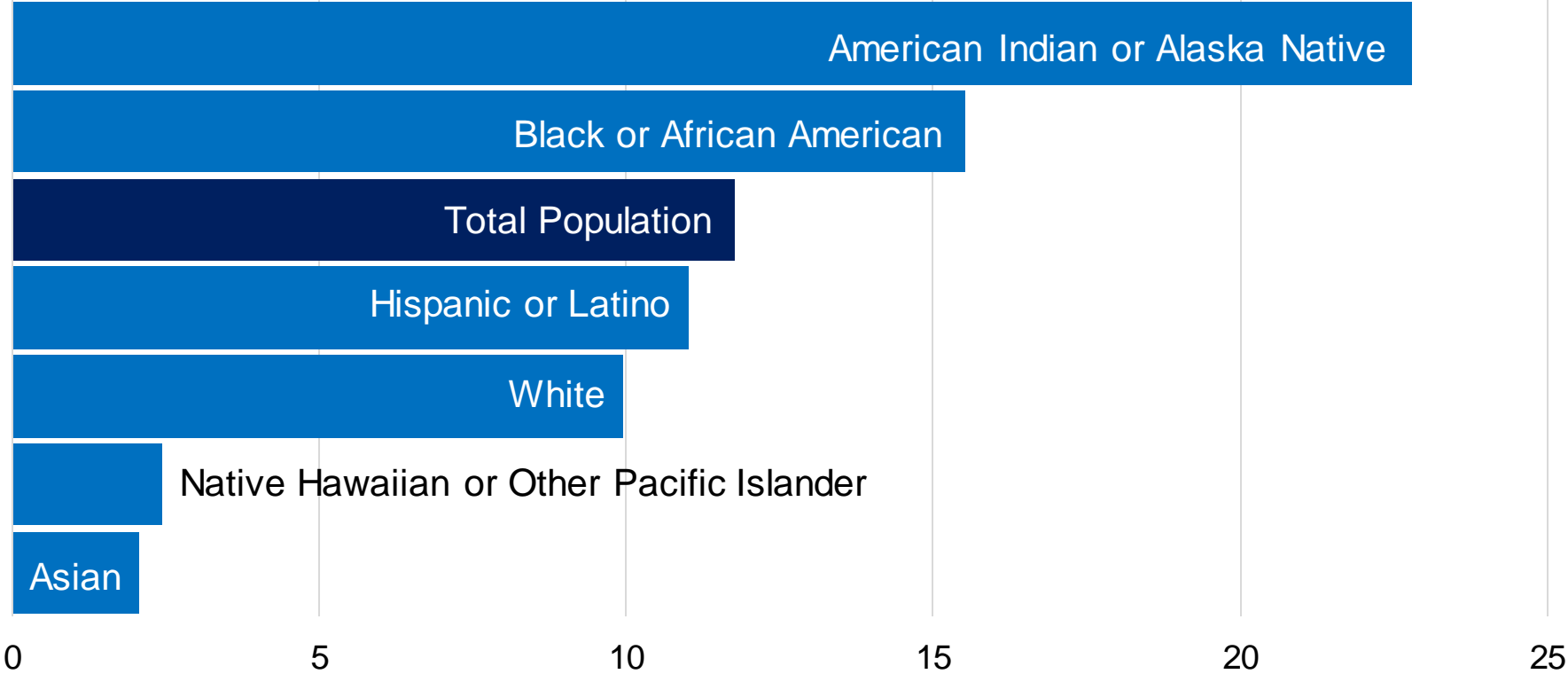


...but progress has stalled over the last decade...

Our National Roadway Safety Problem



Roadway Fatalities per 100,000 Population, by Race (2020)

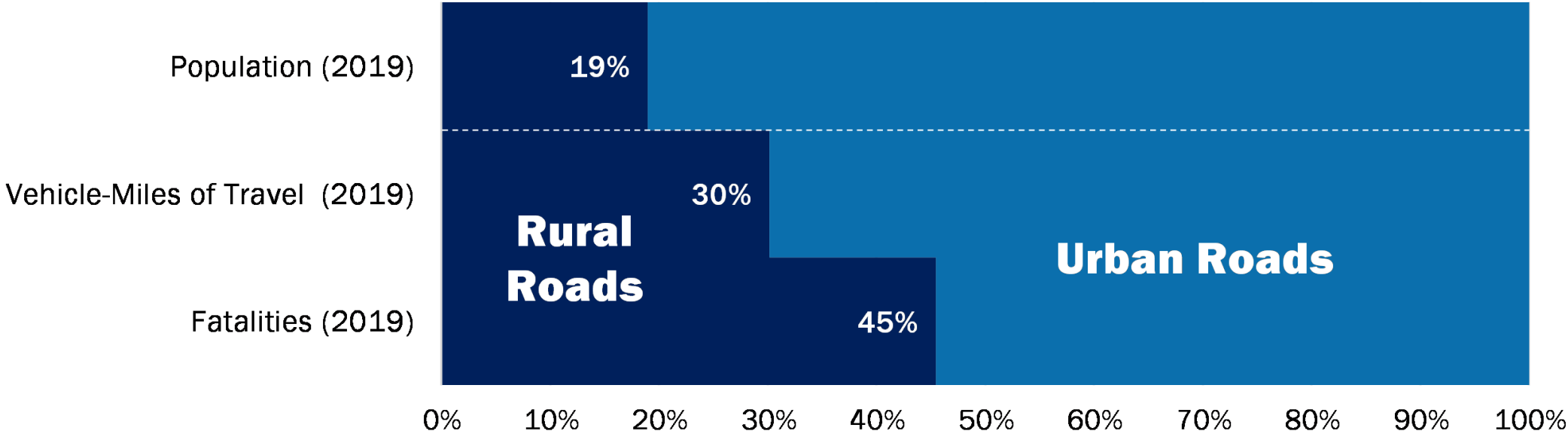


Source: FARS 2020 Final File; Population – Census Bureau

Our National Roadway Safety Problem



Fatalities and **fatal crashes occur disproportionately –**
by both population and vehicle travel – on rural roads.

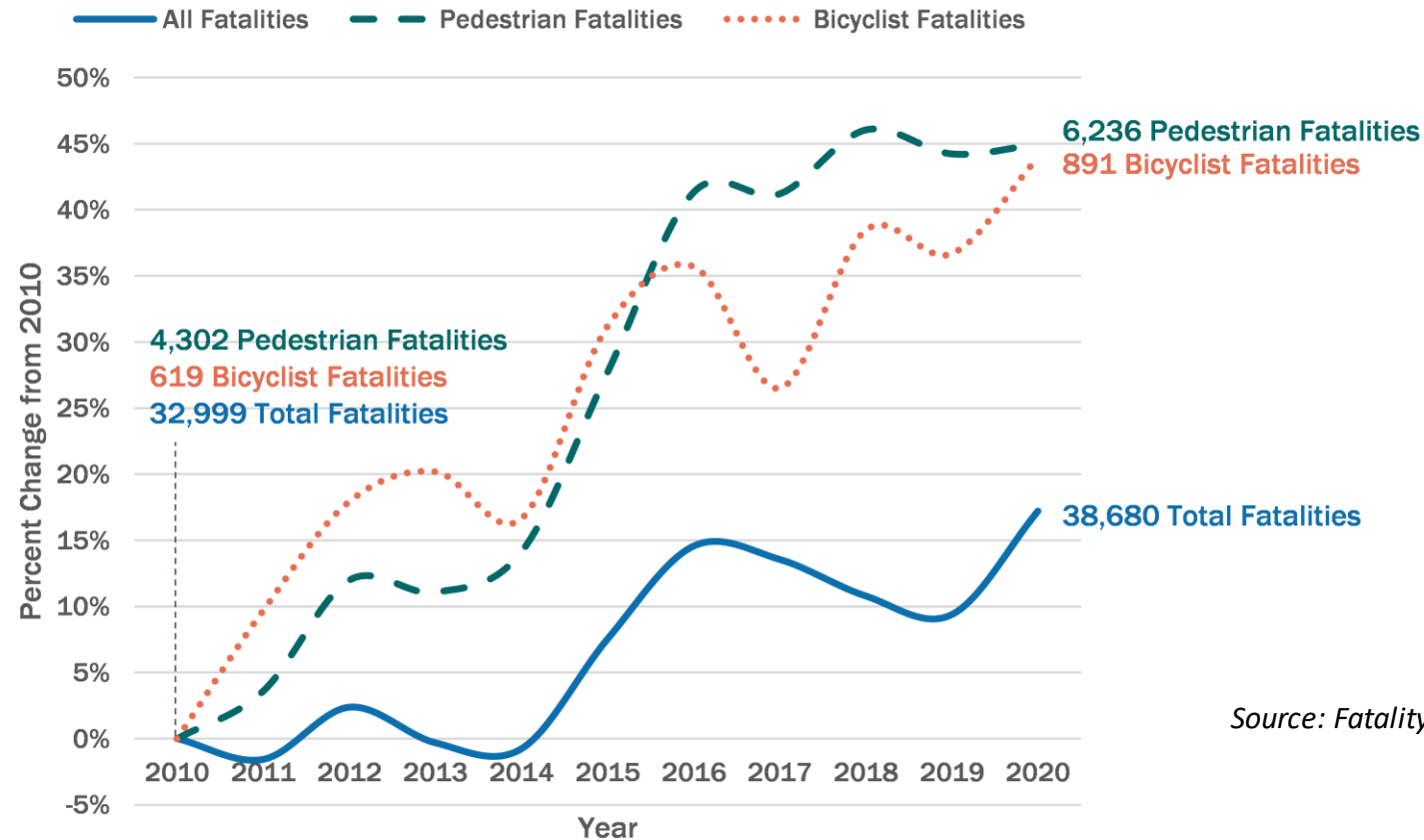


Our National Roadway Safety Problem



Fatalities among **all users** have been increasing.

Fatalities among **pedestrians** and **bicyclists** have been **increasing even faster**.

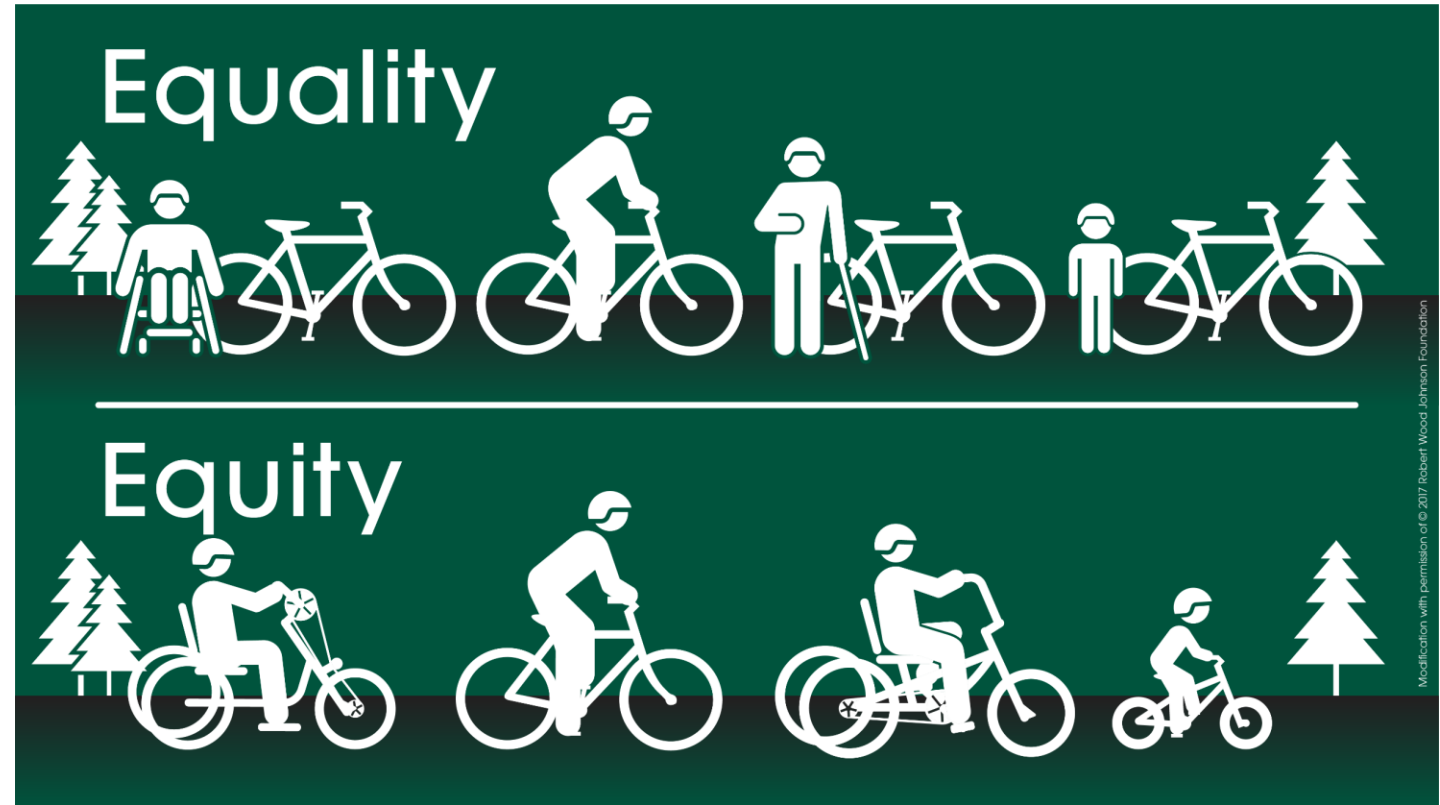


Source: Fatality Analysis Reporting System

Equity



We will make more rapid progress toward the goal of zero deaths by addressing disparate traffic safety outcomes in underserved communities.



Source: FHWA. Modification with permission of © 2017 Robert Wood Johnson Foundation.

National Roadway Safety Strategy



USDOT will leverage the funding and policies in the Bipartisan Infrastructure Law (BIL) to bring this strategy to life:

- **Nearly \$14 billion in NEW funding** for road safety including:
 - **\$6 billion** authorized for the new **Safe Streets and Roads for All (SS4A)** program to fund local efforts to reduce crashes and fatalities
 - **~ \$4 billion** added to HSIP
 - **~ \$4 billion** for improved data collection, vehicle safety programs, and truck safety

In the Senate of the United States,

August 10, 2021.

Resolved, That the bill from the House of Representatives (H.R. 3684) entitled “An Act to authorize funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes.”, do pass with the following

AMENDMENT:

Strike all after the enacting clause and insert the following:

1 **SECTION 1. SHORT TITLE; TABLE OF CONTENTS.**

2 (a) **SHORT TITLE.**—*This Act may be cited as the “In-*
3 *frastructure Investment and Jobs Act”.*

4 (b) **TABLE OF CONTENTS.**—*The table of contents for*
5 *this Act is as follows:*

Sec. 1. Short title; table of contents.

Sec. 2. References.

DIVISION A—SURFACE TRANSPORTATION

Sec. 10001. Short title.

Sec. 10002. Definitions.

Sec. 10003. Effective date.

Call to Action

It will take all of us together to solve this crisis. Whether it is someone driving, in the passenger seat, walking, biking, or rolling, **our roads are used every day by everyone.**

Now is the time for action, and the USDOT calls **all partners and stakeholders** from all levels of government, industry, non-profit, advocacy, researchers, and the public to take action to solve this crisis.

What will you do? We will be partnering with stakeholders to identify actions to get us closer to zero roadway fatalities.





The Safe System Approach (SSA)

www.transportation.gov/NRSS/SafeSystem

Imagine our country as a place where *nobody* has to die from vehicle crashes.



Source: Fehr & Peers

A New Paradigm



The Safe System approach aims to eliminate fatal and serious injuries for all road users by:



**Accommodating
human mistakes**



**Keeping impacts on the human
body at tolerable levels**



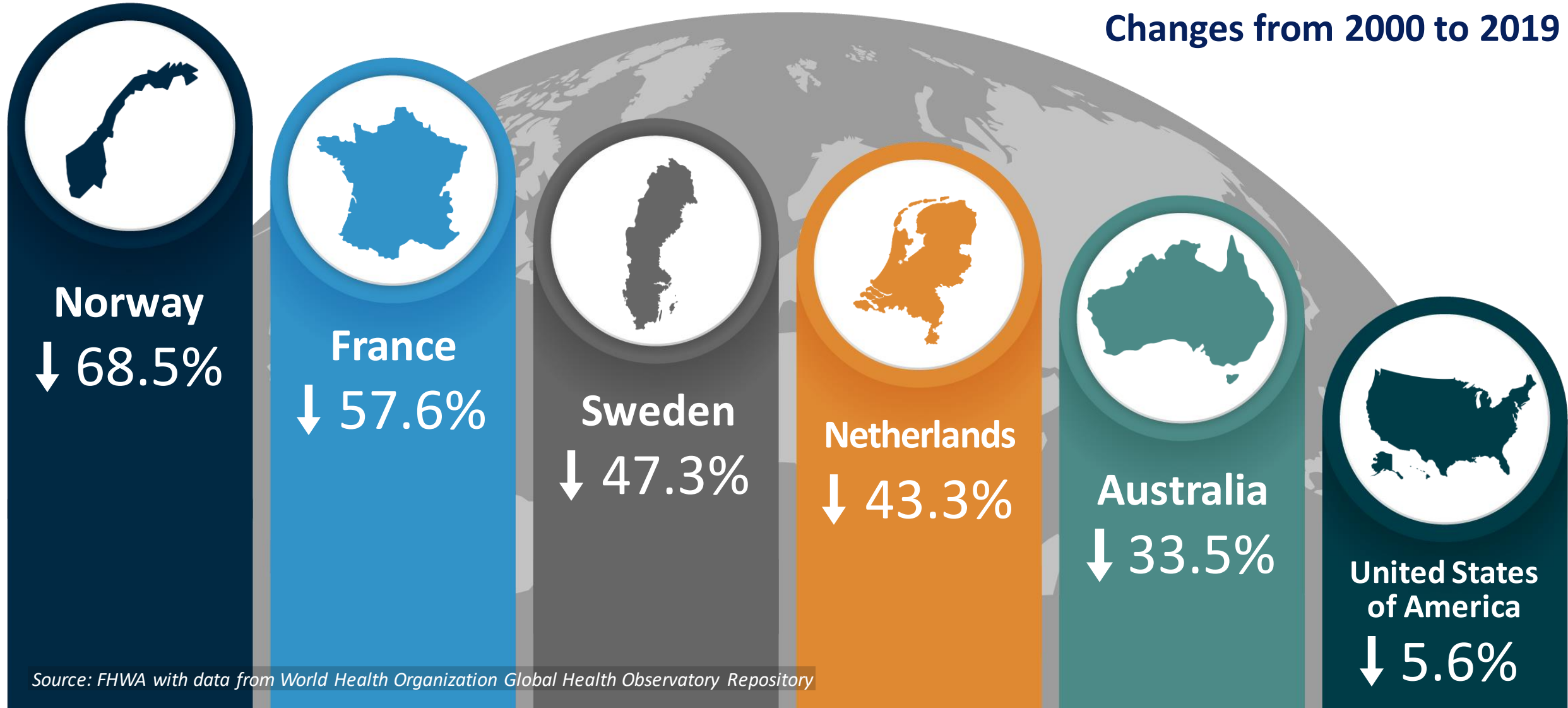
Top 3 Takeaways

- 1. The Safe System Approach is “Principles Based”**
- 2. Achieving a Safe System requires all five elements to be strengthened**
- 3. Safe Roads is a continuum, not an absolute**

Successful Safe System Adopters



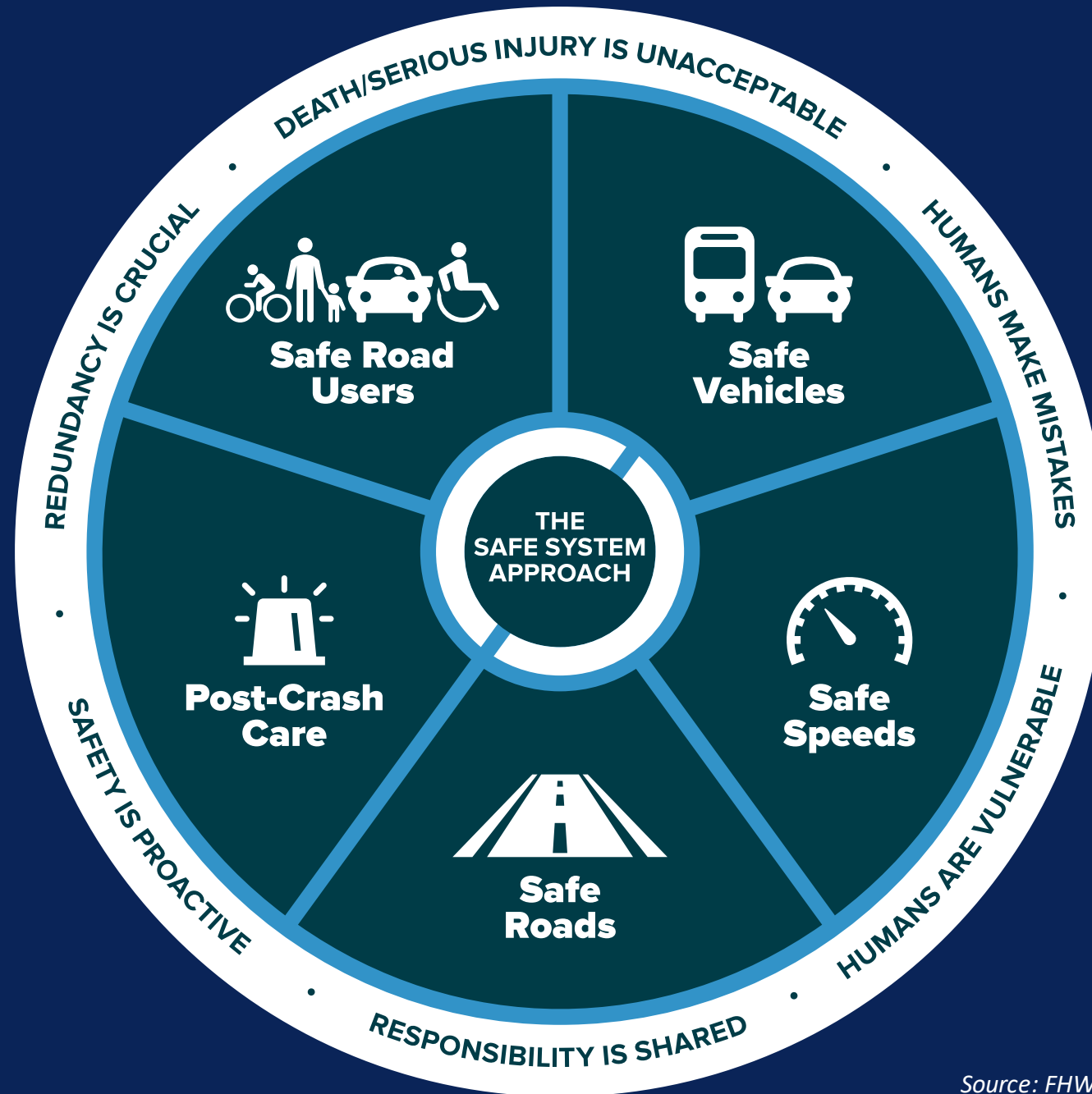
Changes from 2000 to 2019



Source: FHWA with data from World Health Organization Global Health Observatory Repository



THE SAFE SYSTEM APPROACH





THE 6 SAFE SYSTEM PRINCIPLES



Death/serious injury is unacceptable



Humans make mistakes



Humans are vulnerable



Responsibility is shared



Safety is proactive



Redundancy is crucial

Deaths & Serious Injuries are Unacceptable



- 
- 
- 
- 
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- 



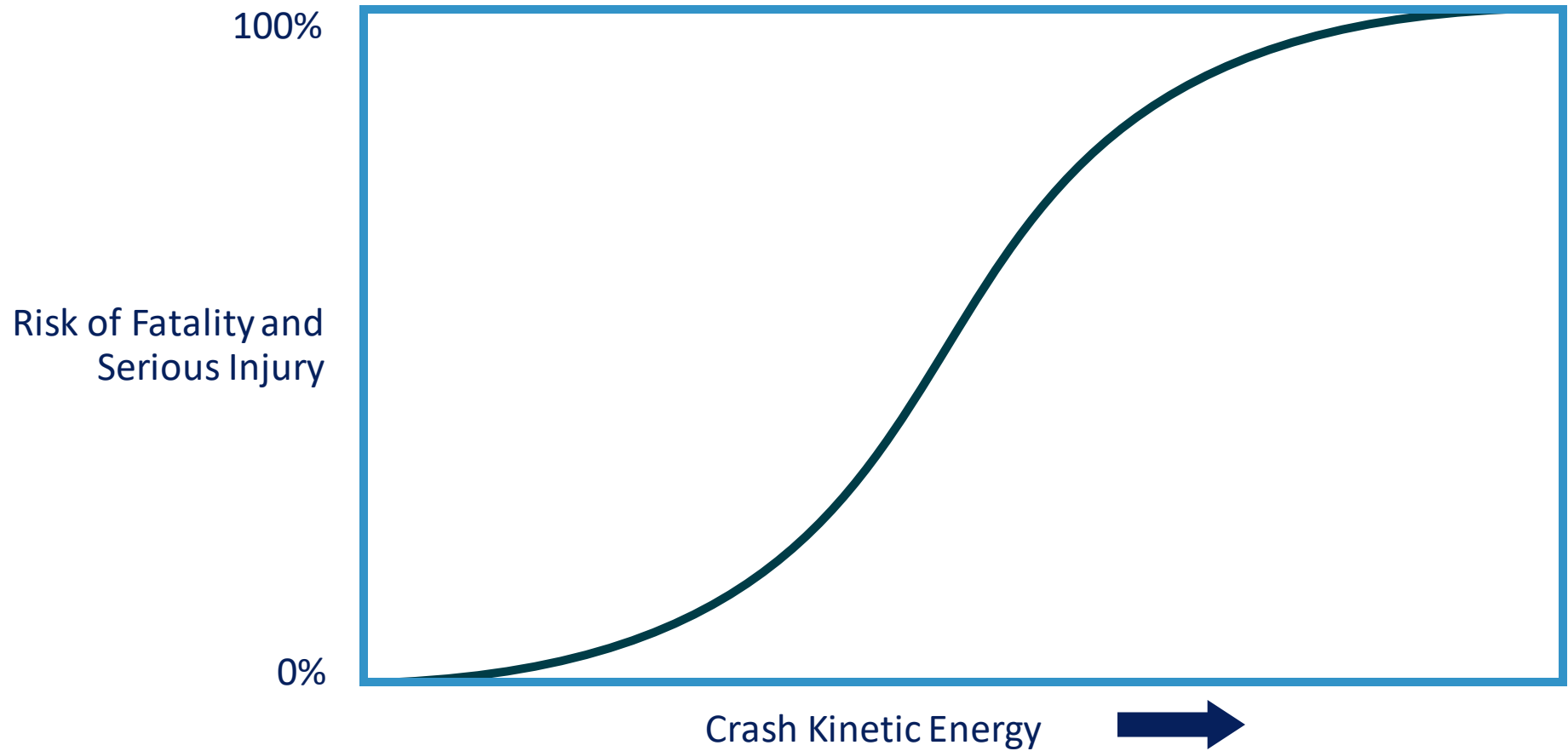
Source: Vision Zero Network

Humans Make Mistakes



Source: Fehr & Peers

Humans are Vulnerable



Responsibility is Shared



- **System managers**
 - Planners, designers, builders, operators, maintenance workers
- **Vehicle manufacturers**
- **Law enforcement personnel**
- **Traffic Incident Management personnel**
- **System users**

Safety is Proactive



Identify risks

Mitigate risks

Redundancy is Crucial



Safe road
users



Safe
vehicles



Safe speeds



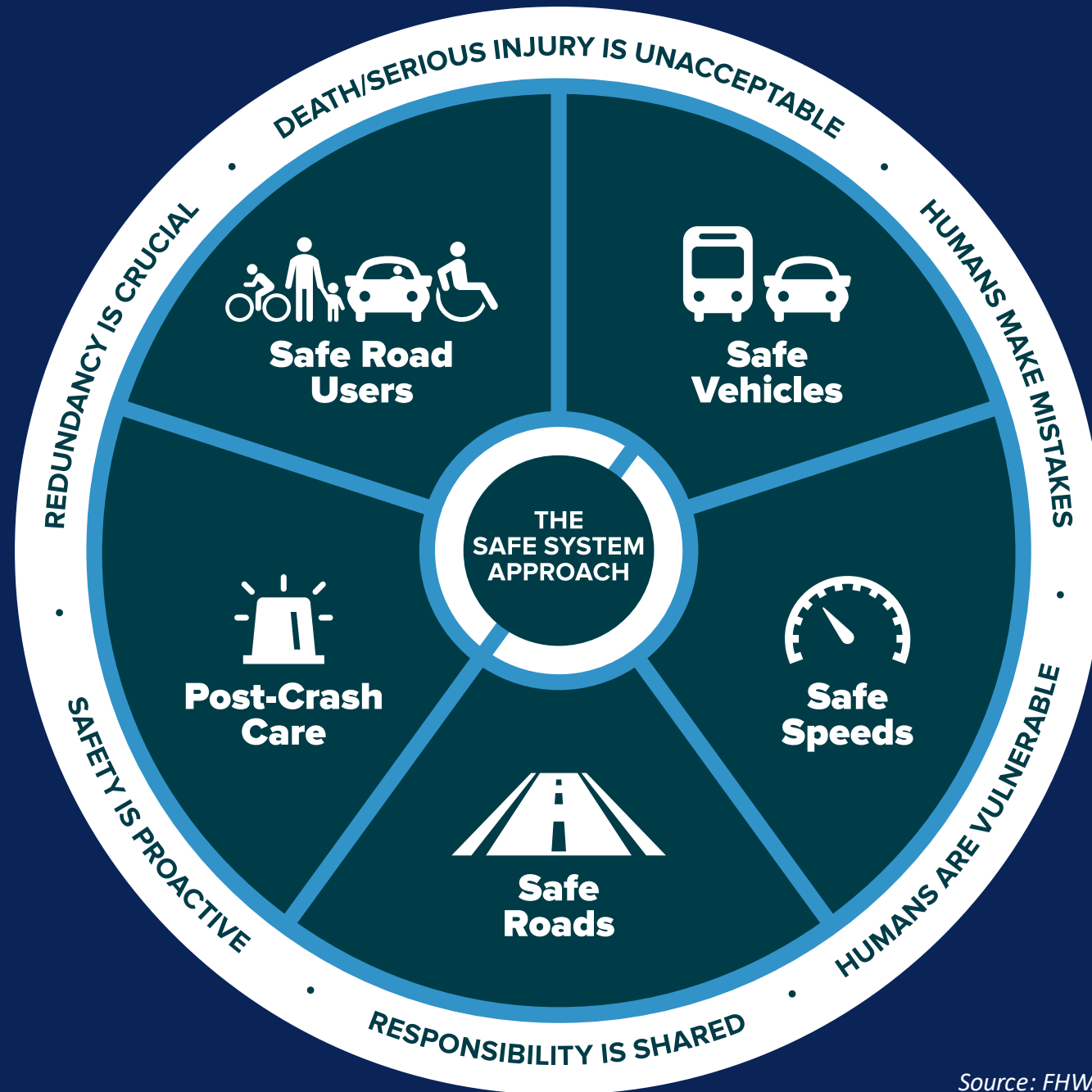
Safe roads



Post-crash
care



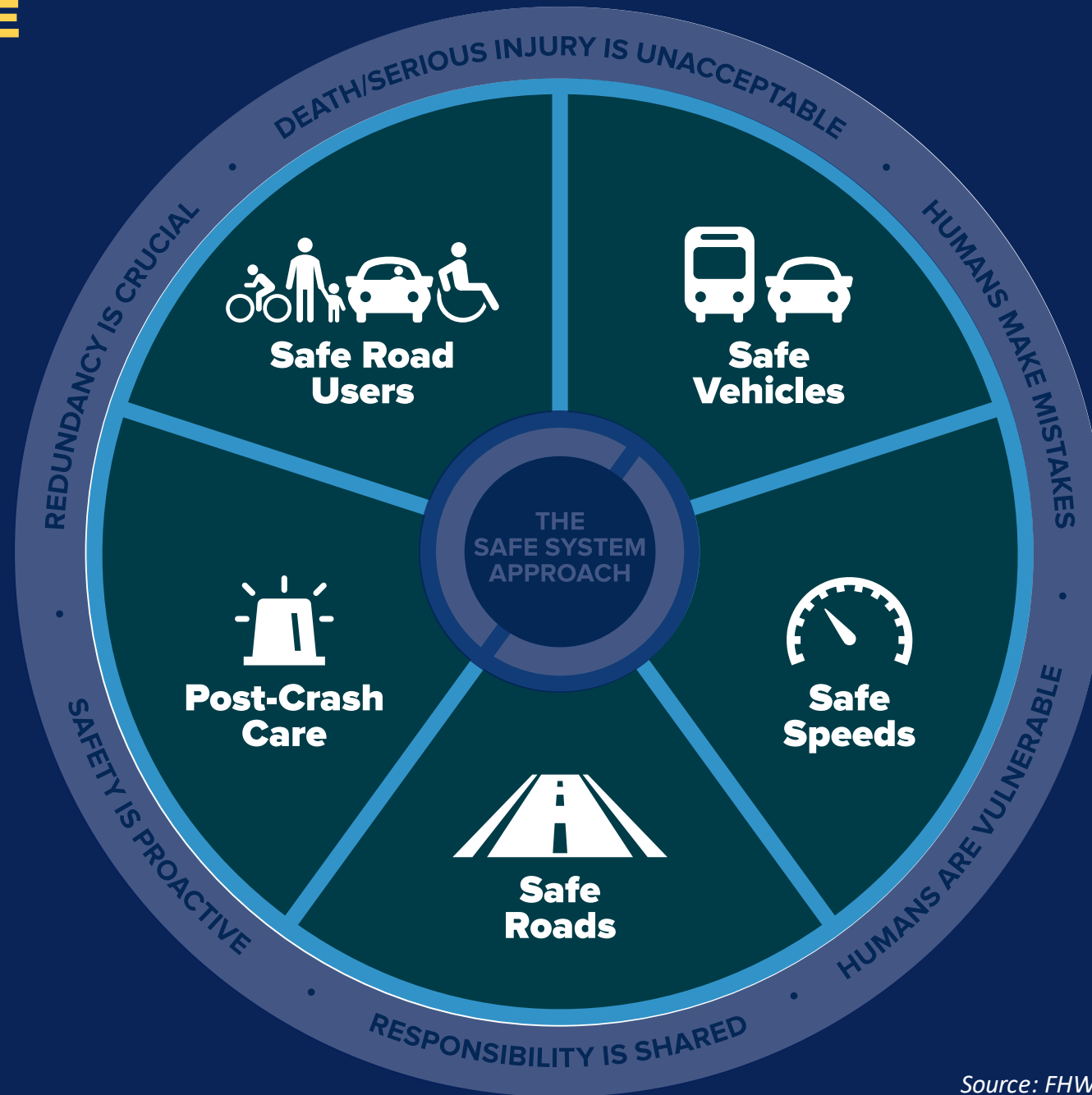
THE SAFE SYSTEM APPROACH



Source: FHWA



THE 5 SAFE SYSTEM ELEMENTS



Source: FHWA

Safe People



Walk



Bike



Drive



Transit



Other

Source for all images: Fehr & Peers

Safe Vehicles



Active safety

Measures to reduce the chance of a crash occurring

- Lane departure warning
- Autonomous emergency braking
- Bicyclist and pedestrian detection

Passive safety

Protective systems for when crashes do occur

- Seatbelts and airbags
- Crash-absorbing vehicle crumple zones
- Vehicle size and design

Safe Speeds



Hit by a vehicle
traveling at

23

MPH

10% risk of death



Hit by a vehicle
traveling at

42

MPH

50% risk of death



Hit by a vehicle
traveling at

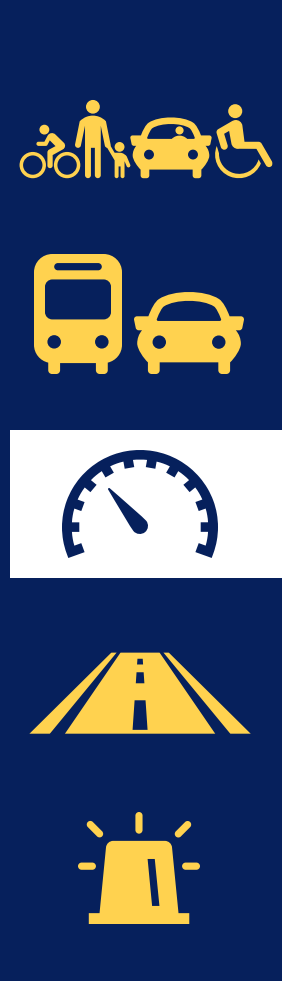
58

MPH

90% risk of death



Safe Speeds



Source: Fehr & Peers



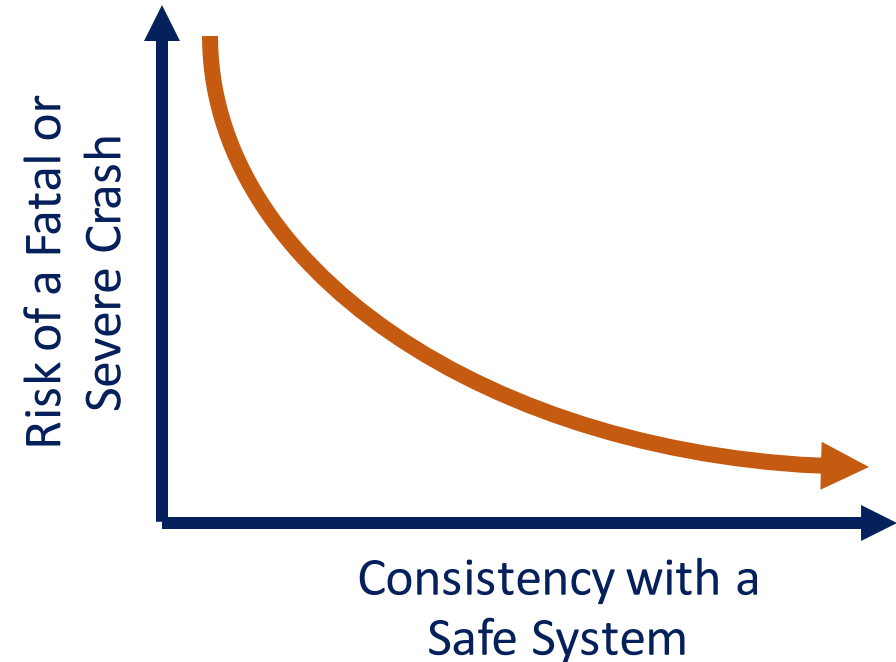
Source: City of Carmel, IN

Safe Roads



Think of “Safe Roads” as a continuum – not an absolute

- Continuously implement Safe System principles in roadway design and operations
- Features appropriate for the intended and actual road use and speed
- Reduce the likelihood and consequences of error



Source: FHWA

Post-Crash Care



Medical care



Engineering



Media



First responders



Crash investigation



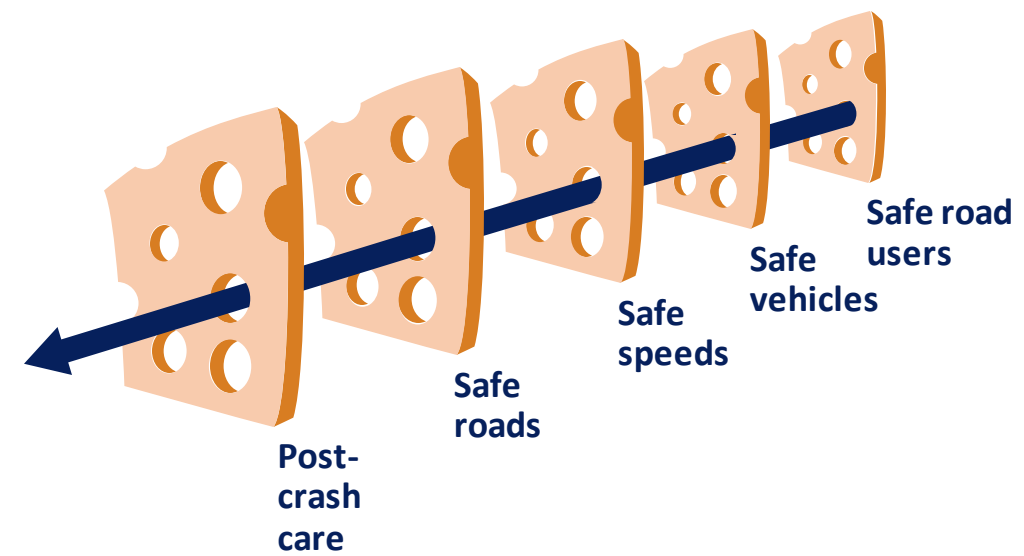
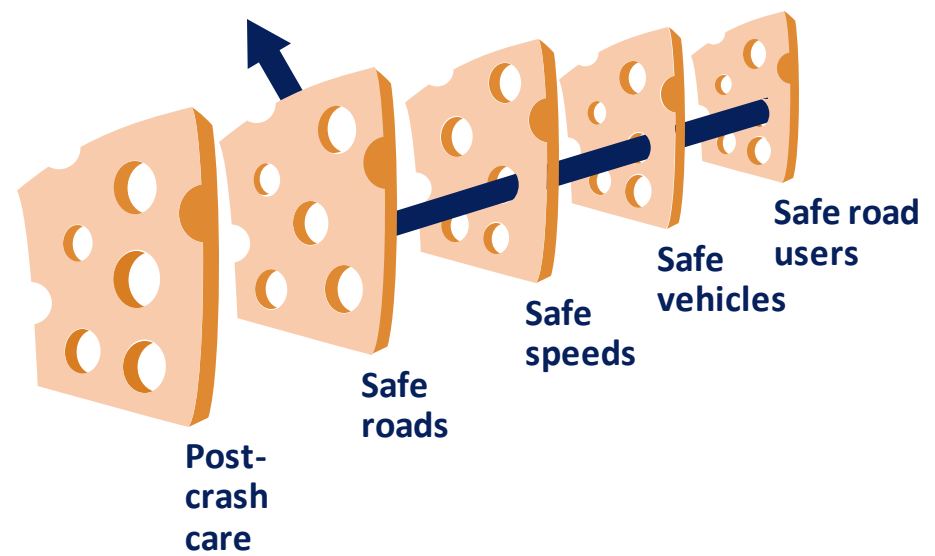
Justice

The 5 Safe System Elements Create Redundancy



The “Swiss Cheese Model” of redundancy creates layers of protection

Death and serious injuries only happen when all layers fail





“Double-Down” on What Works

*Transportation agencies are strongly encouraged to consider widespread implementation of **Proven Safety Countermeasures** to accelerate the achievement of local, State, and National safety goals.*

highways.dot.gov/safety/Proven-Safety-Countermeasures

Where are You on the Safe System Journey?



Traditional Approach

Prevent crashes →

Improve human behavior →

Control speeding →

Individuals are responsible →

React based on crash history →

Safe System Approach

Prevent death and serious injuries

Design for human mistakes/limitations

Reduce system kinetic energy

Share responsibility

Proactively identify and address risks

FHWA Resources



National Roadway Safety Strategy



safety.fhwa.dot.gov/ZeroDeaths

Safe System Approach



www.transportation.gov/NRSS/SafeSystem

Proven Safety Countermeasures



highways.dot.gov/safety/Proven-Safety-Countermeasures

Alan J. Huff

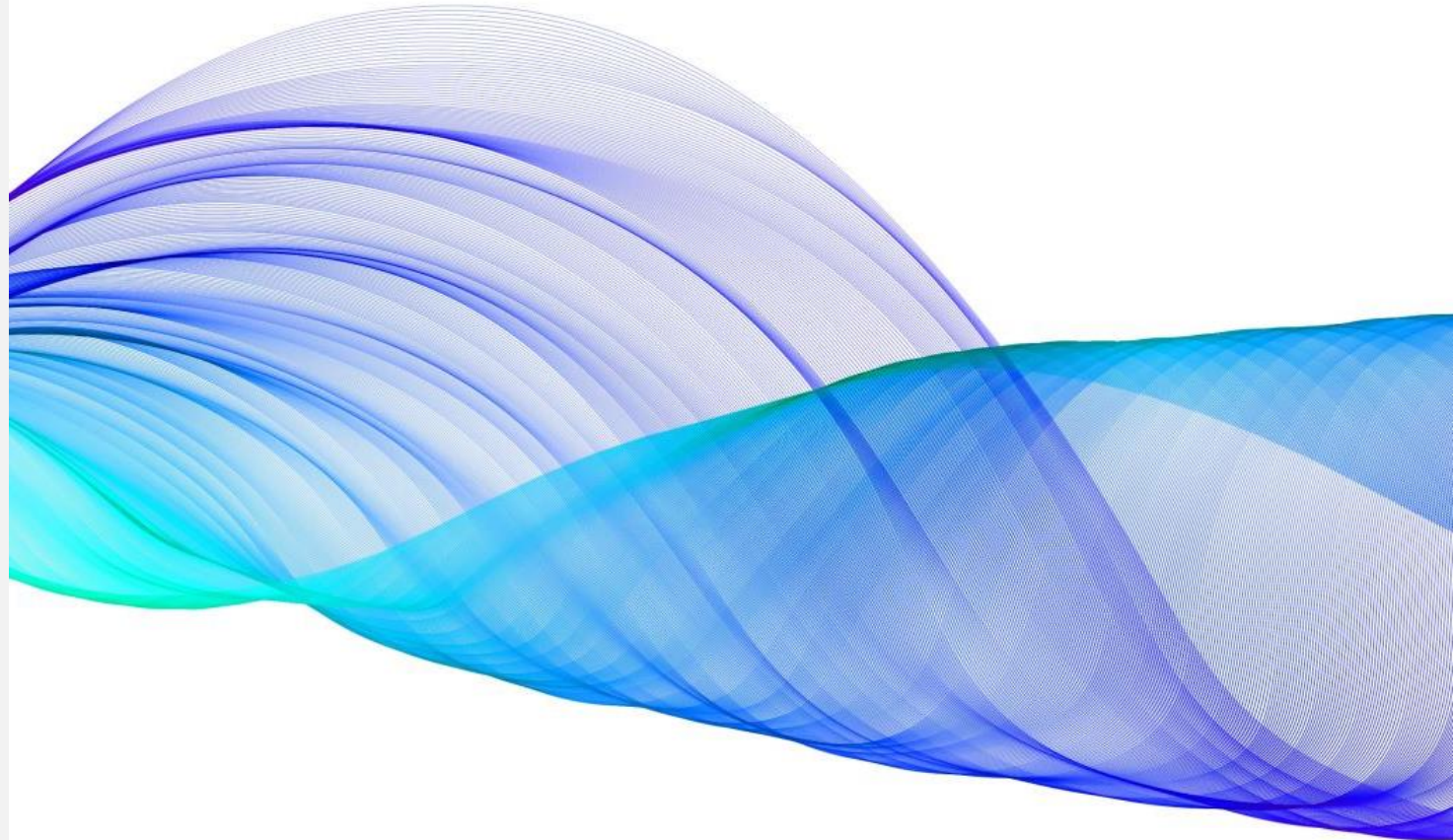
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Safety and Equity in Micromobility

Findings from
Four Research Studies

Hannah Younes, PhD



R | **RUTGERS-NEW BRUNSWICK**
Edward J. Bloustein School
of Planning and Public Policy

Outline

Study 1: Bike/ped crashes and equity in New Jersey

Study 2: Gender and micromobility behavior in Asbury Park

Study 3: Road design and traffic calming in Asbury Park

Study 4: Micromobility injuries nationally

Study 1

Data

Safety Voyager & Numetric
Bike/Ped Crashes

2016-2020

31,000+ crashes

Methods

Hot spot analysis &
Linear Regression



Journal of Safety Research

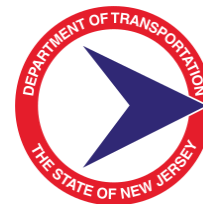
Volume 86, September 2023, Pages 137-147



Pedestrian- and bicyclist-involved crashes: Associations with spatial factors, pedestrian infrastructure, and equity impacts

[Hannah Younes](#) ✉, [Robert B. Noland](#) ✉, [Leigh Ann Von Hagen](#) ✉, [Sean Meehan](#) ✉

Edward J. Bloustein School of Planning and Public Policy, Rutgers, The State University of
New Jersey, 33 Livingston Avenue, New Brunswick, NJ 08901, USA

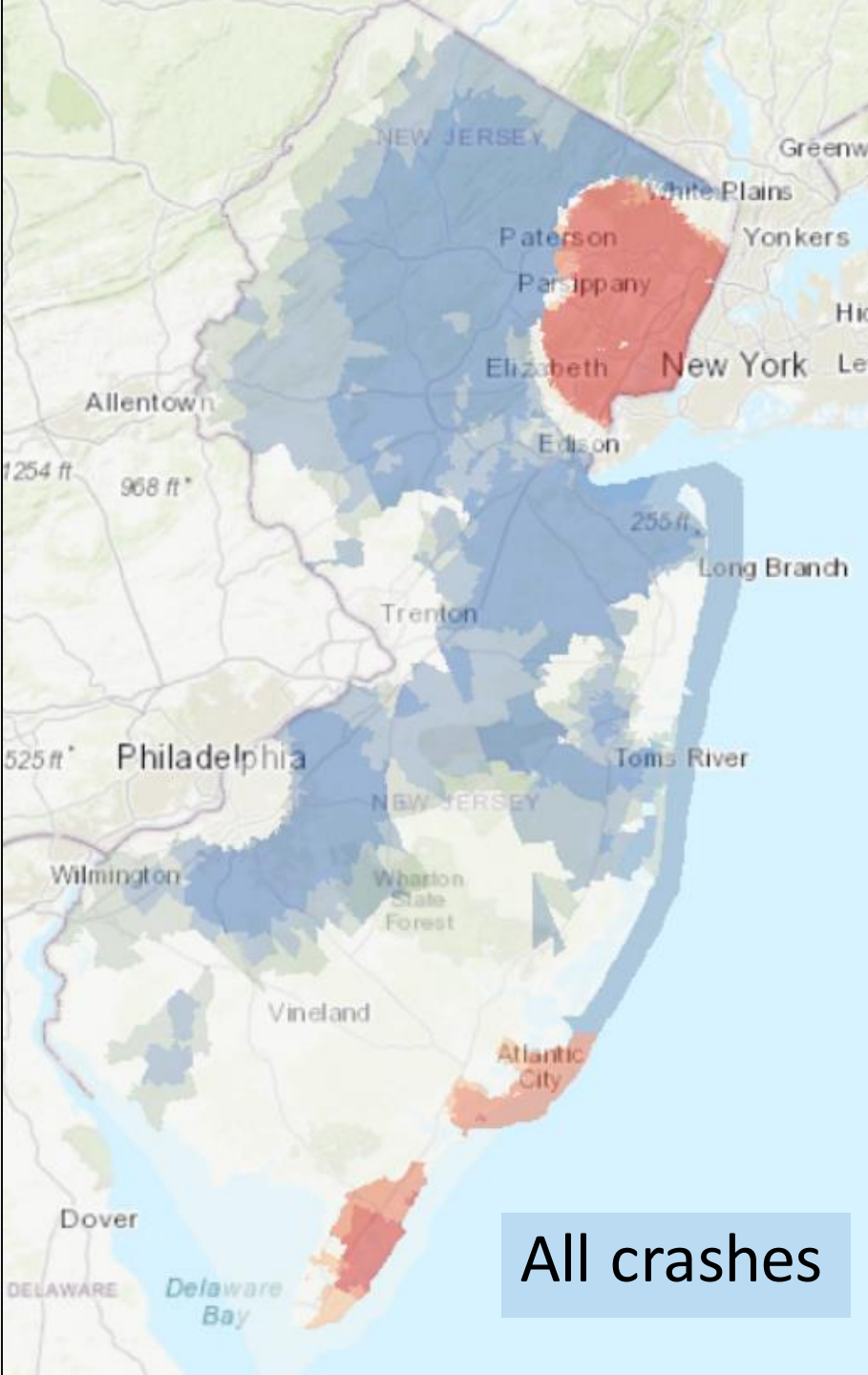


Municipality	Geocoded	All Crashes	% Geocoded
HOBOKEN CITY	349	341	97.71
PERTH AMBOY CITY	312	303	97.12
UNION CITY	475	460	96.84
MONTCLAIR TWP	249	241	96.79
BAYONNE CITY	410	394	96.10
JERSEY CITY	2067	1970	95.31
EDISON TWP	230	219	95.22
IRVINGTON TWP	630	597	94.76
CLIFTON CITY	338	320	94.67
LAKEWOOD TWP	512	484	94.53
ATLANTIC CITY	406	383	94.33
PASSAIC CITY	554	519	93.68
EAST ORANGE CITY	439	408	92.94
FORT LEE BORO	309	285	92.23
WOODBIDGE TWP	275	253	92.00
TEANECK TWP	240	218	90.83
TRENTON CITY	495	447	90.30
NORTH BERGEN TWP	408	362	88.73
NEWARK CITY	2991	2586	86.46
WEST NEW YORK TOWN	330	282	85.45
HACKENSACK CITY	390	329	84.36
NEW BRUNSWICK CITY	389	327	84.06
CAMDEN CITY	571	473	82.84
PATERSON CITY	1382	1129	81.69
ELIZABETH CITY	914	689	75.38

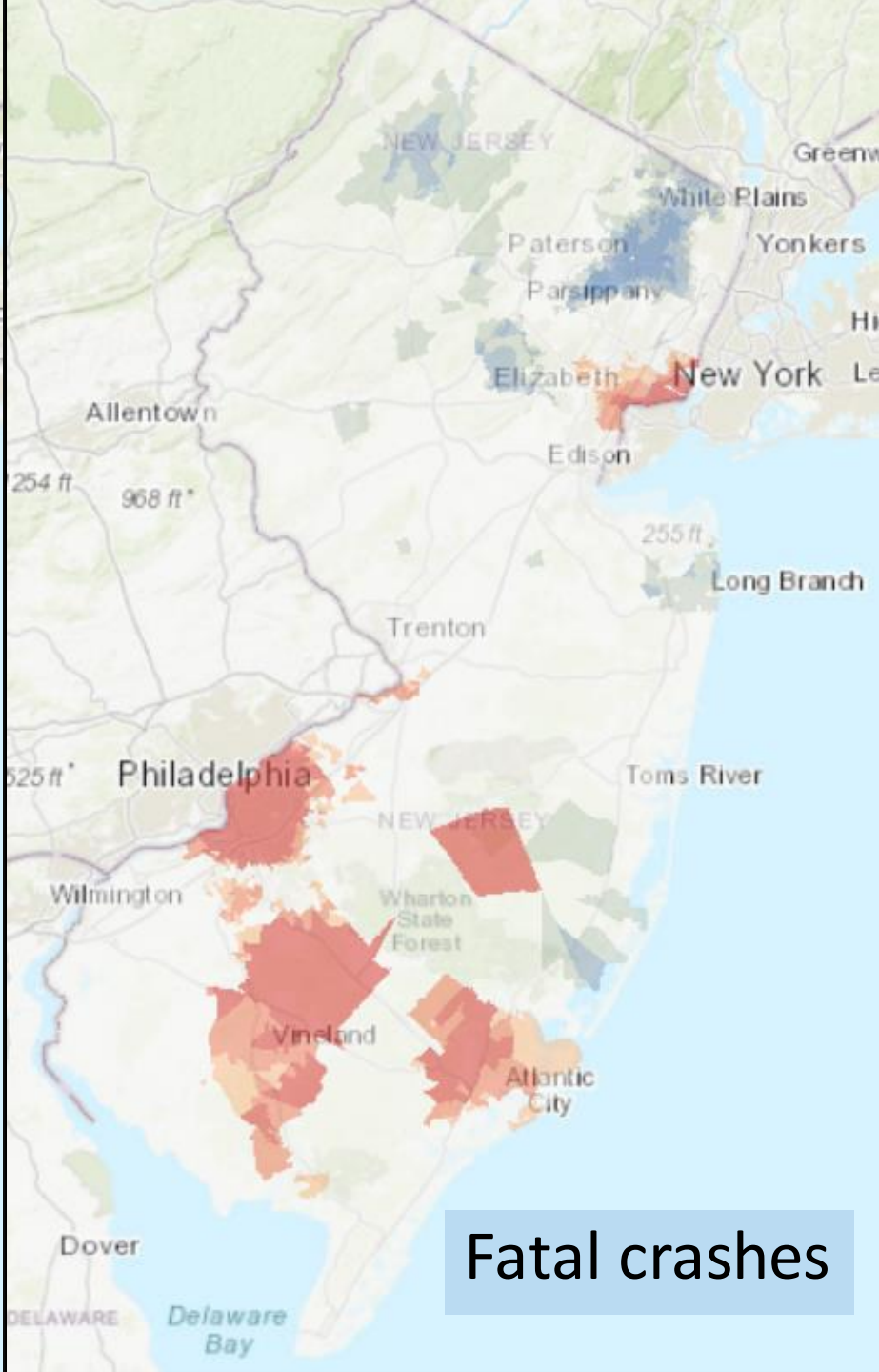
Crashes, Income, & Race

- 90% of crashes are geocoded.
- Crashes are **less likely to be geocoded** in lower income areas and areas with more minorities.
- Crashes **disproportionately** occur in overburdened communities.
 - Overburdened communities make up 21% of the NJ population
 - 40% of crashes occur in overburdened communities

Hotspots for Bicycle & Pedestrian Crashes per Capita



All crashes



Fatal crashes

Light conditions



Crosswalks and
sidewalks



Speed



Necessity for
bike lanes in low-
income areas



Data necessity



Study 2

Data

Traffic camera observations
for 35 hours over 7 days

700+ bicycles and e-
scooters

Methods

Binomial Logistic
Regression & Cross
Tabulations







Case Studies on Transport Policy

Volume 14, December 2023, 101073



Gender split and safety behavior of cyclists and e-scooter users in Asbury Park, NJ

[Hannah Younes](#)  , [Robert B. Noland](#) , [Clinton J. Andrews](#) 



National Science Foundation
WHERE DISCOVERIES BEGIN

Award CNS-1951890

Helmet use Among Cyclists

35% wore a helmet

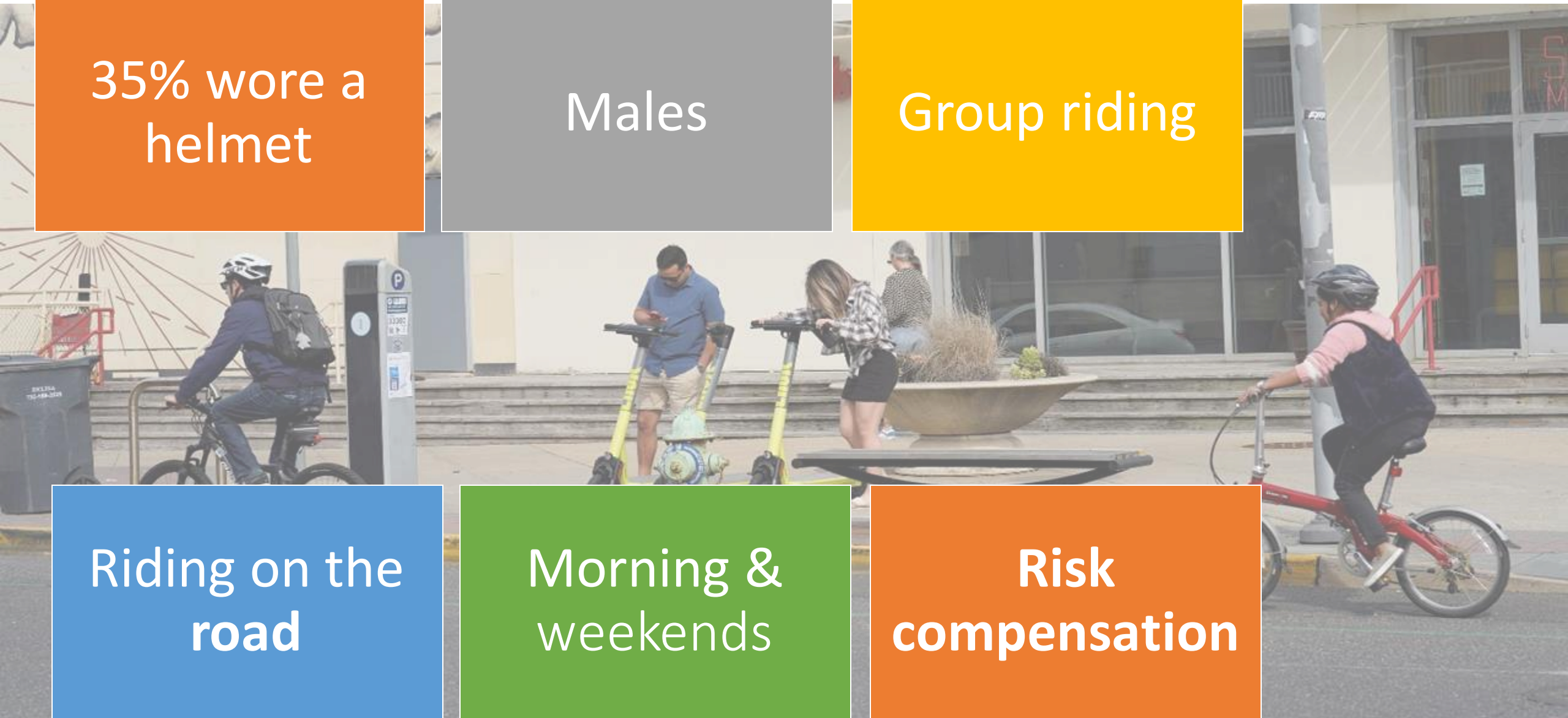
Males

Group riding

Riding on the road

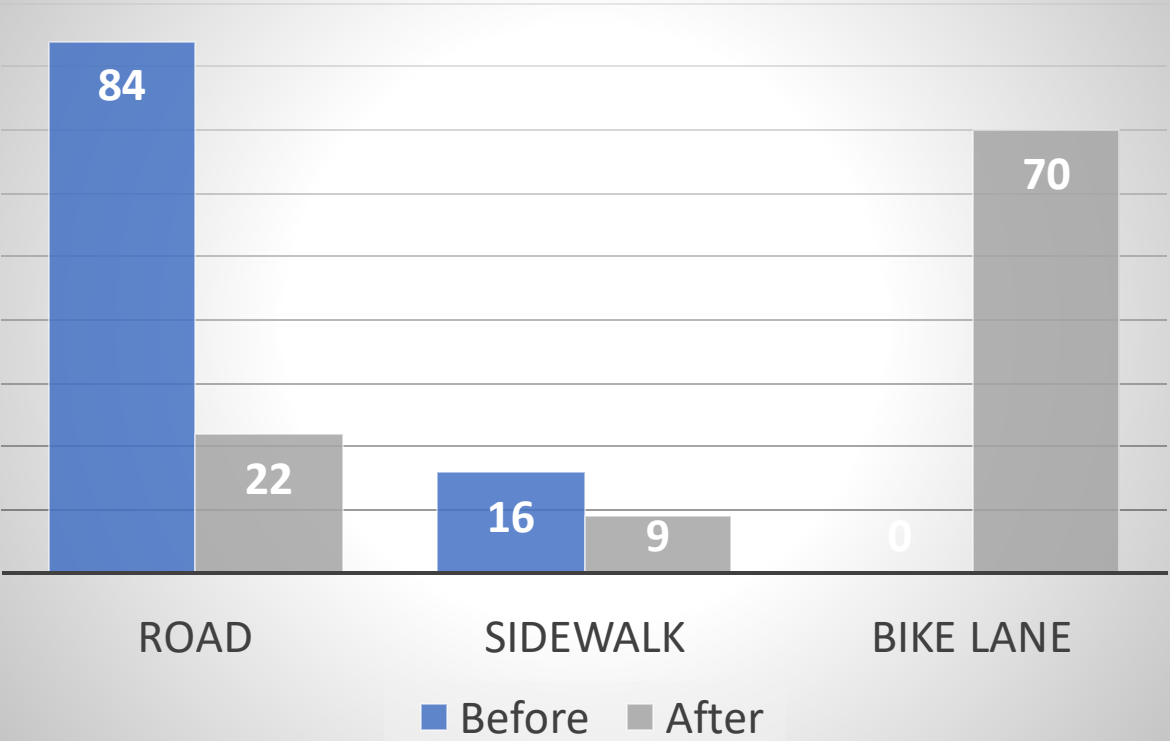
Morning & weekends

Risk compensation

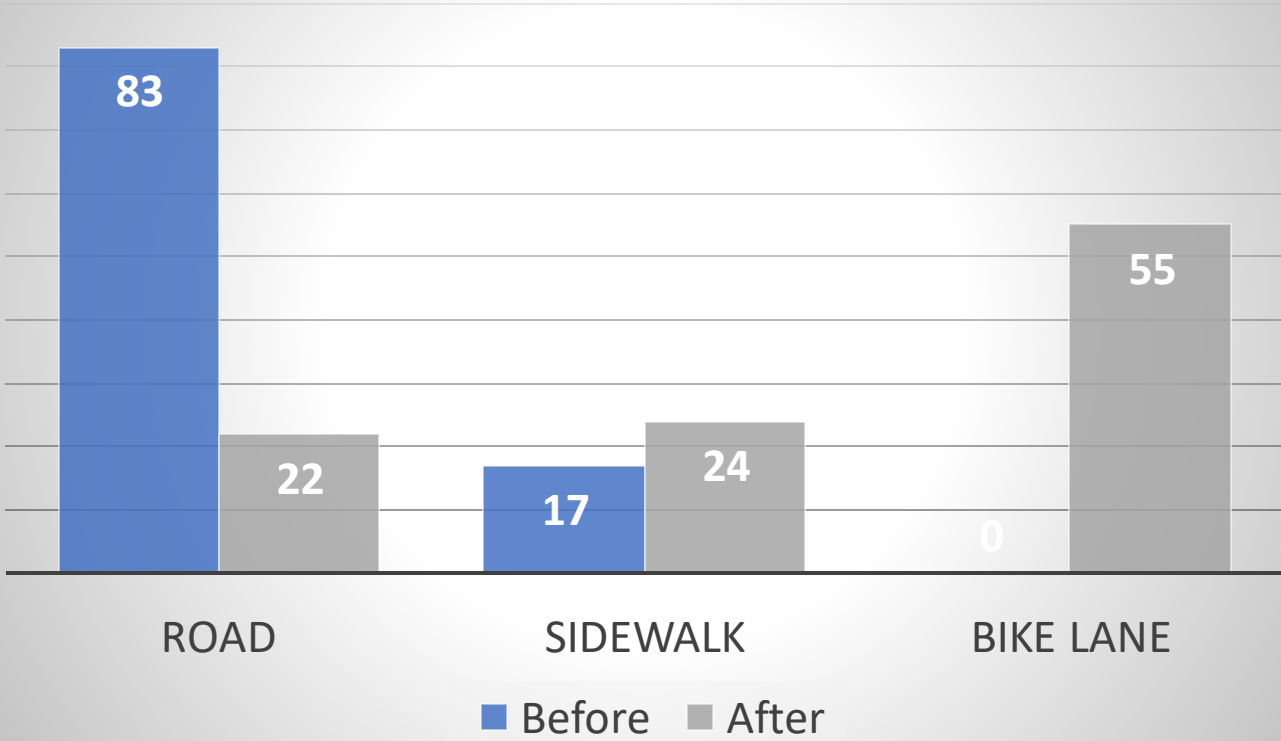


Lane usage **before** and after the bike lane

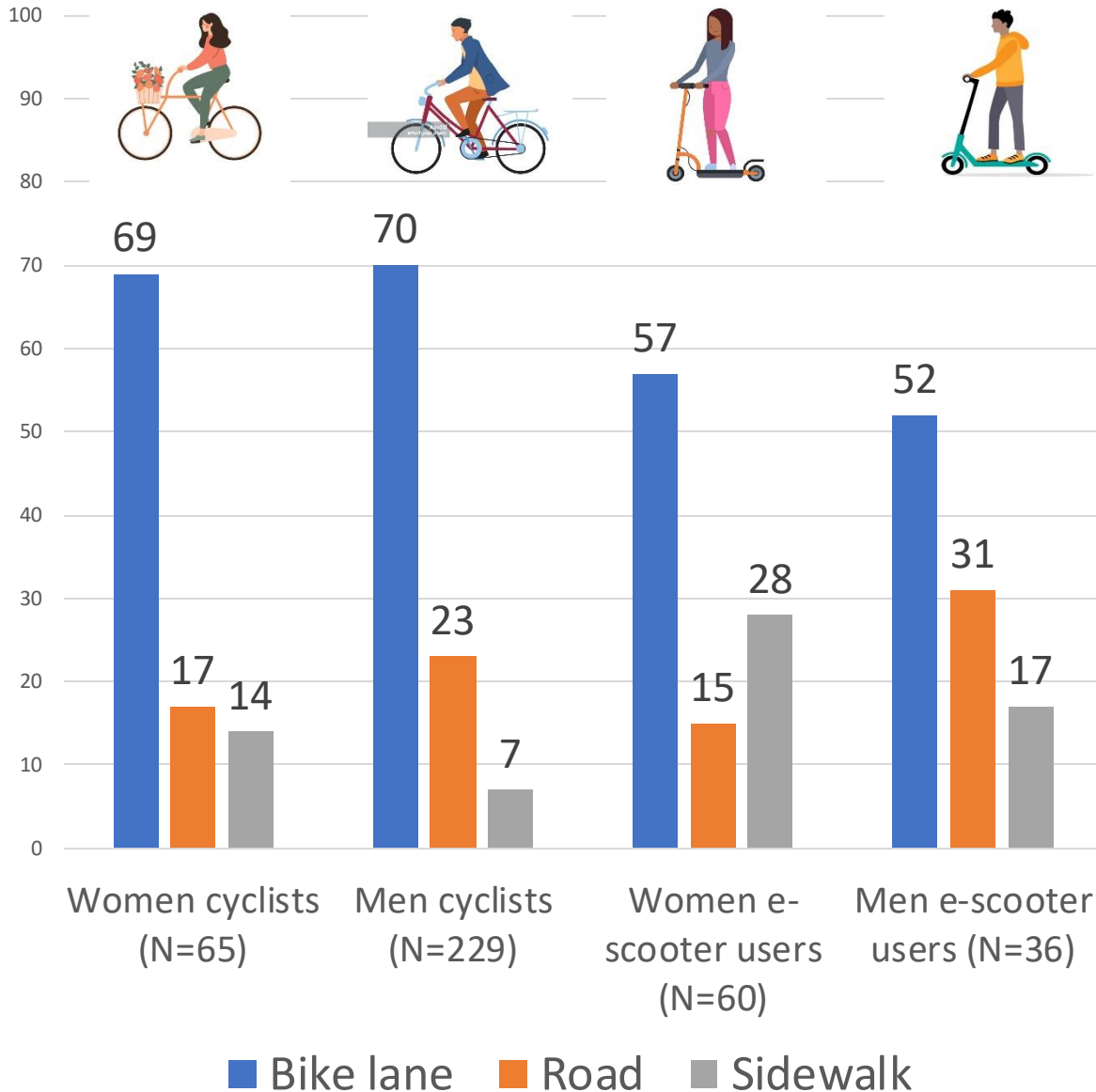
Lane usage among cyclists (%)



Lane usage among e-scooter users (%)

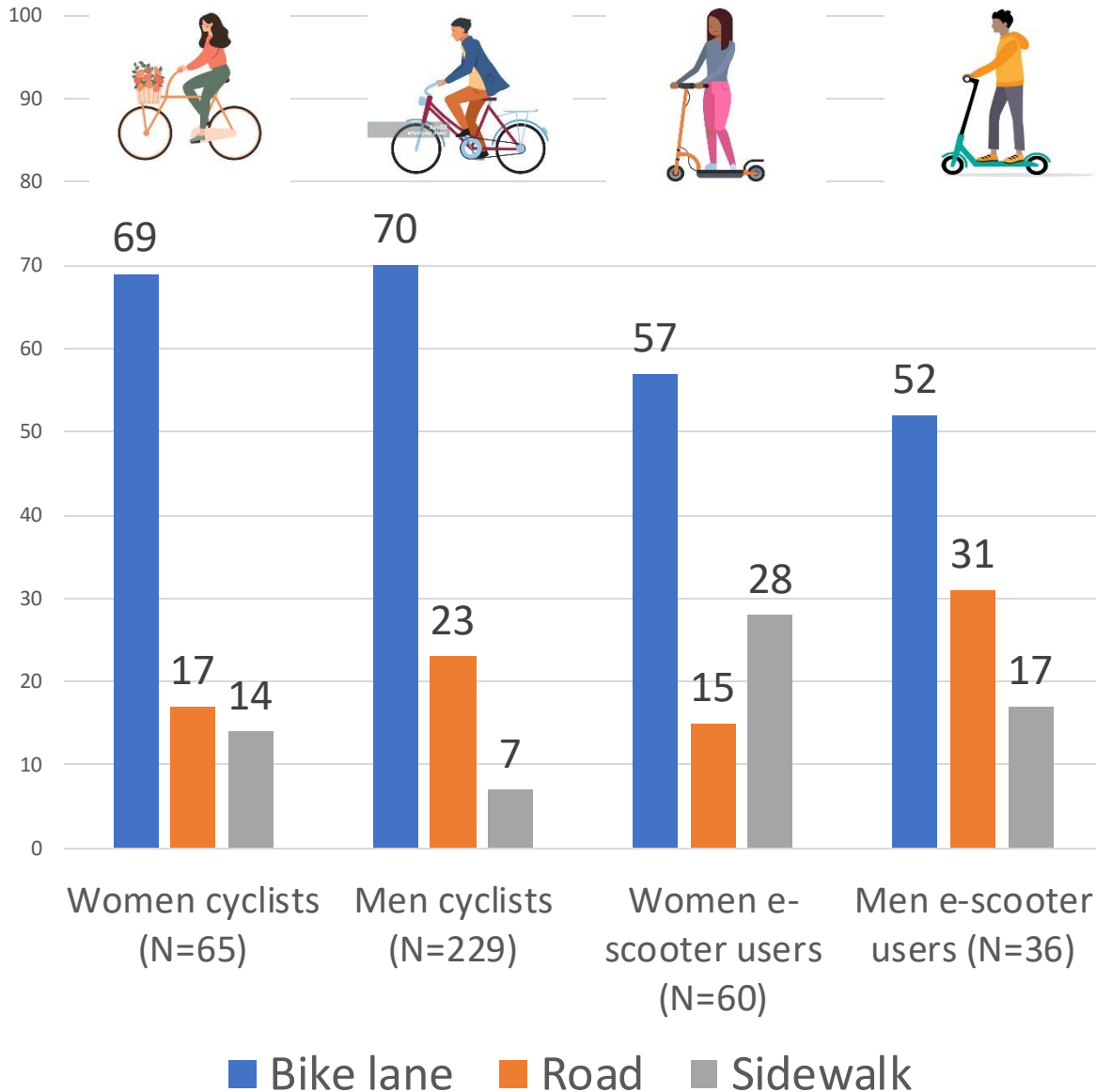


Lane use by gender (after implementation)



- Using a multinomial logistic regression (N=437)
- **Users of the bike lanes** tended to be:
 - Cyclists
 - Not helmet wearers
 - Traveling alone
 - Afternoon travelers (also when there's more traffic)

Lane use by gender (after implementation)



- **Women and e-scooter users** are more likely to use the **sidewalk** than men and cyclists, respectively.
- Men are more likely to ride on the road than women.

Study 3

Data

Traffic camera observations for 40 hours over 10 days
9000+ motor-vehicles

Methods

Computer Vision,
Trajectory Detection and
Linear Regression





Journal of Urban Mobility

Volume 5, June 2024, 100071



The Traffic Calming Effect of Delineated Bicycle Lanes

Hannah Younes^a  , Clinton Andrews^a, Robert B. Noland^a, Jiahao Xia^b, Song Wen^c,
Wenwen Zhang^a, Dimitri Metaxas^c, Leigh Ann Von Hagen^a, Jie Gong^d



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WHERE DISCOVERIES BEGIN

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No Bike Lanes



Bike Lanes with Paint



Bike Lanes with Delineators & Cones



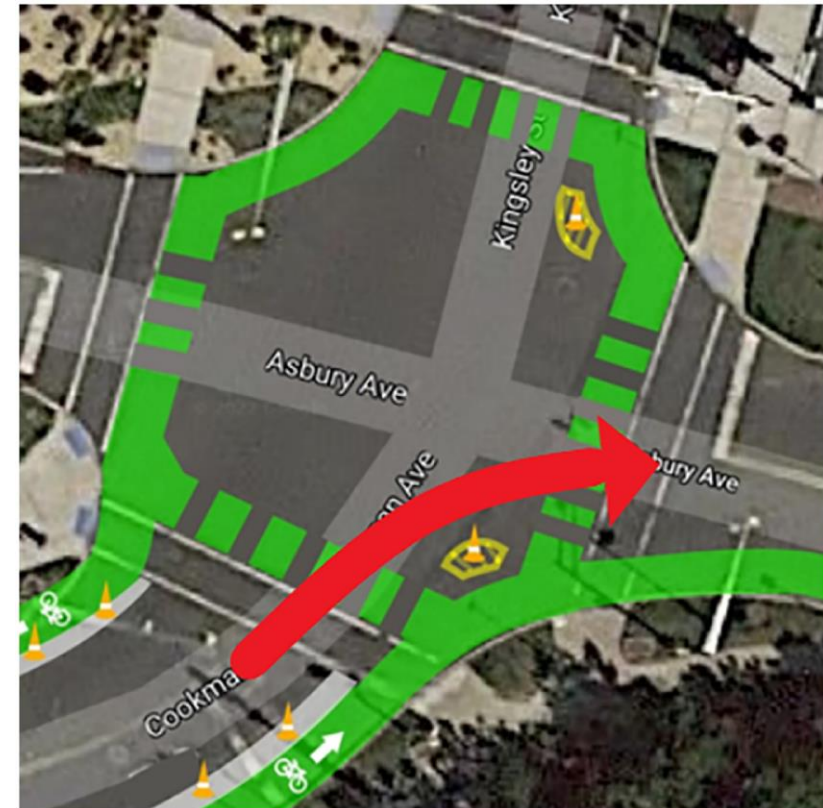
Demonstration Bike/Scooter Lane

Delinicator-Protected Bike Lane: 5% decrease in average speeds going straight



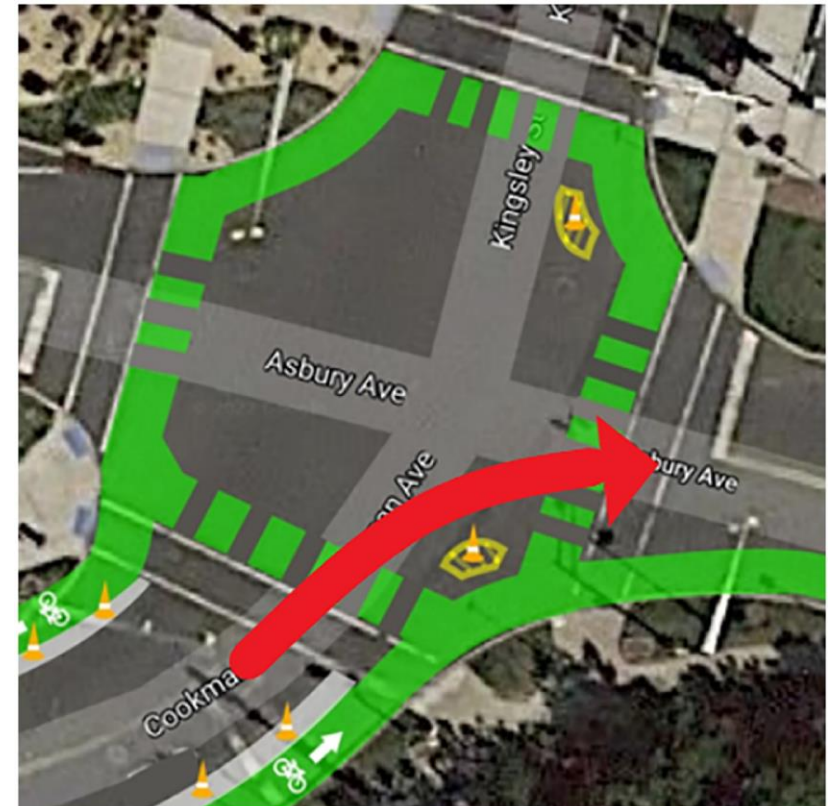
Demonstration Bike/Scooter Lane

Painted-Only Bike Lane: **11% decrease** in average speeds for right turns



Demonstration Bike/Scooter Lane

Delineator-Protected Bike Lane: 21% decrease in average speeds for right turn



Study 4

Data

U.S. CPSC National Electronic Injury Surveillance System:

13,728 injuries from micromobility in 2021 & 2022

Methods

Binomial Logistic Regression & cross tabulations



Are E-Scooter Users More Seriously Injured than E-Bike Users and Bicyclists?

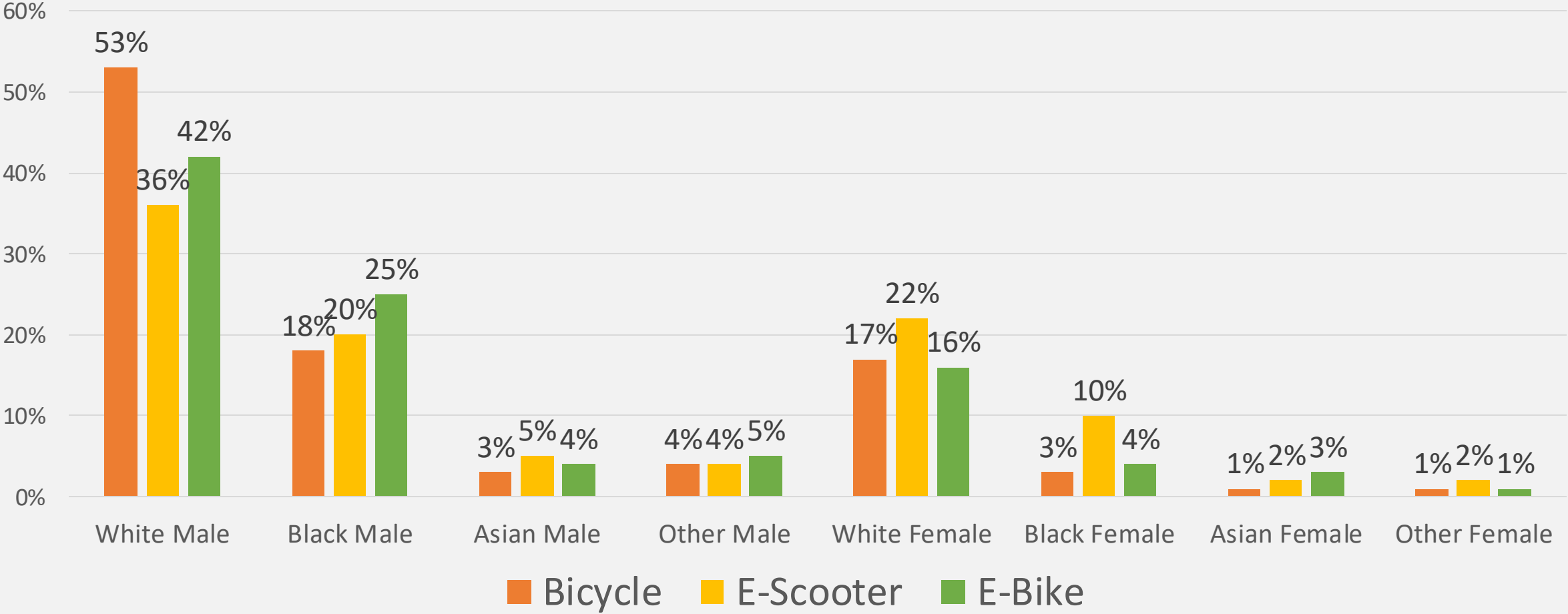
January 25th, 2024



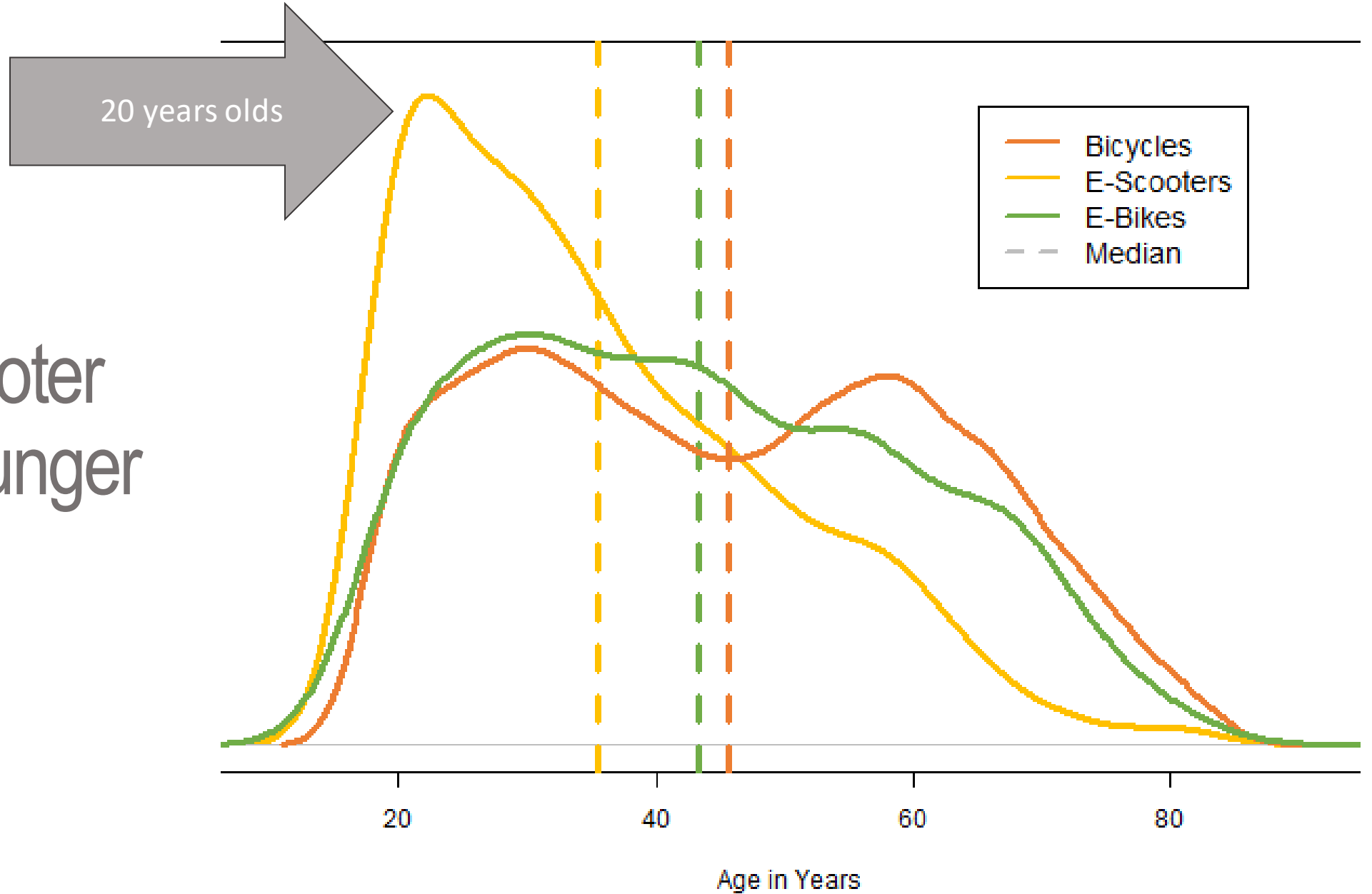
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Demographic Profile of Injured Micromobility Users



Age distribution of micromobility injuries among adults 18-84



Injured e-scooter users are younger

Factors Influencing Admission to Hospitals

Injury type

Age

Older adults are more likely to be admitted

Gender

Males are more likely to be admitted

Motor-vehicle involved

**Alcohol/
Substance use**

***Not significant:*
Micromobility mode**

Summary

Study 1:
Bike/ped
crashes in NJ



- Cyclists/Pedestrian-involved crashes:
- More likely occur in overburdened communities
- Less likely geocoded in overburdened communities

Study 2:
Gender and
micromobility



- E-scooters are more gender equitable than bicycles
- Women were more likely to ride on the sidewalk than men

Study 3: Road
design



- Delineated bike lane had a traffic calming effect on right-turning vehicles

Study 4:
Micromobility
injuries



- Injured e-scooter users don't suffer more severe injuries than other micromobility users

Thank You!



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**Edward J. Bloustein School
of Planning and Public Policy**



Contact

Hannah Younes, PhD

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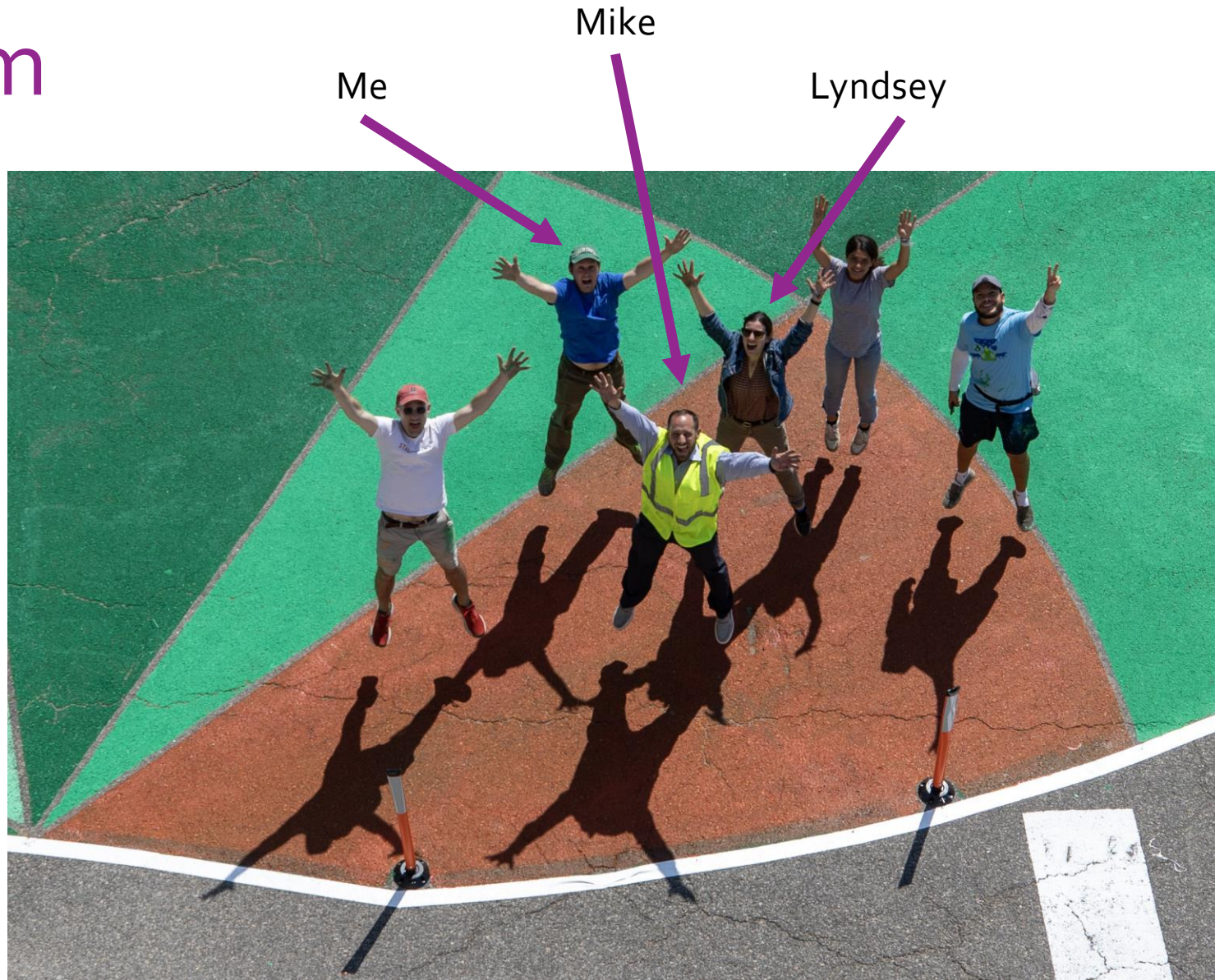
MICROMOBILITY SAFETY IN JERSEY CITY

Rutgers Micromobility 2.0 Workshop

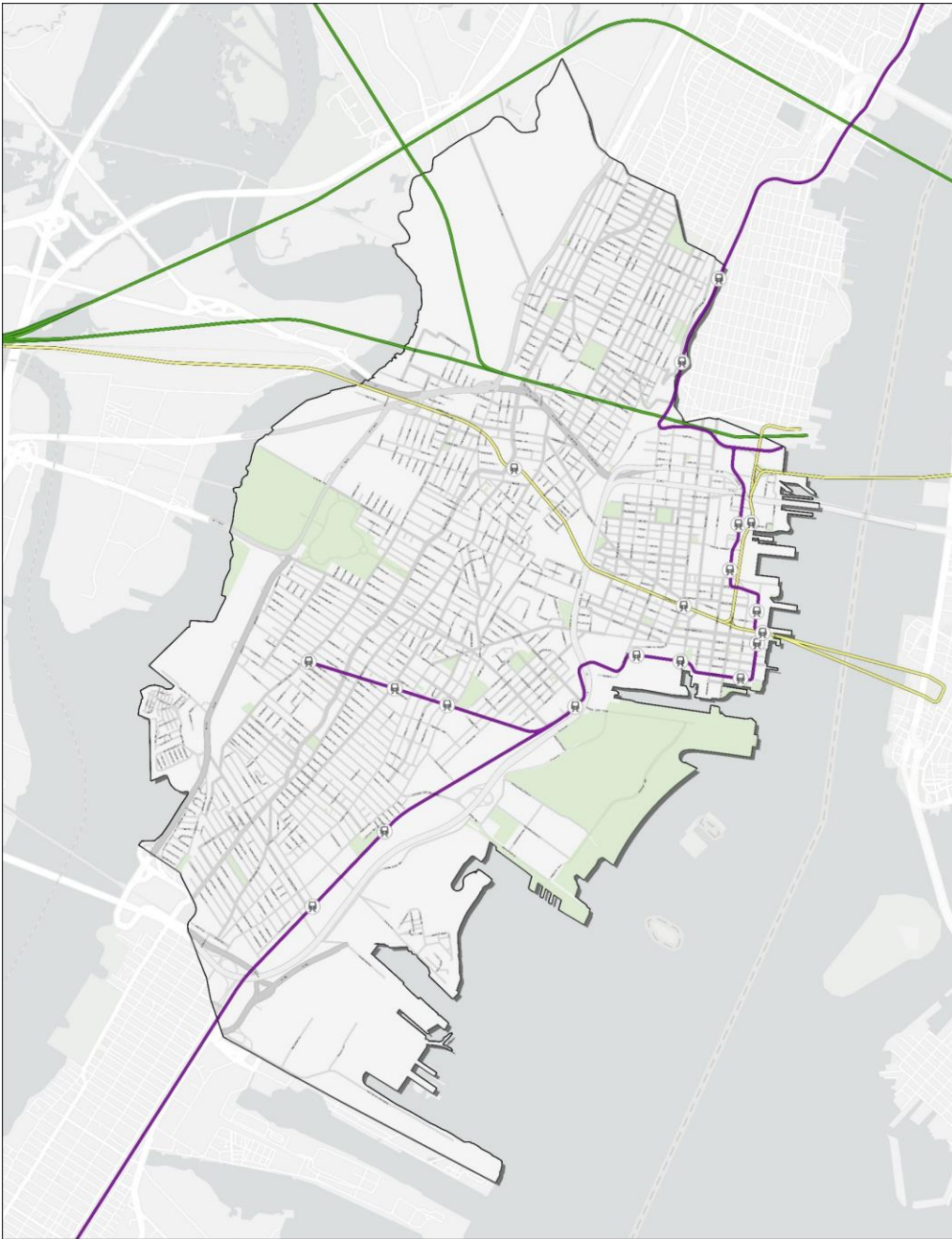
Session 2 - Towards a Safer Future: Innovations for Micromobility Safety

Friday, March 22, 2024

Our Team



INTRO TO JERSEY CITY



1

Rapidly Growing.

New Jersey's second largest City with nearly 300,000 residents.

2

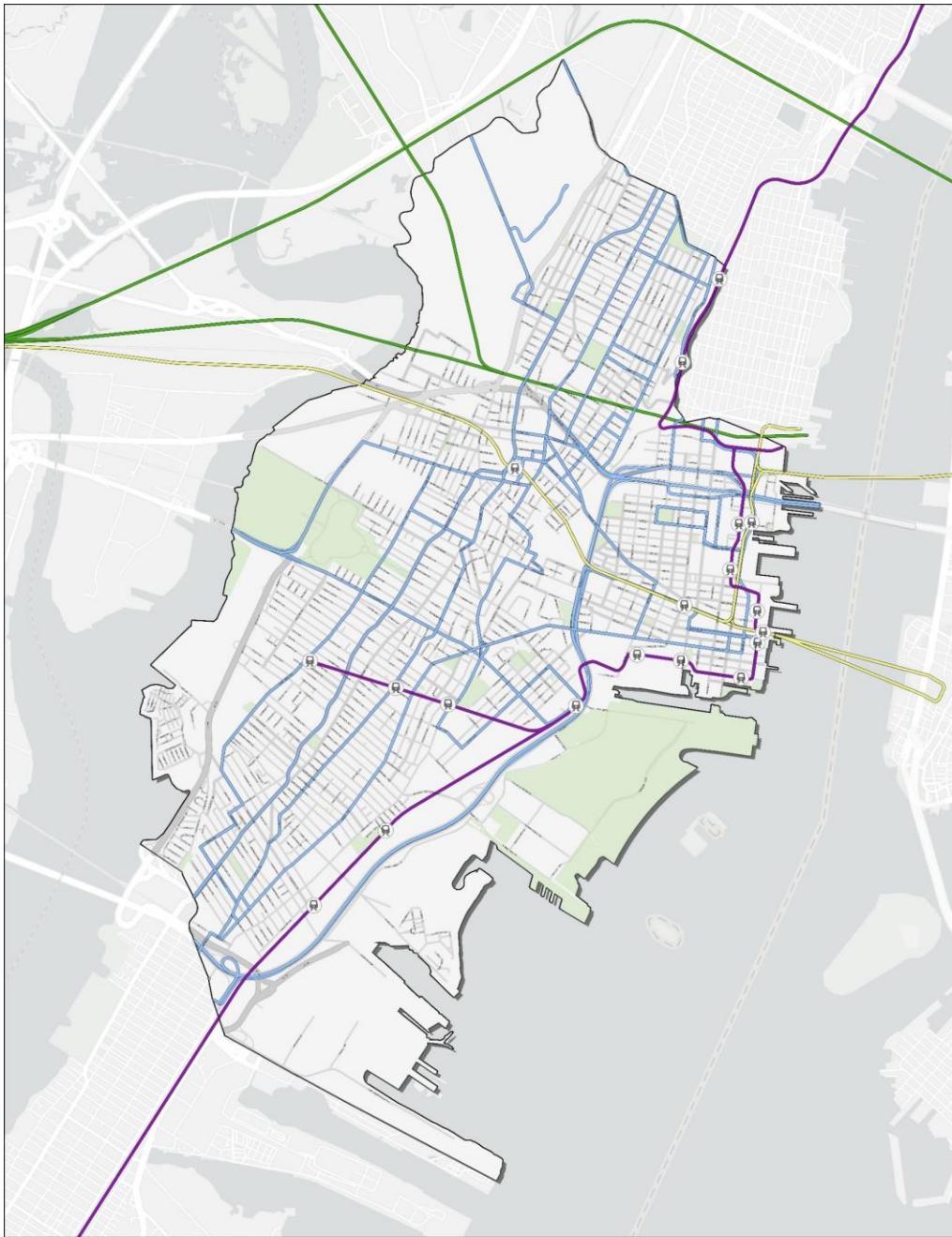
Incredibly Diverse.

The majority of residents speak a language other than English, and four racial/ethnic groups constitute relatively equal shares of the population

3

Multimodal City.

Transit system consists of local and long-distance bus, rail, ferry, bike share and micro transit



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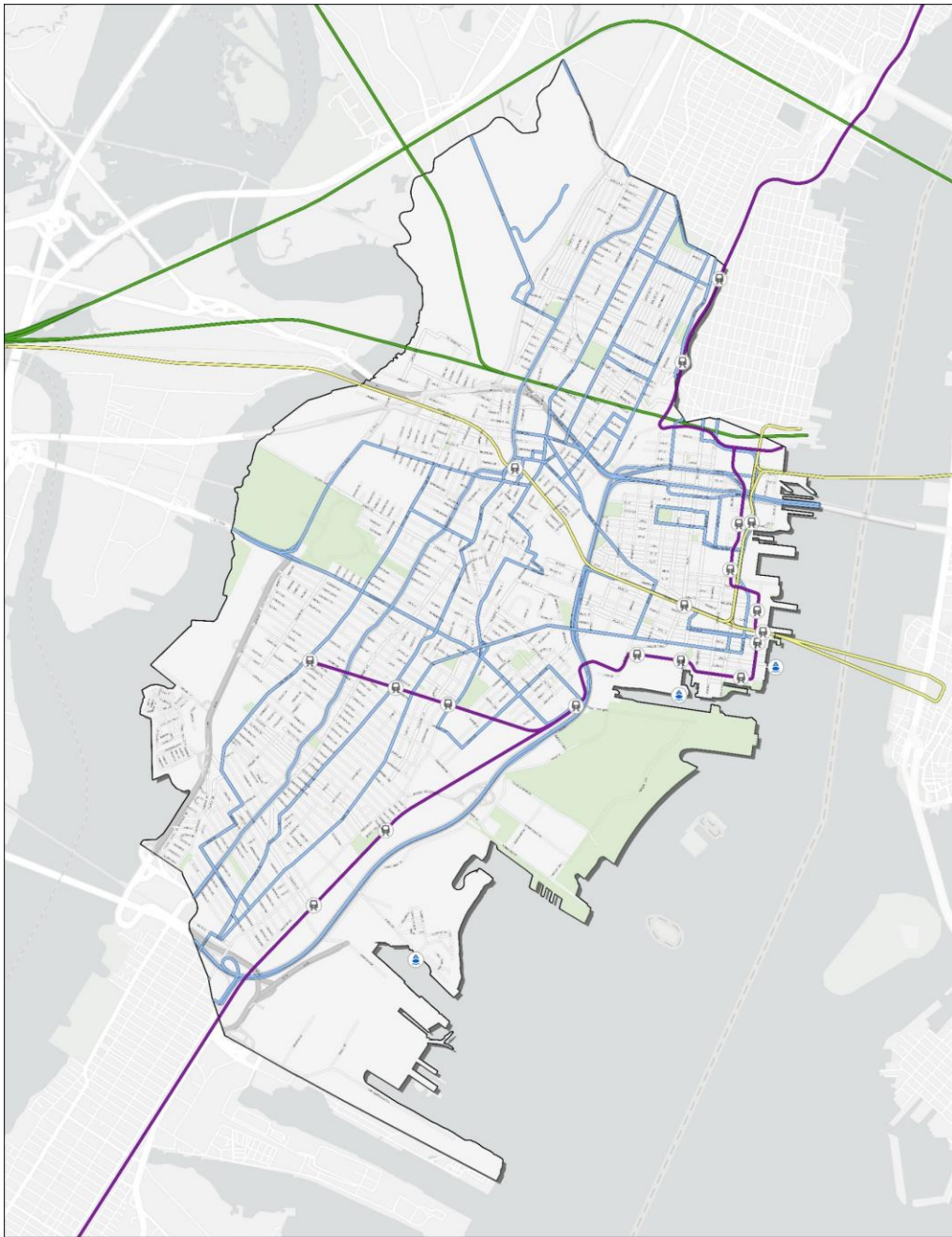
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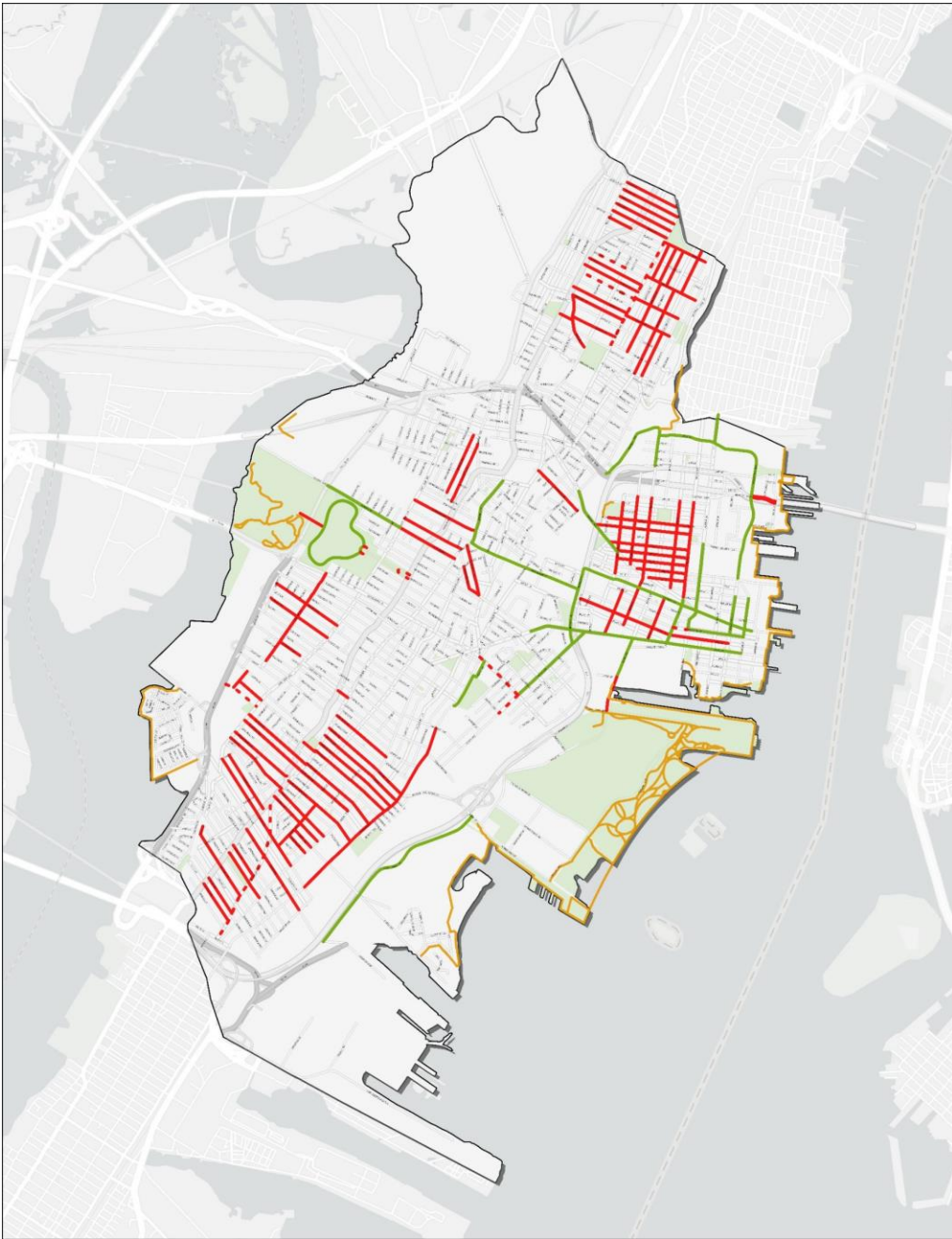
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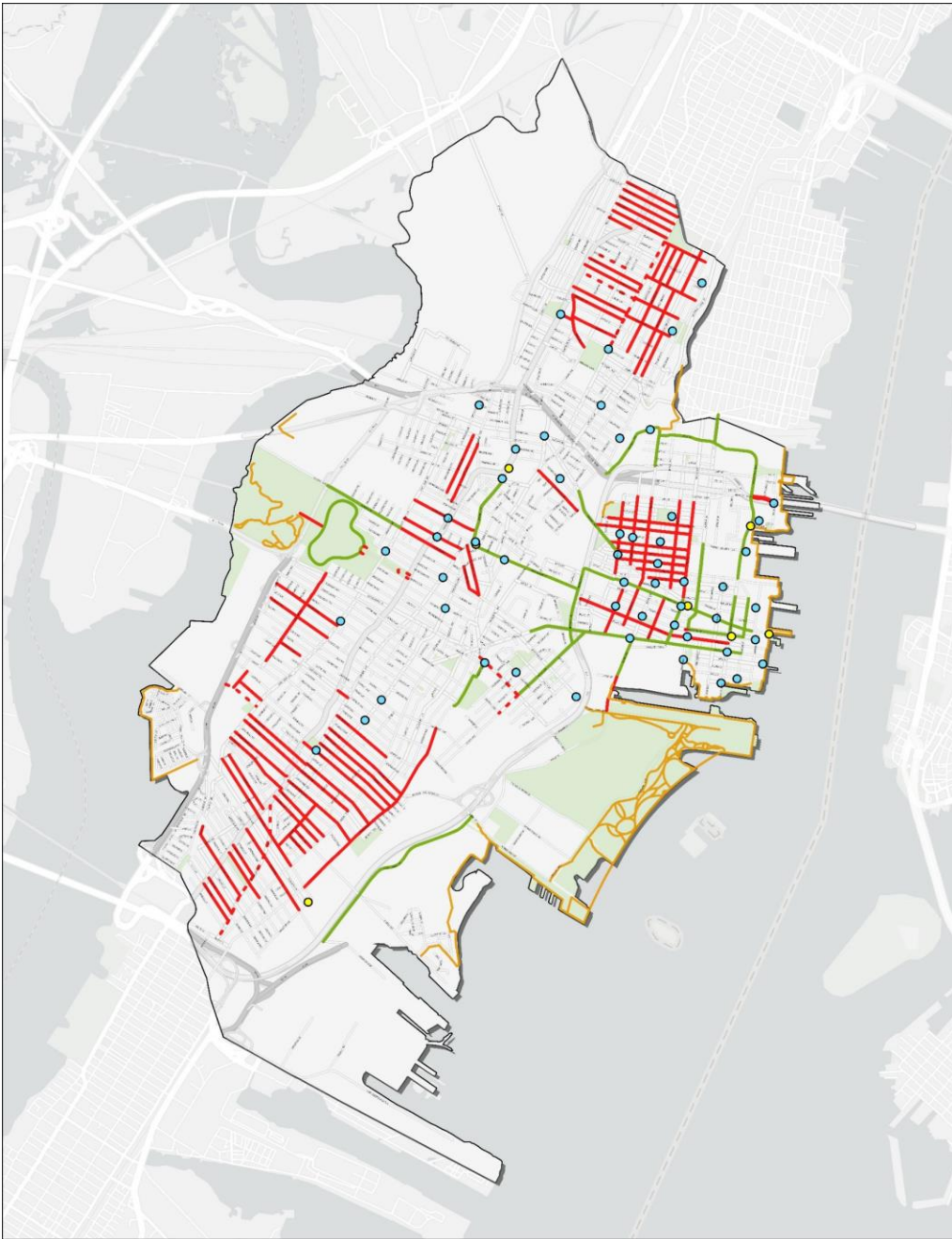
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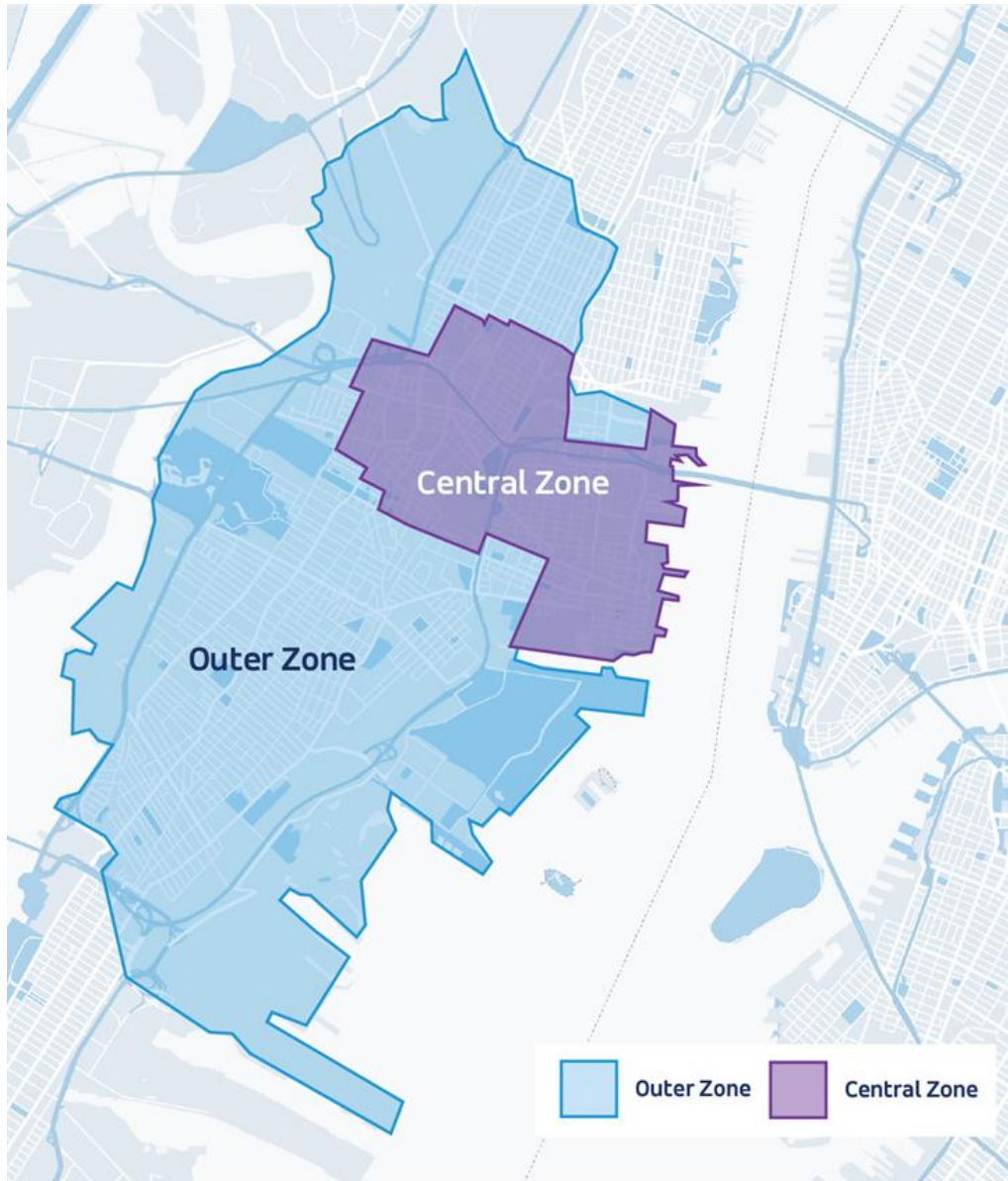
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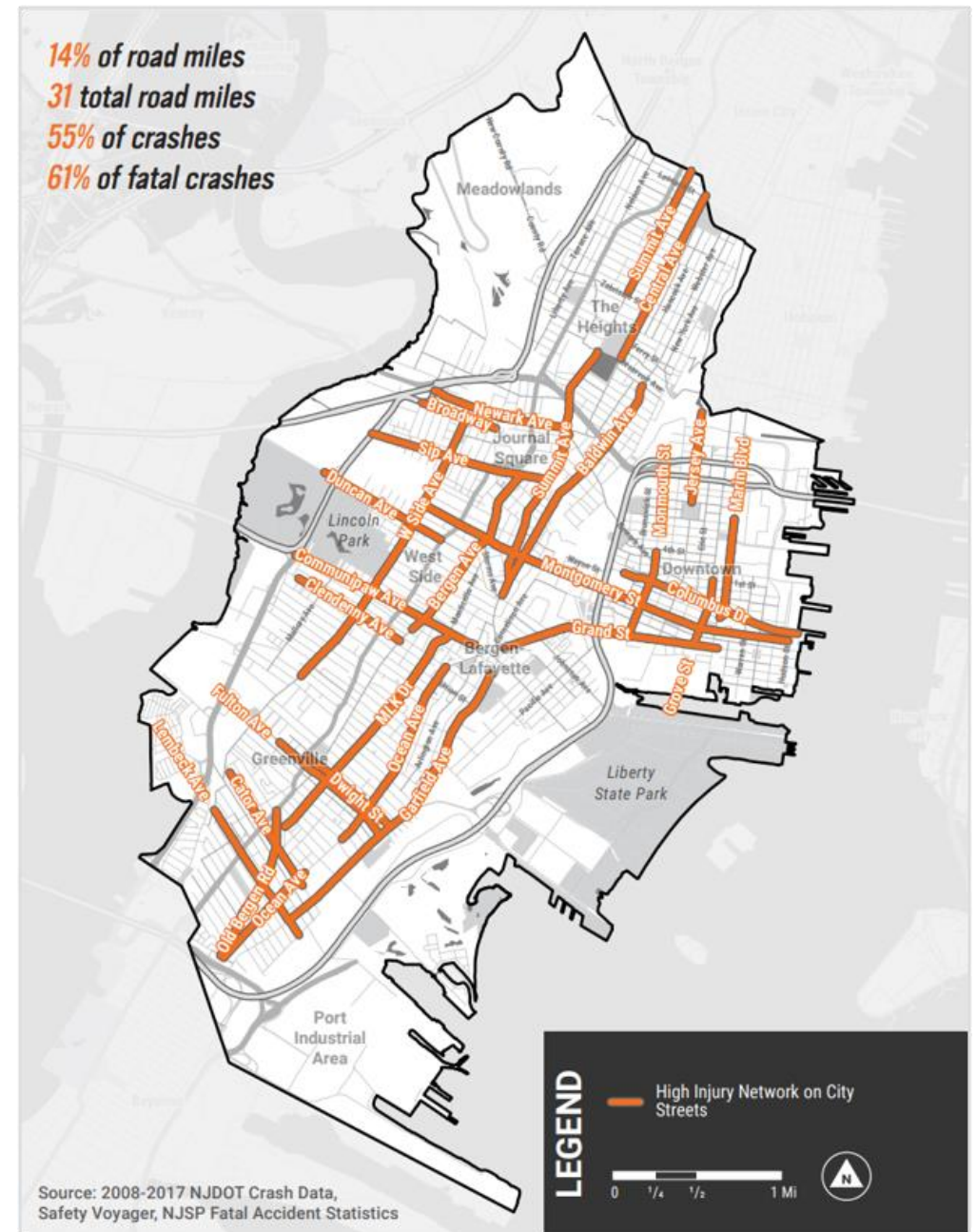
VISION ZERO IN JERSEY CITY

Vision Zero in Jersey City



Vision Zero in Jersey City

- Mayor Fulop signed VZ pledge in February 2018
- Goal: Eliminate traffic fatalities and serious injuries by 2026
- Identified 70+ action items under themes of:
 - Design Safer Streets
 - Promote a Culture of Safety
 - Embed Vision Zero in City Practices
 - Enforcement, Law, and Policy
 - Planning and Leveraging Data



Vision Zero in Jersey City

Since 2019, the Vision Zero Plan has advanced or completed **52 out of 77** actions.

25+
ACTIVE
PARKLETS



680
SPEED HUMPS



**NO
TURN
ON
RED** **190+**
NO TURN ON RED
RESTRICTIONS



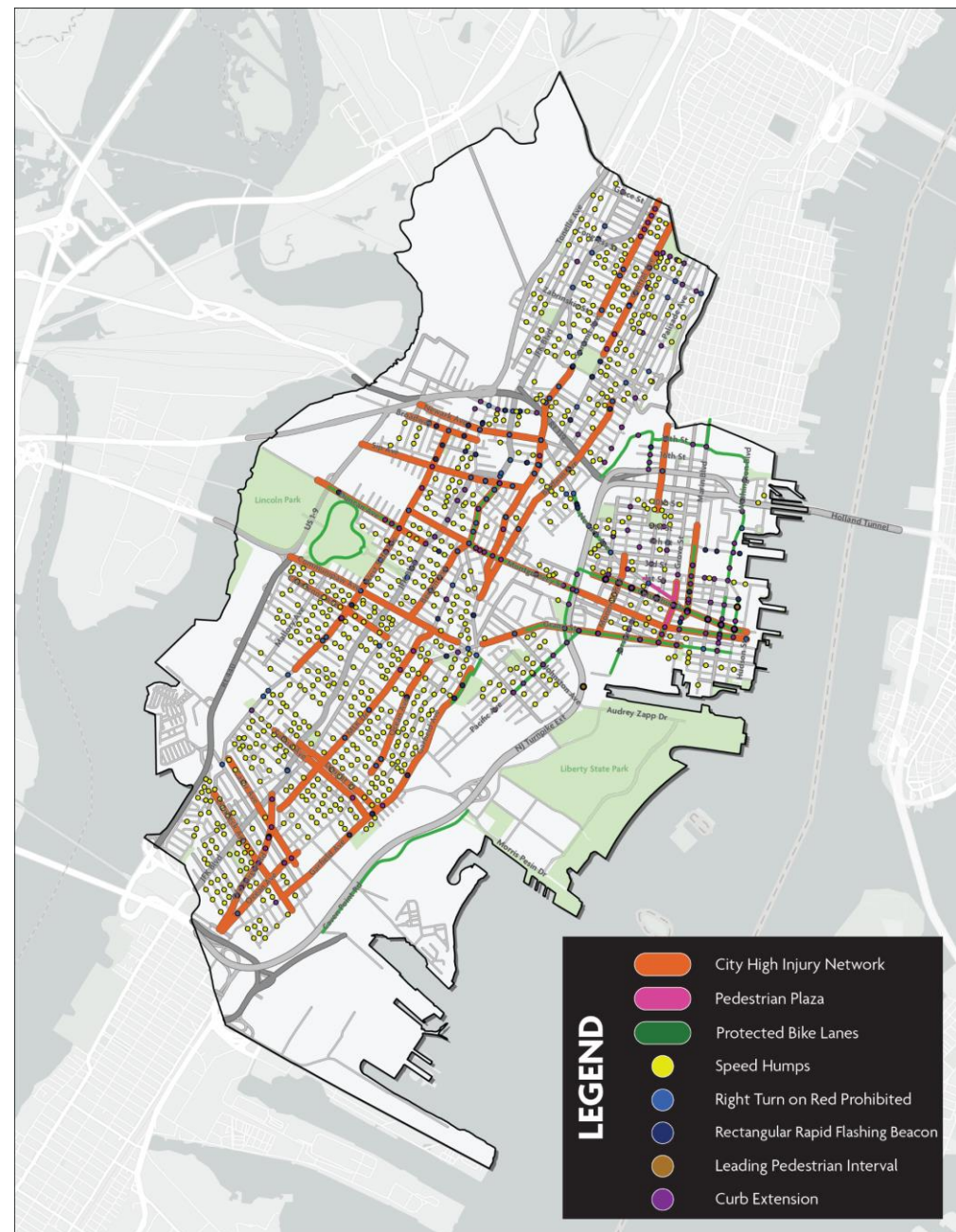
21
BIKE LANE



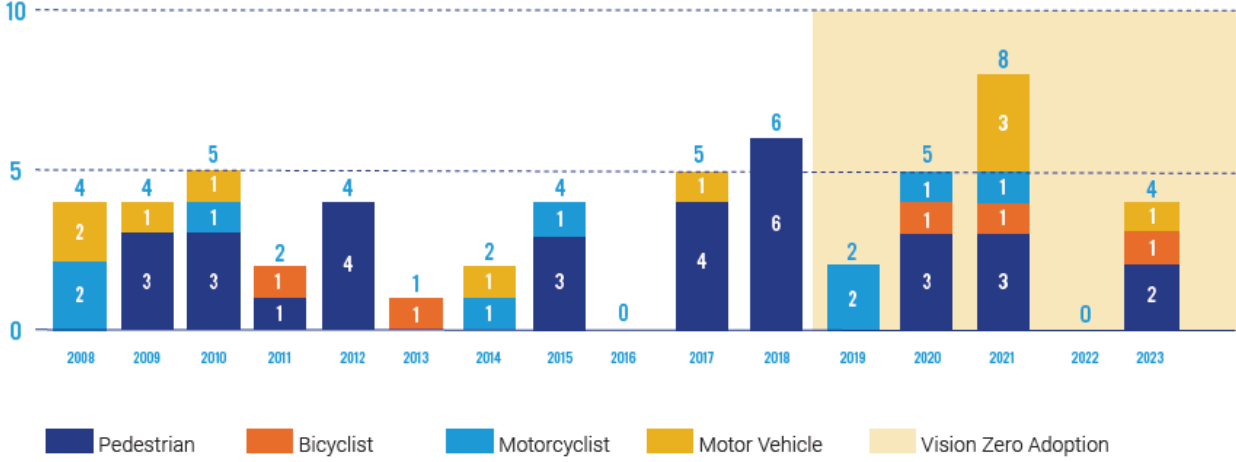
150+
INTERSECTIONS WITH NEW
CURB EXTENSIONS



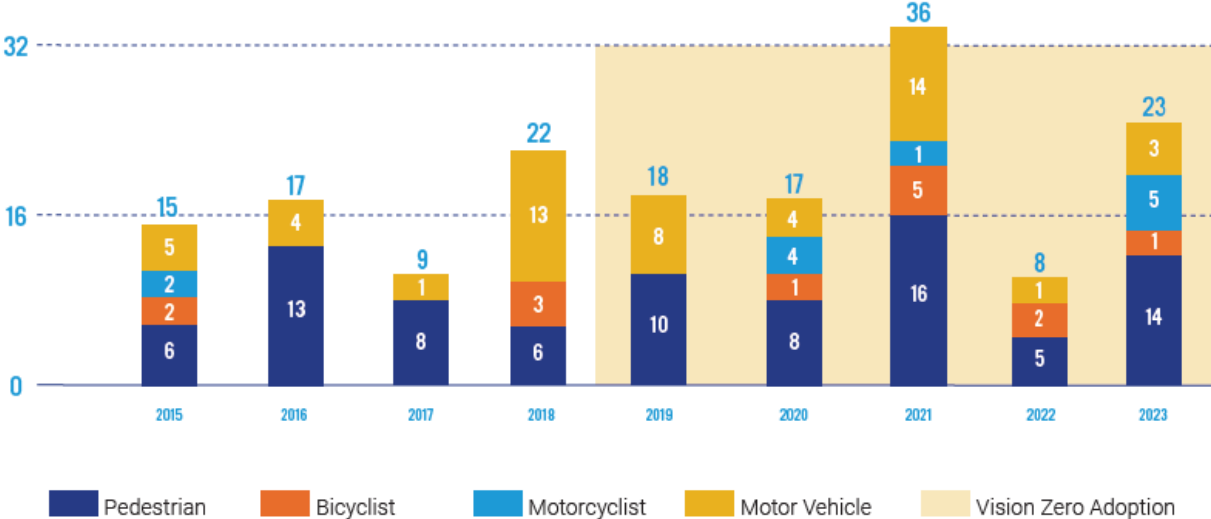
MILES OF
PROTECTED BIKE
LANES



Fatal Traffic Crashes - City Streets (2008 - 2023*)



Serious Injury Traffic Crashes - City Streets (2015 - 2023*)

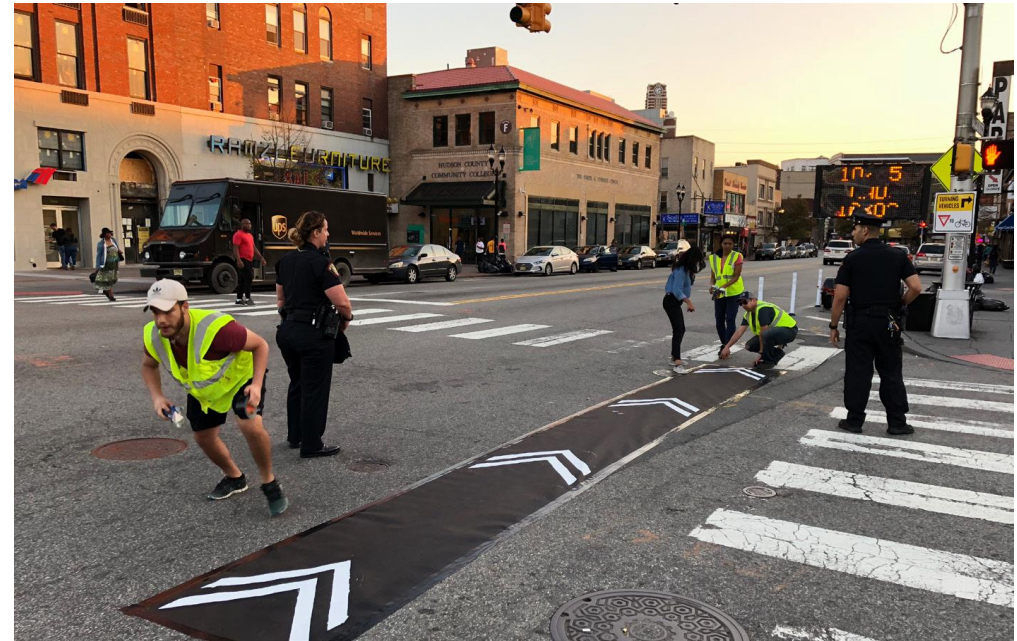


CASE STUDY: BERGEN AVENUE



What we learned

- It was instantly popular with people traveling by bike, scooter, skateboard etc.
- The impact on traffic flow was minor.
- Transit users were still able to use the existing bus service with no major issues.
- Without a protected bike/micro-bility lane on the northbound side of Bergen, many people moved contra-flow on the southbound side; suggesting an opportunity to further test one-way vs. two-way configurations in this specific corridor.
- A few retailers noted the street redesign made the sidewalk feel wider and reduced conflicts

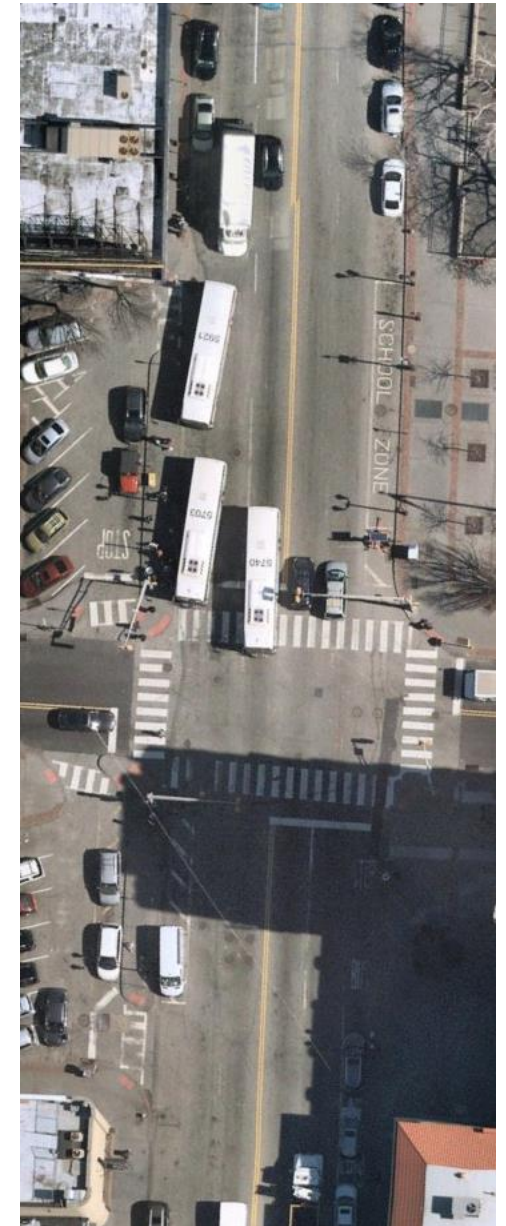
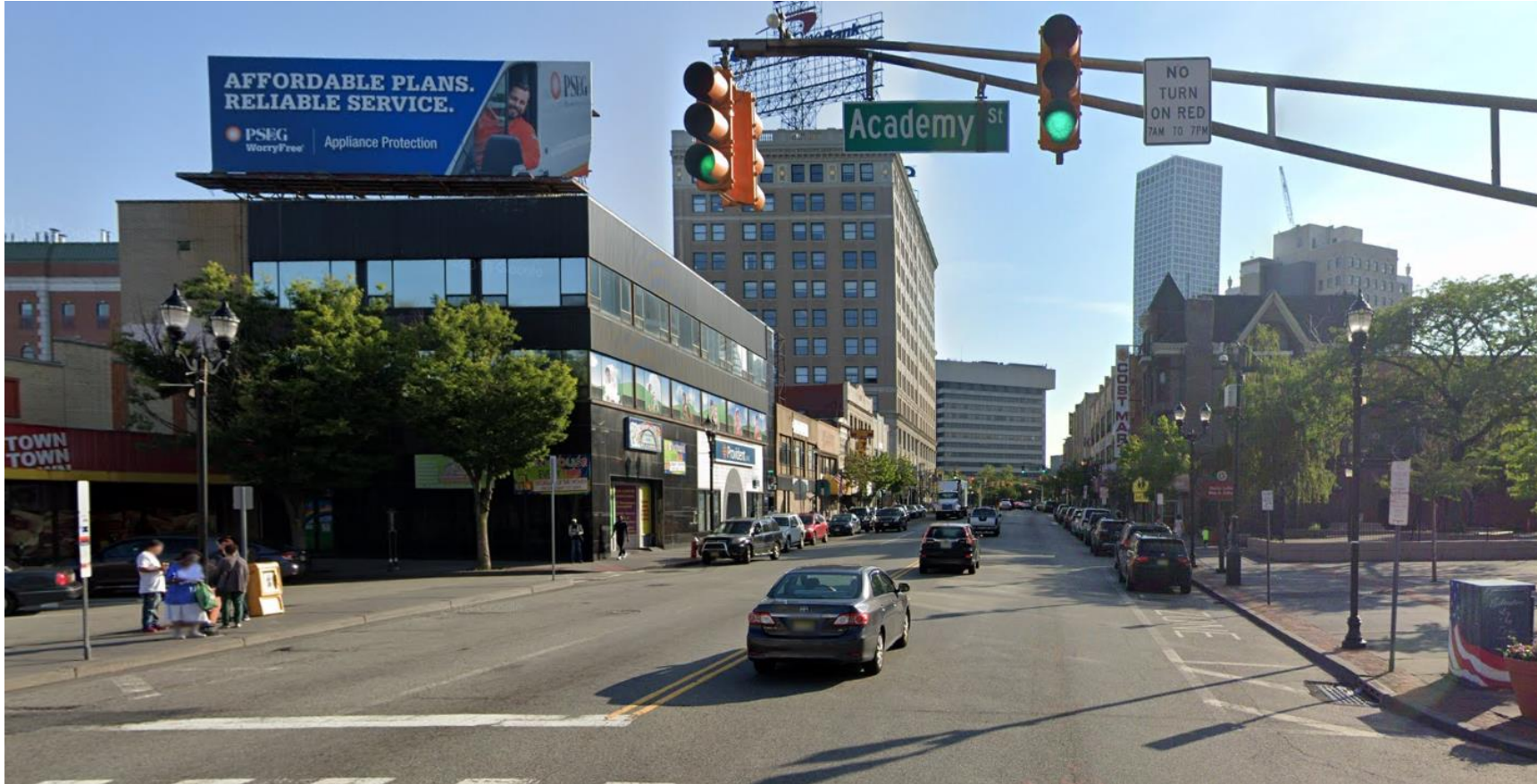


From Pop-up to Permanent

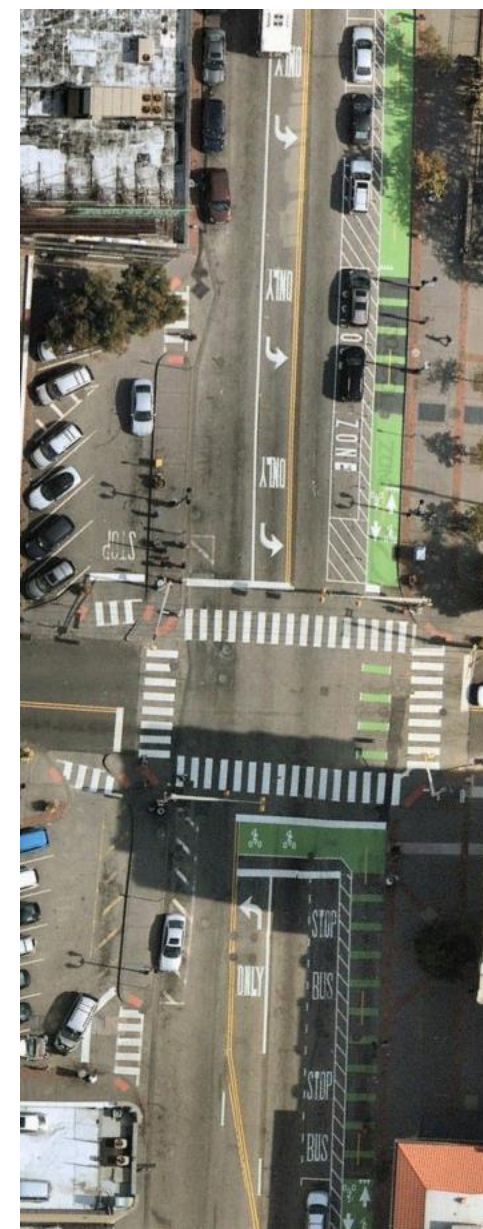
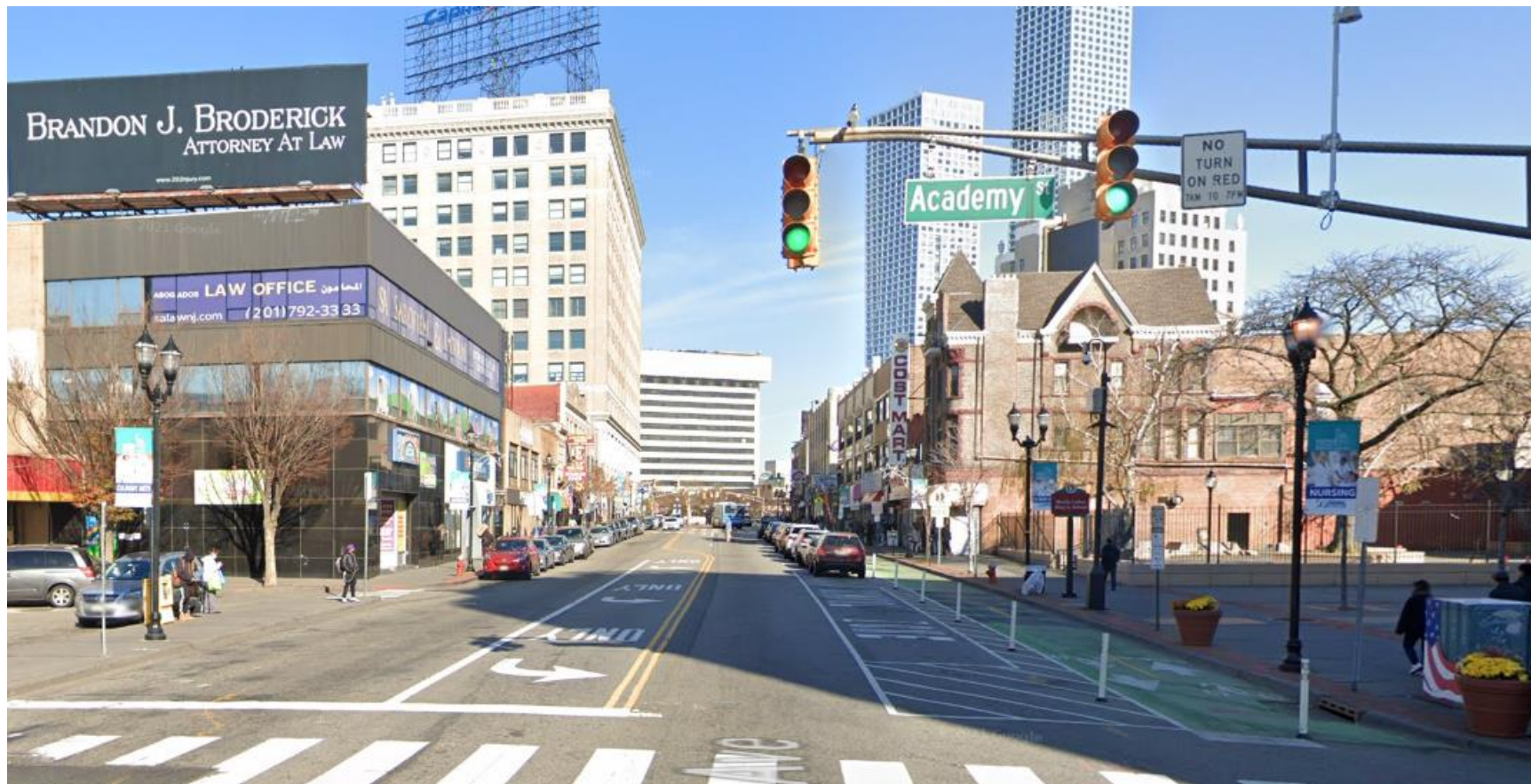
- 0.5 mile protected bike lane installed in 2019
- 4 lane to 2 lane road diet
- Protected intersections installed



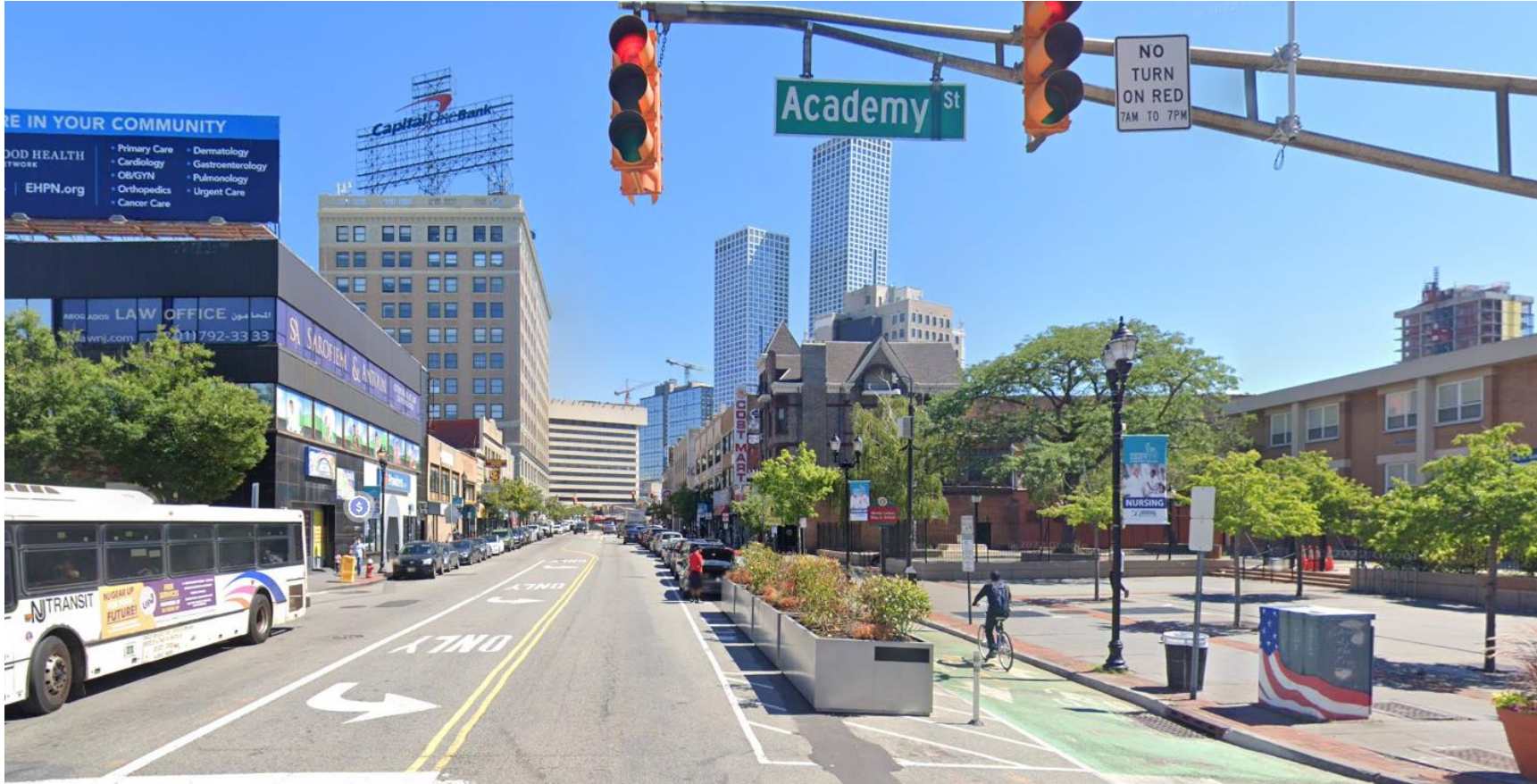
2018



2019



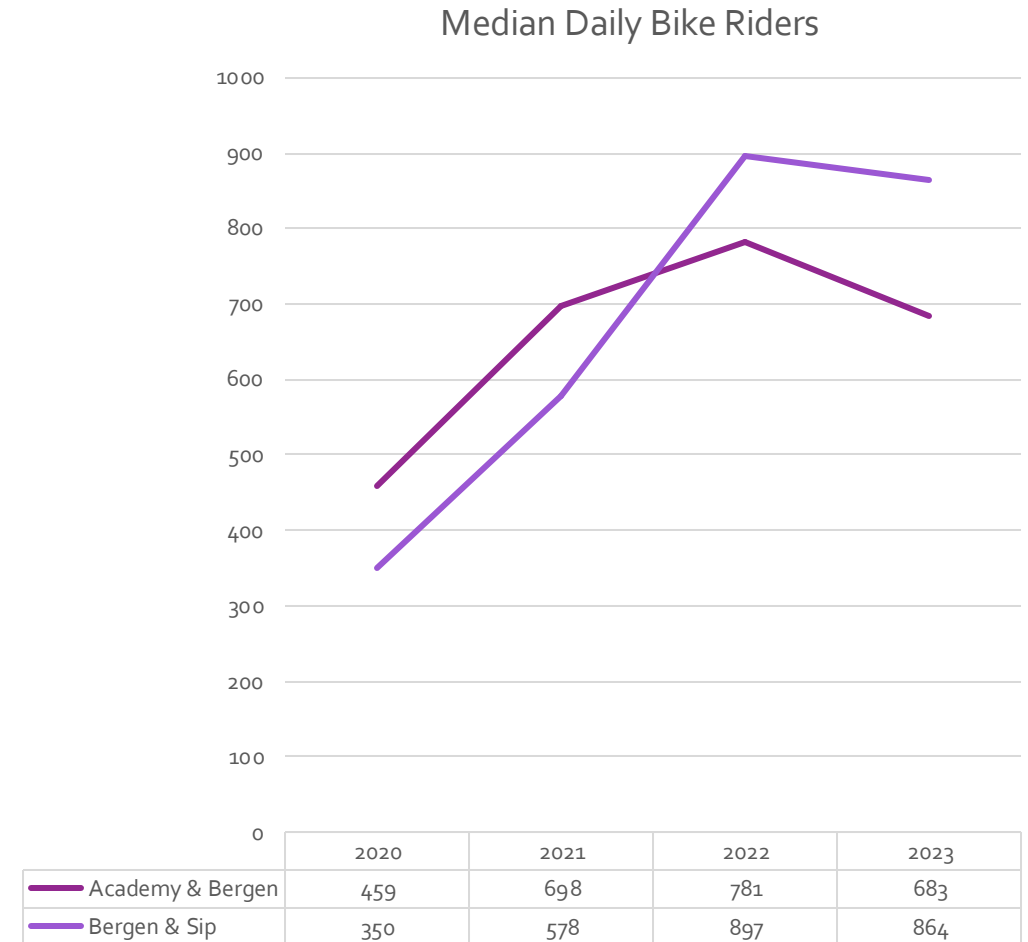
2022





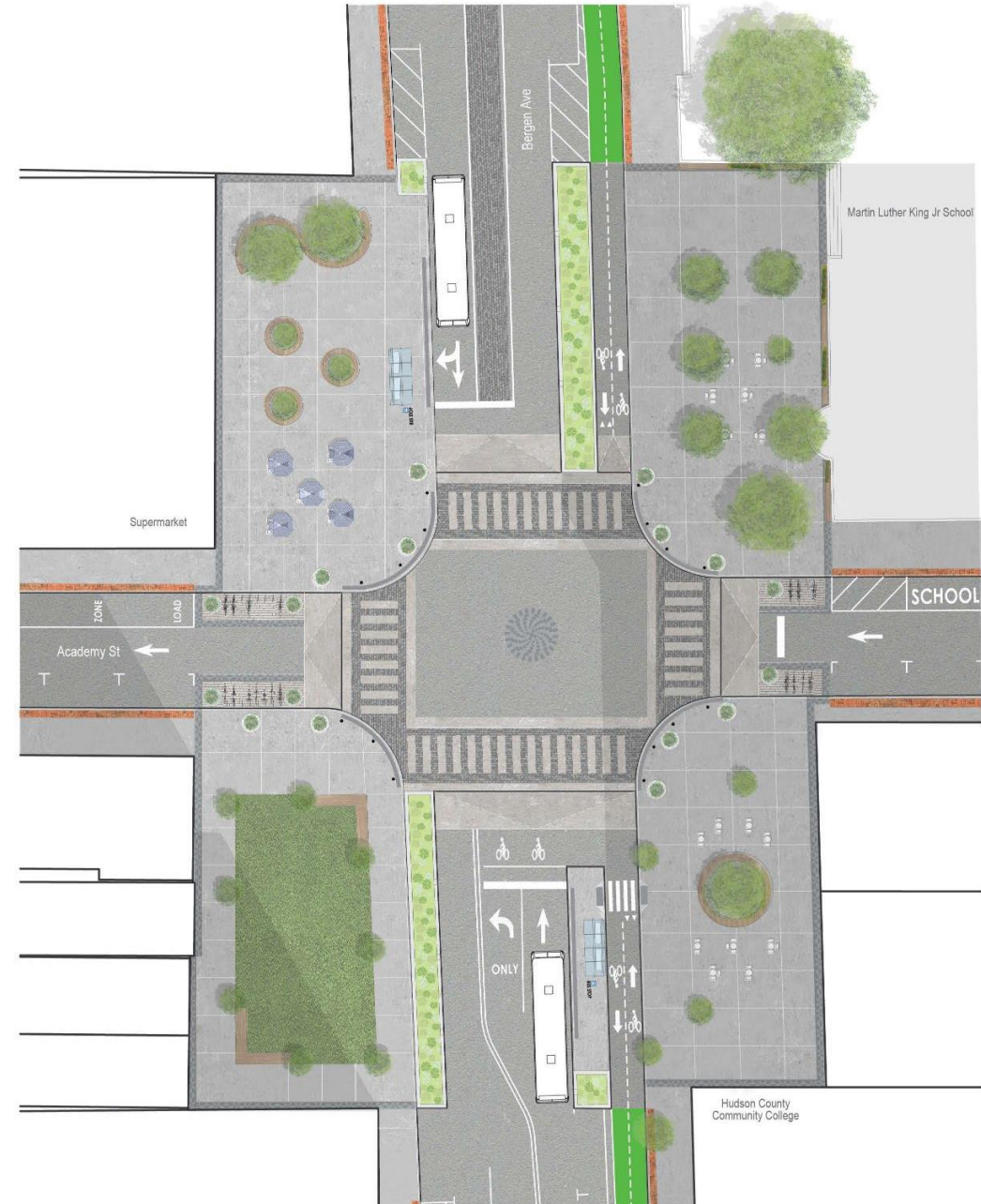
What We've Learned

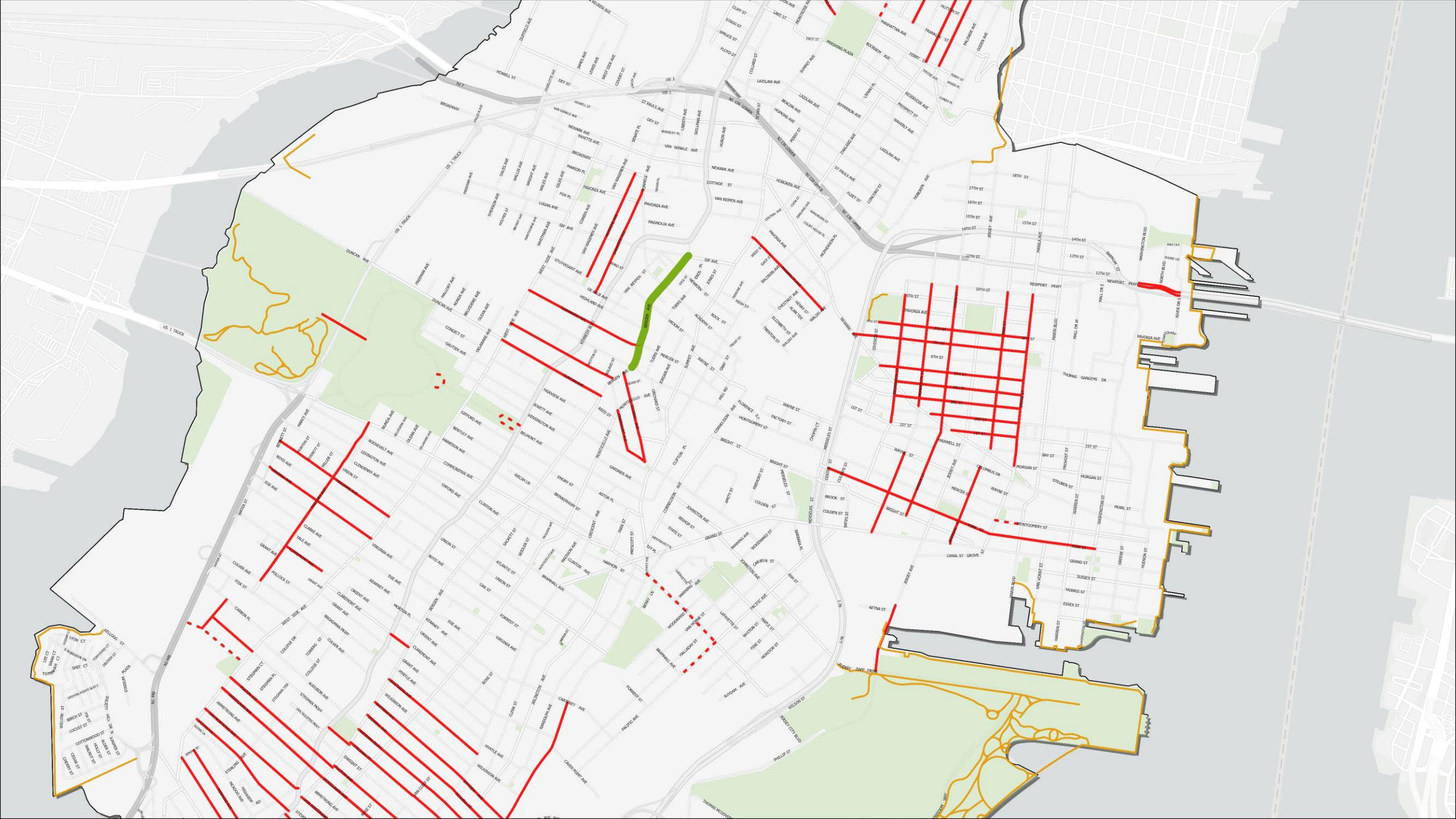
- Demonstration projects are a powerful tool
- Iteration is important
- Ensure safety is at the core of the project
- Safer micromobility infrastructure improves the riding experience and can increase the usage of the corridor
 - Bike traffic along the corridor is up 147% since 2020
 - Nearby bike share stations saw an 35% increase in usage

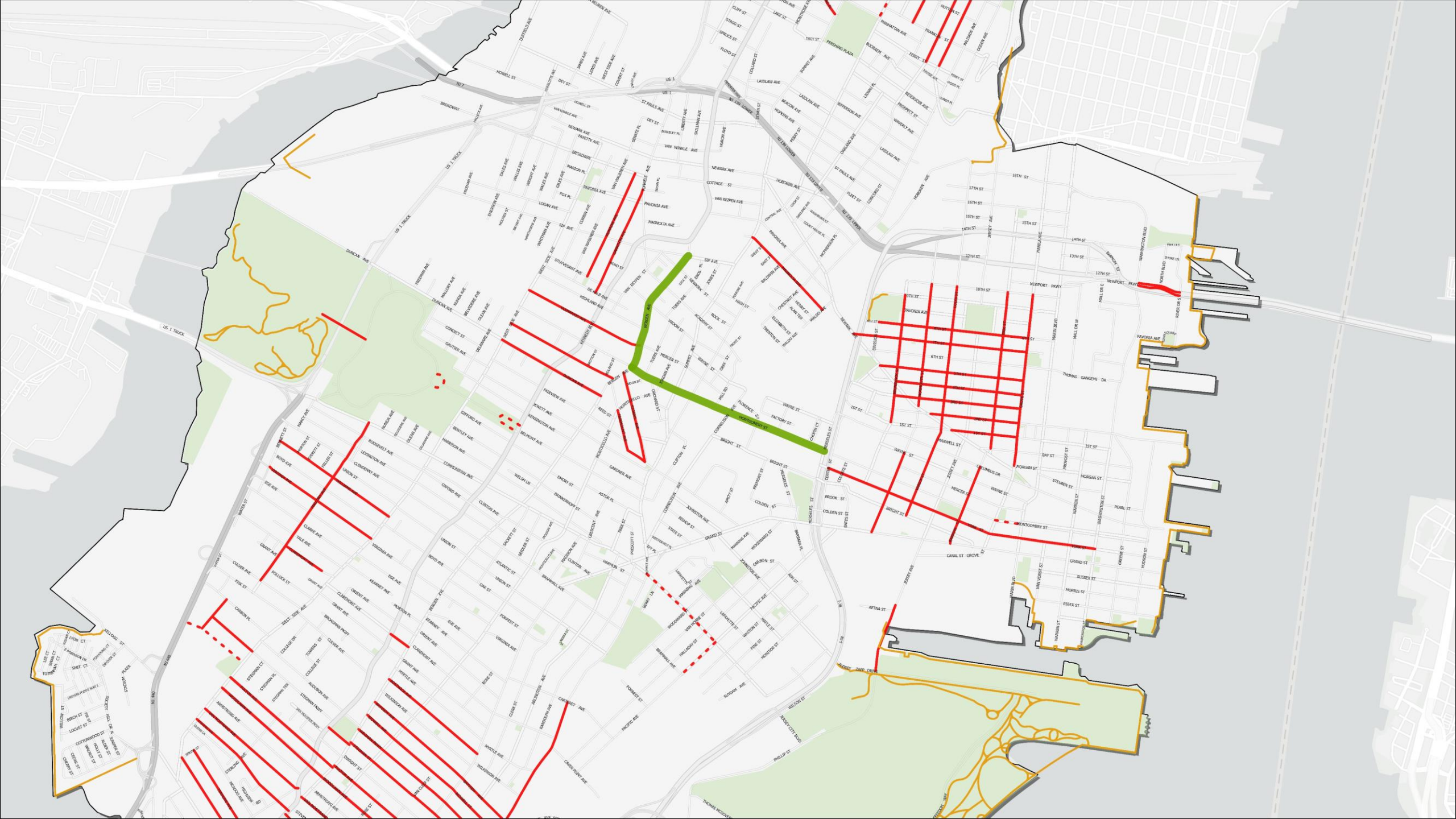


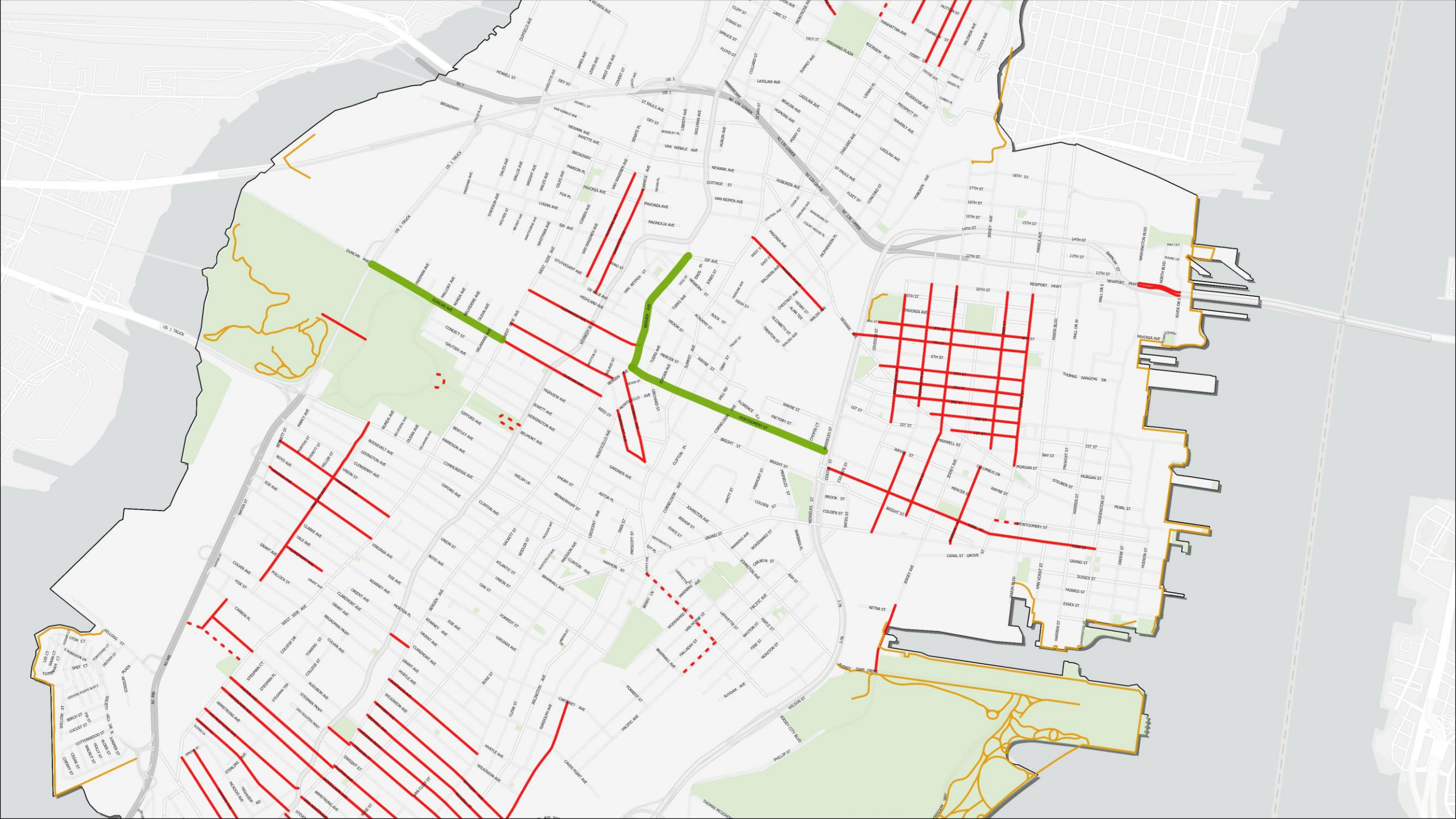
Next Steps

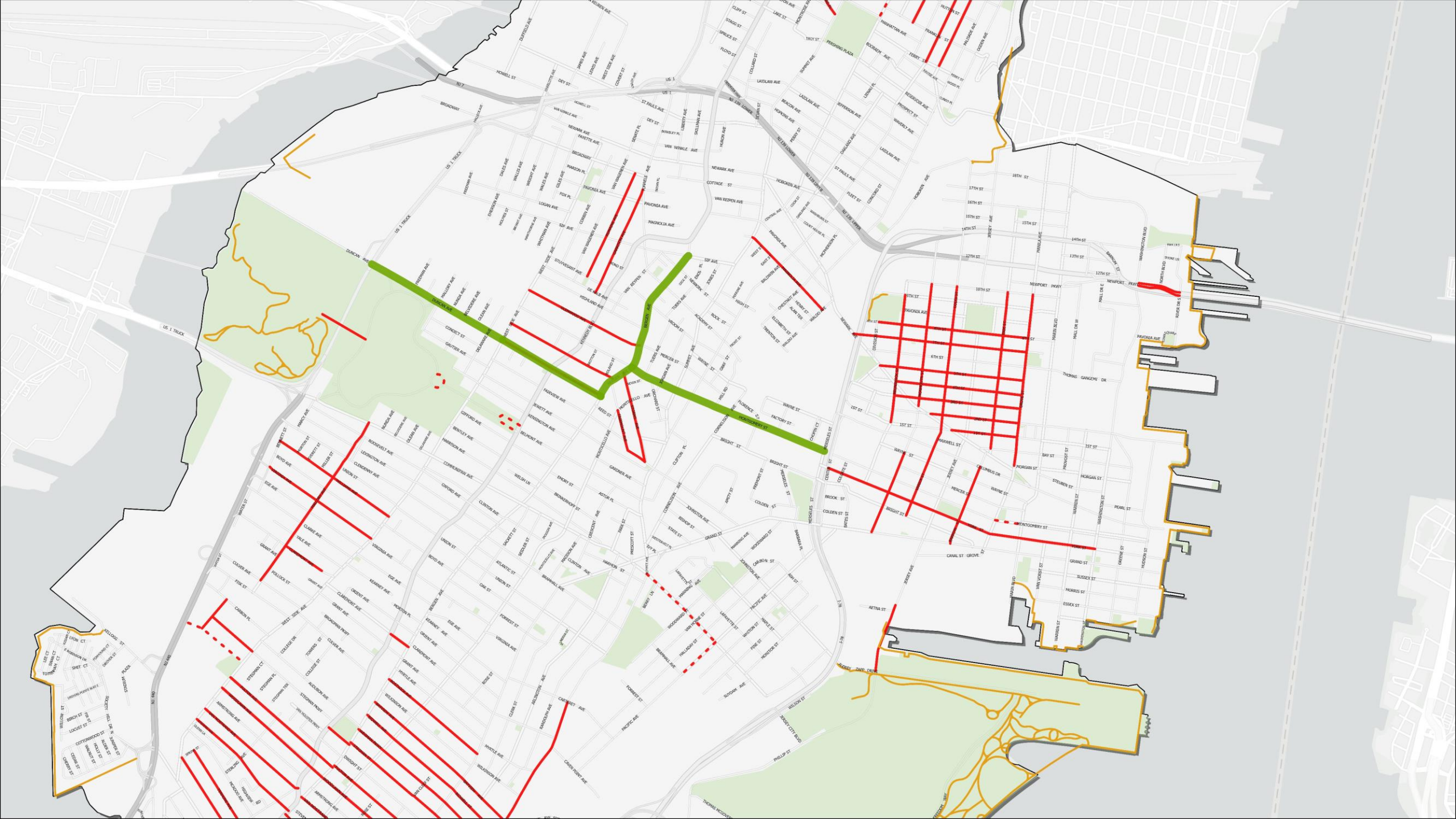
- Raised Intersection and Bike lane
- Improve bike lane protection
- Update Design
- Improve connectivity











Safety Upgrades



- Green Surface Covering (Latex → Endurablend)
- Barrier elements (delineators, Tuff Curb, Jersey barriers, planters)
- Raised bike lanes
- Bike signals



Questions for the Future

- How do we accommodate the wide range of micromobility options safely on our roads?
- How do we best use our limited resources to improve micromobility safety?
 - Upgrade existing infrastructure?
 - Add more protected bike lanes?
 - Use more detection and monitoring technology?
- Will the micromobility infrastructure design of today need to change as the field evolves?



QUESTIONS?

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Toward a Safer Future: Innovation in Micromobility Safety



Bronwen Keiner (Moderator)

Transportation Specialist

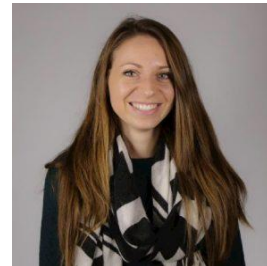
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Alan Huff

Safety Specialist

Federal Highway Administration



Hannah Younes, PhD

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Alan M. Voorhees Transportation Center
Bloustein School of Planning and Public Policy
Rutgers University



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Senior Transportation Planner

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