IMPACTS OF PEDESTRIAN AND BICYCLE INFRASTRUCTURE ON SAFETY, HEALTH, AND ECONOMIC GROWTH IN MIAMI-DADE

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TPO
Miami-Dade Transportation Planning Organization

SFRPC
South Florida Regional Planning Council
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Executive Summary

This study evaluates how expanding Miami-Dade County's pedestrian and bicycling network can improve safety, public health, and economic vitality. Grounded in the concept of "bikeconomics," the report integrates a literature review, crash-exposure analysis, a health-impact assessment (HIA), and a 25-year benefit-cost analysis (BCA) to quantify returns on proposed infrastructure investments and to guide policy and funding priorities.

In this report, the South Florida Regional Planning Council (SFRPC) links detailed crash and travel-exposure data to five common bicycle facility types, revealing that physically separated or buffered facilities consistently reduce risks of crashes. Buffered bike lanes recorded just 0.25 crashes per 1,000 trip-miles during the day, and none at night, whereas unprotected lanes reached 6.41 crashes per 1,000 trip-miles in daylight. Wide curb lanes, while moderate in daylight, exhibited the highest night-time risk (25.54 crashes per 1,000 trip-miles). Countywide, bicycle crashes rose 32 percent between 2020 and 2024, and pedestrian crashes rose more than 50 percent, underscoring the urgency of targeted safety upgrades even as recent design interventions have begun to temper fatality trends.

The HIA adapts the US DOT value-of-statistical-life guidance to Miami-Dade demographics in a modified methodology suited to Miami-Dade County. Driving behavior changes, an across-the-board 1 percent increase in adult walking and cycling, would avert roughly 0.5 premature deaths per year and yield about $6.9 million in annual economic value, while a 5 percent increase would avert 2.6 deaths and save $35.6 million annually in countywide health expenditures. A targeted shift in which just 1 percent of drive-alone commuters switch to cycling would prevent 5.2 deaths and generate about $71 million in annual benefits; doubling that mode shift would more than double public benefits.

These health benefits feed directly into the 25-year BCA. Using a 3 percent real discount rate, capital and lifecycle costs of the County's $1.367 billion active-transportation plan translate into a net-present-cost of $952 million. Scenarios that rely on incremental county-wide activity gains produce low benefit cost ratios (BCRs) (0.12–0.63). By contrast, a 1 percent commuter mode shift yields a BCR near 1.6, and a 2 percent mode shift produces a BCR of 2.5, meaning every dollar invested returns $2.50 in avoided premature-death costs alone. Broader macroeconomic modeling suggests cumulative 25-year gains in countywide personal income between $149.5 million and $3.1 billion, alongside annual job-equivalent gains up to 388 jobs under the most ambitious scenario.

Beyond the documented health and congestion benefits, the report highlights additional economic and accessibility improvements. For example, protected corridors can increase nearby retail sales by up to 30% and are associated with higher property values within a quarter mile of upgraded infrastructure. These enhancements contribute to more walkable, connected environments, supporting local businesses and economic activity. Additionally, improved first- and last-mile connections expand mobility options for communities that rely on transit, fostering greater access to employment, services, and resources. By enhancing transportation networks, these improvements support broader goals of accessibility and infrastructure hardening, ensuring that future developments provide widespread benefits.

The findings lead to four recommendations:

Prioritize safety in high-injury through rapid build-out of protected lanes, smart signals, and traffic calming.

Expand the protected network, 438 miles of separated or buffered facilities by 2050 to realize economies of scale in safety and mode-shift benefits.

Continue Build Out of streets for all transportation modes and dedicate funding to ensure consistent design standards and reliable maintenance.

Embed health metrics in capital programming so that avoided fatalities, injuries, and chronic-disease reductions carry formal weight in project selection.

Taken together, the study demonstrates that strategic investments in active-transportation infrastructure can curb Miami-Dade's persistently high cyclist and pedestrian crash rates, deliver significant public-health savings, and stimulate local economic growth. Achieving the larger, commuter-focused mode-shift scenarios envisioned here would more than pay for the County's long-range network plan, positioning bikeconomics as a practical pathway toward a safer, healthier, and more prosperous Miami-Dade.

Introduction: Background and Objective

This study identifies how integrating pedestrian and bicycle infrastructure around transit hubs, schools, and parks can enhance community safety, public health, and economic vitality. Central to this investigation is the concept of "*bikeconomics*," which demonstrates how such infrastructure improvements not only strengthen connections between neighborhoods and major destinations but also serve as catalysts for economic development. More specifically, the study shows how improving access to biking and walking pathways can attract investment, stimulate local growth, and generate long-term benefits for residents and the broader Miami-Dade community.

I. The Concept of Bikeconomics

The term "*Bikeconomics*" refers to the economic benefits generated by investing in bicycle infrastructure and cycling-friendly policies. These investments may include adding bike lanes, expanding bike-sharing programs, installing secure bicycle parking, or designing safer cycling routes. These efforts can spur local economic growth, raise property values, reduce transportation costs, and foster urban development. By promoting cycling, bikeconomics contributes to:

- Healthier communities, by encouraging regular physical activity.
- Economic growth, by creating jobs, attracting businesses, and boosting tourism.
- Resilient and prosperous economies by supporting multimodal transportation options and increased mobility.

A bikeconomics-driven infrastructure strategy for Miami-Dade County would forefront the need for bicycle and pedestrian infrastructure investments as a pathway to economic mobility and growth through diversified transportation choices for residents. As more bicycle facilities become accessible, the more viable walking and cycling become alternatives to motorized vehicles in meeting the needs of County residents.

II. Miami-Dade TPO's Approach and Baseline Comparisons

Supported by the South Florida Regional Planning Council (SFRPC), the Miami-Dade Transportation Planning Organization (TPO) conducted:

1. A Literature Review, consolidating existing research on bicycle and pedestrian infrastructure from local sources and national studies.
2. A Benefit-Cost Analysis, evaluating the Return on Investment (ROI) or "*bikeconomics*" of non-motorized infrastructure, capturing financial gains alongside broader community benefits.

3. A Health Impact Assessment (HIA) to quantify non-monetary benefits of cycling infrastructure, such as reduced mortality rates, improved air quality, and accident reductions.

These three components, along with current Miami-Dade traffic data, provide a comprehensive view of how bicycle and pedestrian infrastructure enhances safety, health, and overall well-being. By analyzing present conditions and modeling future scenarios, this information can be used to convey data-driven decisions for infrastructure planning, policy development, and community outreach.

Safety was the primary focus of the baseline analysis, as it is one of the most important factors that influences whether an individual will drive or cycle. Utilizing a case study approach, fatality rates of pedestrians and bicyclists were compared between Miami and other major cities across the United States. Then, various bicycle safety improvements across the cities were compared for their potential impact on reducing fatalities.

Table A.3 provides an overview of changes in pedestrian fatality rates (per 100,000 residents) across major U.S. cities between two-time frames: 2013–2017 and 2018–2022. According to data from the League of American Bicyclists, City of Miami's **pedestrian deaths** increased from 4.2 to 5.5 per 100,000, a 31% jump, while Atlanta experienced a similarly sizable increase (31%) over the same period. Houston showed the largest percentage increase at 35%. In contrast, New York City and Boston saw meaningful declines in pedestrian fatalities; both cities reported decreases of about 0.3 deaths per 100,000, translating to a 19% and 18% reduction, respectively. These figures suggest that while some urban centers are improving pedestrian safety, others, particularly in rapidly growing Sun Belt regions, are facing ongoing challenges in reducing traffic-related fatalities.

Table A.3: Comparison Per Capita Pedestrian Fatalities

City	State	2013-2017 Pedestrian Deaths Per 100k	2018-2022 Pedestrian Deaths Per 100k	Difference	Percent Change
Miami	**FL**	**4.2**	**5.5**	**1.3**	**31%**
Houston	TX	2.8	3.8	1	35%
Atlanta	GA	4.2	5.5	1.3	31%
Los Angeles	CA	2.7	3.5	0.8	29%
New York City	NY	1.6	1.3	-0.3	-19%
San Francisco	CA	2.2	1.9	-0.3	-14%
Boston	MA	1.5	1.2	-0.3	-18%

Source: The League of American Bicyclists. https://data.bikeleague.org/data/cities-biking-walking-road-safety/. Accessed January 27, 2025.

Table A.4 highlights trends in **bicycle fatality rates** (per 100,000 residents) for the same comparative time frames (2013–2017 vs. 2018–2022). Notably, Atlanta shows the largest percentage increase in bicycle fatalities, a 100% jump, though the absolute numbers remain relatively low (0.1 rising to 0.2 per 100,000). Houston also experienced a substantial increase (67%), reflecting the city's struggles to accommodate a growing number of cyclists amidst car-centric roadways.

Meanwhile, San Francisco reported a significant decrease of 67%, dropping from 0.3 to 0.1 bicycle deaths per 100,000. These patterns underscore the importance of context-specific, data-driven strategies to enhance bicycle safety, particularly in areas experiencing rapid population or infrastructure growth.

Table A.4: Comparison Per Capita Bicycle Fatalities

City	State	2013-2017 Bicycle Deaths Per 100k	2018-2022 Bicycle Deaths Per 100k	Difference	Percent Change
Miami	FL	0.8	0.9	0.1	13%
Houston	TX	0.3	0.5	0.2	67%
Atlanta	GA	0.1	0.2	0.1	100%
Los Angeles	CA	0.4	0.4	0	0%
New York City	NY	0.2	0.2	0	0%
San Francisco	CA	0.3	0.1	-0.2	-67%
Boston	MA	0.2	0.2	0.05	0%

Source: The League of American Bicyclists. https://data.bikeleague.org/data/cities-biking-walking-road-safety/. Accessed January 27, 2025.

III. Reducing Non-Motorized Fatalities: Comparing Miami to San Francisco and Boston

Since New York City far surpasses Miami in size, density, and especially alternatives to single-occupancy vehicles, comparisons with the policies and investments of San Francisco and Boston may be more useful for the County's future non-motorized investments. **Table A.5** compares Miami to those two cities across several safety and access measures.

Table A.5: Comparing Miami, San Francisco, and Boston Across Safety and Access Measures

Measure	Miami	San Francisco	Boston
Protected Bike Lanes	Limited (10.2 miles)[1]	Extensive (43+ miles)[2]	Moderate (27+ miles)[3]
Bike Share Programs	CitiBike Miami	Bay Wheels	Blue Bikes
Intersection Safety	Bike boxes	Separated bike signals, protected intersections	Separated bike signals, bike boxes
Speed Limits	25-35 mph on most streets	20-25 mph citywide[4]	25 mph citywide[5]
Bike Parking	Secured Bike Lockers at transit stations and Bike Racks	Extensive, including secure bike lockers	Mix of racks and covered parking
Painted Bike Lanes	54.7 miles[6]	139+ miles[7]	195+ miles[8]
Educational Programs	Vision Zero and bike safety courses, such as BikeSafe for children	Vision Zero programs	Vision Zero, Extensive "Boston Bikes" programs

Sources: See Footnotes.

[1] Miami One Of The Most Dangerous Cities To Ride A Bike: Report – NBC 6 South Florida. May 24, 2023. Accessed January 30, 2025. According to the Miami-Dade TPO 2050 Bike Ped Master Plan, there were 3.8 miles of protected bike lanes in 2022.

[2] San Francisco Officially Opens Two-Way Battery Bike Lane- Streetsblog San Francisco. March 5, 2023. Accessed February 1, 2025.

[3] The Future of Biking in Boston: Creating a Network Everyone Wants to Use | Kittelson & Associates, Inc., Sept. 6, 2023 and Boston announces plans for 10 new miles of bike lanes, May 18, 2024. Accessed February 1, 2025.

[4] Speed Management | SFMTA. Accessed February 1, 2025.

[5] 25 in Boston | Boston.gov. Accessed February 1, 2025.

[6] Miles of Shared Use lanes, per the Miami-Dade TPO 2050 Bike Ped Master Plan

[7] Watch San Francisco's Bike Network Bloom | SFMTA, November 21. 2021. Accessed February 1, 2025.

[8] Boston Bike Network Plan, Fall 2013_FINAL_tcm3-40525.pdf. Accessed February 1, 2025.

IV. Study Methodology

A multi-faceted research strategy was employed to evaluate the impact and benefits of bikeway projects in Miami-Dade County. This approach integrated a literature review, benefit-cost analysis, data visualization, and a health impact assessment (HIA). By focusing on bikeway infrastructure that connects transit hubs, schools, and parks, the study quantified economic and health-related outcomes that can guide broader mobility goals and inform future planning.

Task 1 – Literature Research and Data Gathering

1. Comprehensive Review of Existing Reports
    - Purpose: Collect and analyze existing engineering and planning documents on non-motorized transportation improvements.
    - Safety: Examine patterns in bicyclist crashes (fatal and non-fatal).
        - *Primary Data Source*: Florida Department of Transportation (FDOT), Signal 4 Analytics
    - Mobility: Investigate accessibility to key amenities (schools, transit hubs, parks) within a ¼ mile radius for pedestrians and a ½ mile radius for cyclists. Evaluating population counts near potential infrastructure projects.
        - *Primary Data Sources*: Miami-Dade Parcel Data, U.S. Census, American Community Survey (ACS), FDOT, Miami-Dade TPO
    - Social Factors: Community demographics including age, income, household makeup, along with public health indicators (diabetes, obesity, mental health, cardiovascular disease).
        - *Primary Data Sources*: U.S. Census, ACS, Centers for Disease Control and Prevention (CDC)

These initial findings framed the broader analysis of mobility, safe and reliable access to transportation options, and health impacts associated with non-motorized transportation.

2. Assessment of Peer-Reviewed Research
    - Approach: Summarize academic studies on bicycle and pedestrian infrastructure across the U.S. to complement state and local data.
    - Outcomes: Produce visually engaging infographics highlighting key insights and case studies, emphasizing the most effective strategies and highest returns on bicycle and pedestrian investments.

3. Assessment Across Key Areas
    - Health: Evaluate potential reductions in mental health issues, cardiovascular disease, diabetes, obesity, hospital visits, and mortality rates attributable to increased physical activity.
    - Safety: Investigate changes in user perceptions, total fatalities, and crash rates involving bicyclists before and after infrastructure improvements.
    - Mobility: Examine access to commercial, recreational, educational, and medical destinations, as well as changes in walking and bicycling rates.
    - Environment: Estimate reductions in energy use and improvements in air quality.
    - Social: Explore enhancements in overall quality of life and neighborhood satisfaction.

By combining benefit-cost analysis outcomes with findings from the health impact assessment, the study reveals new insights into Miami-Dade County's *bikeconomics*. These insights will support evidence-based planning, policymaking, and outreach efforts, helping the Miami-Dade TPO align future infrastructure projects with broader goals of advancing transportation options and promoting overall community well-being. As this study also considers the role of pedestrian-oriented infrastructure connecting to or interacting with cycling infrastructure, *bikeconomics* also considers the role of pedestrian-supportive infrastructure.

Chapter 1: Comprehensive Literature Review

This literature review synthesizes findings from an extensive body of mostly United States focused-research to explore the health, safety, mobility, and socio-economic implications of pedestrian and bicycle infrastructure in Miami-Dade County. Those concerns encompass design, safety outcomes, economic impacts, health implications, benefit-cost analysis for decision support, and implementation strategies for supportive infrastructure. Public interest in alternatives to driving have placed investment in non-motorized infrastructure at the center of many planning initiatives in highly urbanized areas of the United States.

1.1 Health

Active transportation, defined as walking and cycling for transport, has been widely recognized for its role in improving public health by increasing physical activity levels and reducing sedentary behaviors. Numerous studies have quantified its impact on mortality, chronic disease prevention, and mental health outcomes.

1.1.1 Mortality and Chronic Disease Prevention

Evidence suggests that incorporating active travel into daily routines significantly reduces mortality risk. A longitudinal study in Scandinavia found a **28% lower mortality rate** among workers who cycled to work (Giles-Corti et al., 2010). A Danish study identified that individuals who cycled to work had a **40% lower risk of dying from cardiovascular diseases** (Saunders et al., 2013).

Similarly, active commuting, such as walking or biking, has been linked to lower risks of developing chronic diseases such as type 2 diabetes, cardiovascular diseases, and obesity. Several cohort studies show a dose-response relationship, where higher levels of active travel correlate with better health outcomes (Saunders et al., 2013).

1.1.2 Obesity and Weight Management

Cross-sectional and longitudinal studies provide mixed evidence regarding the relationship between active travel and obesity. While some studies suggest a negative correlation between active travel and obesity levels, others indicate that the contribution of active commuting alone may be insufficient to offset modern sedentary lifestyles (Saunders et al., 2013). One European study comparing walking and cycling rates to obesity prevalence found that countries with higher rates of active travel had lower obesity levels (Giles-Corti et al., 2010).

1.1.3 Public Health Integration in the United States

Health impact assessments (HIAs) are increasingly being used to inform transport planning. When supported by focused health data, the TPO can add health impacts to their investment decision practices. One study estimated that if the entire population in a metropolitan area in the United States walked an additional 37.4 minutes per week, 38 premature deaths could be prevented annually (Mansfield & Gibson, 2016).

Cycling is strongly associated with health benefits, including improved cardiovascular health, reduced obesity rates, and lower risks of chronic diseases.[9] Quantitative studies have shown that modest increases in cycling can lead to significant reductions in premature deaths and healthcare costs.[10] By integrating bicycle infrastructure into urban design, cities can promote active transportation as a public health strategy.

1.2 Safety

Miami-Dade County's fragmented bicycle network and traffic congestion present challenges to enhancing pedestrians and bicyclists. Despite challenges, Miami-Dade County has expanded the bicycle network to incorporate multiple types of bicycle infrastructure with varying safety impacts. While safety investments can provide a wide range of benefits, some investments yield high ROI improvements over baseline conditions.

1.2.1. Safety and Infrastructure Design in Miami-Dade

Safety remains a key concern in active transportation, particularly in Florida counties like Miami-Dade, where pedestrian and cyclist fatality rates are among the highest, resulting in the region being ranked 4th in bicyclist fatalities per capita and 8th in pedestrian fatalities per capita nationwide between 2018 and 2022.[11] This literature review draws from national studies to contextualize the relevance of advanced safety measures in bicycle and pedestrian infrastructure, focusing on their potential application in Miami-Dade.

1.2.2 Safety Innovations

Infrastructure design directly impacts cyclist safety. Protected bike lanes and bike-specific signals effectively reduce crash rates and improve cyclist visibility. Protected bike lanes have demonstrated a 31% reduction

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[9] Mansfield, T. J., Gibson, J. M. (2016). Estimating Active Transportation Behaviors to Support Health Impact Assessment in the United States. *Frontiers in Public Health*, 4, 63.
[10] IBID.
[11] The League of American Bicyclists. https://data.bikeleague.org/data/cities-biking-walking-road-safety/. Accessed January 22, 2025.

in collision rates compared to traditional painted lanes.[12] These findings highlight the importance of incorporating advanced safety measures into infrastructure planning.

Intersections remain a critical area for safety interventions. Right-hook crashes, common at conventional intersections, are mitigated through designs that separate cyclist and vehicle movements. Protected intersections, with features such as raised crossings and clear markings, enhance visibility and reduce conflict points.[13]

1.2.3 Design of Bicycle Infrastructure

The design of bicycle infrastructure significantly affects cyclist behavior, safety, and overall ridership. Protected bike lanes and raised cycle tracks, offer physical separation from vehicular traffic, enhancing safety and comfort for cyclists.[14] Protected intersections, which incorporate features like corner refuge islands and setback crossings, reduce collision risks by improving sightlines and creating predictable interactions between cyclists and motorists.[15]

Other design elements, including buffered bike lanes and **Shared Roadways**[16], play specific roles depending on urban contexts. While Shared Roadways are suitable for low-speed, low-traffic environments, their safety benefits are limited compared to physically separated facilities.[17] Buffered bike lanes, which add lateral space between cyclists and traffic, provide an intermediate level of safety and comfort.[18]

Teschke et al. (2012) provides evidence that well-designed crossings and dedicated cycling infrastructure reduce crash rates and improve safety for cyclists in cities like Vancouver and Toronto in Canada. The key findings related to crossings and crash rates include:

- **Cycle tracks had the lowest injury risk**, about **nine times safer** than major streets with parked cars and no bike infrastructure.
- **Bike lanes on major streets without parked cars had nearly half the risk** of the reference condition compared to major streets with parked cars and no bike infrastructure.

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[12] DiGioia, J., Watkins, K. E., Xu, Y., et al. (2017). Safety impacts of bicycle infrastructure: A critical review. *Journal of Safety Research*, 61, 105-119.

[13] Lee, K., Mehrara Molan, A., Pande, A., et al. (2024). Assessing the impact of bicycle infrastructure on safety and operations using microsimulation and surrogate safety measures. *International Journal of Transportation Science and Technology*, 13(1), 25-40.

14 https://www.transitalliance.miami/campaigns/build-it-bike-it-lanes

15 https://www.miamidade.gov/global/recreation/neatstreets/pedestrian-safety.page

[16] Shared lanes include lane marked referred to as “sharrows” to indicate that a lane is shared by both bicycles and vehicles.

17 https://www.miamidade.gov/transit/library/reports/transit-system-bicycle-master-plan.pdf

18 https://www.fdotmiamidade.com/bicycle-pedestrian-mobility-improvement-program

- Local streets designated as **bike routes with traffic calming** measures also demonstrated significantly lower injury risk.[19]

Overall, there is wide variation in the various safety treatments for bike mobility in the United States. In many cases, protected bike lanes are a cornerstone of safe cycling infrastructure. Studies consistently highlight their effectiveness in reducing crashes and improving cyclists' confidence. Cicchino et al. (2010) demonstrate that protected bike lanes reduce the risk of collisions by up to 90% compared to cycling on roads without dedicated facilities.[20] In Miami-Dade, where busy corridors such as Rickenbacker Causeway, connecting the City of Miami to Key Biscayne, see high volumes of vehicular and cyclist traffic, with more than 1,411 Average Daily Bicycle Trips (ADBT)[21], implementing protected bike lanes could reduce crash rates[22]. However, protected bike lanes are not the only type of infrastructure for cycling. **Table 1.1** summarizes the range of bike lane infrastructure.

19 Teschke, Kay, M. Anne Harris, Conor C. O. Reynolds, Meghan Winters, Shelina Babul, Mary Chipman, Michael D. Cusimano, Jeff R. Brubacher, Garth Hunte, Steven M. Friedman, Melody Monro, Hui Shen, Lee Vernich, and Peter A. Cripton."Route Infrastructure and the Risk of Injuries to Bicyclists: A Case-Crossover Study." American Journal of Public Health 102, no. 12 (2012): 2336–2343.

20 Cicchino, J. B., McCarthy, M. L., Newgard, C. D., et al. (2020). Not all protected bike lanes are the same: Infrastructure and risk of cyclist collisions and falls. Accident Analysis and Prevention, 141, 105490.

[21] Florida Department of Transportation. (2025). Non-Motorized Traffic Monitoring Program Data Dashboard. Rickenbacker Causeway.

[22] Florida Department of Transportation. (2025). Non-Motorized Traffic Monitoring Program Data Dashboard. South Dade Trail at SW 152nd St Count Station. https://app.powerbigov.us/view?r=eyJrIjoiNzRlNjhiMzYtODk5Yy00ZTczLTk3ODMtMGM1ZmRmZGEwZmJhIiwidCI6ImRiMjFkZTVkLWJjOWMtNDIwYy04ZjNmLThmMDhmODViNWFkYSJ9&pageName=ReportSection57074e80abb8698619bc

Table 1.1: Bike Infrastructure Typology and Comparisons

Type	Design	Pros	Cons	Best For
Shared Roadways	Cyclists share the road with vehicles when roads are marked with "Sharrows" (shared lane markings).	Easy and inexpensive to implement.	No separation; not safe for most users.	Low-traffic, low-speed streets.
Bike Lanes (Conventional)	Dedicated lane for cyclists, marked with painted lines and symbols.	Provides basic separation from vehicles.	No physical barrier; limited safety.	Urban streets with moderate traffic.
Buffered Bike Lanes	Painted buffer zone between bike lane and vehicle traffic or parked cars.	Greater separation than conventional lanes.	No physical protection; relying on driver compliance.	High-traffic roads with space for buffers.
Protected Bike Lanes	Physically separated by barriers (e.g., bollards, curbs) or parked cars.	High safety and comfort, which attracts more users.	Higher cost and complexity.	Busy streets with high traffic speeds.
Sidewalk-Level Bike Lane (Raised Cycle Track)	Bike lane built at or near sidewalk grade, separated from roadway by a curb or furnishing zone.	Maximum separation from traffic. Injury risk lower than street riding. Attractive to novice riders.	High construction cost. Intersection visibility challenges. Possible pedestrian encroachment.[23]	Dense urban corridors where a full rebuild is feasible.
Off-Street Bike or Shared Use Paths	Shared paths for cyclists and pedestrians, away from roadways.	Complete separation from vehicles; scenic.	Potential conflicts between users.	Parks, greenways, and scenic areas.
Bicycle Boulevards	Low-traffic streets optimized for bikes with traffic calming (e.g., speed bumps, diverters).	Very safe and pleasant for cyclists.	Limited to neighborhood streets.	Residential or low-traffic areas.
Bi-directional Protected Lanes	Single physically separated path accommodating two-way bike traffic	Space-efficient for constrained corridors	Complex intersection interactions	Linear corridors with limited ROW (e.g., US 1)

Source: (Adapted From) The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature. Conor CO Reynolds, M Anne Harris, Kay Teschke, Peter A Cripton, and Meghan Winters. *Environmental Health* 2009, 8:47 and Cicchino, J. B., McCarthy, M. L., Newgard, C. D., et al. (2020). Not all protected bike lanes are the same: Infrastructure and risk of cyclist collisions and falls. *Accident Analysis and Prevention*, 141, 105490.

[23] Federal Highway Administration. *Separated Bike Lane Planning and Design Guide*. Publication No. FHWA-HEP-15-025. Washington, DC: U.S. Department of Transportation, Federal Highway Administration, May 2015.

Additionally, buffer zones and physical barriers, such as planters or flex posts, enhance safety by creating a clear separation between vehicles and cyclists. These features are particularly critical for mitigating risks on high-speed roads, a common feature in most of Miami-Dade's suburban neighborhoods.

1.2.4 Intersections and Safety Innovations

Intersections are among the most hazardous areas for cyclists and pedestrians. Right-turns crashes, where turning vehicles collide with cyclists traveling straight, are prevalent in urban settings. Protected intersections, as studied by Monzer et al. (2023), offer design solutions to reduce these risks.[24] By incorporating corner refuge islands and bike-specific signals, these intersections prioritize cyclist and pedestrian safety.

In Miami-Dade, major intersections along NW 3rd Avenue, NW 7th Street, NW 14th Street, Dade Boulevard, NW 17th Avenue, and Ives Dairy Road which are identified in Miami-Dade's High Injury Network, a network of streets with the highest concentration of severe and fatal crashes, would benefit from these designs.[25] Bicycle-specific traffic signals and bike boxes, which allow cyclists to start ahead of vehicles at intersections, further enhance visibility and reduce conflict points.

1.2.5 Road Characteristics and Adaptations

Miami-Dade's roadways often lack sufficient width for traditional bike lanes, necessitating innovative solutions. Wider bike lanes, as recommended by Meuleners et al. (2023), provide greater maneuverability and reduce the likelihood of collisions caused by close-passing vehicles. The study emphasizes the importance of context-sensitive designs, such as shared-use paths in areas where road expansion is unfeasible.

Road attributes such as width, curvature, and the presence of on-street parking influence cyclist safety. Wider lanes and single-lane roads improve overtaking safety by increasing the distance between cyclists and vehicles.[26] Conversely, roundabouts and curved mid-block sections present elevated risks, particularly in high-speed or poorly designed areas. Widening bike lanes on these segments has been shown to reduce crash rates and improve rider confidence.[27]

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[24] Monzer, Y. I., Hussein, M. (2023). Safety Assessment of Different Bike Infrastructure Types: A Data-Driven Approach. McMaster University.

[25] Miami-Dade County. (2024). Miami-Dade County Vision Zero Action Plan. https://www.miamidade.gov/transit/library/2024-vision-zero-action-plan.pdf

[26] https://www.miamidadetpo.org/library/plans/miami-dade-2040-bicycle-pedestrian-plan.pdf

[27] https://www.railstotrails.org/trailnation/miami-loop/

1.2.6 Pedestrian Safety and Shared Infrastructure

Ensuring pedestrian safety is a central concern in Miami-Dade's efforts to create a more inclusive, multimodal transportation system. As the county continues to implement the Strategic Miami Area Rapid Transit (SMART) Program and expand active transportation infrastructure, the integration of pedestrian-oriented design features becomes essential. This section outlines key strategies to enhance pedestrian safety through the development of shared-use paths, improvements to crosswalk design and visibility, and inclusive design standards that accommodate the needs of vulnerable populations.

1.2.6a Shared-Use Paths

Shared-use paths are a vital component of Miami-Dade's active transportation network, particularly in areas like The Underline and Ludlam Trail. Studies by Volker and Handy (2021) indicate that such paths reduce pedestrian and cyclist conflicts by offering separate zones for active modes of transport.[28] In high-density areas like Wynwood and Little Havana, expanding shared-use paths can improve safety for all users.

1.2.6b Crosswalk Design and Visibility

Crosswalks play a critical role in pedestrian safety. When roadway conditions permit improvements, enhanced visibility measures, such as raised crosswalks and high-visibility markings, significantly reduce pedestrian injury risks. However, such improvements are only encouraged when Florida Department of Transportation guidelines can be met along the roadway. For Miami-Dade, retrofitting eligible intersections with pedestrian-focused safety features, including countdown signals and improved lighting, aligns with the county's Vision Zero goals.

1.2.6c Design for the Elderly, Children, and People with Disabilities

Design principles must prioritize the needs of different segments of the population, including children, older adults, and individuals with disabilities. Buehler and Dill (2015) recommend infrastructure features such as wider sidewalks, curb ramps, and tactile paving to enhance safety and accessibility. In Miami-Dade, integrating these elements into projects like the SMART Plan ensures that safety improvements benefit all users, regardless of ability, age, or income level.

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[28] Volker, J. M. B., Handy, S. (2021). Economic Impacts on Local Businesses of Investments in Bicycle and Pedestrian Infrastructure: A Review of the Evidence. *Transport Reviews*, 41(4), 401-431.

1.2.7. Technological Innovations in Safety

1.2.7a Smart Infrastructure

Smart infrastructure, including adaptive traffic signals and real-time monitoring systems, offers promising solutions for enhancing safety. Marshall and Ferenchak (2019) highlight the potential of connected devices to detect and prevent collisions in high-risk areas. For Miami-Dade, deploying smart technologies along critical corridors could provide immediate safety benefits. For example, pedestrian detection systems integrated with traffic signals can improve crossing safety in busy areas like downtown Miami.

1.2.7b Data-Driven Planning

Data analytics play a crucial role in identifying high-risk zones and prioritizing interventions. Studies emphasize the importance of leveraging crash data, cyclist counts, and user feedback to inform infrastructure planning. Davidson (2023) demonstrates how socio-spatial analyses can guide investments in safety measures tailored to local needs.

1.3 Mobility

The integration of active transportation systems in Miami-Dade County plays a vital role in improving mobility for schools, transit hubs, and parks. This synthesis explores how bicycle and pedestrian infrastructure, as supported by relevant studies, can be adapted to address the specific needs of these critical community spaces. By prioritizing accessibility, safety, and multimodal connectivity, Miami-Dade can create a transportation network that supports its population and growing employment base.[29]

1.3.1. Active Transportation and Schools

Active transportation infrastructure plays a critical role in ensuring safe and equitable access to schools while promoting student health. In Miami-Dade County, where many students live within walking or biking distance of their schools, investments in protected infrastructure can reduce risks, increase mobility options, and encourage daily physical activity. The following subsections highlight safety enhancements and wellness benefits associated with active transportation near schools.

1.3.1a Enhancing Active Transportation Safety to Schools

Creating safe routes to schools is essential for encouraging walking and cycling among students. Studies show that protected bike lanes, crosswalks, and traffic-calming measures reduce crash risks and improve

[29] sfregionalcouncil.org/wp-content/uploads/2024/10/2024-South-Florida-CEDS-Annual-Draft-Report-1.pdf

parental confidence in allowing children to walk or bike to school (Teschke et al., 2012). In Miami-Dade, where schools like Booker T. Washington High School are located adjacent to high traffic volume streets, implementing protected infrastructure can mitigate risks posed by vehicular congestion. [30] Protected bike lanes, crosswalks, and traffic-calming measures can make commuting safer for students in neighborhoods with high traffic volumes and average speeds.

Infrastructure that considers all road users ensures that students in areas with community investment needs, such as Liberty City, Little Haiti, and Opa-Locka, have safe and reliable access to schools. Design elements for all ages and abilities, such as curb ramps and wide sidewalks, cater to students with disabilities. These measures align with findings from Braun et al. (2019), which stress the importance of accessible infrastructure in reducing educational disparities. Coordination between the Miami-Dade Transportation Planning Organizations, Miami-Dade Department of Transportation and Public Works, and Miami-Dade County Public Schools has contributed to multiple successful projects to improve pedestrian safety conditions around schools. With funding from the Safe Routes to School Grant Program, Miami-Dade has improved conditions around Flagami Elementary, Carrie P. Meek/Westview Elemenary, Shadowlawn Elementary, Hubert O. Sibley Elementary, and many other schools.

1.3.1b Encouraging Active Lifestyles

Bicycle and pedestrian infrastructure near schools fosters active lifestyles and may reduce childhood obesity. Studies by Parker et al. (2011) emphasize the role of well-designed paths in promoting physical activity among children.[31] Connecting Miami-Dade schools to nearby parks via shared-use paths, such as extensions of the Ludlam Trail, can further support student wellness initiatives.

1.3.2. Integrating Transit Hubs and Active Transportation

Transit hubs need direct, safe connections for travelers arriving on foot or by bicycle. Integrating high-quality bike facilities with each hub increases transit ridership and lowers vehicle traffic. The subsections that follow detail two priority measures for Miami-Dade County: improving first- and last-mile links and expanding secure bicycle parking.

1.3.2a Enhancing First-and-Last Mile Connectivity

Transit hubs in Miami-Dade, including the Miami Intermodal Center (MIC) and Dadeland South Metrorail Station, serve as critical nodes for multimodal transportation. Bicycle infrastructure plays a pivotal role in addressing the first-and-last mile problem. Studies suggest that integrating bike-sharing stations and

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[30] Booker T. Washington Senior High School- Google Maps

[31] Parker, K. M., Gustat, J., Rice, J. C. (2011). Installation of bicycle lanes and increased ridership in an urban, mixed-income setting in New Orleans, Louisiana. *Journal of Physical Activity and Health*, 8(S1), S98-S102.

protected lanes with transit hubs can increase ridership and reduce reliance on private vehicles (Marshall and Ferenchak, 2019).

1.3.2b Secure Bicycle Parking

Secure bicycle parking at transit hubs encourages cycling as a feeder mode. Findings by Volker and Handy (2021) highlight that well-maintained bike racks and storage facilities reduce barriers to multimodal travel.[32] In Miami-Dade, expanding secure bike parking at stations along the SMART Program corridors, as well as at existing Metrorail, Tri-Rail, Brightline, and Metromover stations can enhance transit accessibility for cyclists.

1.3.3. Connecting Parks through Active Transportation

Parks that are linked by continuous low-stress walking and cycling routes function as a single, county-wide greenway network. The following subsection explains how such connections expand safe travel options, increase park access, and create a stronger active transportation spine for Miami-Dade.

1.3.3a Linking Green Spaces with Shared-Use Paths

Shared-use paths connecting Miami-Dade parks, such as The Underline and the Miami River Greenway, enhance recreational mobility. These paths reduce dependency on cars and provide safe routes for cyclists and pedestrians. Buehler and Dill (2015) note that interconnected greenways increase park visitation rates, fostering greater community engagement with public spaces.

1.4 Environment

Transportation choices shape environmental quality in Miami-Dade. Shifting short trips from cars to walking and cycling can ease respiratory burdens and cut health costs. Green infrastructure in bike lanes and paths can manage stormwater and add visual appeal. Weather-responsive designs—shade, permeable pavements, and bioswales also harden the network against heat and flooding while expanding safe mobility.

1.4.1 Air Pollution and Environmental Health

Reducing reliance on motorized transport has additional economic benefits related to environmental health. A study estimated that shifting a portion of short car trips to walking and cycling could significantly **reduce urban air pollution**, cutting healthcare costs associated with respiratory and cardiovascular diseases (Giles-Corti et al., 2010).

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[32] Volker, J. M. B., Handy, S. (2021). Economic Impacts on Local Businesses of Investments in Bicycle and Pedestrian Infrastructure: A Review of the Evidence. *Transport Reviews*, 41(4), 401-431.

1.4.2 Infrastructure Hardening

Integrating nature-based infrastructure with safety features offers environmental co-benefits. Bioswales and rain gardens, incorporated into bike lanes, enhance stormwater management while providing aesthetic value. For a flood-prone region like Miami-Dade, these solutions align with broader climate adaptation goals.

1.4.3 Addressing Climate Considerations

Miami-Dade's exposure to extreme weather and coastal challenges calls for durable infrastructure to protect communities and support long-term stability. Incorporating shaded bike lanes, permeable pavements, and bioswales into park pathways enhances usability during extreme weather and strengthens infrastructure while supporting the local environment. Shaded bike paths and permeable pavements not only enhance usability during extreme weather but also provide safe and reliable access to transportation options as increased investment leads to the network effects of greater ridership.

1.5. Socio-Economic Conditions: Reliable Access to Transportation and Economic Impacts

Reliable access to transportation is essential to ensure that all residents have safe, affordable, and reliable ways to get around. Bicycle infrastructure can enhance mobility and safety, but strategic investments in areas with fewer transportation options, such as those with limited car access or public transit, can expand benefits to more communities. Studies show that protected bike facilities provide added safety for families, new riders, and those who rely on biking for daily travel, reinforcing the value of well-planned infrastructure.[33]

1.5.1 Reliable and Safe Access to Transportation in Areas with Community Investment Needs

Hockmair, Brossell, and Fu's *Identification of Transit Service Gaps through Accessibility and Social Vulnerability Mapping in Miami-Dade County* (2022), examines the connection between transit access and community needs in Miami-Dade County to identify areas where public transportation improvements could expand mobility and economic opportunity. The research employs a transit-based accessibility index derived from General Transit Feed Specification (GTFS) data from three public transit agencies and a

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[33] Huemer, A. K., Rosenboom, L. M., Naujoks, M., et al. (2022). Testing cycling infrastructure layout in virtual environments: An examination from a bicycle rider's perspective in simulation and online. *Transportation Research Interdisciplinary Perspectives*, 14, 100586.

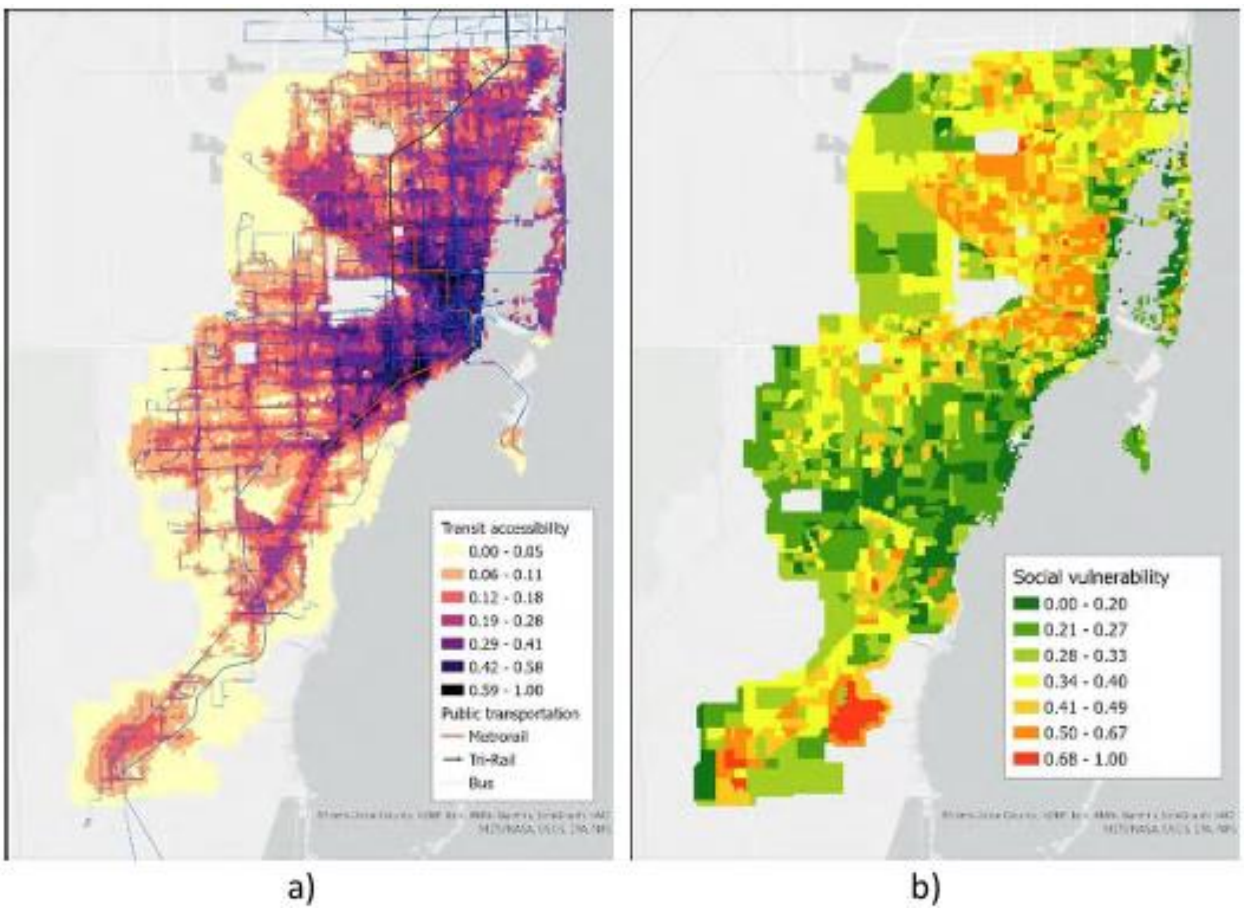
vulnerability index based on socioeconomic factors, including poverty rates, car ownership, and demographic characteristics.

This study combines these indices into a service provision score to identify areas where improving transit services could increase access to essential services such as jobs, healthcare, and food. The findings show significant differences across Miami-Dade, with lower-income, transit-dependent populations often facing limited access. Hotspot analysis reveals that the areas with the greatest transportation needs do not always coincide with those offering strong public transit options, highlighting the importance of focused transit improvements.

Figure 1(a), on the left-hand side of **Figure 1.1,** illustrates the accessibility of hospitals via public transit within a 30-minute travel time window. The findings show that a significant portion of Miami-Dade County lacks convenient hospital access by transit, particularly in suburban and peripheral areas. This suggests a critical gap in healthcare accessibility for transit-dependent populations, who may face long or impractical travel times to reach medical services.

Figure 1(b), on the right-hand side of **Figure 1.1,** maps accessibility to parks and recreational areas using the same 30-minute travel by transit threshold. In contrast to hospital accessibility, access to parks appears more evenly distributed, with most urban and suburban areas having reasonable transit connectivity to recreational spaces. This implies that while Miami-Dade has successfully integrated parks into accessible locations, other essential services, such as healthcare, remain inadequately served by the transit network. These differences highlight the need for a more comprehensive approach to transit planning that prioritizes accessibility to critical services for vulnerable populations.

Figure 1.1: Mapping Transit Accessibility and Community Needs in Miami-Dade County



Source: Hochmair, H. H., E. Brossell and Z. J. Fu (2022). "Identification of Transit Service Gaps through Accessibility and Social Vulnerability Mapping in Miami-Dade County." *GI Forum* 2022(1): 17-32.

Studies show that neighborhoods with limited resources often face higher pedestrian and cyclist fatality rates due to inadequate infrastructure. Braun et al. (2019) emphasize the need for targeted investments in these areas, particularly in communities like Liberty City and Little Haiti. [34] Protected bike lanes, pedestrian crossings, and traffic-calming measures in neighborhoods with limited resources can address these differences, ensuring that all residents have access to safe and reliable active transportation options. Braun also notes that Miami is one of the top three least accessible cities in the United States in terms of protected bicycle lane mileage.

Since Hockmair, Brossell, and Fu's *Identification of Transit Service Gaps through Accessibility and Social Vulnerability Mapping in Miami-Dade County* in 2022, Miami-Dade County has deployed the Better Bus Network with increased bus stop frequency and accessibility. Additionally, with the South Dade TransitWay at 92% completion as of February 2025 and additional bicycle and pedestrian improvements along the TransitWay's corridor, Miami-Dade is progressing towards a more accessible transportation network.

1.5.2 Differences in Infrastructure Investment through History

Historically, infrastructure investments in Miami-Dade have focused on higher-income areas, often leaving low-income communities with limited access to services like tree canopy, parks, and safe sidewalks.[35] An analysis by Braun et al. (2019) highlights those neighborhoods with low median incomes experience significantly higher pedestrian and cyclist fatality rates, largely due to inadequate infrastructure.

These differences are compounded by Miami-Dade's car-centric urban design, which prioritizes vehicular traffic over multimodal options. Addressing these community transportation needs requires a deliberate shift in planning priorities to focus on areas with limited resources, ensuring that investments in active transportation benefit all residents.

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[34] Braun, L., Daniel A. Rodriguez, Penny Gordon-Larsen. (2010, Social (in)equity in access to cycling infrastructure: cross sectional associations between bike lanes and area-level sociodemographic characteristics in 22 large US cities. *Journal of Transport Geography* 80, 102544.

35 Miami-Dade County Department of Transportation and Public Works. Sidewalk Transition Plan. Miami-Dade County, 2022; and Trust for Public Land. 2024 ParkScore Index: Miami, FL. Trust for Public Land, 2024; and Hochmair, Hartwig Henry, Daniel Gann, Adam Benjamin, and Zhaohui Jennifer Fu. Miami-Dade County Urban Tree Canopy Assessment. Florida International University, GIS Center, June 2016; and Sadeghvaziri, Eazaz, Ramina Javid, and Mansoureh Jeihani. Investigating Walking and Biking Activities Among Low-Income African Americans. Morgan State University, Urban Mobility & Equity Center, March 3, 2023. Accessed February 5, 2025.

1.5.3. Designing Infrastructure that includes all Ages and Abilities

Active transportation infrastructure must serve every resident. Universal design and continuous connectivity are the two cornerstones of such a network. Features like curb ramps, tactile paving, wide sidewalks, and clearly marked crossings allow children, older adults, and people with disabilities to travel safely. A seamless grid of low-stress routes removes detours and barriers, making cycling and walking a viable daily option across Miami-Dade. The subsections that follow explain how applying these principles closes equity gaps and raises system-wide usability.

1.5.3a Universal Design Principles

Designs that prioritize accessibility for all users, including those with disabilities, children, and older adults, ensure that investments in active transportation benefit all residents. In Miami-Dade, curb ramps, wide sidewalks, tactile paving, and pedestrian refuge islands can ensure that infrastructure meets the needs of diverse populations. Studies emphasize that these features are particularly impactful in neighborhoods with high concentrations of residents with specific needs.

1.5.3b Connectivity Challenges

Disconnected or fragmented bicycle networks severely hinder usability and deter potential users. Researchers emphasize that seamless connectivity across urban areas is essential to encourage cycling as a primary mode of transportation.[36] Infrastructure gaps, particularly at intersections, increase risks and reduce the perceived utility of the network.[37]

1.5.4. Access to Employment

Reliable access to transportation, where mobility is income and race-neutral, is closely linked to economic mobility. For many low-income residents of Miami-Dade, cycling or walking is not a choice but a necessity due to limited access to cars or public transit. The lack of safe routes for cyclists and pedestrians disproportionately affects these residents, forcing them to navigate dangerous roads. Volker and Handy (2021) found that investments in protected bike lanes and pedestrian crossings near employment centers improve job access for populations with limited resources, those residents who lack motorized mobility options, such as car or high-quality transit service.[38]

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36 https://www.nbcmiami.com/news/local/cyclist-safety-enhancements-coming-to-miami-dades-most-dangerous-roadways/3306182/. Accessed January 30, 2025.
37 https://www.fdotmiamidade.com/userfiles/files/FDOTD6_MDC_Bicycle_Connectivity_Assessment_Final.pdf
38 Volker, J. M. B., Handy, S. (2021). Economic Impacts on Local Businesses of Investments in Bicycle and Pedestrian Infrastructure: A Review of the Evidence. Transport Reviews, 41(4), 401-431.

In Miami-Dade, connecting residential neighborhoods to employment hubs like downtown Miami and the Miami International Airport through protected bike lanes can reduce commute times and enhance economic opportunities.

1.5.5. Distribution of Parks and Recreational Opportunities

Parks and recreational spaces are often more accessible in higher-income areas of Miami-Dade, while low-income neighborhoods still face challenges in accessing these resources.[39] Shared-use paths and bike lanes that connect these neighborhoods to parks can bridge this gap. Studies by Buehler and Dill (2015) highlight that recreational access through active transportation improves mental and physical health outcomes, particularly in communities with limited resources. Ensuring reliable and safe access to parks is an important aspect of improving overall transportation options for all communities.

1.5.6 Boosting Local Economies

Safety improvements often lead to increased active transportation, which benefits local businesses. Parker et al. (2011) found that areas with safe and accessible bike lanes experienced a 30% increase in retail sales.[40] Miami-Dade's commercial districts, such as Coral Gables and South Miami, as well as others, stand to gain significantly from similar investments.

Investments in bicycle infrastructure generate measurable economic returns. Businesses located near bike lanes often experience increased patronage due to higher foot and cyclist traffic.[41] Property values also tend to rise in areas with high-quality bicycle facilities, attracting investments and fostering economic growth.[42]

Liu and Shi (2017) examine the influence of bike facilities on residential property values, using data from Portland, Oregon. Their study employs a hedonic pricing model to analyze how proximity to different types of bike infrastructure, such as bike lanes and shared-use paths, affects home prices.[43] Findings suggest that properties near high-quality cycling facilities experience modest price premiums, reflecting increased demand for active transportation options. However, impacts vary by facility type and neighborhood characteristics.

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[39] Trust for Public Land. 2024 ParkScore Index: Miami, FL. Trust for Public Land, 2024

[40] Parker, K. M., Gustat, J., Rice, J. C. (2011). Installation of bicycle lanes and increased ridership in an urban, mixed-income setting in New Orleans, Louisiana. *Journal of Physical Activity and Health*, 8(S1), S98-S102.

[41] Garber, M. D., Watkins, K. E., Flanders, W. D., et al. (2023). Bicycle infrastructure and the incidence rate of crashes with cars: A case-control study with Strava data in Atlanta. *Journal of Transport and Health*, 32, 101669.

[42] Liu, Jenny, and Wei Shi (2017) Impact of Bike Facilities on Residential Property Prices. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2662, 2017, pp. 50–58.

[43] Hedonic pricing models estimate the value of a good or service by decomposing it into its constituent attributes, assigning implicit prices to each characteristic based on market data. Commonly used in real estate and environmental economics, these models assess how factors like location, amenities, or environmental quality influence overall price.

The Liu and Shi study highlights the role of bike infrastructure in urban development, suggesting that investments in cycling amenities can yield economic benefits alongside transportation and environmental improvements. The authors found that single-family homes being ¼ mile closer to the nearest advanced bike facility was linked to an increase in value of $1,571. Additionally, every extra ¼ mile of facility density (the number of bike facilities within a buffer area) added another $1,399 to the property value (Liu and Shi, 2017). Multi-family properties saw a smaller gain of $211 for each ¼ mile decrease in distance to an advanced bike facility. However, each extra ¼ mile of facility density resulted in a significant increase of $3,683 in property value.

On the other hand, a study by Conrow et al. (2021) examines the relationship between residential housing prices, bicycle infrastructure, and ridership volumes in Tempe, Arizona, and found a much smaller relationship. Using the same hedonic procedure as Liu and Shi, but with different parameters and a different location, the authors find that the density of bicycle infrastructure is positively associated with home sale prices, whereas bicycle ridership volume itself has no significant impact. The research suggests that the presence of bicycle lanes and related facilities enhances property values, potentially increasing property tax revenues. However, the findings do not indicate that more bicycle riders necessarily lead to higher property values. The study also highlights the limitations of using crowdsourced ridership data from smartphone applications like Strava, which may not fully capture diverse cycling populations.

Overall, the results contribute to the discussion on the economic value of bicycle-friendly urban design, supporting the idea that investments in bicycle infrastructure can positively influence housing markets. Using sales in 2016 as an example, Conrow found that each additional mile of on-street cycling infrastructure within 0.5 miles of a property is expected to increase mean sale prices in that year by approximately $619.

The findings of this study have direct relevance to Miami-Dade County, where efforts to expand bicycle infrastructure intersect with concerns about housing affordability, urban mobility, and transit-oriented communities (TOC). Miami-Dade has been investing in multimodal transportation solutions, including dedicated bicycle lanes, greenways, and trails, as part of its broader mobility initiatives.

1.5.7 Healthcare Cost Savings

A review of economic evaluations of cycling and walking infrastructure found that the benefit-cost ratios (BCRs) for active travel interventions ranged from 2:1 to 20:1 (Powell et al., 2010). This suggests that for every dollar spent on walking and cycling infrastructure, there are substantial economic savings in healthcare costs due to reduced disease burden. One study estimated that increasing daily moderate physical activity by just five percentage points could prevent 600 deaths per year in Australia, translating to millions in healthcare cost savings (Giles-Corti et al., 2010).

1.5.8 Productivity and Economic Growth

Active transportation promotes workforce productivity by reducing absenteeism. Employees who engage in regular active commuting report fewer sick days and increased workplace efficiency (Powell et al., 2010). The economic case for infrastructure investments is further strengthened by evidence that cities with high rates of active travel have stronger local economies, as more money is spent within communities rather than on fuel and car-related expenses (Powell et al., 2010).

1.5.9 Benefit-Cost Analysis of Bicycle Infrastructure

Li and Faghri (2014) provide a structured framework for conducting a Benefit-Cost Analysis (BCA) of bicycle infrastructure investments, integrating direct and indirect benefits such as mobility, health, environmental benefits, and congestion reduction. Their analysis highlights that while initial capital and maintenance costs can be significant, long-term benefits often outweigh these costs, especially when health-related savings and environmental externalities are factored in. The study applies a Health Impact Assessment methodology quantifying mortality reduction from safety improvement and finds that benefits exceed costs under most scenarios. However, they caution that monetizing benefits remains challenging due to the absence of a direct market for many of these externalities.

Analysts have developed some convenient benchmarks to estimate the health benefits of walking and biking for planning-level appraisals. These can serve as rules of thumb in benefit-cost calculations when detailed modeling is not feasible:

- **Healthcare Cost Savings per Mile:** On average, an adult walking one mile reaps about $0.50 of avoided medical costs, and an adult cycling one mile about $0.20 in avoided costs.[44]

These estimates come from aggregated data on medical expenditures vs. activity levels and encapsulate the long-term savings from lower incidence of chronic illness. (They assume an average U.S. adult; benefits may be larger for sedentary or high-risk populations.)

- **Disability Adjusted Life-Years (DALYs) Averted per Distance:** Every 1,000 miles walked (cumulative across persons) is associated with roughly 0.0033 DALYs gained, and every 1,000 miles cycled with about 0.0013 DALYs. In other words, for every ~300,000 miles walked by a population, about 1 healthy life-year (DALY) is gained. This rule-of-thumb is derived from the above cost savings and

[44] Litman, Todd. *Evaluating Active Transport Benefits and Costs: Guide to Valuing Walking and Cycling Improvements and Encouragement Programs*. Victoria Transport Policy Institute, March 11, 2025.

typical valuations (e.g. valuing one DALY ≈ $100k). It aligns with health economic analyses suggesting ~$100k–$150k per DALY as a reasonable valuation.[45]

Planners can use these factors to quickly gauge the health impact: for example, a project adding 10,000 miles of walking per year in a community would save on the order of 0.03 DALYs/year (valued around $3,000). While small per mile, these gains scale with large shifts in behavior.

- **Avoided Mortality Risk:** Regular walking and biking significantly reduce mortality risk. Meeting physical activity guidelines (e.g. 150 minutes of brisk walking per week) is associated with roughly a 20–30% reduction in all-cause mortality risk in epidemiological studies. For rule-of-thumb purposes, one can estimate that each additional mile walked or biked (per person per day) reduces an individual's annual mortality risk by a fraction of a percent (compounded over many people and years, this translates to lives saved). Another way to frame it: on a population level approximately 8–9 million miles of walking or ~20 million miles of cycling are needed to statistically avert one premature death (this reflects the rarity of deaths in a large population but also underscores that even small daily distances across millions of people add up to significant life-saving benefits). These estimates are in the same ballpark as U.S. Department of Transportation safety statistics and public health findings. When a BCA predicts, say, 50 million new walking miles per year citywide, it is reasonable to include a prevented fatalities benefit on the order of 5–6 lives annually (50 million/9 million) – valued at about $65 million/year if using a VSL of $13 million.[46]

One study investigating the impacts of active transportation on public health outcomes generated a useful hypothetical toolkit that can be applied to this Bikenomics study (Mansfield and MacDonald Gibson, 2016). This study develops a statistical model to estimate baseline active transportation behaviors to support health impact assessments (HIAs) of transportation and urban planning decisions. The researchers used data from the 2009 U.S. National Household Travel Survey (NHTS) to create regression models that estimate walking and biking trip counts, trip purposes, and trip durations based on commute mode, demographic factors, and built environment characteristics.[47]

The analysis found that commute mode significantly influences active transportation behaviors. Compared to those who drive to work, individuals who walk to work are 16.6 times more likely to take at least one daily walk trip, while those who use public transit are 4.73 times more likely. Bicycle commuters take 1.48

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[45] https://www.healthdata.org/research-analysis/library/health-care-spending-effectiveness-estimates-suggest-spending-improved-us#:~:text=burden%2C%20median%20spending%20was%20US%24114%2C339,time%20has%20purchased%20health%20improvements

[46] https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis#:~:text=Based%20on%20the%20methodology%20adopted,shown%20in%20the%20table%20below

[47] Mansfield, Theodore J., and Jacqueline MacDonald Gibson. 2016. "Estimating Active Transportation Behaviors to Support Health Impact Assessment in the United States." Frontiers in Public Health 4:63. https://doi.org/10.3389/fpubh.2016.00063.

times as many bike trips as car commuters. The built environment also plays a role, with higher population density and percentage of rental housing associated with increased walking and biking.

Key findings from the statistical models include:

- Individuals who walk to work spend an additional 19.8 minutes per day walking compared to car commuters.
- Public transit users walk an extra 5.0 minutes per day versus car commuters.
- Bicycle commuters' cycle for an additional 28.0 minutes per day compared to car commuters.

The researchers validated their model using survey data from the Raleigh-Durham-Chapel Hill, NC metropolitan area. The model predicted observed transportation physical activity to within 0.5 MET-hours per day (about 9 minutes of walking) for 83% of observations.

To demonstrate the model's application, the researchers estimated health impacts for the Raleigh-Durham-Chapel Hill region under a scenario where the entire population walked 37.4 minutes per week for transportation (the average observed in previous studies of walkable neighborhoods). This analysis estimated that 38 premature deaths could potentially be avoided annually under this scenario.

The study also modeled three hypothetical interventions to promote active transportation:

1. A 10% increase in land-use diversity, transit coverage, and intersection density across the region, resulting in a 7.9% increase in walking for the entire population.
2. The same built environment changes causing 7.9% of current drivers to switch to walking for their commute.
3. A 50% increase in transit coverage, leading 14.5% of current drivers to switch to public transit for commuting.

These scenarios illustrate how the model could support quantitative HIAs of proposed transportation and land use changes.

The approach developed in this study offers several advantages for transportation HIAs:

1. It provides a method to estimate baseline active transportation behaviors using readily available American Community Survey data, addressing a common data gap in HIAs.
2. The model accounts for both commute trips and non-work trips, providing a more comprehensive picture of active transportation.
3. It allows for estimation of active transportation behaviors at fine geographic scales, enabling analysis of how impacts may vary across a region.
4. The health impact calculations incorporate demographic factors, allowing for assessment of how benefits may be distributed across population subgroups.

Perhaps the most significant implication of the study is that applying the case study method to Miami-Dade County requires few assumptions and relatively simple mathematics. When applied to Benefit-Cost analysis, agencies often apply standard monetary values to health outcomes. Common benchmarks are a VSL of about $10–$13.2 million per fatality (per USDOT guidance[48] A value per life-year (DALY/QALY) of $100,000, a mid-range value often used in health policy analyses[49]

These can be used to convert predicted reductions in mortality or DALYs into dollar benefits. For example, if a bike network is expected to avert 0.05 deaths per year, the annual benefit would be 0.05 x $13 million = $650,000 from mortality reduction. Such standardized values provide a convenient "plug-in" for health benefits in benefit-cost calculations.

1.6 Miami-Dade County and Municipal Plans and Reports

Miami-Dade's active transportation and transit objectives are guided by a set of county and municipal plans issued between 2015 and 2024. Together these documents define safety targets, network priorities, and project pipelines that shape where and how bicycle, pedestrian, and transit investments proceed. Section 1.6 summarizes each plan's scope, key goals, and proposed mileage so that stakeholders can see how Vision Zero, the 2050 Bicycle-Pedestrian Master Plan, the SMART transit corridors, and related municipal studies reinforce one another and fill gaps in the regional network.

1.6.1 Miami-Dade Vision Zero Plan Summary

The Miami-Dade 2024 Vision Zero Action Plan outlines strategies for achieving Miami-Dade's goal of zero serious and fatal injuries by 2040. Areas with the highest density of crashes were included within the High Injury Network (HIN) and were then analyzed for projects to inhibit future crashes. Downtown Miami, South Miami Beach, Hialeah, and South Dade along US 1 had some of the highest crash densities in the County for both vehicular and pedestrian crashes[50].

Projects were prioritized based on various social, economic, environmental factors, and connectivity to existing transportation infrastructure. Key themes of the 2024 Vision Zero Action Plan included:

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[48] https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis#:~:text=Based%20on%20the%20methodology%20adopted,shown%20in%20the%20table%20below

[49] https://www.healthdata.org/research-analysis/library/health-care-spending-effectiveness-estimates-suggest-spending-improved-us#:~:text=burden%2C%20median%20spending%20was%20US%24114%2C339,time%20has%20purchased%20health%20improvements

[50] miamidade.gov/transit/library/2024-vision-zero-action-plan.pdf. Accessed January 6, 2025.

1) **Enhance City Processes and Collaboration:** Establishing a permanent funding source to achieve Vision Zero, improve coordination amongst departments and Vision Zero staff, and the adoption of a county resolution to protect all road users, including pedestrians, bicyclists, transit vehicles, and freight.
2) **Build Safe Streets for Everyone:** Incorporating safety considerations into transportation projects and retrofits, modifying signals to reduce crashes, and developing processes to implement Vision Zero projects.
3) **Create Safe Speeds:** Reducing speeds from 45 mph to 35 mph on major arterials and roadways and from 30 mph to 20 mph in residential areas, installation of speed enforcement tools along HIN, and automated enforcement of traffic violations.
4) **Promote a Culture of Safety:** Expanding education programming for residents (with emphasis on communities with limited resources and youth groups) and conducting outreach through social media, radio, billboards, and transit stations.
5) **Improve Data and Be Transparent:** Strategies include annual evaluation reports, collaboration with municipal partners, the establishment of an online Vision Zero dashboard to track projects, and annual meetings with data partners.

1.6.2 2050 Bicycle-Pedestrian Master Plan

Released by the Miami-Dade TPO in September 2024, the 2050 Bicycle-Pedestrian Master Plan identified projects that fulfill the goal of creating a safer, reliable, accessible, and sustainable transportation system for non-motorized transportation users. The plan assessed the existing 525 miles of bicycle and pedestrian facilities within Miami-Dade, including paved shoulders, bike lanes, shared-use paths, and multi-use trails within the context of county and municipal plans.

Based on the finding that more than 64% of the existing bicycle and pedestrian network is unprotected and 67% of riders feel unsafe riding on Miami-Dade streets, the plan recommends building 438.5 miles of either protected or separate bicycle facilities (i.e., shared-use paths and protected bicycle lanes). In total, the 543.3 miles of recommended projects focus on providing access to community amenities such as transit stops, parks, employment centers, schools, and high population areas to ensure that residents can use bicycle and pedestrian infrastructure for recreation and commuting.

1.6.3 Miami-Dade Bicycle Network Connectivity Assessment, Florida Department of Transportation, 2022

The Miami-Dade Bicycle Network Connectivity Assessment addresses gaps in Miami-Dade's bicycle network to improve connections and provide a safe and accessible alternative to personal vehicles. The Assessment involved robust collaboration with local representatives, including Miami-Dade County, the Miami-Dade Transportation Planning Organization, and 34 municipalities to ensure the findings reflect the local context and align with ongoing initiatives. As the first iteration, it outlines four long-term goals to guide future decision-making:

1) Strive towards Florida's Vision Zero.
2) Allow visitors and residents to bicycle to any destination.
3) Ensure that residents who need an alternative mode of transportation can rely on bicycle infrastructure as a remedy.
4) Shift the culture of the county to a more bike-friendly environment.

After cataloging the existing network, "Essential Areas," where demand for bicycle infrastructure may be higher, were modeled to guide where connections would have the greatest impact on the surrounding population. The proposed projects were separated into two categories: Countywide Connectors and Point of Interest Connections:

- Countywide Connectors offer long-distance transportation options and are primarily made up of greenways and trails. Examples include the Underline and the Ludlam Trail.
- Point of Interest Connections aims to provide access to everyday locations such as schools, parks, and employment areas while connecting existing and planned projects. Examples include protected, buffered, and conventional bike lanes.

The 639-project proposed 727 miles of additional bicycle facilities for Miami-Dade County, prioritizing connectivity to existing and proposed local projects and a cohesive non-motorized transportation system.

1.6.4 Florida's Miami Loop, Rails to Trails Conservancy, 2018

The Miami Loop is a proposed 225-mile shared-use path network connecting 11 regional trails of Miami-Dade County into a larger looped network. As of 2018, 54% of the trail has been completed, with 86% of the land publicly owned. The plan was developed by the Miami-Dade Trail Alliance with support from local advocacy groups such as the Rails to Trails Conservancy and the Miami Foundation.

1.6.5 Public Easement Bicycle/Pedestrian Network Plan, 2018

Florida Power and Light, the South Florida Water Management District, and Miami-Dade County collaborated on the Public Easement Bicycle/ Pedestrian Network Plan to find the most feasible opportunities for regional multi-use path developments. Of the 11 potential opportunities along publicly owned canals and powerline corridors, a 14-mile trail connecting the Fontainebleau community[51], Florida International University, and the Falls were identified as the preferred trail.

1.6.6 The Miami-Dade SMART Plan

The Miami-Dade Strategic Miami Area Rapid Transit (SMART) Program advances six rapid transit corridors identified by the People's Transportation Plan to expand Miami-Dade's mass transit system through bus express rapid transit, light rail, and people movers. The five corridors are:

- **Beach Corridor:** The Beach corridor is planned to connect the Design District, Midtown Miami, and Downtown Miami to the Miami Beach Convention Center via automated people movers, such as the Metromover, or monorail service. Bicycle and pedestrian access to the Beach corridor was a major component of Miami-Dade and Miami Beach's considerations given the high bicycle, scooters, and walking prevalence in Miami Beach. Constructing bike lanes, improving intersection treatments, and expanding sidewalks are planned around the Beach corridor transit stations in the Miami Beach First/Last Mile Connections to the SMART Plan Study.
- **East-West Corridor:** This Bus Rapid Transit Corridor features dedicated bus lanes on SR 836/Dolphin Expressway. The corridor connects Virgina Gardens, Miami Springs, Tamiami, West Miami, Hialeah, and Coral Gables to the MIC which connects Tri-Rail and Metrorail service lines and provides residents access to Miami International Airport.
- **Kendall Corridor**: This Bus Rapid Transit Corridor along SR 94/SW 88th Street/Kendall Drive connects residential communities from SR 997/Krome Avenue to Downtown Dadeland. The corridor connects to Metrorail and The Underline via the Metrorail Dadeland North Station.
- **North Corridor:** Expansion of the Metrorail north to NW 215th Street, locally known as County Line Road, which is bordered on the south by Miami-Dade and on the north by Broward County, connecting residents to the existing Metrorail, Hardrock Stadium, and Miami-Dade College.
- **Northeast Corridor:** 13.5 miles of new rapid transit service From MiamiCentral station in downtown Miami to West Aventura station. The Northeast corridor includes seven stations, including the existing Brightline Miami Central and West Aventura stations and five new stations in Wynwood, Design District, Little Haiti, North Miami, and FIU North Campus.
- **South Corridor:** This 20-mile Bus Rapid Transit Corridor extends from the Dadeland South Metrorail Station to the SR 9336/SW 344th Street Park-and-Ride Transit Terminal along US 1. The South Corridor runs next to the South Dade Trail, a shared use path part of the East Coast Greenway system, that begins at the end of The Underline providing recreational opportunities and enhanced access to the planned Bus Rapid Transit Corridor.

[51] Fontainebleau is a suburban community and census-designated place in Miami-Dade County with a 2020 population of 59,860. This community is located near Florida International University.

1.6.7 Miami Beach- First/Last Mile Connections to the SMART Plan Study, 2022

After the release of the Miami-Dade SMART Plan, a county-wide plan to expand transit through the development of light rail and bus rapid transit corridors, the City of Miami Beach developed the Miami Beach First/Last Mile Connections to the SMART Plan Study. Miami Beach's Plan outlines strategies to improve accessibility to Miami-Dade's Beach corridor; which will provide Bus Express Rapid Transit and Metromover service to the municipality. The identified projects were integrated into the Miami Beach Transportation Master Plan to ensure the community is prepared for the Beach Corridors opening.

Projects included expanding bicycle lanes, providing long-term bicycle storage, creating mid-block crossings along the Convention Center Arena, increasing the frequency of the Miami Beach trolley stops and extending service hours, co-locating bikeshare services at transit stations, and creating mobility hubs in parking garages.

1.6.8 Florida City Hub Mobility and Accessibility Study, 2021

The Miami TPO Study analyzed accessibility to the proposed Multimodal Mobility Hub in Florida City along SR 9336/SW 344th Street next to the South Dade Transitway. The study emphasizes pedestrian accessibility to the Bus Rapid Transit multimodal mobility hub by recommending increasing designated bike lane density and intersection safety elements and continuous bicycle and pedestrian paths from homes and workplaces. It includes both short- and long-term solutions to increase pedestrian safety and accessibility to the Multimodal Mobility Hub including connecting the fragmented sidewalk network, installation of street furniture, and high-contrast green paint on roadways to improve crossing visibility and creating a new bicycle network for residents.

1.6.9 Village of Palmetto Bay Multi-Use Trail and SMART Plan Connectivity Study, 2021

The Village of Palmetto Bay completed the Village of Palmetto Bay Multi-Use Trail and SMART Plan Connectivity Study to enhance the mobility, safety, and accessibility of residents accessing the South Dade Transitway. The study analyzed four east-west corridors along SW 144 Street, SW 152 Street, SW 168 Street, and SW 184 Street for multimodal improvements to enhance connections to the South Dade Transitway. The corridors were selected based on project feasibility and public input, resulting in SW 152 Street and SW 184 Street as the final corridors for 5-foot-wide protected bicycle lanes with concrete barriers. In total, the Village of Palmetto Bay's Plan recommends 35 projects that include filling in sidewalk gaps and implementing ADA upgrades, providing shade trees, midblock crossings, and pedestrian facilities such as benches and lighting.

1.6.10 Village of Key Biscayne Transit Mobility Study, 2015

The Village of Key Biscayne aims to balance the unique transportation needs of local and seasonal residents, visitors, and workers in Key Biscayne by providing transportation options that address the diverse needs of their residents. The Village identified demographic shifts from older seasonal residents to younger families and off-island employment as a major contributor to daytime traffic and parking constraints. These issues can be addressed through reductions in single-occupancy vehicle (SOV) dependency. The study highlights intersection enhancements, increased golf cart access, parking, micro-transit facility improvements, bicycle and pedestrian facilities, and specialized elderly transportation services as strategies to meet congestion reductions and improve non-motorized transportation access.

1.6.11 Coral Gables Bicycle and Pedestrian Stress Assessment Study, 2019

Aiming to provide safe opportunities for residents to walk or cycle, the City of Coral Gables' Bicycle and Pedestrian Stress Assessment Study expands upon the 2014 Bicycle and Pedestrian Master Plan. This study includes an implementation plan and refining recommendations for a connected and improved multi-modal network. The City of Coral Gables analyzed the level of traffic stress experienced by residents, connectivity to highly trafficked corridors, safety at intersections, and sidewalk gap analysis. Twenty-three eligible bicycle corridors were selected for project development such as: a shared use path on University Drive connecting University of Miami students to Downtown Coral Gables, separated bike lanes on Ponce De León Boulevard, and a buffered bicycle lane along Alhambra Circle. Pedestrian improvements include standardizing 6- to 8-foot-wide sidewalks, connecting gaps in the sidewalk network, marking crosswalks for improved visibility, mid-block crossings, and pedestrian call buttons with audible cues, while eliminating right and left vehicle turn conflicts during walk phases.

1.7 Summary of Bicycle and Pedestrian Infrastructure Best Practices

Section 1.7 summarizes numbers on leading bicycle and pedestrian design features. Sources include peer-reviewed studies and recent project evaluations. The metrics show reductions in crashes, gains in ridership, and stronger sales near improved corridors. Planners can use this evidence to rank options and choose designs with the largest benefits for Miami-Dade.

1.7.1 Protected Intersections for Bicyclists and Pedestrians

- Incorporate corner refuge islands, bike-specific signals, and raised crossings to reduce right-hook crashes.
- Left-turn phasing improvements at signalized intersections reduced injury crashes by 46%, with an even greater 60% reduction in left-turn crashes. This suggests that protected intersections that separate turning vehicles from cyclists can significantly improve safety (Pauw et al., 2015).

- On-street parking, protected bike lanes have demonstrated a 31% reduction in collision rates compared to traditional painted lanes (DiGioia, et al, 2017).

Bicycle-Specific Traffic Signals

- Leading Bicycle Intervals (LBI) allow cyclists to start ahead of cars at green traffic lights, reducing conflict points.
- 46% fewer intersection crashes involving cyclists when bike signals are installed (Pauw et al., 2015).
- 33% increase in bicycle volume after signal implementation (Russo et al., 2023).

Two-Stage Turn Boxes for Cyclists

- Enables cyclists to make safe left turns by waiting in designated spaces at intersections.
- 23% reduction in cyclist-involved left-turn crashes after installation (Garber et al., 2023).
- 31% increase in compliance with traffic signals at intersections (DiGioia et al., 2017).

Pedestrian and Cyclist Crossings

- Raised crossings slow down cars and improve pedestrian visibility.
- A study found that mid-block pedestrian signals (MPS) reduced pedestrian crashes by approximately 44.6% and decreased all fatal and injury crashes by 34% compared to locations without pedestrian control devices (Fitzpatrick et al., 2023).

High-Visibility Crosswalks and Pedestrian Refuge Islands

- Brightly marked crossings and mid-street refuge islands reduce pedestrian crash risks.
- Refuge islands reduce pedestrian crossing delays by a statistically insignificant 5%; however, they may still be effective on roadways with greater than 12,500 average daily trips on three-lane roads (Monsere et al., 2020).
- This finding is consistent with Teschke et al (2012), which found that without traffic calming measures, crossings did not reduce the risk of injury. With calming measures, cyclists experienced about 34% lower injury risk.

Smart Crosswalk Technology (Pedestrian-Activated Signals)

- Motion-activated pedestrian signals improve visibility and compliance at crossings.
- Pedestrian-activated signals reduce crossing-related injuries by 50–60% (Huang et al., 2000).

Improved Crosswalk Timing for Walkability

- Longer signal timing for pedestrians ensures safe crossings.

- Longer pedestrian signal times can reduce crossing accidents, although pedestrian and driver behavior also play significant roles.
- Miami-Dade's Vision Zero Plan calls for extended crosswalk times at high-risk intersections (Miami-Dade TPO, 2024).

Pedestrian and Urban Design Enhancements

Wider sidewalks, curb ramps, and tactile paving improve overall accessibility.

- Curb ramps, audible signals, and braille wayfinding make streets safer for people with disabilities.
- Reducing lanes, adding medians, and lowering speed limits make streets safer for pedestrians and cyclists.
- Road diets were found to reduce total crashes by 38% and fatal/injury crashes by 64% on road segments.
- At signalized intersections, road diets reduced total crashes by 35% and fatal/injury crashes by 46%.
- **No significant safety benefits** were found for road diets at unsignalized intersections (Lim and Fontaine, 2022).

Shaded Sidewalks and Bike Paths with Green Infrastructure

- Tree-lined pathways and bioswales reduce urban heat, making walking and biking more comfortable.

Wayfinding, Signage and Pavement Markings

- Clear signage and painted lanes guide non-motorized travel along designated routes.
- Adding wayfinding and incremental distance signage to trails supported a 33% increase in trail usage following a marketing campaign (Clark, 2014).

Economic Impacts

- Parker et al. (2011) found that areas with safe and accessible bike lanes experienced a 30% increase in retail sales.
- Using sales in 2016 as an example, Conrow (2021) found that each additional mile of on-street cycling infrastructure within ½ mile of a property is expected to increase mean sale prices in that year by approximately $619.
- On the other hand, Liu and Shi (2017) found that for single-family homes being ¼ mile closer to the nearest advanced bike facility was linked to an increase in value of $1,571. Additionally, every extra ¼ mile of facility density (the number of bike facilities within a buffer area) added another $1,399 to the property value (Liu and Shi, 2017).

- Multi-Family Homes: These properties saw a smaller gain of $211 for each ¼ mile decrease in distance to an advanced bike facility. However, each extra ¼ mile of facility density resulted in a significant increase of $3,683 in property value (Liu and Shi, 2017).

1.8 Strengths, Weaknesses, Opportunities, and Threats (SWOT)

A SWOT analysis is a strategic planning tool used to assess a community's internal and external environment by identifying its Strengths, Weaknesses, Opportunities, and Threats (SWOT). Strengths and weaknesses are internal factors, such as resources, investment capacity, or community needs and lack of reliability and safety in transportation options or economic mobility. Opportunities and threats generally come from external influences like transportation initiatives or legislation, demographic changes, or economic conditions. By analyzing these four elements, organizations can develop informed strategies to leverage their advantages, address community needs, build on emerging opportunities, and mitigate risks.

Strengths

1. **Transit by Bicycle-** South Floridians can travel with their bikes on Tri-Rail, Metrorail, and Metrobus
2. **Planned Network Expansion** – The 2050 Bicycle-Pedestrian Master Plan aims to add 438.5 miles of protected bicycle infrastructure.
3. **Public Support and Advocacy** – Local and national organizations, such as the League of American Bicyclists, the East Coast Greenway Alliance, the Florida Bicycle Association, and the Rails-to-Trails Conservancy, support Miami-Dade's bicycle initiatives.
4. **Shared-Use Paths and Greenways** – Projects like The Underline and the Atlantic Greenway Trail offer high-quality off-street cycling options.
5. **Adaptation Potential** – Bicycle infrastructure can integrate green stormwater management (bioswales, rain gardens), mitigating Miami's flood risks to prepare for extreme weather conditions.
6. **Public Commitment** – The Vision Zero Action Plan prioritizes pedestrian and cyclist safety with dedicated funding and infrastructure goals.
7. **Growing Bicycle Culture** –Educational programs such as BikeSafe, and community cycling events promote increased bicycle use.

Weaknesses

11. **High Fatality Rates** – Miami-Dade has one of the highest per capita bicycle fatality rates in the United States. (0.9 per 100,000).
12. **Infrastructure Gaps and Connectivity Issues** – The existing network lacks continuous, protected routes, leading to safety risks at major intersections.
13. **Car-Dominated Urban Design** – Roads are primarily designed for cars, making bicycle commuting challenging.

14. **Limited Bike Parking and Security** – Few transit hubs and public areas offer secure bike storage, discouraging multimodal commuting.
15. **Funding Constraints** – Bicycle projects often compete with road and highway expansions for limited transportation funding.

Opportunities

16. **Tourism and Economic Growth** – Expanding bike infrastructure could boost Miami's tourism economy by attracting cycling visitors and businesses.
17. **Technology Integration** – Smart infrastructure, such as adaptive traffic signals and bike detection systems, can improve safety and usability.
18. **Public-Private Partnerships** – Collaboration with developers and businesses could fund bicycle-friendly improvements near retail and residential areas.
19. **Equity and Mobility Justice** – Investments in areas with limited resources (e.g., Liberty City, Little Haiti) could reduce pedestrian and cyclist injuries while improving transportation access.

Threats

21. **Resistance from Car Users and Businesses –** Some businesses and drivers oppose removing on-street **parking or vehicle lanes for bike infrastructure.**
22. **Extreme Weather and Flooding –** Hurricanes, extreme weather, and heavy rain create challenges for maintaining and expanding bike infrastructure.
23. **Reliable Access Concerns –** The introduction of new bike lanes in certain neighborhoods may contribute to gentrification, potentially displacing lower-income residents.
24. **Enforcement and Compliance Issues –** Lack of enforcement of bike lane protections (e.g., illegal parking in bike lanes) diminishes safety.
25. **Slow Implementation Timelines** – Bureaucratic delays and funding limitations may unnecessarily hinder the timely rollout of planned infrastructure projects.

Chapter 2: Data Analysis and Data Visualization

Chapter 2 examines Miami-Dade's bicycle and pedestrian network through quantitative analysis and clear visual summaries. It begins with a baseline inventory of existing facilities, such as lanes, trails, shared roads, and paved paths, showing how their distribution varies across urban and suburban contexts. Subsequent sections translate research findings into infographics that communicate health, safety, economic, and environmental returns on active-transportation investments.

The chapter then turns to empirical patterns. It pairs Strava Metro data with state traffic counters to track ridership trends, origin–destination flows and commuting hot spots. Exposure-adjusted crash statistics reveal where and when different facility types offer the greatest safety benefits. A final segment quantifies access to transit, parks, schools, and other community assets, identifying gaps that most affect lower-resourced neighborhoods.

2.1 Existing Conditions

Since the 1960s, Miami-Dade County has been dedicated to expanding its bicycle network to provide transportation alternatives and recreational opportunities to residents.[52] As of 2021, Miami-Dade's bicycle network includes 515 miles of protected and unprotected bike lanes, shared-use trails, paved paths, wide turn lanes, shared use lanes, and trails.[53] Of the 515 miles, 379 miles include dedicated bicycle facilities (i.e., paved paths, trails, and bike lanes).[54] Each type of bike facility provides a different level of protection and comfort with shared use trails, paved paths, and protected bicycle lanes providing the highest level of protection and shared roadways offering no protection from motorists. Miami-Dade hosts a range of options for cyclists including:

- **Paved Shoulders:** Extended edges off the roadways, typically on suburban roads that can be used by bicyclists without an explicit designation. While not intended for bicycles, they can provide a safer alternative than riding directly with motorists. When funding is not available for more extensive bicycle protections, paved shoulders can be useful tools in streets with low speeds and traffic.

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[52] Miami-Dade Transportation Planning Organization, n.d. Bicycle Pedestrian Program. *History of the Program.* https://www.miamidadetpo.org/tpo/bicycle-pedestrian-program.page

[53] Florida Department of Transportation. District 6. (2022). M*iami-Dade Bicycle Network Connectivity Assessment.* https://www.fdotmiamidade.com/miami-dade-county-bicycle-connectivity-assessment.html. Accessed January 30, 2025.

[54] Florida Department of Transportation. District 6. (2022). M*iami-Dade Bicycle Network Connectivity Assessment.* https://www.fdotmiamidade.com/miami-dade-county-bicycle-connectivity-assessment.html. Accessed January 30, 2025.

- **Wide Curb Lanes:** A widened lane closest to the curb of the street that is typically 14-feet-wide to accommodate bicycle and motorist traffic side-by-side. Wide curb lanes are only suggested when other bicycle infrastructure is not possible, especially on streets with low traffic and speeds.
- **Shared Roadways:** Shared roadways are roads with markings indicating that bicyclists and motorists must share the road. They serve as visual cues to remind drivers to watch out for cyclists and are only appropriate on streets with speeds lower than 35 miles per hour.[55]
- **Bike Lanes:** On-street, designated lanes for bicyclists, usually marked with striping and signage. Bike Lanes can be protected, buffered, or unprotected from adjacent, providing a dedicated space for bicyclists to improve safety and predictability. Bike lanes are a cost-effective tool to promote active transportation and reduce vehicle congestion, especially in densely populated urban areas.
- **Paved Paths:** Paved paths, also known as shared use paths, are off-street facilities designed for non-motorized transportation such as walking and cycling. Paved paths are common in parks and greenways and can serve as safe connections between neighborhoods. They are low-stress, scenic options for leisure and commuting. While trails cover longer distances offering regional transportation, paved paths serve neighborhood-level travel.
- **Trails:** Off-street regional connections that can be paved or unpaved. Intended for recreation, trails also serve the purpose of supporting bicycle commuting as well, especially when combined with transit. Trails are the cornerstone of regional active transportation networks providing low-stress and safe bicycling options.

[55] Florida Department of Transportation, 2025. 2025 Design Manual. https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/fdm/2025/2025-fdm-complete.pdf?sfvrsn=624b0e74_10

Figure 2.1: Overview of Different Types of Bicycle Infrastructure

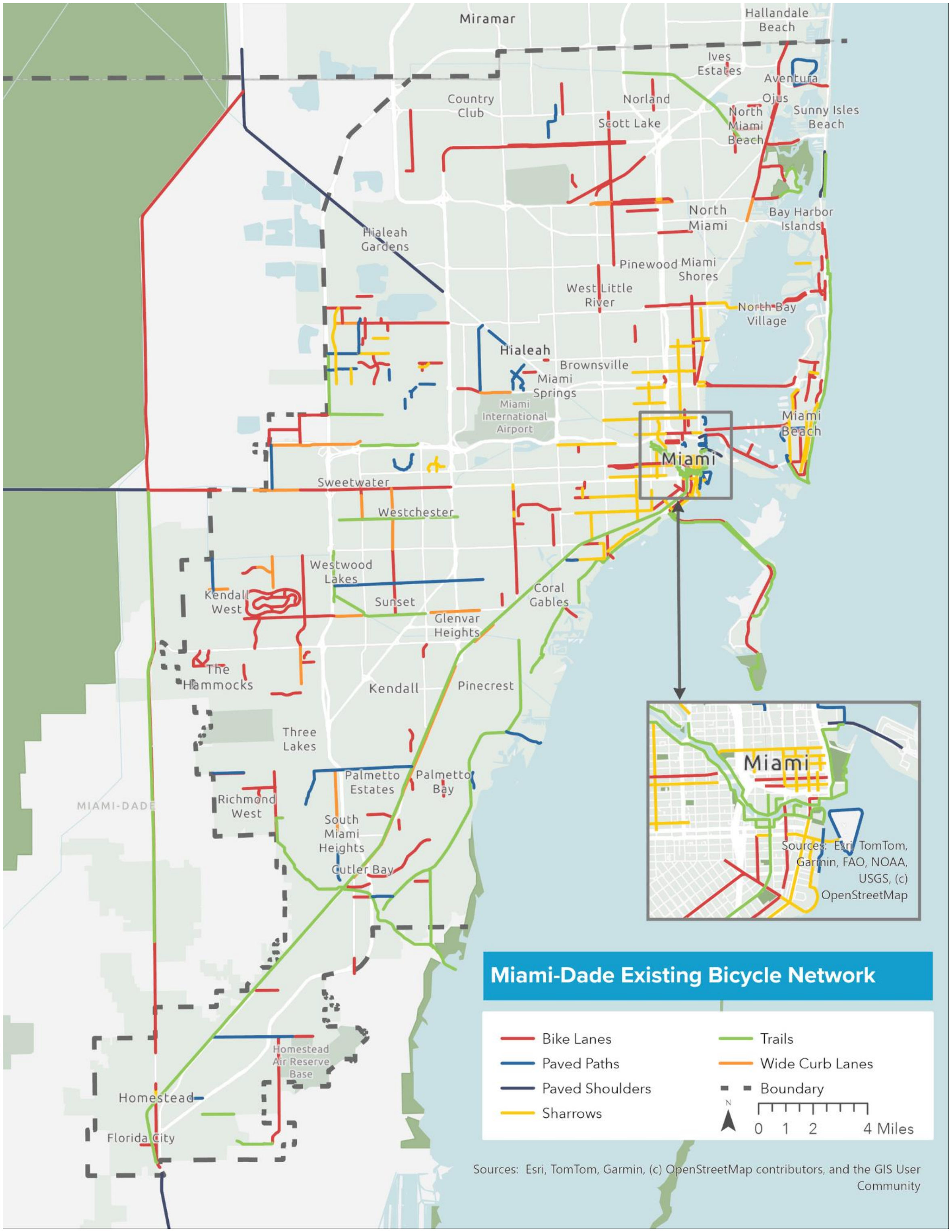
Source: SFRPC Summary of Chapter 1: Comprehensive Literature Review Findings of Various Bicycle Facility Improvements, 2025

Figure 2.2 depicts Miami-Dade's Existing Bicycle Network as of 2021 by bicycle facility type including bike lanes, paved paths, paved shoulders, shared roads, trails, and wide curb lanes. The City of Miami and Miami Beach have the greatest concentration of bicycle facilities due to decades of investments in active transportation infrastructure.[56] Downtown Miami's bicycle network is predominately comprised of bike lanes, paved paths, and shared roads. Downtown Miami's dense bicycle network is further supported by regional trails such as The Underline and Miami Riverwalk. In suburban land use contexts, bicycle facilities have also expanded, as evidenced by infrastructure in the City of Doral, North Miami, and the neighborhood of West Kendall.

Paved shoulders and short recreational trails are more common in suburban areas, indicating a more dispersed and less connected network. Trails on the coast provide recreational opportunities for residents along Miami Beach, Virginia Key, and Cutler Bay and serve as attractions for Miami-Dade residents and the tourism industry. Beyond the Urban Development Boundary, there is a steep drop in bicycle facilities, with trails and bike lanes serving as regional connections throughout Miam-Dade's agricultural lands.

[56] Miami-Dade Transportation Planning Organization, n.d. Bicycle Pedestrian Program. *History of the Program.* https://www.miamidadetpo.org/tpo/bicycle-pedestrian-program.page

Figure 2.2: Miami-Dade Existing Bicycle Network



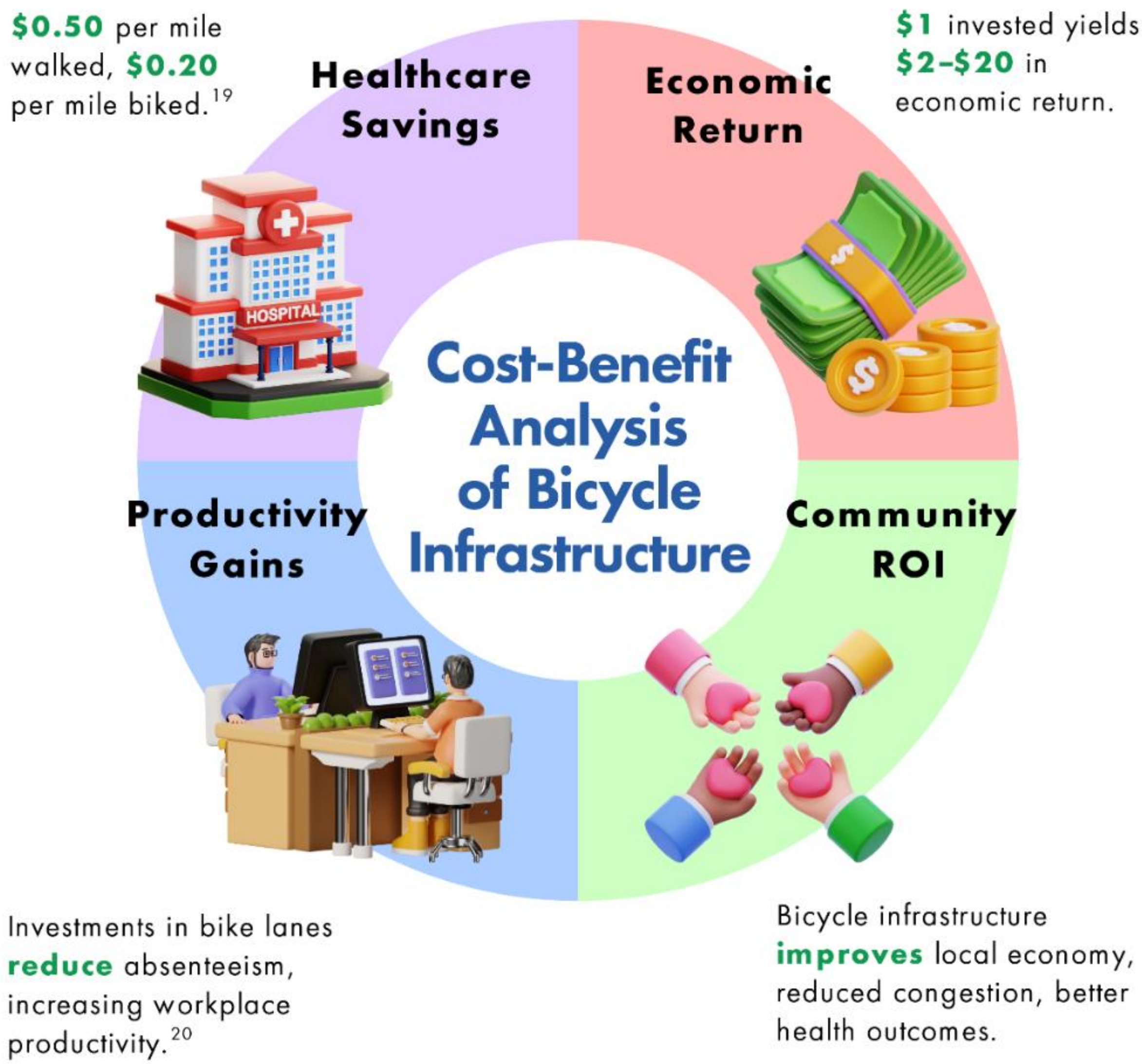
Source: SFRPC adaption of Miami-Dade TPO Existing Bicycle Network, 2025.

2.2 Infographics

The infographics presented in this section illustrate the findings of **Chapter 1: Comprehensive Literature Review** regarding the health, safety, economic, and environmental benefits of bicycle infrastructure. The infographics serve as communication tools to demonstrate how Miami-Dade's continued investment in the bicycle network improves residents' quality of life.

Investments in bicycle infrastructure contribute significantly to strengthening the local economy in Miami-Dade County, primarily by reducing traffic congestion and enhancing public health outcomes. By facilitating safe and convenient cycling routes, these improvements not only alleviate pressure on roadways, decreasing commuting times and associated economic costs, but also promote increased physical activity, resulting in reduced healthcare expenditures linked to chronic conditions such as obesity and diabetes. Moreover, the presence of well-designed bicycle paths and facilities has been shown to stimulate local businesses through heightened visitor spending and property value appreciation, creating tangible economic benefits for surrounding communities.

Figure 2.3: Benefit-Cost Analysis of Bicycle Infrastructure

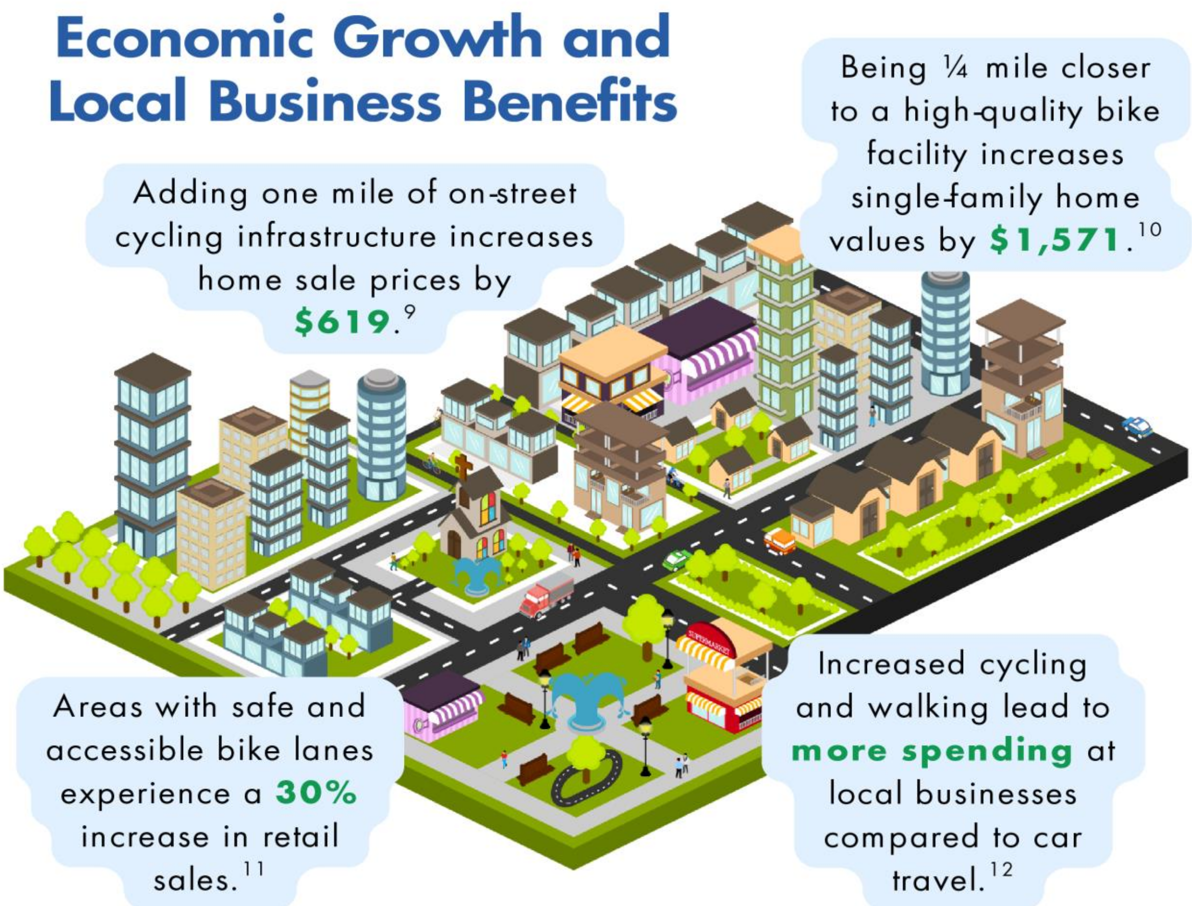


[19] Litman, Todd. Evaluating Active Transport Benefits and Costs: Guide to Valuing Walking and Cycling Improvements and Encouragement Programs. Victoria Transport Policy Institute, March 11, 2025.

[20] (Powell, Jane, Anja Dalton, Christian Brand, and David Ogilvie. "The Health Economic Case for Infrastructure to Promote Active Travel: A Critical Review." Built Environment 36, no. 4 (2010): 504–520.

Figure 2.3 summarizes the findings of Litman (2025) and Powell (2010) who found each mile of biking provides .20 cents in healthcare savings due to increased physical activity and each $1 of investment produces $2- $20 in economic return. Businesses could see increased spending at stores with up to a 30% increase in sales. Single-family home values have been shown to increase by up to $1,571 within a quarter mile of a bike facility as shown in **Figure 2.4: Economic Growth and Local Business Benefits.**

Figure 2.4: Economic Growth and Local Business Benefits



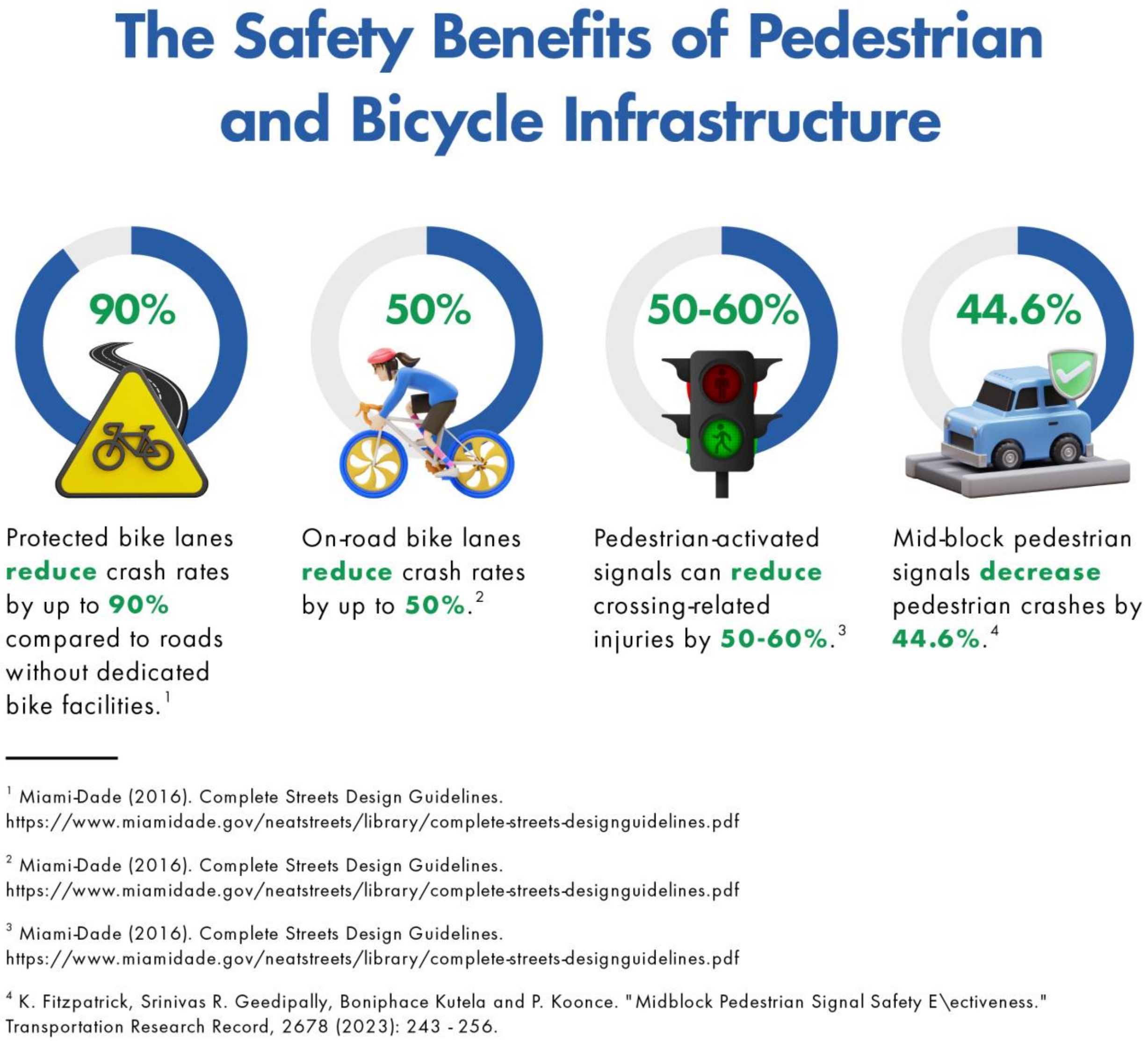
[9] Conrow, L., Mooney, S., and Wentz, E. A. (2021). The association between residential housing prices, bicycle infrastructure and ridership volumes. Urban Studies, 58(4), 787-808.

[10] Liu, Jenny and Wei Shi (2017) Impact of Bike Facilities on Residential Property Prices. Transportation Research Record: Journal of the Transportation Research Board, No. 2662, 2017, pp. 50–58.

[11] Parker, K. M., Gustat, J., Rice, J. C. (2011). Installation of bicycle lanes and increased ridership in an urban, mixed-income setting in New Orleans, Louisiana. Journal of Physical Activity and Health, 8(S1), S98-S102.

[12] Parker, K. M., Gustat, J., Rice, J. C. (2011). Installation of bicycle lanes and increased ridership in an urban, mixed-income setting in New Orleans, Louisiana. Journal of Physical Activity and Health, 8(S1), S98-S102.

Figure 2.5: The Safety Benefits of Pedestrian and Bicycle Infrastructure



In addition to promoting economic activity, bicycle and pedestrian infrastructure such as bike lanes and pedestrian signals reduce the risk of bicycle collisions with motorists. Figure 2.5 emphasizes the multiple methods local governments can employ to improve the safety of their transportation network. Each of the solutions presented above can be incorporated based on the local context, funding availability, and roadway conditions. While one solution may not fit a particular site, there are alternatives to ensure both motorists and pedestrians can travel safely.

As a nation, the United States spent $4.9 trillion on healthcare in 2023, or $14,570 per person.[57] Healthcare expenses related to heart disease, cancer, obesity, mental illness and diabetes encompass $4.5 trillion or 90% of annual healthcare expenditure.[58] However, medical research continues to show that lifestyle changes such as increasing physical activity can prevent, delay, and manage chronic diseases. By improving access to biking or walking for recreation and utility, Miami-Dade can improve the health of its residents by reducing the long-term risk of chronic illness. Research shows that a 5% increase in moderate physical activity prevents 600 deaths annually as shown in **Figure 2.6: Health Benefits of Active Transportation**.[59]

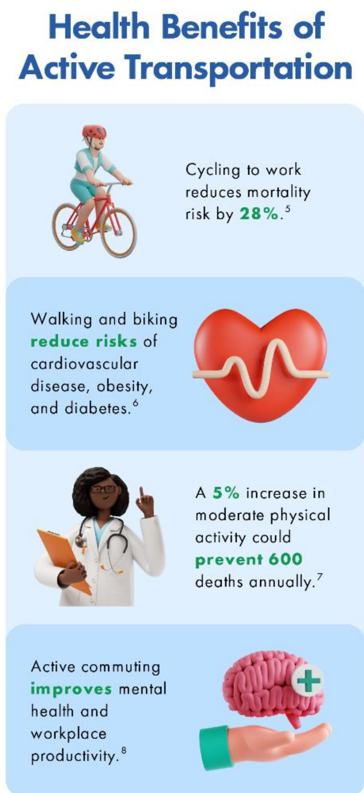
Furthermore, modal shifts from car usage to active transportation are associated with reduced air pollution and respiratory illnesses as a result of reduced particulate matter in the atmosphere. When bicycle and pedestrian improvements are combined with environmental improvements, such as bioswales and tree plantings, water quality and the urban heat island effect are also managed, **Figure 2.7: Environmental Benefits of Non-Motorized Transportation**. An in-depth analysis of the health savings associated with Miami-Dade's bicycle network is further explored in **Chapter 3: Health Impact Analysis and Benefit Analysis.**

[57] Centers for Medicare & Medicaid Services, n.d. National Health Expenditure Data, 2025. Retrieved from: https://www.cms.gov/data-research/statistics-trends-and-reports/national-health-expenditure-data/historical

[58] https://www.cms.gov/data-research/statistics-trends-and-reports/national-health-expenditure-data/historical

[59] Giles-Corti, Billie, Sarah Foster, Trevor Shilton, and Ryan Falconer. "The Co-benefits for Health of Investing in Active Transportation. "*NSW Public Health Bulletin* 21, no. 5-6 (2010): 122–127

Figure 2.6, 2.7, and 2.8: Benefits of Non-Motorized Transportation



[5] Giles-Corti et al., 2010

[6] Mansfield, T. J., Gibson, J. M. (2016). Estimating Active Transportation Behaviors to Support Health Impact Assessment in the United States. Frontiers in Public Health, 4, 63. A

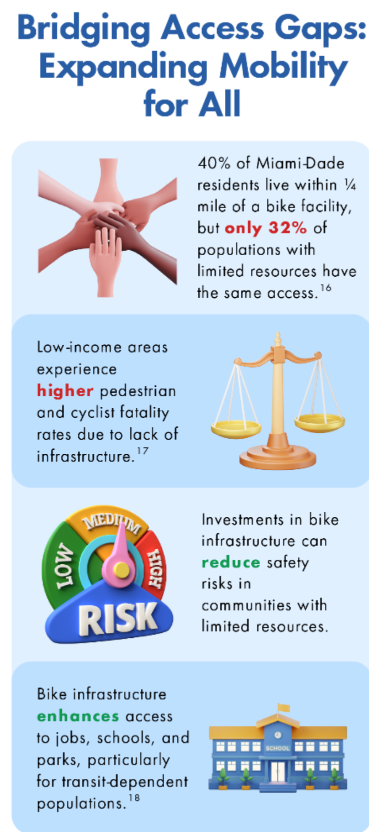
[7] Giles-Corti, Billie, Sarah Foster, Trevor Shilton, and Ryan Falconer. "The Cobenefits for Health of Investing in Active Transportation. "NSW Public Health Bulletin 21, no. 5-6 (2010): 122–127

[8] Powell, Jane, Anja Dalton, Christian Brand, and David Ogilvie. "The Health Economic Case for Infrastructure to Promote Active Travel: A Critical Review." Built Environment 36, no. 4 (2010): 504–520.

[13] Giles-Corti, Billie, Sarah Foster, Trevor Shilton, and Ryan Falconer. "The Cobenefits for Health of Investing in Active Transportation. "NSW Public Health Bulletin 21, no. 5-6 (2010): 122–127 Cities with high cycling rates report lower urban air pollution levels.

[14] Lemieux, C., Bichai, F., & Boisjoly, G. (2023). Synergy between green stormwater infrastructure and active mobility: A comprehensive literature review. Sustainable Cities and Society, 99, 104900.

[15] Cheela, V. S., John, M., Biswas, W., & Sarker, P. (2021). Combating urban heat island e\ect— A review of reflective pavements and tree shading strategies. Buildings, 11(3), 93.



[16] SFRPC analysis of U.S. Census Bureau. "TOTAL POPULATION." Decennial Census, DEC 118th Congressional District Summary File, Table P1, 2020, https://data.census.gov/table?q=population&g=050XX00US12086$1500000

[17] Braun, L., Daniel A. Rodriguez, Penny Gordon-Larsen. (2010Social (in)equity in access to cycling infrastructure: cross sectional associations between bike lanes and area-level sociodemographic characteristics in 22 large U.S. cities. Journal of Transport Geography 80, 102544. Investments in bike infrastructure can reduce safety risks in communities with limited resources.

[18] SFRPC adaptation of the Manfield and Gibson (2016) methodology, 2025.

2.3 Community Mobility Improvements

2.3.1 Bicycle Trips and Ridership

As a result of continued investment, Miami-Dade's bicycle network supported 424,100 bicycle trips and provided active transportation and recreational opportunities to 33,200 cyclists in 2024.[60] **Figure 2.9** displays bicycle trip trends from 2020-2025, showing peak ridership during the COVID-19 pandemic from February 2020 through 2021 as individuals sought outdoor activities amid stay-at-home and social distancing restrictions. The COVID-19 Pandemic's unique impact on bicycle ridership began in 2020 when Strava recorded 536,035 trips and 28,715 bicyclists in Miami-Dade as seen in **Figure 2.10**. After the implementation of stay-at-home orders in March 2020, ridership climbed from 25,902 in January to 32,789 in March, a 27% increase. May 2020 recorded 55,778 trips; the highest monthly levels ever recorded on Strava for Miami-Dade and a 115% increase in trips from the beginning of the year. During this time, bicycles were selling out across the nation. Bicycle sales nationwide increased by 64% to $5.4 billion, bringing in $5.4 billion to the bicycle industry.[61] Momentum continued into 2021 with 548,436 trips and 31,944 bicyclists, finally normalizing in June 2021 when COVID-19 restrictions eased.

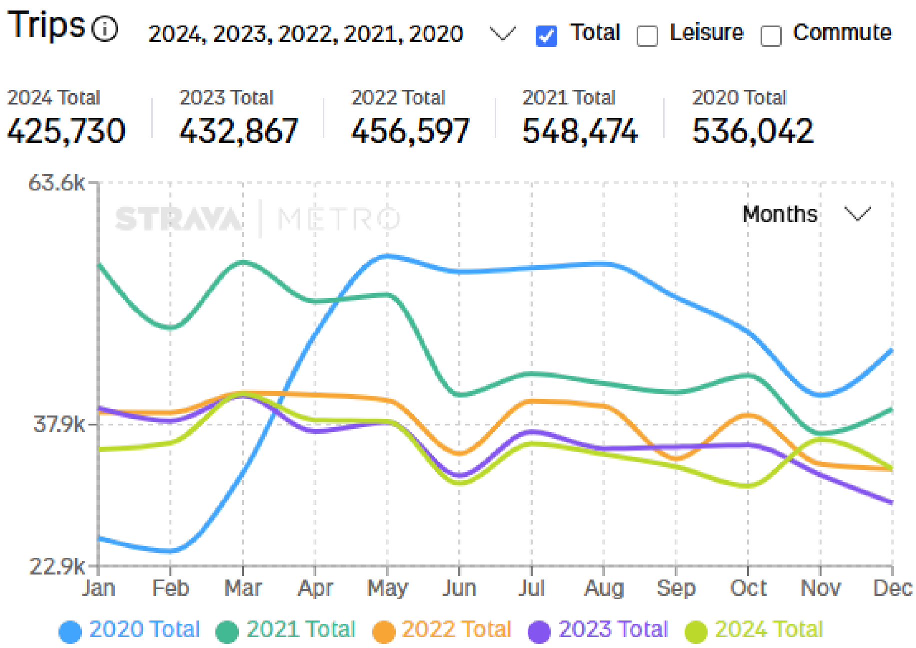
Record high ridership during COVID-19 influenced local support for pedestrian streets and bicycle infrastructure advancements across the United States. According to the "*Shifting Streets*" COVID-19 Mobility Dataset, an archive of changes made to public spaces during the COVID-19 Pandemic, local governments in Miami-Dade adapted streets to improve pedestrian and bicyclists' experiences in public spaces amid increased demand.[62] Miami Beach closed Ocean Drive and Washington Street to car traffic, installing temporary painted bike lanes and permanent bicycle lanes along nine blocks of Washington Street to accommodate the increased demand for outdoor recreation. The City of Miami established a micromobility network of shared roads and bike lanes in the center of Downtown and reprogrammed state, county, and city signalized intersections to automatic pedestrian recall to provide more time for crossing.

[60] Strava Metro. (2025). STRAVA Metro Total Trips and People Miami-Dade County for 2024, 2025

[61] Bike shops boomed early in the pandemic. It's been a bumpy ride for most ever since | AP News

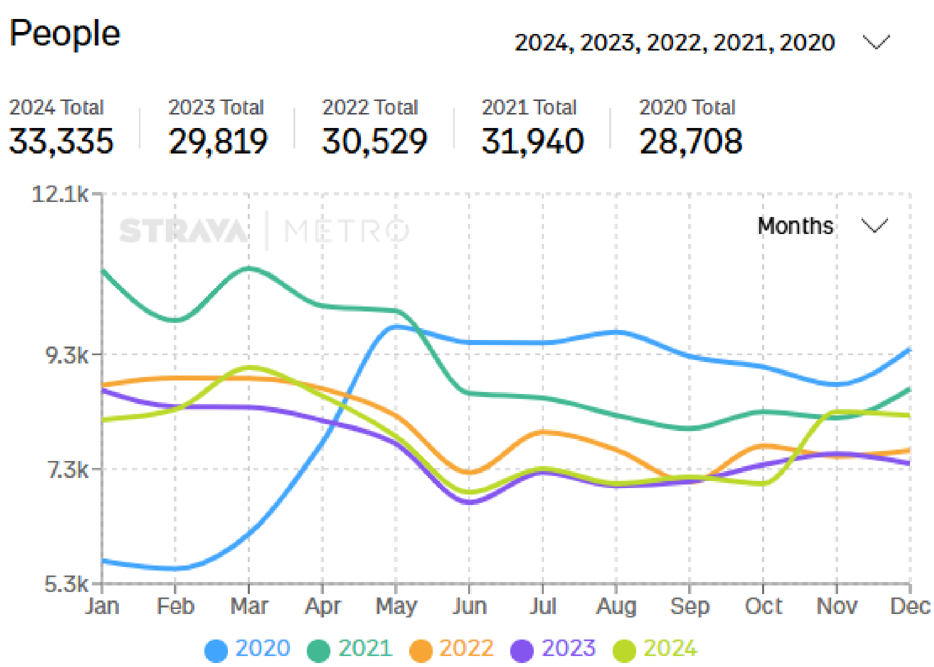
[62] PBIC, NUMO, Mobility Works, Streetplans, EpiAndes, Datasketch (2020). The "Shifting Streets" Covid-19 mobility database. Available from https://datasketch.github.io/mobility-actions/.

Figure 2.9: Bicycle Trips from 2020-2025 in Miami-Dade County



Source: Strava Metro 2020-2025 Streets Bicycle Trip Trends, 2025.

Figure 2.10: Bicycle Ridership (Population) from 2020-2025 in Miami-Dade County



Source: Strava Metro 2020-2025 Streets Bicycle User Trends, 2025.

While many bicycle enhancements implemented during COVID-19 were temporary, such as Miami Beach's closure on Ocean Drive, support for active transportation has remained constant. Even after COVID-19 ridership surges in the 500,000s, annual bicycle trips remained within the 400,000s between 2022 and 2024, as shown by **Figure 2.10**. January ridership records demonstrate Miami-Dade residents' continued support for active transportation. Strava data offers a glimpse into pre-pandemic ridership in January 2020, allowing for a comparison in January ridership levels from 2020 to 2025. When Strava records began in 2020, 25,902 bicycle trips occurred in January. Since the inaugural January 2020 record, January ridership has consistently stayed within the 33,000-39,000 range from 2022 to 2025 as seen in **Table 2.1**, an increase from pre-COVID-19 levels. Between January 2020 and January 2025, ridership increased by 30.4% demonstrating County residents continued support for active transportation.[63] While trips dipped in January 2025 compared to January 2024, more individuals are participating as of March 2025. As of March 2025, 9,652 riders were recorded, almost equal to the initial COVID-19 peak of May 2020 at 9,753 riders.

Table 2.1: January Ridership Trends 2020-2025

Month-Year	Bicycle Trips
January 2020	25,902
January 2021	54,955
January 2022	39,234
January 2023	39,682
January 2024	35,224
January 2025	33,775

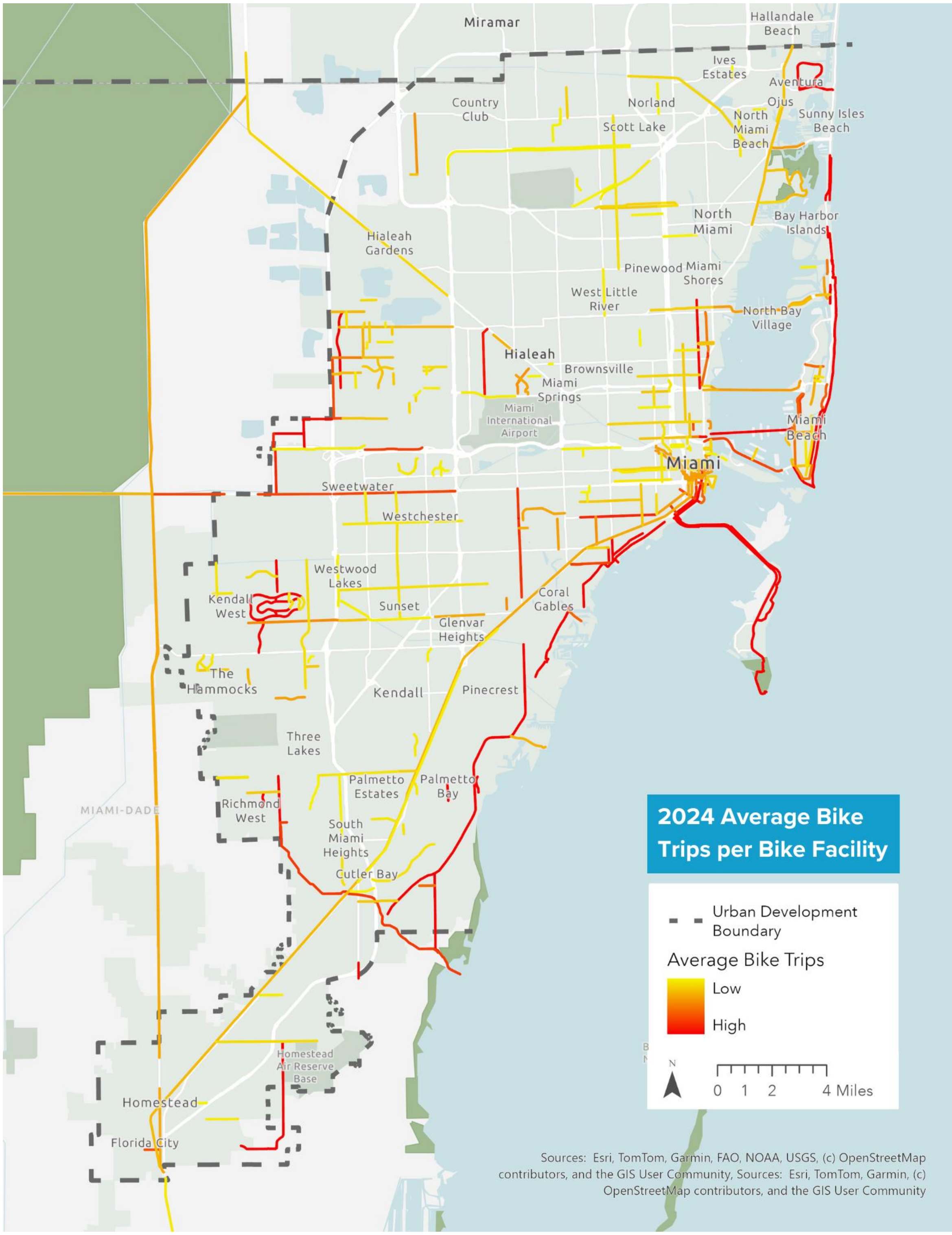
Source: SFRPC analysis of Strava Metro 2024 Monthly Bicycle Ridership Trends, 2025.

As demonstrated by **Figure 2.2**, most bicycle facilities are in residential areas with few connections to commercial and office centers. As such, it is difficult for residents to safely commute without relying on sidewalks or streets to complete their trips, which may expose them to car traffic and other hazards. According to Strava, most bicycle trips in Miami-Dade are recreational, with Strava commuting levels at 11.7% of total trips in 2024.[64] Strava commutes are defined as any utilitarian trip, such as traveling to the grocery store, work, or medical appointments. An analysis of the most popular bicycle facilities as shown in **Figure 2.11** was conducted to understand which factors contribute to high bicycle ridership.

[63] SFRPC analysis of STRAVA Metro 2024 Monthly Bicycle Ridership Trends, 2025.

[64] Strava Metro. (2025). STRAVA Metro Trips by Recreational and Commute for 2024.

Figure 2.11: Average Trips by Bike Facility Usage



Source: SFRPC analysis of Strava Metro 2024 Streets Bicycle Ridership Trends, 2025.

Figure 2.11 illustrates average bike trips per bicycle facility in Miami-Dade for 2024. The map utilizes average trips rather than total trips to avoid the double counting of bicycle trips along the same roadway. Strava data for bicycle trips along streets are split into segments, with each street and intersection comprised of multiple distinct line segments. Thus, an individual traveling on only one roadway can cross multiple segments and is counted each time they cross a line boundary. To analyze an entire street or bicycle facility, these segments and the associated data must be merged. Utilizing average trips rather than totals avoids double-counting individuals traveling on the same bicycle facility.

Table 2.2 through **Table 2.5** shows bicycle facilities with the highest average use by type. These figures represent a sample of the overall cycling population of Miami-Dade that uses the fitness app Strava. In 2024, 33,200 people recorded bicycle trips in Strava, a significant, but smaller, portion of the Miami-Dade population.[65]

Table 2.2: Most Frequented Trails by Average Annual Trips

Rank	Trail Name	Average Annual Bike Trips
1	Rickenbacker Trail	39,169
2	Commodore Trail	30,721
3	Biscayne Trail	18,774
4	Atlantic Greenway	16,701
5	Old Cutler Trail	11,199
6	Miami Riverwalk	5,563
7	Biscayne-Everglades Greenway	2,937
8	Black Creek Trail	2,279
9	Kitty Roedel Trail	2,217
10	Turnpike Trail	2,088

Source: SFRPC Analysis of Strava Metro 2024 Bicycle Ridership Data, 2025.

Some of the most frequented trails include the Rickenbacker Trail connecting Miami to Key Biscayne via Rickenbacker Causeway, the Commodore Trail connecting Miami, Coconut Grove, and Coral Gables, and the Biscayne Trail in Key Biscayne's southern end. A common theme between the topmost frequented trails is location, length, and completion. The top five trails are complete and span across neighborhood and city boundaries, allowing residents to travel between neighborhoods to scenic destinations such as Key Biscayne, Miami Beach, and historic Coconut Grove. Incomplete trails with smaller segments open to the public garnered lower ridership such as the Biscayne-Everglades Trail and Miami Riverwalk. However, upon completion, these projects will expand Miami-Dade residents' recreational opportunities and strengthen connections between existing facilities, potentially encouraging ridership in current low-ridership

[65] Stra Strava Metro.(2025). STRAVA Metro Commuter Trips for 2024.

communities such as Homestead. For example, when complete, the Biscayne-Everglades trail will connect Everglades National Park and Biscayne Bay National Park while also expanding network connections to the South Dade Trail and Krome Path.

Table 2.3: Most Frequented Shared Roads by Average Annual Trips

Rank	Shared Roads Name	Average Annual Bike Trips
1	Tiger Tail Avenue	21,461
2	Brickell Avenue	12,692
3	Grand Avenue	7,107
4	SE 15th Road	5,876
5	Mary Street	4,533
6	SW 57 Avenue	3,812
7	NW 114 Avenue	3,074
8	NE 14 Street	2,899
9	SW 22 Street	2,548
10	NE 4 Street	2,441

Source: SFRPC Analysis of Strava Metro 2024 Bicycle Ridership Data, 2025.

The data in **Table 2.3** highlights key corridors that attract the highest volumes of bicycle traffic on shared roads, based on average annual trips. While shared roads are not considered bicycle infrastructure, they provide valuable insights into popular routes and potential areas for bicycle facility expansion. In the absence of bike lanes, trails, or paths, shared roads are used by Miami-Dade bicyclists to connect to destinations. Popular shared roads throughout Miami-Dade have comparable ridership levels to trails ranging from 2,000- 21,000 average annual riders. Tiger Tail Avenue recorded the highest use, with 21,461 annual bike trips, suggesting it serves as a vital route for cyclists and may benefit from further infrastructure enhancements, such as dedicated bike lanes or safety improvements. Brickell Avenue and Grand Avenue follow with 12,692 and 7,107 trips, respectively, indicating substantial usage that warrants continued maintenance and potentially upgraded facilities. Notably, the sharp drop in volume on Shared Use lanes like NE 4 Street, with 2,441 trips, may indicate a need for increased safety improvements to encourage ridership.

Table 2.4: Most Frequented Bike Lanes by Average Annual Trips

Rank	Bike Lane Name	Type of Protection	Average Annual Bike Trips
1	Crandon Boulevard	Buffered	152,380
2	Rickenbacker Causeway	Unprotected	122,875
3	SW 137 Court	Unprotected	46,179
4	SW 146 Avenue	Unprotected	37,533
5	SW 68 Street	Unprotected	34,036
6	SW 62 Street	Unprotected	33,484
7	SW 66 Street	Unprotected	30,525
8	SW 59 Street	Unprotected	24,288
9	SW 26 Road	Unprotected	22,086
10	Venetian Causeway	Unprotected	16,172

Source: SFRPC Analysis of Strava Metro 2024 Bicycle Ridership Data, 2025.

Table 2.4 reveals critical insights into the usage of bike lanes based on their level of protection. Crandon Boulevard, the only buffered bike lane on the list, overwhelmingly leads with 152,380 annual bike trips, nearly 30,000 more than the second-ranked unprotected Rickenbacker Causeway bike lane at 122,875 trips. This notable ridership increase along Crandon Boulevard underscores the strong preference for protected infrastructure, suggesting that even limited buffering significantly enhances rider confidence and usage. The remaining top-used bike lanes still see substantial traffic, indicating a demand for cycling infrastructure despite the lack of physical separation from vehicle traffic. However, the consistent presence of unprotected lanes among the most frequented routes may also point to a lack of safer alternatives rather than true rider preference.

These findings highlight the importance of expanding protected infrastructure where demand is high on shared use lanes and unprotected bike lanes, particularly those like SW 137 Court and SW 146 Avenue with tens of thousands of trips annually to improve safety and encourage broader adoption of cycling as a mode of transportation.

To provide additional context to Strava ridership counts, bicycle traffic counter data from the Florida Department of Transportation's Non-Motorized Traffic Monitoring Program Data Dashboard is included in **Table 2.5.** The Non-Motorized Traffic Monitoring Program Data Dashboard records data on bicycle and pedestrian traffic along the State's Shared Use Non-Motorized (SUN) Trails. SUN trails with count stations: Krome, Atlantic Greenway, Rickenbacker Causeway, Snake Creek, South Dade, Biscayne-Everglades Greenway, and Snapper Creek. This data demonstrates that incomplete bike counts provided by Strava do not accurately reflect the ridership of important trails such as the Atlantic Greenway and Rickenbacker Trail. For example, the Atlantic Greenway Trail along the Atlantic Coast of Miami-Dade County, the fourth most frequented trail according to Strava, recorded 16,701 trips in 2024. However, the Florida Department of Transportation Traffic Counters recorded 129,150 individuals. If each individual made a complete trip and the traffic counter double-counted them, 64,575 people used Atlantic Greenway in 2024. Similarly, Rickenbacker Causeway recorded 158,063 individuals, representing 79,031 individuals assuming every individual made a complete trip.

Table 2.5: SUN Trail Bicycle Traffic 2024

Rank	Trail Name	Annual Bike Traffic	Average Daily Bicycle Traffic
1	Rickenbacker Trail[66]	158,063	1,265
2	Atlantic Greenway[67]	129,150	1,196
3	Biscayne-Everglades Greenway[68]	10,341	41
4	Snake Creek Trail[69]	12,376	50
5	Krome Path[70]	6,933	20
6	South Dade[71]	4,579	38
7	Snapper Creek[72]	744	6

Source: SFRPC Analysis of Strava Metro 2024 Bicycle Ridership Data, 2025.

2.4.2: Origins and Destinations

Strava's 2024 data on bicycle trip origins and destinations across Miami-Dade County provides a comprehensive look at how riders utilize the region's evolving cycling infrastructure. This section explores key spatial trends in trip patterns, distinguishing between high-density recreational routes and more focused commuting corridors. By highlighting hotspots in areas like Miami, Miami Beach, Coral Gables and, as well as along emerging corridors such as The Underline and the South Dade Trail, the data underscore how infrastructure availability and urban form shape cycling behavior. In particular, the analysis draws attention to the geographic divide between residential suburbs and employment centers, emphasizing

[66] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Rickenbacker Causeway at William Powell Bridge (Dual Site). Bicycle Traffic Counts for 2024.
[67] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Atlantic Greenway Trail. Bicycle Traffic Counts for 2024.
[68] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Biscayne Everglades Greenway at Kindman Road. Bicycle Traffic Counts for 2024. https://app.powerbigov.us/view?r=eyJrIjoiNzRlNjhiMzYtODk5Yy00ZTczLTk3ODMtMGM1ZmRmZGEwZmJhIiwidCI6ImRiMjFkZTVkLWJjOWMtNDIwYy04ZjNmLThmMDhmODViNWFkYSJ9&pageName=ReportSection57074e80abb8698619b
[69] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Snake Creek at SR 7. Bicycle Traffic Counts for 2024.
[70] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Krome Path. Bicycle Traffic Counts for 2024.
[71] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* South Dade Trail at SW 152nd St. Bicycle Traffic Counts for 2024.
[72] Florida Department of Transportation. (2025). *Non-Motorized Traffic Monitoring Program Data Dashboard, Individual Site.* Snapper Creek Trail at SW 40th St. Bicycle Traffic Counts for 2024.

current limitations and strategic opportunities for enhancing commuter connectivity through targeted infrastructure improvements and mixed-use development.

The origins and destination analysis of 2024 bicycle trips revealed geographic dispersion across the entire County with few areas where bicycle trips did not occur as shown by **Figure 2.12** and **Figure 2.13**. The origins and destinations of bicycle trips reveal an overlap in trip locations. Overlapping origin and destination locations is related to the high level of recreational trips, 88.3% of all trips. Recreational trips are highly likely to originate and end at a single location, such as a residence or park. Therefore, overlap may be attributed to Strava users recording the one location as both the trip's origin and destination.

The greatest trip densities are in areas with existing and extensive bicycle infrastructure as demonstrated by hotspots within the City of Aventura, Miami, Miami Beach, Doral, Coral Gables, Coconut Grove, Village of Key Biscayne and the community of Kendall Lakes. These communities have multiple forms of bicycle infrastructure, connections to recreational areas such as parks or beaches, and accessibility to commercial areas. Additionally, bicycle facilities connecting to transit are present in the City of Miami and Coconut Grove, potentially encouraging residents towards active transportation to address the first-last mile transit connections.

The US 1 Corridor along the Underline saw high ridership densities in 2024 despite ongoing construction. The recently opened Downtown Miami section of the Underline contributed to Downtown Miami and Coral Gables' already high bicycle ridership levels. The southern half of US 1, south of Palmetto Estates and along the South Dade Trail saw fewer bicycle trips, which may be attributed to high traffic volumes and safer bicycle routes further east such as the Old Cutler Trail and neighborhood streets. Ongoing improvements to the pedestrian experience along US 1, including the completion of The Underline and enhancement of the South Dade Trail as part of Miami-Dade SMART Plan, is expected to boost ridership in US 1 adjacent communities such as Kendall, Pinecrest, and Palmetto Bay.

There is a notable gap in both origins and destinations in West Little River and Brownsville. The absence of bicycle trips correlates with the low level of bicycle facilities in these neighborhoods. **Figures 2.12** and **Figure 2.13** show only two bicycle facilities: the NW 15 Avenue Bike Lane and SR 9/ NW 27 Avenue Bike Lane. The few origins in West Little River and Brownsville include residential neighborhoods and the Brownsville Metrorail Station. Connecting the two bicycle lanes currently available to these communities could improve transportation between neighborhoods. Furthermore, this connection could provide safe transportation to local destinations including Gwen Cherry Park, Poinciana Park Elementary, Lillie C. Evans Elementary, Westview Elementary, D.A Dorsey Technical College, and the Martin Luther King Metrorail Station which are all within a mile of the existing bike lanes.

The City of Opa-locka also saw low levels of bicycle ridership. Unlike West Little River and Brownsville, Opa-locka has multiple bike lanes connecting community members to parks, employment centers such as the Opa-locka Airport, Lejune Industrial Park, and Seaboard Industrial Park, and other areas such as North Miami. Therefore, gaps in origins and destinations may be the result of Strava's underrepresentation of populations with low app usership. In 2023, Strava data was analyzed by Venter et al. (2023) revealing that Strava users were more likely to be between 35-54 years old and lacked representation of young, elderly, and low-income communities.[73] Given this data challenge, feedback from community members, utilization of traditional traffic counts, and incorporating other data sources is essential. While West Little River, Brownsville, and Opa-locka communities had low ridership levels according to Strava, American Community Survey commuting data and Signal 4 crash data indicate bicycle reliance in these communities. Many census blocks in the three areas are one-to-no car households who may rely on bicycles to commute to work. For example, Opa-locka contains the eleventh highest census track for bicycle commuting in Miami-Dade at 6.5%, compared to the County average of 0.5% according to the American Community Survey.[74] Furthermore, all three communities are hotspots for bicycle crashes, according to the Florida Department of Transportation, which is further discussed in **Section 2.4**.

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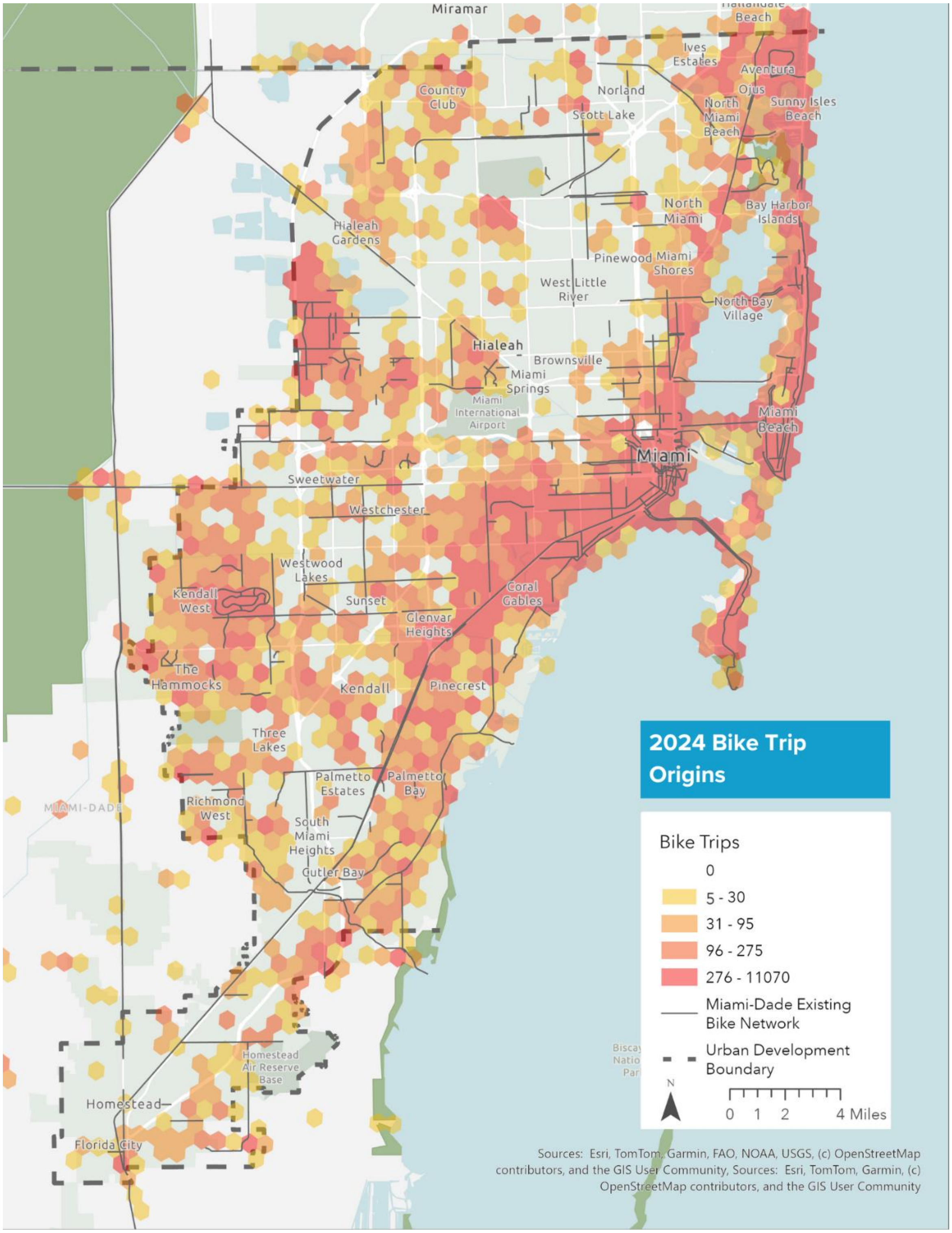
[73] Venter, Zander S., Vegard Gundersen, Samantha L. Scott, and David N. Barton. "Bias and precision of crowdsourced recreational activity data from Strava." *Landscape and Urban Planning* 232 (2023): 104686.

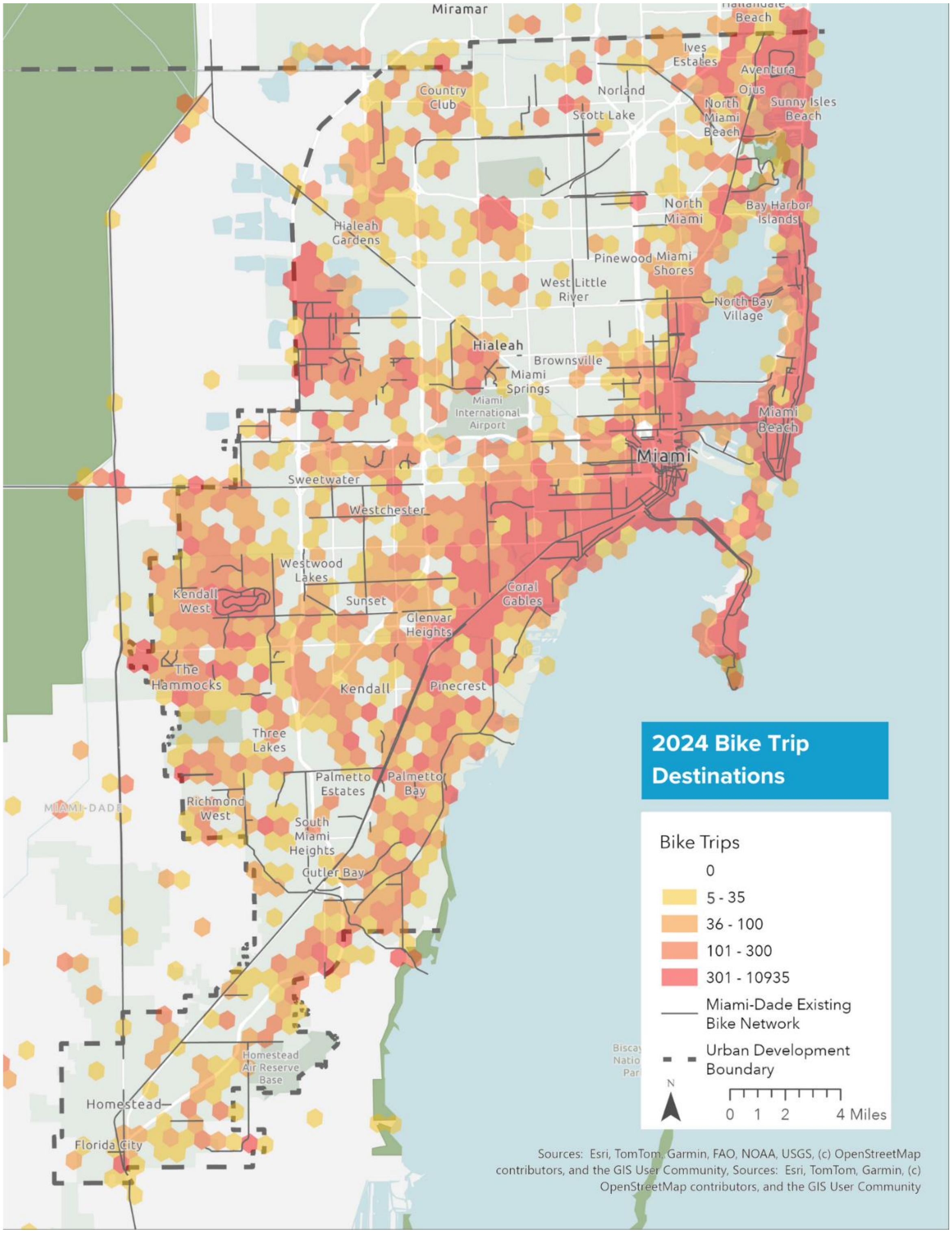
[74] U.S. Census Bureau, U.S. Department of Commerce. "Commuting Characteristics by Sex." *American Community Survey, ACS 5-Year Estimates Subject Tables, Table S0801*, 2023, https://data.census.gov/table/ACSST5Y2023.S0801?q=Table+S0801&g=050XX00US12086$1400000. Accessed on May 28, 2025.

Figure 2.12 2024 Bike Trip Origins



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025.

Figure 2.13: 2024 Bike Trip Destinations



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025.

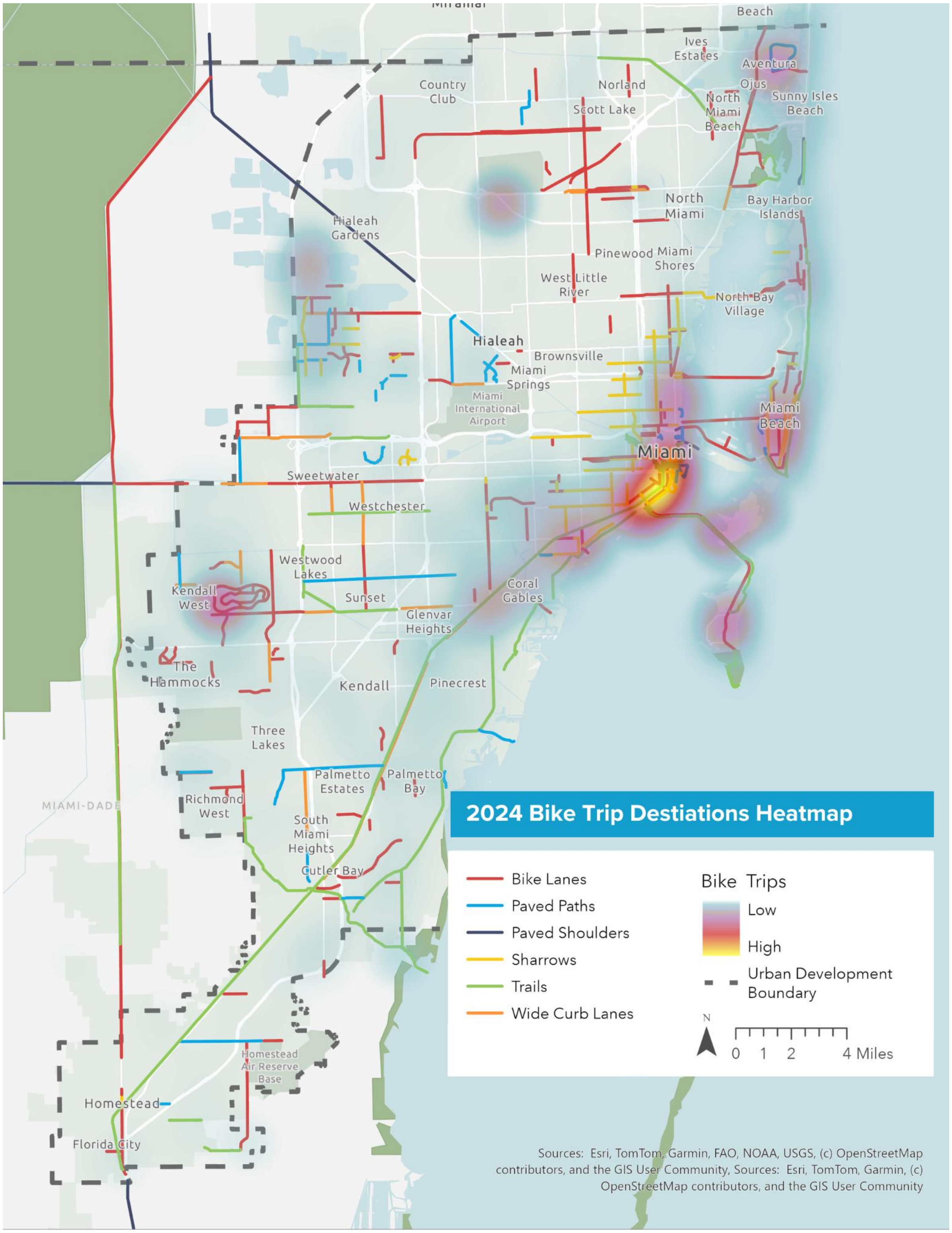
Visualizing origins and destinations as a heatmap, as shown in **Figure 2.14** and **2.15**, further demonstrates that municipalities promoting mixed-use development, bicycle infrastructure improvements, and connections to recreational and commercial centers attract the greatest proportion of bicycle trips in Miami-Dade. These hotspot communities (i.e. Aventura, Doral, Miami Beach, Miami, Coral Gables, and West Kendall) offer safer cycling environments than other areas throughout Miami-Dade and share the following characteristics contributing to higher ridership:

- **Connections to Recreational Centers:** Bicycle hotspot communities offer residents connections from homes to parks, beaches or state parks where they may continue their trip or meet with friends or family. These recreation centers offer additional bicycle trails that riders utilize in combination with County bicycle facilities. For example, two popular locations for bicyclists include Oleta River State Park in North Miami and Crandon Park in the Village of Key Biscayne which both saw high ridership at park entrances. Additionally, bike lanes surrounding Miccosukee Golf and Country Club in West Kendall support the only bicycle hotspot within south-west Miami-Dade highlighting the importance of access to bicycle facilities in bicycle activity within low-ridership areas.
- **Adjacent to Commercial or Downtown Areas:** The City of Aventura, Doral, Miami, and Miami Beach offer bicycle connections to commercial areas, allowing residents to complete daily errands while avoiding traffic congestion. Providing connections to commercial areas bolsters the impact of bicycle activity on the local economy.
- **Multiple Types of Bicycle Infrastructure:** The presence of more than one type of bicycle facility such as trails, bike lanes, and shared roads in combination had positive effects on ridership. In particular, the presence of multiple interconnected bicycle facilities such as a bike lane, shared road, or trail network encompassing one broader network was extremely successful. For example, Downtown Miami's Micromobility Network of shared roadways which connects to multiple regional trails and bike lanes, saw high ridership in terms of both recreational and commuting trips.

The above-mentioned commonalities are distinct from low-ridership communities such as North Miami, Kendall, West Little River, and Brownsville which demonstrated the following trends:

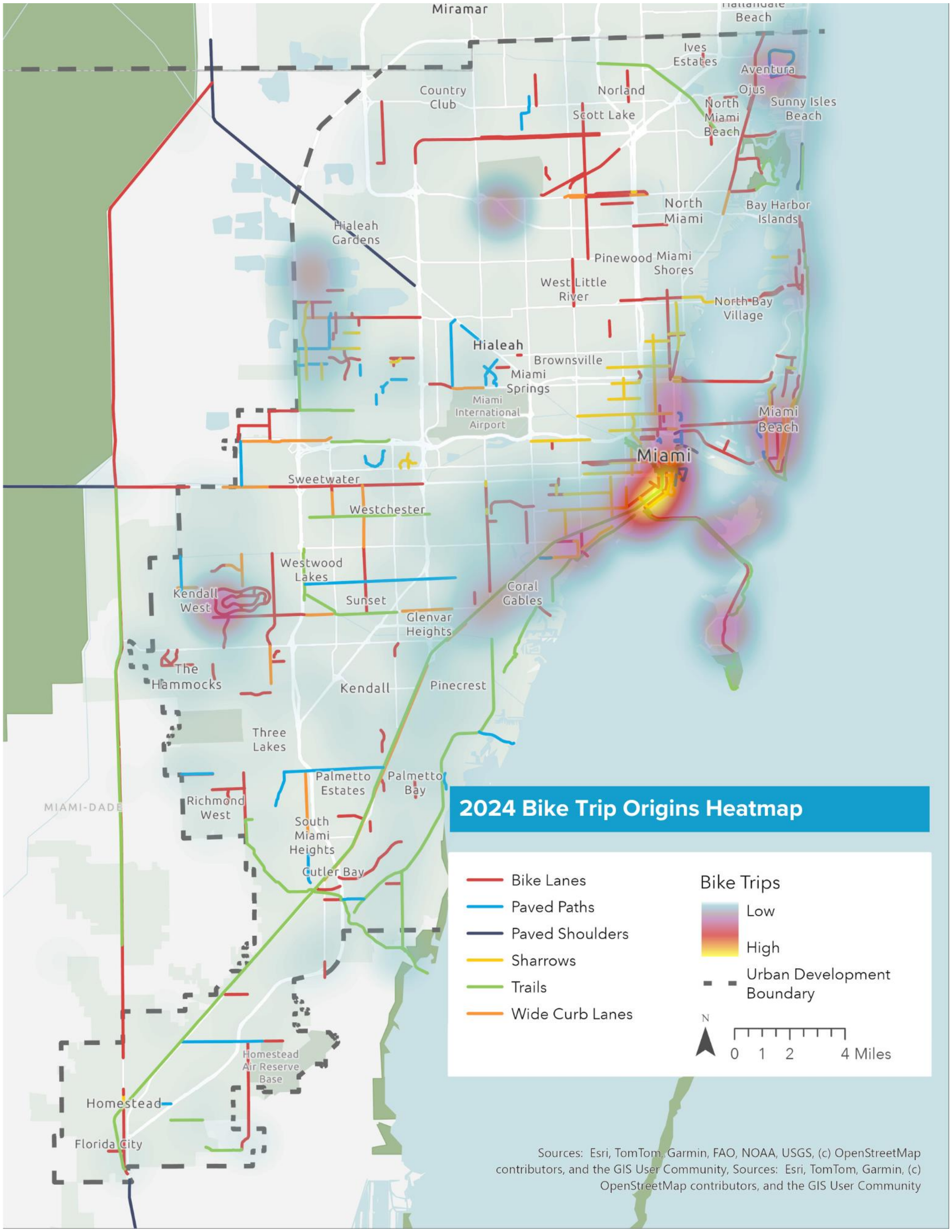
- **Reduced Bicycle Infrastructure:** Gaps in bicycle ridership correlate with low levels of bicycle infrastructure as shown by the communities of North Miami, Kendall, West Little River, and Brownsville. Without infrastructure to safely travel on, residents are less likely to travel via bicycle, reducing the health and economic impacts of *bikenomics* in Miami-Dade.
- **Distanced from Transit:** Throughout this analysis, communities adjacent to transit stations demonstrated higher bicycle activity, emphasizing the relationship between transit and cycling as a method to improve first-last mile connections. Trips identified as commutes were more likely to occur along the Metrorail and Metromover routes.
- **Few Recreational and Commercial Connections:** In combination with low bicycle infrastructure, these communities had low accessibility to recreational and commercial areas. Future improvements to the bicycle network can maximize the economic and health impacts by linking neighborhoods to parks, stores, and other community resources where residents can complete daily tasks or increase physical activity.

Figure 2.14: 2024 Bike Trip Destination Heatmap



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025.

Figure 2.15: 2024 Bike Trip Origins Heatmap



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025

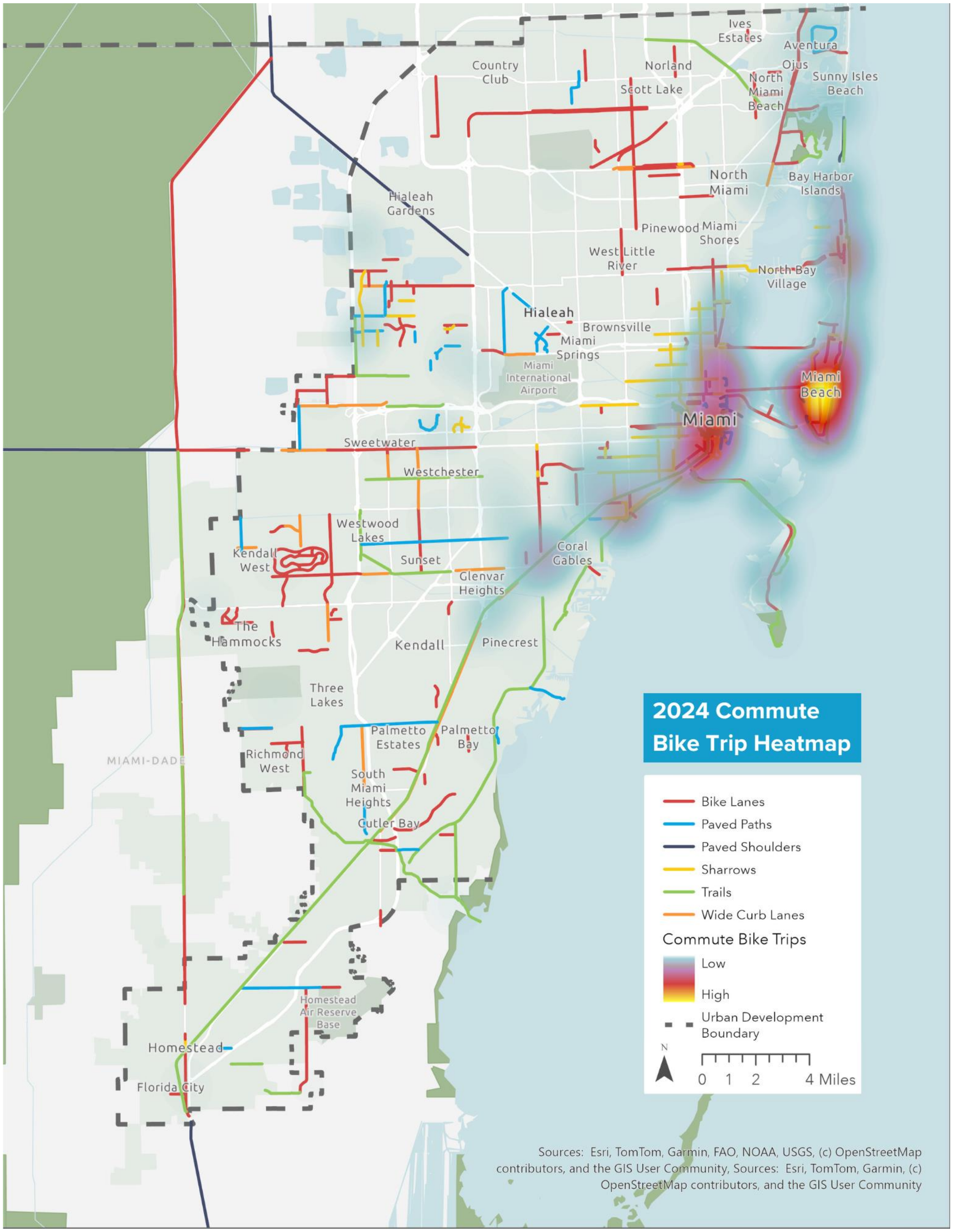
2.4.3: Commuting Patterns

Figure 2.16 through **Figure 2.18** displays 11.7% of all bicycle trips recorded as commutes in 2024. Commuting patterns differ from recreational trips and are more concentrated within highly urbanized areas. In 2024, commutes recorded in Strava were clustered in the highly urbanized South Miami Beach, Downtown Miami, and Brickell areas. Smaller commuting footprints were displayed in North Miami Beach, Aventura, Coral Gables, Virginia Key, and a slight but notable presence in Doral. These maps depict how commuting patterns impact utilization of the existing bicycle network, revealing that commuting is highest in mixed-use, urbanized communities with a bicycle network crossing individual neighborhood boundaries, and connections to transit. Individuals in suburban neighborhoods are more likely to use bicycle facilities for commuting when commercial areas are within close and safe proximity.

In contrast to recreational cycling, where individuals may utilize facilities without regard to destination, commuting trips are dependent on residential-commercial connections. Yet, Miami-Dade's commercial and residential areas are spatially separated between east and west with a large proportion of the population located in suburban communities to the west while commercial and employment hubs are located on the east. This partially explains the clustering of bicycle commuting in communities closest to employment centers such as Miami Beach, Bickell, and Coral Gables. Currently, the absence of consistent regional east-west connections precludes many individuals from commuting to work or connecting to transit.

Short-term maximization of the existing network for commuting can be achieved through connections to neighborhood level centers that support commutes outside of work such as schools, shopping centers, and transit stations. A case study of this strategy is demonstrated by the City of Doral's bicycle connections to CityPlace and Aventura's commercial areas surrounding Aventura Mall, both mixed-used environments with shopping, entertainment, and residential areas that support neighborhood-level commuting for residents.

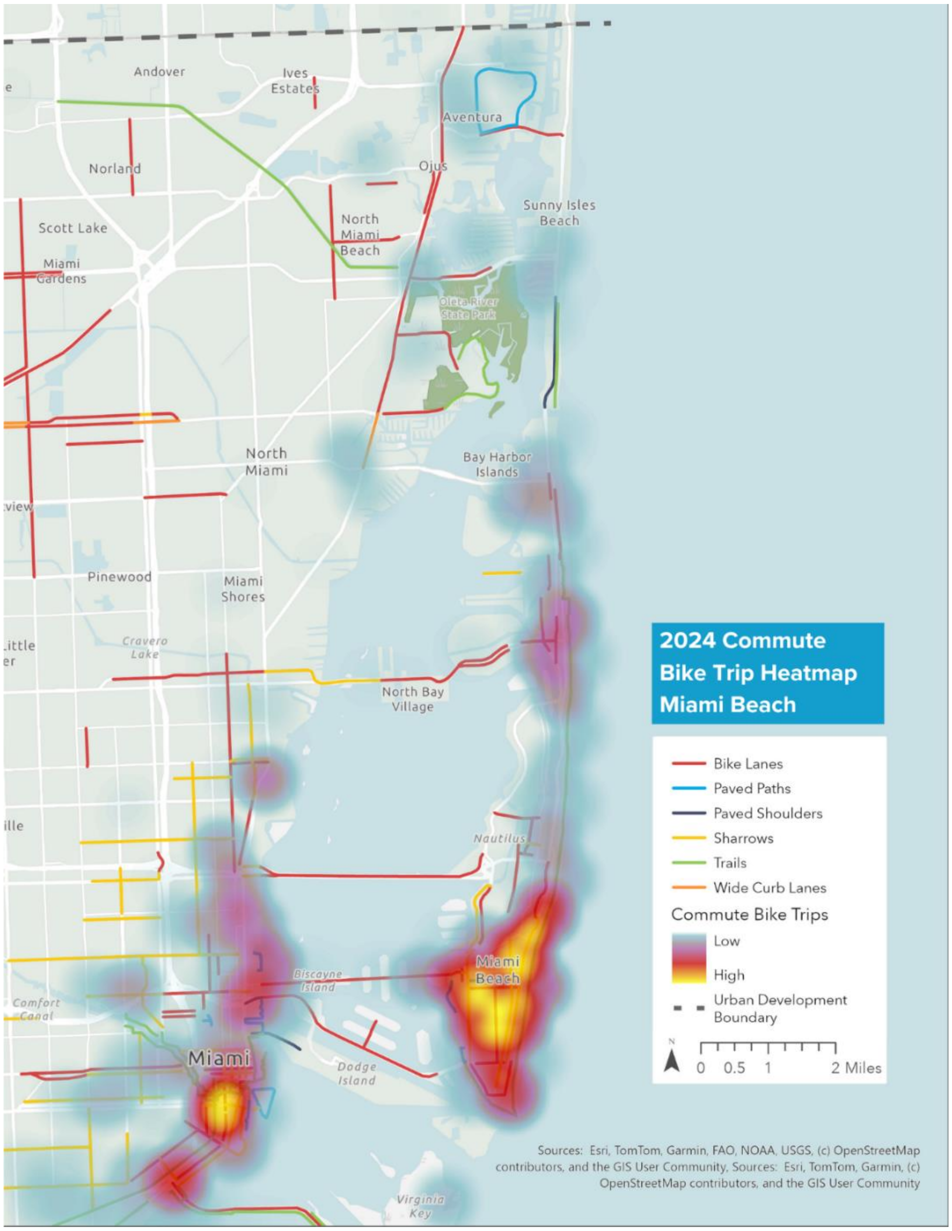
Figure 2.16: 2024 Commute Bike Trip Heatmap



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025.

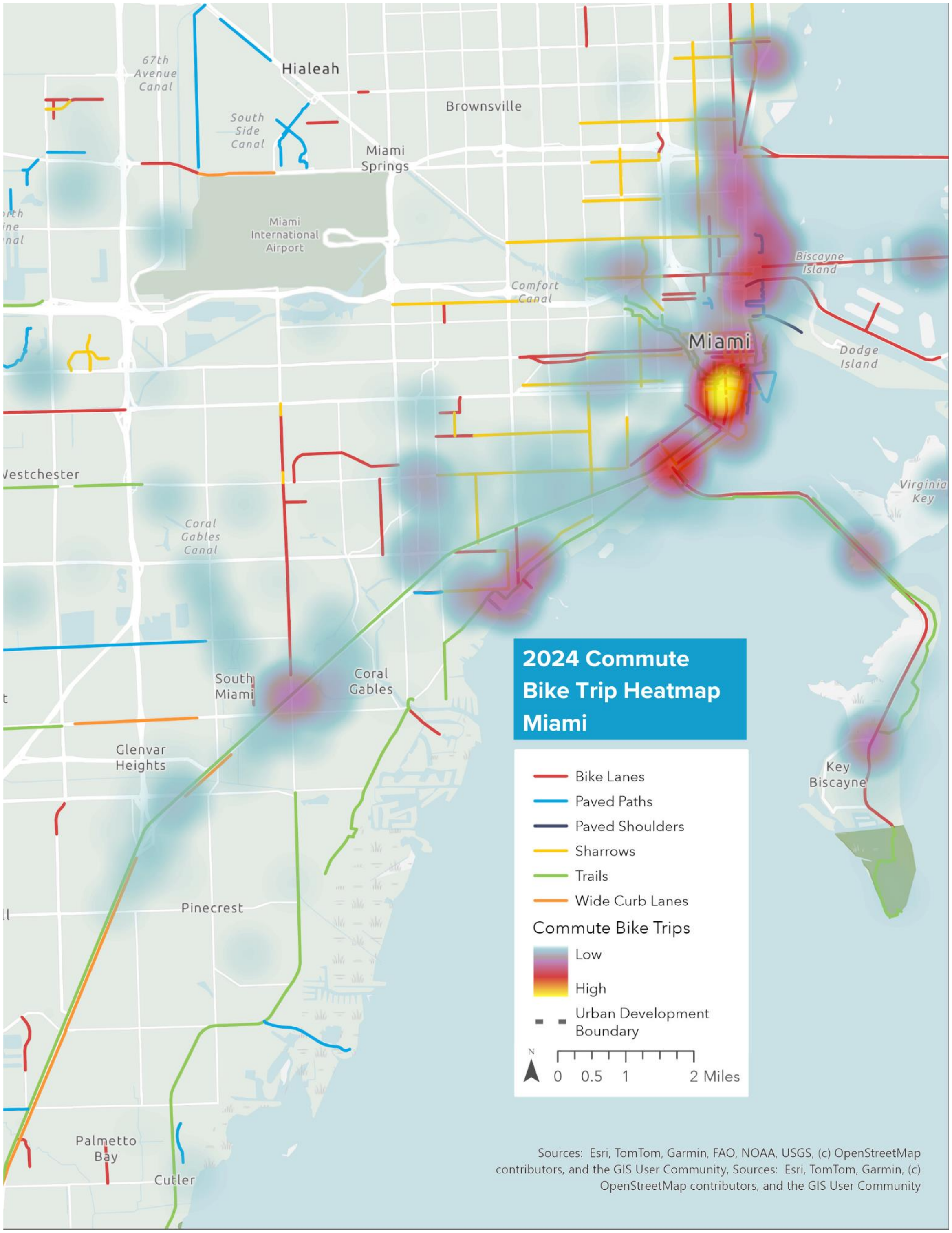
Figure 2.17 displays 2024 commuting hotspots in Miami Beach. Commuting is centralized in South Miami Beach which has a high density of commercial, hotel, and residential properties and connections to Miami Beach transit. These aspects in combination with low parking availability have fostered high bicycle ridership in densely populated South Miami Beach. Bicycle ridership follows the Atlantic Greenway Trail along the coast, indicating that trails meant for recreation can promote commuting in compact and dense land use contexts.

Figure 2.17: 2024 Commute Bike Trip Heatmap Miami Beach



Source: SFRPC Analysis of Strava Metro 2024 Origin and Destinations, 2025

Figure 2.18: 2024 Commute Bike Trip Heatmap Miami

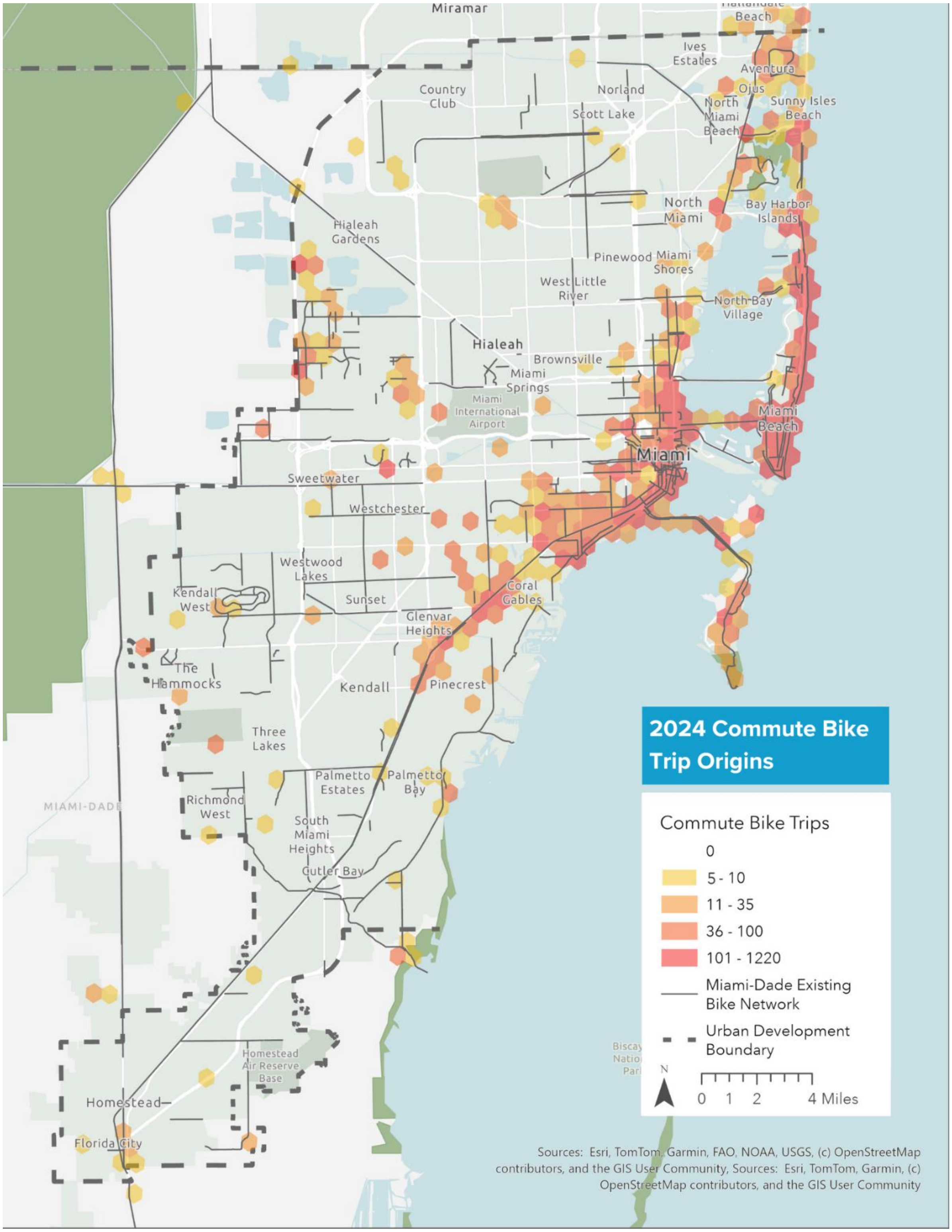


Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations, 2025

In addition to Miami Beach, the City of Miami demonstrated high commuting levels Downtown and along the US 1 corridor, which includes transit opportunities with Metrorail and Metromover access and The Underline. While shared roads offer less protection than other bicycle facilities, Downtown Miami's Micromobility Network encompassing interconnected bike lanes and shared roads offer vital intercity connections to offices and homes. Similarly, Coconut Grove's high commuting levels are supported by a network of bike lanes, trails, shared roads emphasizing the importance of network connection over isolated facilities.

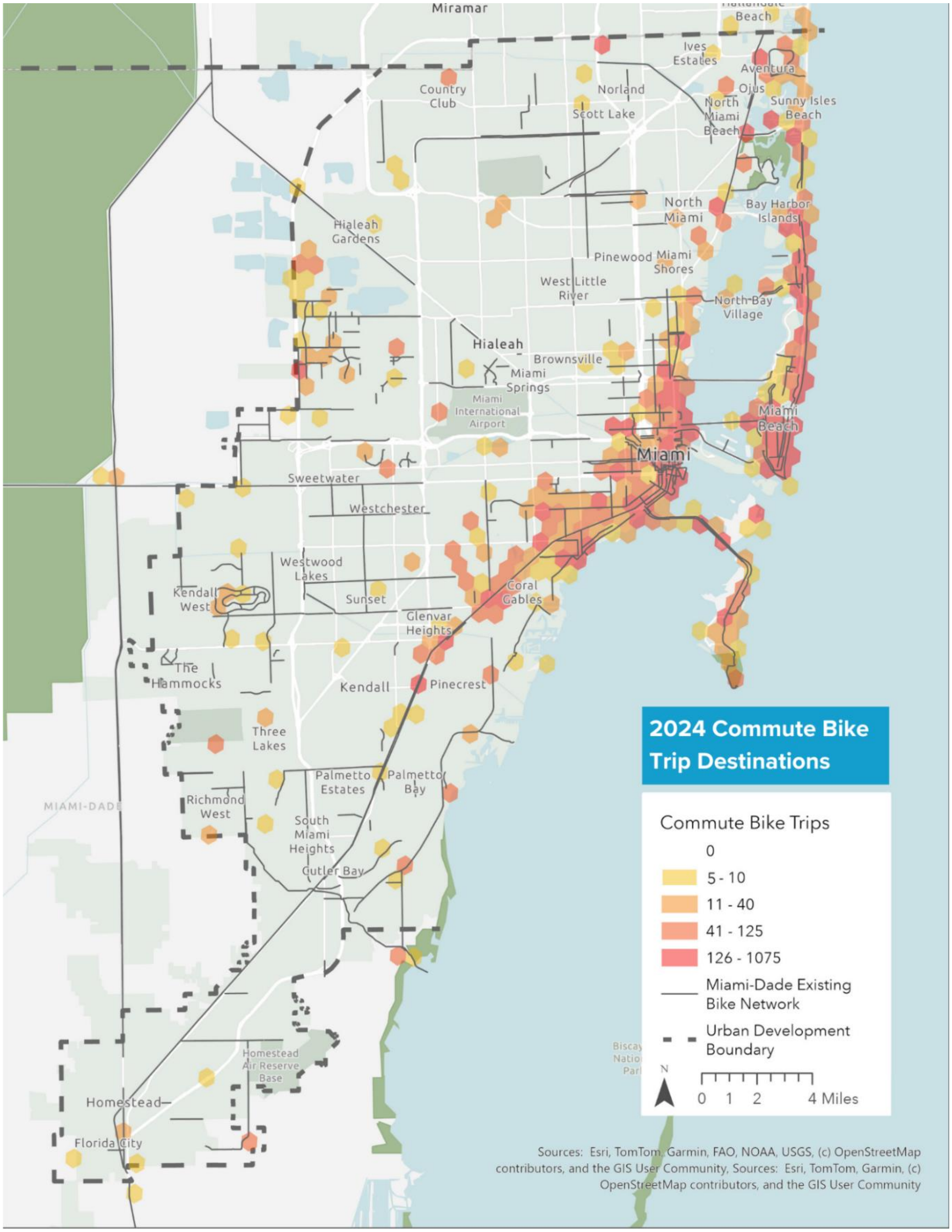
Figure 2.19 and Figure 2.20 display commuting trip origins and destinations as hexagons with high trip densities displayed in dark red. There are slight, but crucial differences between the two maps, elucidating commuting trends in Miami-Dade's urban core. In general, the maps highlight the stark contrast between urban and suburban communities with sporadic and less frequent commuting in central and western Miami-Dade County and clustering of commutes with high density cities on the east. Subtle changes in origins and destinations within the City of Miami Beach reveal that commuter origins are spread across the municipality's eastern coast while destinations are at the highest densities within South Miami Beach commercial centers.

Figure 2.19: 2024 Commute Bike Trip Origins



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations

Figure 2.20: 2024 Commute Bike Trip Destinations



Source: SFRPC analysis of Strava Metro 2024 Origin and Destinations

2.4.4 Expanded Access to Community Assets

Bicycle facilities support everyday needs by enhancing access to community resources, including transit stops, parks, and schools. Accessibility to community assets was analyzed to understand how residents can utilize the existing bicycle network. Accessibility in **Table 2.6** was defined as a bicycle facility, such as shared use path, bicycle lane, paved shoulders, or wide curb lanes, within 500 feet, quarter mile, and half mile biking shed of an existing community resource. The most accessible resources via the existing bicycle network are Metromover and Metrorail stations highlighting the County's dedication to providing multimodal access to transit. While many community resources are within a short bike quarter to half mile bike ride, direct access to a facility is still a challenge. The number of community resources within 500 feet of a bicycle facility is lower across all community resources, indicating that addressing bicycle network gaps is essential to providing connectivity. Under current conditions, bicyclists may rely on sidewalks and streets to complete their journey where gaps exist.

Table 2.6: Accessibility to Community Resources via Existing Bicycle Facilities in Miami-Dade County

Community Resources	500 feet	1/4 mile	1/2 mile	Total Facilities in Miami-Dade
Metrorail Stations[75]	13	16	18	23
Metromover Stations[76]	16	21	21	21
Metrobus Stops[77]	2,066	3,175	4,419	6,482
Municipal Parks[78]	204	301	422	563
County Parks[79]	98	130	211	397
Private Schools[80]	268	458	633	974
Public Schools[81]	82	183	275	445
Hospitals[82]	15	21	24	37
Tri Rail Stations[83]	1	3	3	3
Brightline Stations[84]	1	2	2	2
Amtrack[85]	0	0	1	1

Source: SFRPC Analysis of Miami-Dade County Open Data Hub, 2025, https://gis-mdc.opendata.arcgis.com/.

[75]Miami-Dade County Open Data Hub, 2025.*Metrorail Stations*. Retrieved from: https://gis-mdc.opendata.arcgis.com/datasets/ee3e2c45427e4c85b751d8ad57dd7b16_0/explore

[76] Miami-Dade County Open Data Hub, 2025. *Metromover Stations*. Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/aec76104165c4e879b9b0203fa436dab_0/explore?location=25.774921%2C-80.191711%2C14.65

[77] Miami-Dade County Open Data Hub, 2025.*County and Muncipal County Bus Stops.* Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/1d22a8ad52784234b9443f3d7fdecade_1/explore?location=25.777485%2C-80.243198%2C11.93

[78] Miami-Dade County Open Data Hub, 2025.*Municipal Park Boundary.* Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/16fe02a1defa45b28bf14a29fb5f0428_0/explore?location=25.750850%2C-80.235561%2C11.88

[79] Miami-Dade County Open Data Hub, 2025.*County Parks Boundary.* Retrieved from https://gis-mdc.opendata.arcgis.com/search?q=county%20parks

[80] Miami-Dade County Open Data Hub, 2025.*Private Schools.* Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/7fecb87ea1b1494eb2beb13906465de9_0/explore?location=25.707296%2C-80.462915%2C10.45

[81] Miami-Dade County Open Data Hub, 2025.*Public Schools.* Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/d3db0fce650d4e40a5949b0acae6fe3a_0/explore?location=25.705805%2C-80.314781%2C10.46

[82] Miami-Dade County Open Data Hub, 2025.*Hospitals.* Retrieved from https://gis-mdc.opendata.arcgis.com/datasets/0067a0e8b40644f980afa23ad34c32c4_0/explore?location=25.693681%2C-80.314258%2C10.39

[83] SFRPC GIS Records, 2025

[84] SFRPC GIS Records, 2025

[85] SFRPC GIS Records, 2025

Utilizing data from the 2020 Decennial Census and the Environmental Protection Agency (EPA), the population within 500 feet, a quarter mile, and half mile buffer of a bicycle facility was calculated. Census block group data were overlayed with census blocks identified by the EPA to have a higher proportion of negative health outcomes, low incomes, limited or no access to personal vehicles, and lower access to community assets such as transit and parks. These census blocks are referred to as "*population with limited resources*." The results in **Table 2.7** outline the number and percentage of residents with access to an existing bicycle facility. Overall, 40% of Miami-Dade's population is within a quarter mile and 63% is within a half mile of at least one form of bicycle facility (i.e., paved paths, trails, bike lanes, shared use lanes, wide curb lanes, and paved shoulders).[86] The population with limited resources would benefit from additional access to bicycle facilities. Currently, 32% of the limited resource population is within a quarter mile and 50% within a half mile of a bicycle facility.

Table 2.7: Miami-Dade County Population Accessibility to Existing Bicycle Facilities From Place of Residence

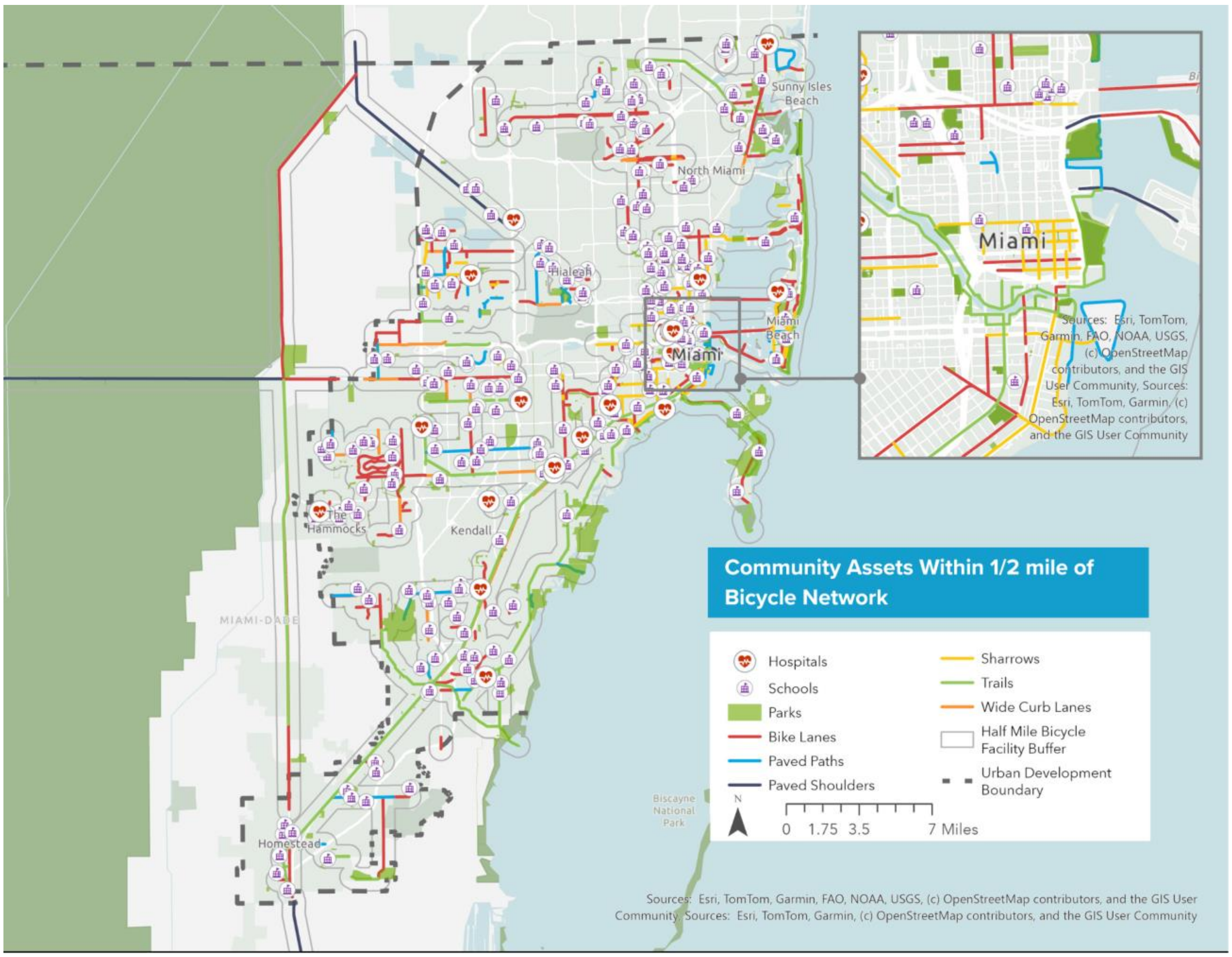
Distance	Population	% of Population	Population with Limited Resources	% of Population with Limited Resources
500 feet	909,909	34%	710,225	33%
Within a ¼ Mile	1,089,141	40%	856,715	32%
Within a ½ Mile	1,714,712	63%	1,344,924	50%
Total Population	2,701,767	100%	2,153,221	80%

Source: SFRPC analysis of U.S. Census Bureau. "TOTAL POPULATION." *Decennial Census, DEC 118th Congressional District Summary File, Table P1*, 2020, https://data.census.gov/table?q=population&g=050XX00US12086$1500000

[86] SFRPC analysis of U.S. Census Bureau. "TOTAL POPULATION." *Decennial Census, DEC 118th Congressional District Summary File, Table P1*, 2020, https://data.census.gov/table?q=population&g=050XX00US12086$1500000

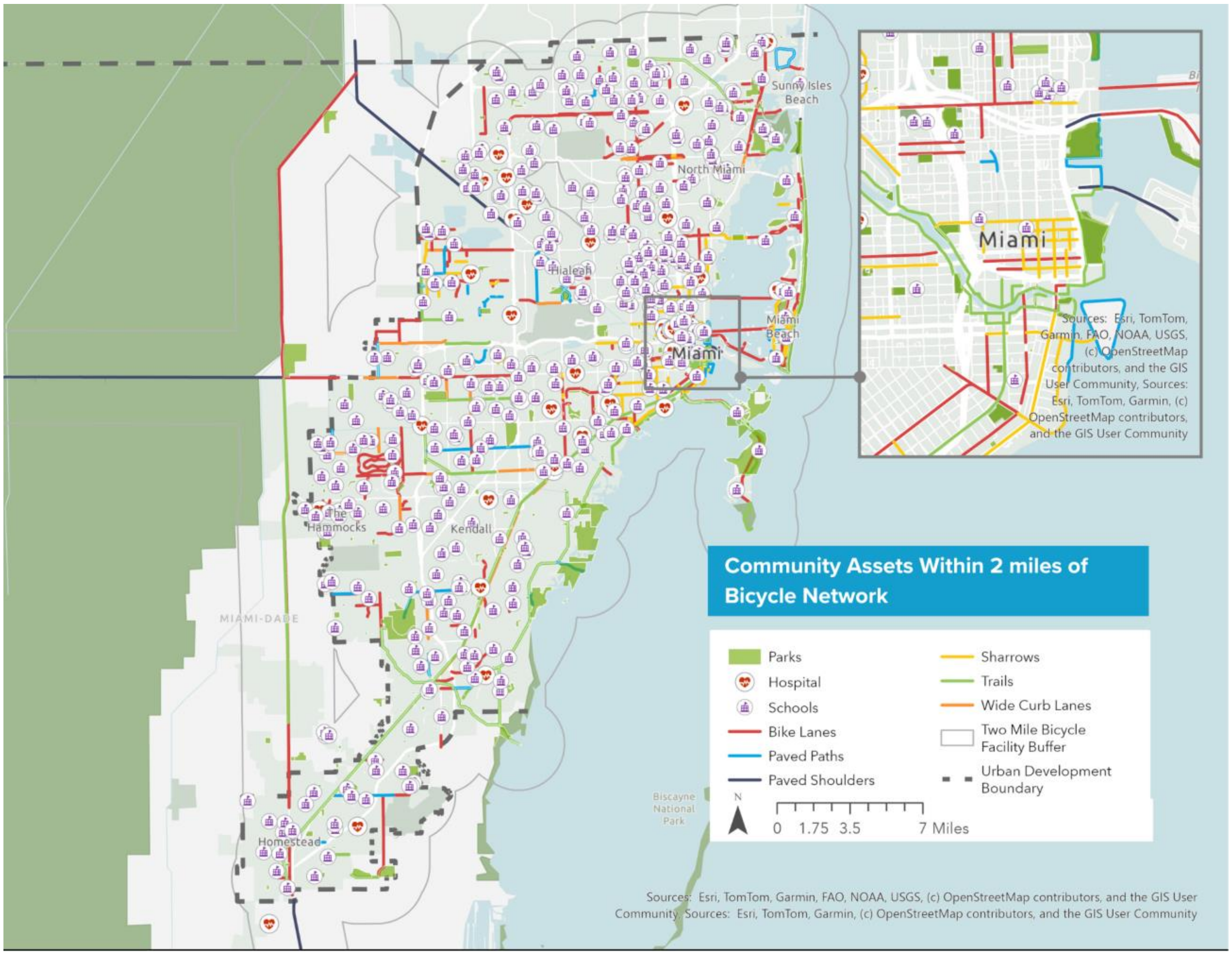
Figure 2.21 and **Figure 2.22** visualize the community assets, such as schools, hospitals, and parks, accessible via existing bicycle facilities within a half mile and two-mile biking shed. As mentioned in **Table 2.6**, there are 633 private schools, 275 public schools, 24 hospitals, 422 municipal parks, and 211 county parks within half a mile of existing facilities. Areas without bicycle access to community assets include the City of Miami Gardens, North Miami, Hialeah, and Opa-Locka. Almost all community assets are accessible within a two-mile biking shed, except for a small area within Hialeah in Northern Miami-Dade.

Figure 2.21: Community Assets Within Half Mile of Bicycle Network



Source: SFRPC Analysis of Miami-Dade County Open Data Hub, 2025, https://gis-mdc.opendata.arcgis.com/..

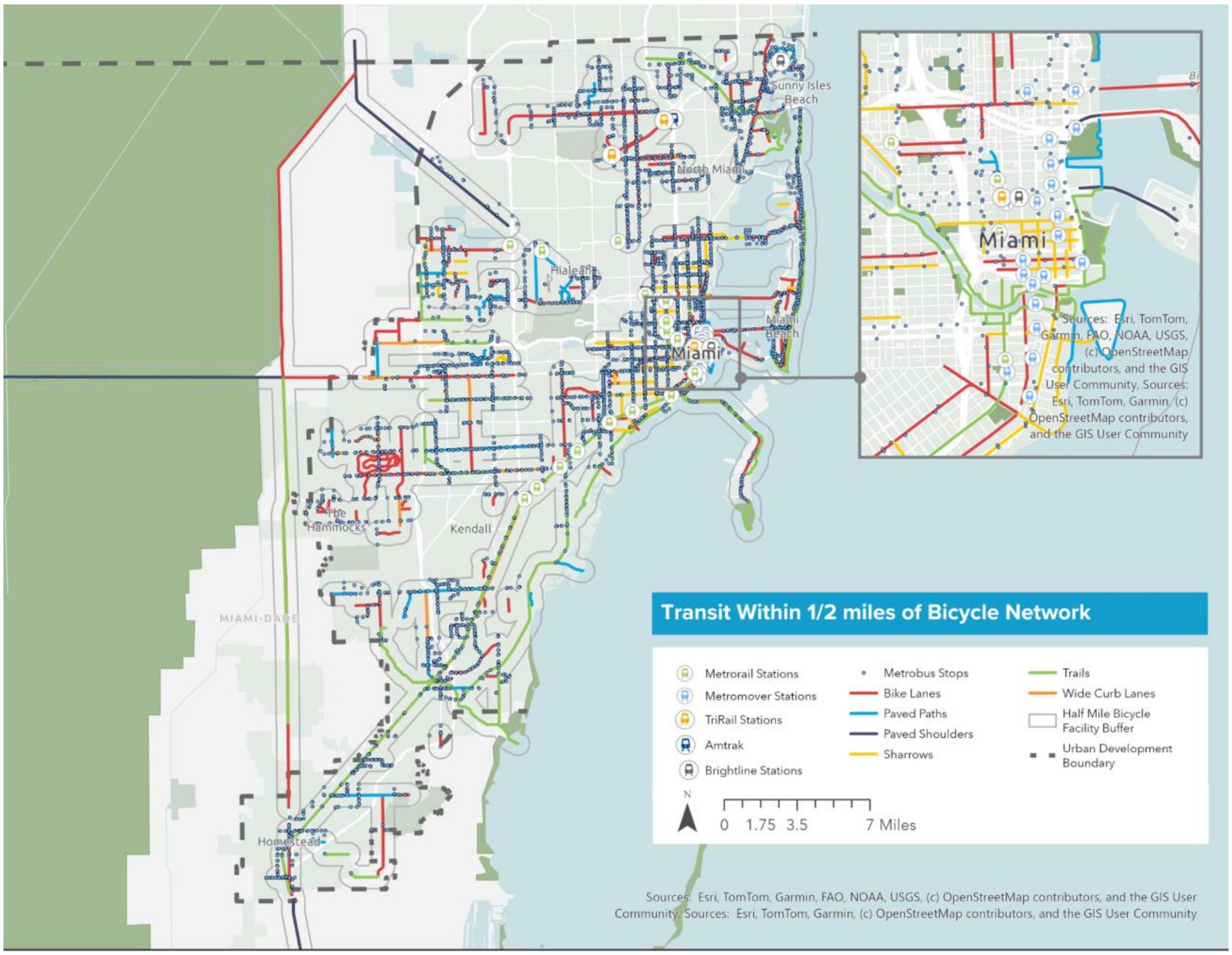
Figure 2.22: Community Assets Within Two Miles of Bicycle Network



Source: SFRPC Analysis of Miami-Dade County Open Data Hub, 2025, https://gis-mdc.opendata.arcgis.com/..

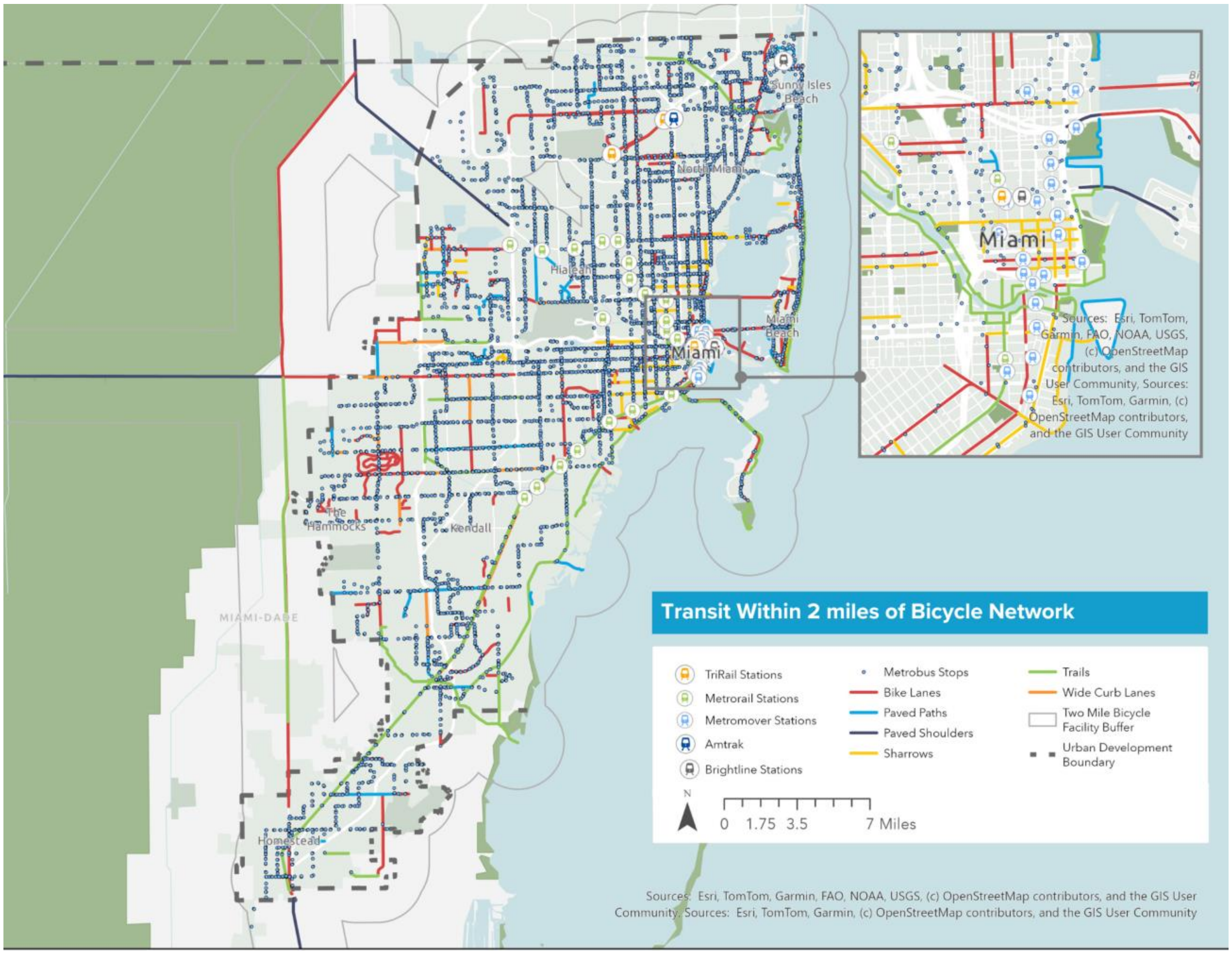
Figure 2.23 and **Figure 2.24** display Transit including Metrobus, Metrorail, Metromover, Tri-Rail, Amtrack, and Brightline Stations available to residents in a half mile and two-mile bicycle shed of existing bicycle facilities. Many transit resources are accessible via bicycle facilities with 23 Metrorail stations, XX Metromover stations, 4,419 Metrobus stops, and all Tri-Rail, Brightline, and Amtrack stations accessible within a half mile. Similar to accessibility to community assets, most transit options are available to Miami-Dade residents except for Metrobus stations within a small area of Hialeah.

Figure 2.23: Transit Within Half Mile Buffer of Bicycle Network



Source: SFRPC Analysis of Miami-Dade County Open Data Hub, 2025, https://gis-mdc.opendata.arcgis.com/..

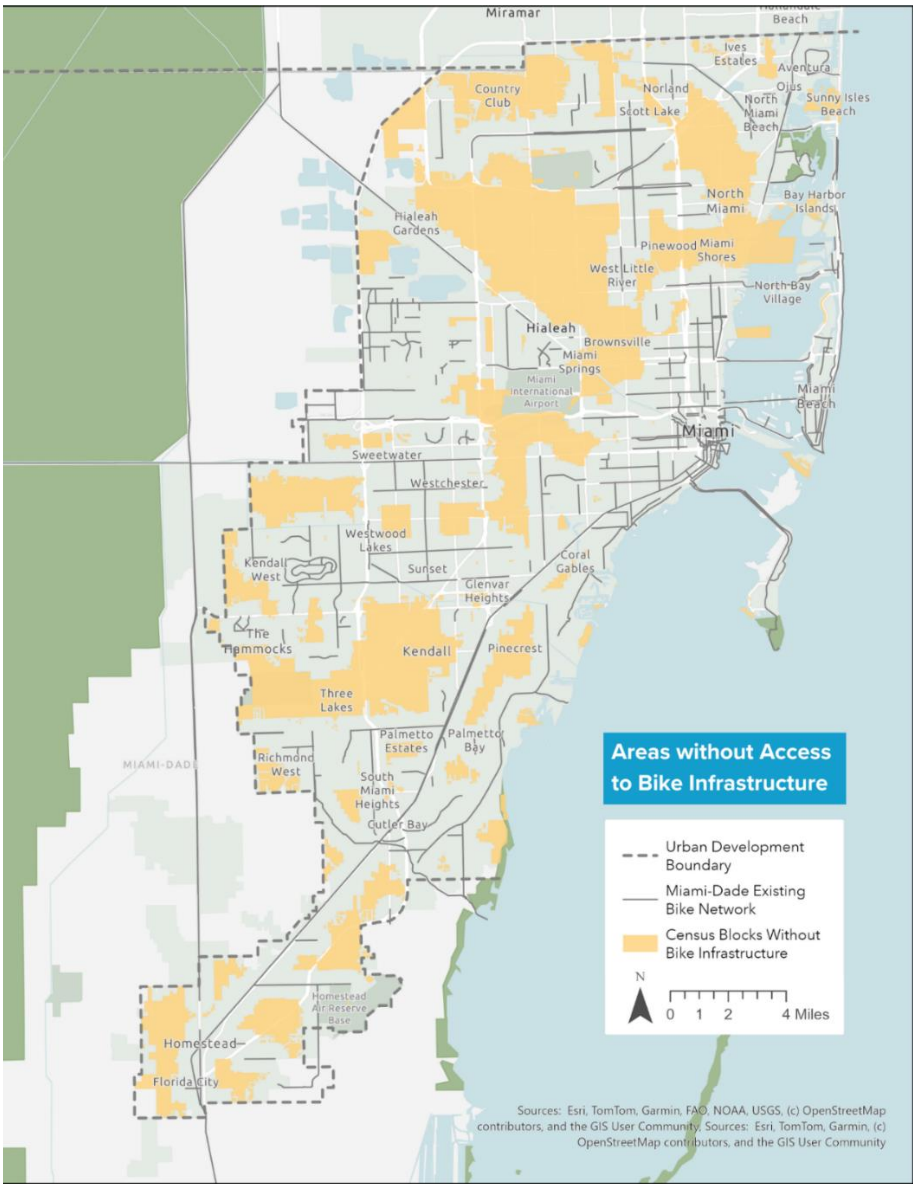
Figure 2.24: Transit Within Two Mile Buffer of Bicycle Network



Source: SFRPC Analysis of Miami-Dade County Open Data Hub, 2025, https://gis-mdc.opendata.arcgis.com/..

Figure 2.25 identifies neighborhoods further than a half mile from a bicycle facility. Within the Urban Development Boundary, North Miami, Hialeah Gardens, and Homestead would benefit from additional bicycle improvements due to the low proportion of bicycle infrastructure. Additionally, pockets of unincorporated west Miami-Dade County including Three Lakes, Kendall, and Westwood Lakes are outside of the existing bicycle network.

Figure 2.25 Areas without Access to a Bike Infrastructure



Source: SFRPC analysis of U.S. Census Bureau. "TOTAL POPULATION." *Decennial Census, DEC 118th Congressional District Summary File, Table P1*, 2020, https://data.census.gov/table?q=population&g=050XX00US12086$1500000https://data.census.gov/table?q=population&g=050XX00US12086$1500000

2.4 Vulnerable Population Impacts

In Miami-Dade County, demographic patterns reveal distinct vulnerabilities among those involved in bicycle and pedestrian crashes. Adults 65 and older experience the highest rates of bicycle fatalities, highlighting increased risk for older riders, who may be more susceptible to severe outcomes in crashes.[87] At the same time, younger adults aged 25 to 34 represent a disproportionately high share, about 18%, of all bicycle and pedestrian injuries in 2024. This suggests that while older adults are more likely to die in crashes, younger riders are more frequently injured, possibly due to higher exposure through recreational or school-related travel. Gender disparities are also significant. Men are six times more likely to die in a bicycle crash than women and five times more likely to be injured.[88] These differences may be linked to behavioral factors such as higher ridership rates among men, risk-taking tendencies, or greater exposure during peak traffic conditions.

Geography further compounds these risks. A striking 80% of bicycle fatalities occur in urban areas, resulting from Miami-Dade's predominantly car-oriented environment and high vehicle speeds.[89] The dense, high-speed roadway network and limited protected infrastructure for non-motorized users place vulnerable road users at greater risk, especially in heavily trafficked urban corridors where pedestrian and cyclist visibility and safety are compromised.

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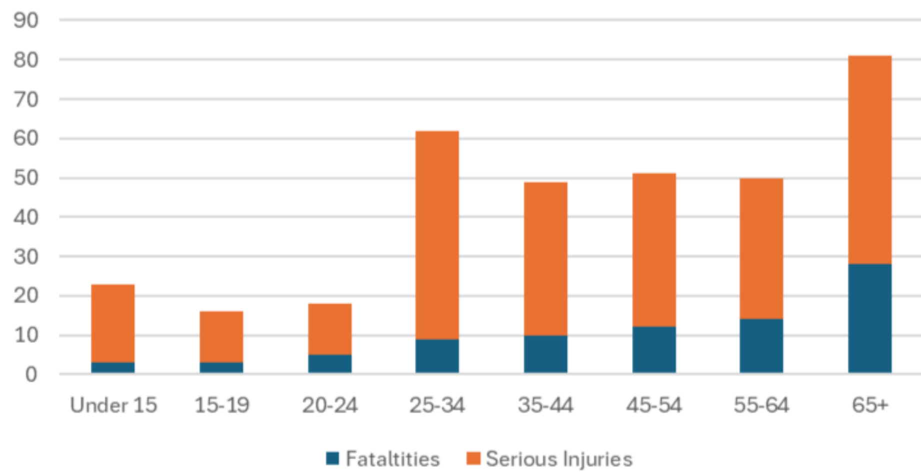
[87] Signal Four Analytics. Bicycle and Pedestrian Crashes by Age Group. Miami-Dade County. https://signal4analytics.com/. Accessed June 30, 2025.

[88] CDC. "Bicycle Safety." *Pedestrian, Bicycle, and Motorcycle Safety*, 28 May 2024, www.cdc.gov/pedestrian-bike-safety/about/bicycle-safety.html. Accessed 30 June 2025.

Figure 2.26: Bicycle and Pedestrian Crashes by Age, Miami-Dade County, 2024

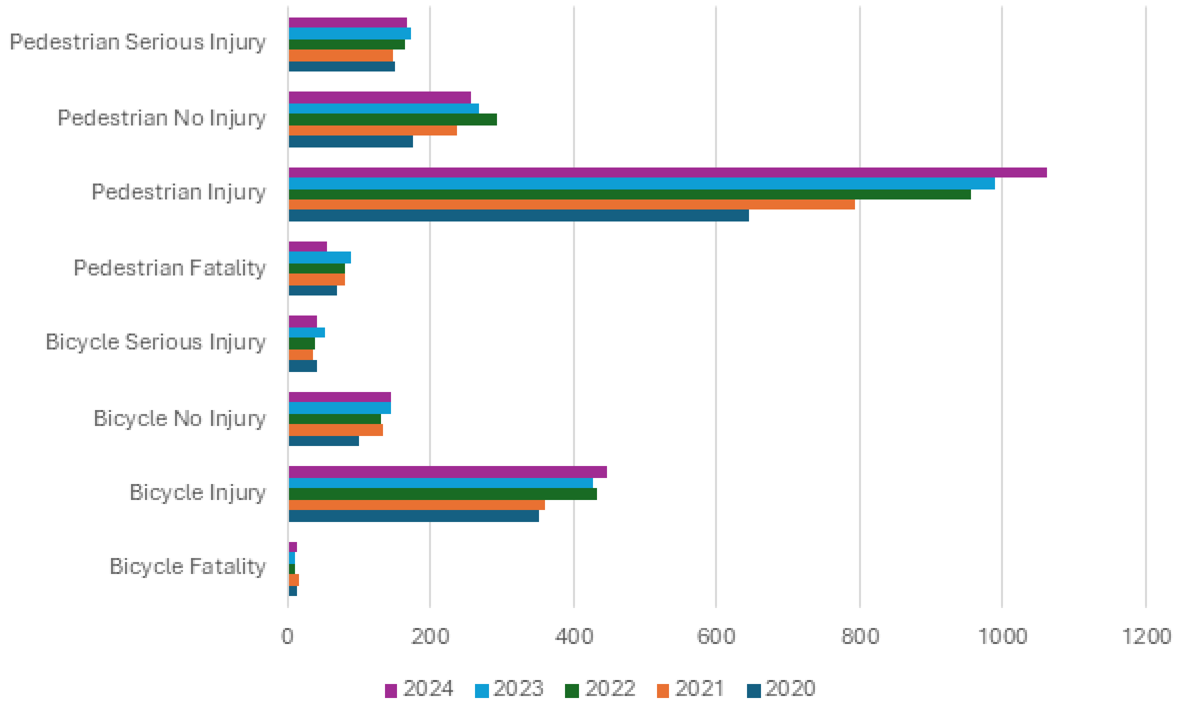


Source: Signal Four Analytics. Bicycle and Pedestrian Crashes. Miami-Dade County. https://signal4analytics.com/.

2.5 Crash Trends and Safety Data

Florida Highway Safety and Motor Vehicles records show a consistent increase in bicycle and pedestrian crashes in Miami-Dade County between 2020 and 2024, as shown in Figure 2.26. Pedestrian crashes rose 53 percent, from 1,221 to 1,873, and injuries climbed from 960 to 1,503. Bicycle crashes grew 27 percent over the same period, with injuries rising from 352 to 445. Notably, pedestrian fatalities fell by about 10 percent, dropping from 101 deaths in 2023 to 75 in 2024, coinciding with recent crosswalk upgrades, lower speed limits, and better lighting. These data indicate expanding exposure for people walking and cycling and underscore the need to accelerate proven safety measures.

Figure 2.27: Bicycle and Pedestrian Crashes, Miami-Dade County, 2020-2024

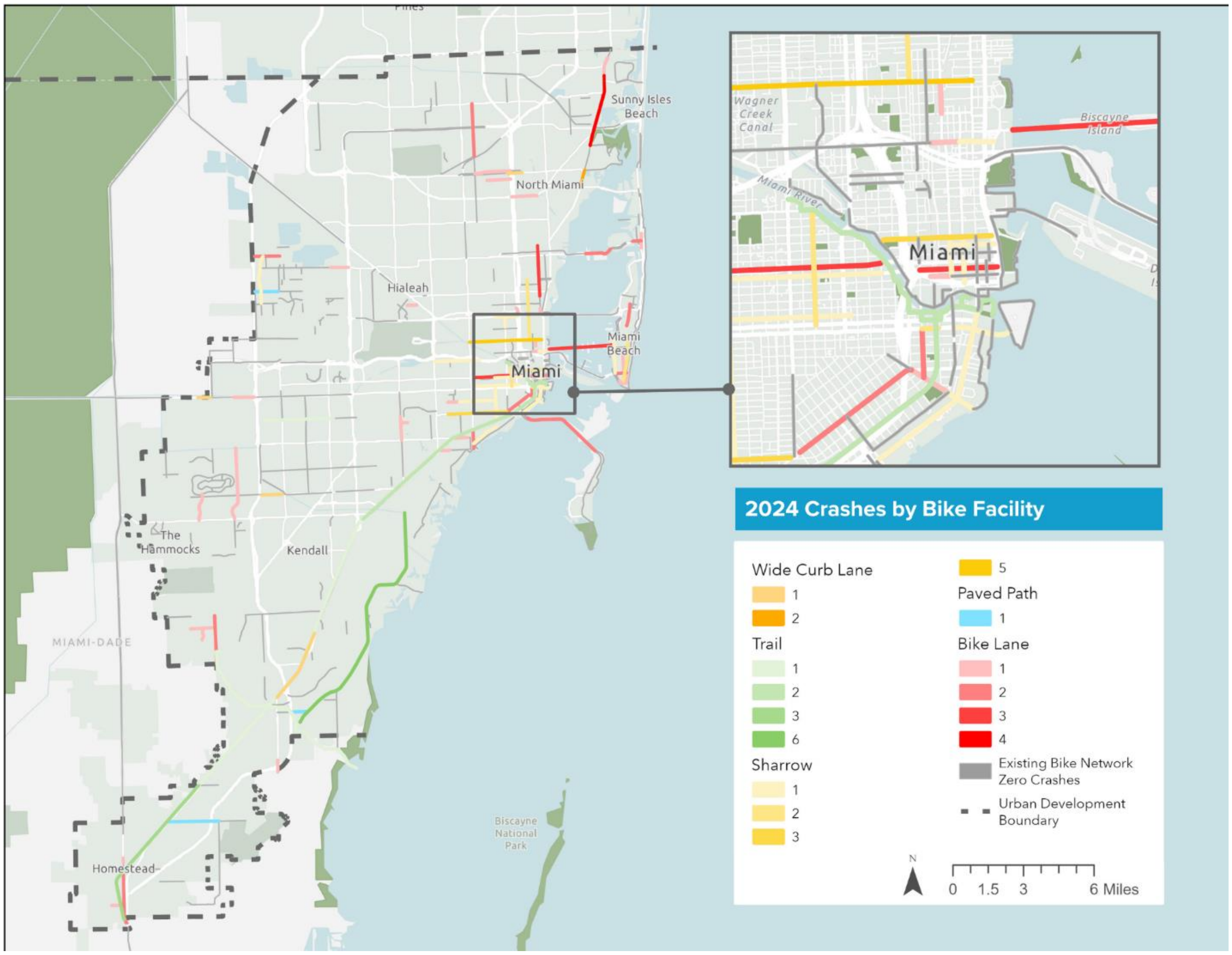


Source: Florida Highway Safety and Motor Vehicles Crash Dashboard, 2025.

In summary, both bicyclists and pedestrians are facing a growing risk of being involved in traffic incidents in Miami-Dade County. The consistent rise in crash and injury counts underscores a need for more aggressive safety interventions. However, the recent decline in pedestrian fatalities is a positive signal that targeted safety efforts may be having an effect. Sustaining and expanding those efforts, especially in the face of rising exposure, will be critical for reversing these trends.

Figure 2.27 illustrates crashes involving bicyclists and motorists along the existing bicycle network in 2024. Each bicycle facility is symbolized by the number of crashes recorded and varies by color intensity; high color intensity correlates with a greater number of recorded crashes. Bicycle facilities in gray have zero recorded crashes in 2024. Crashes along the existing bicycle network are highest on shared roads, and unprotected bike lanes along heavily trafficked roadways in urbanized areas, where vehicle and bicyclist interactions are more common than on low-traffic suburban roads. Interventions such as fixed barriers protecting bike lanes and pedestrian-activated signals at intersections reduce the risk of collisions between motorists and cyclists.[90]

Figure 2.28: 2024 Crashes by Bike Facility



Source: SFRPC analysis of Signal 4 2024 Bicycle Crash Reports, 2025.

Integral to expanding opportunities for cyclists is ensuring safety among existing facilities. **Figure 2.28** displays a heatmap of crashes between bicyclists and motorists in 2024. North Miami-Dade has a greater density of bicycle crashes potentially, resulting from a lower level of bicycle infrastructure and high vehicle speeds. Additionally, the City of Homestead, a rural but rapidly developing municipality, experienced a high density of bicycle crashes within its boundaries.

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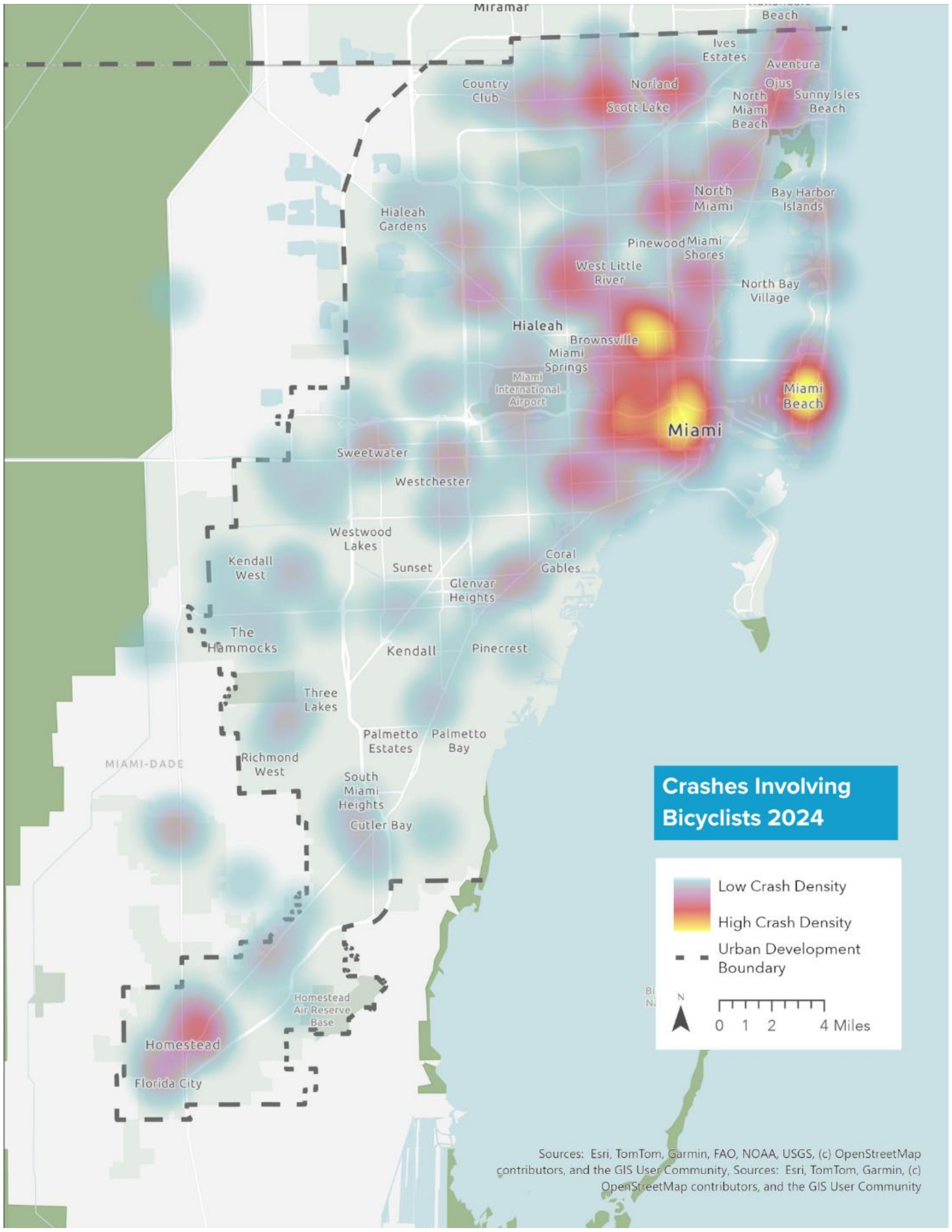
[90] Miami-Dade (2016). Complete Streets Design Guidelines. https://www.miamidade.gov/neatstreets/library/complete-streets-design-guidelines.pdf

Figure 2.29: Crashes Involving Bicyclists 2024



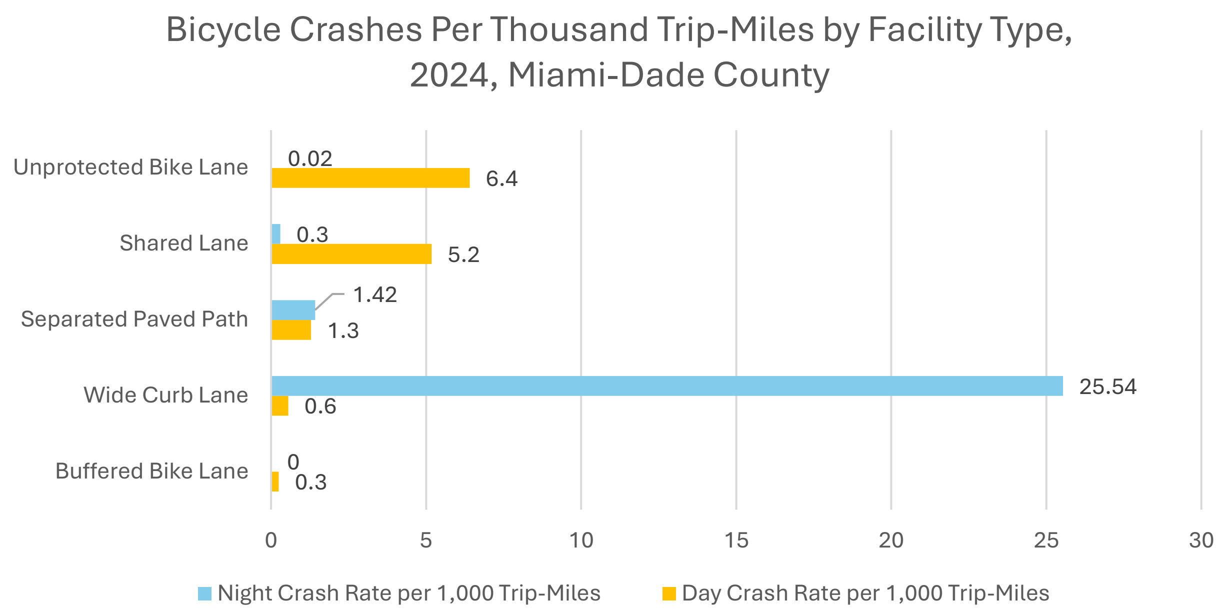
Source: SFRPC analysis of Signal 4 2024 Bicycle Crash Reports, 2025.

2.6 Bicycle Facility Analysis: Which are the Safest Facility Types

This section presents findings from a comparative safety analysis of bicycle facility types across selected corridors in Miami-Dade County. The objective was to determine which types of bicycle infrastructure are associated with the lowest relative crash risk, using a statistically robust, exposure-adjusted framework, described in the Appendix. The analysis relied on recorded crash data involving bicyclists and categorized each incident by facility type.

This chart displays the estimated number of bicycle-involved crashes per 1,000 trip-miles by facility type, disaggregated by day and night conditions for non-junction locations in Miami-Dade County in 2024, based on Signal 4 crash data A frequency analysis of the data to present results was conducted in Figure 2.29. With a larger sample size, a more detailed statistical analysis can provide more insight. For these results, the data highlight substantial variation in safety performance across facility types and between lighting conditions.

Figure 2.30: Crashes Per Thousand Trip-Miles with No Intersection in 2024



Source: SFRPC Analysis of Signal 4 Data, 2025.

This analysis compares bicycle crash rates per 1,000 trip-miles across five major facility types during day and night conditions, using disaggregated crash-level data linked with trail and street segment trip counts and lengths. The crash risk metric normalizes crash frequency by exposure, enabling a valid comparison of safety performance across infrastructure types regardless of usage levels or segment lengths.

The results reveal substantial variation in safety outcomes both by facility type and by lighting condition:

- Buffered Bike Lanes exhibit the lowest crash rate during the day, with 0.25 crashes per 1,000 trip-miles, and no crashes reported at night in this dataset. This suggests buffered lanes provide a high level of protection and visibility.

- Wide Curb Lanes show a moderate daytime crash rate (0.56), but a higher nighttime crash rate (25.54), more than 45 times higher than during the day. This indicates a substantial vulnerability for cyclists in shared roads with motor vehicles under low-visibility conditions.
- Separated Paved Paths, often considered among the safest facilities, have 1.29 crashes per 1,000 trip-miles during the day and a slightly higher rate at night (1.42). These rates suggest generally consistent safety performance regardless of time of day, likely due to their separation from vehicular traffic.
- Shared roads demonstrate a significantly higher crash risk in the day (5.18), but this drops markedly at night to 0.30, possibly due to lower nighttime cyclist or vehicle volumes in shared-use environments.
- Unprotected Bike Lanes, marked lanes adjacent to traffic with no physical barrier, have the highest daytime crash rate at 6.41 crashes per 1,000 trip-miles. Notably, their nighttime crash rate is extremely low (0.02), possibly reflecting lower ridership or underreporting at night.

These findings support key conclusions:

- Physically separated or buffered facilities (e.g., Buffered Bike Lanes, Separated Paved Paths) generally yield safer outcomes than on-road lanes with no physical separation.
- Crash risk during night conditions is particularly elevated in shared facilities like Wide Curb Lanes, which lack dedicated space or visual separation for cyclists.
- The counterintuitive decrease in crash rates for some facilities at night may reflect reduced exposure, visibility-related risk aversion by cyclists, or reporting bias.

Given these patterns, infrastructure upgrades should prioritize physical protection and visibility, especially for corridors with heavy nighttime cycling activity or poor ambient lighting. Moreover, facilities like Wide Curb Lanes may require lighting improvements, traffic calming, or conversion to protected lanes to reduce crash risk during off-peak hours.

2.6.1. Infrastructure-Driven Risks and Countermeasure Effectiveness

A 2008 study found that high-crash zones like South Beach, Liberty City, Little Havana, and Little Haiti, representing about 1% of land area but 20% of crashes share characteristics: missing/broken sidewalks, speed limits greater than 40 mph, faded crosswalks, and lack of protected bike lanes.[91] Approximately 21% of bicyclists killed in crashes had a blood alcohol content (BAC) of 0.01% or greater, indicating that impairment contributes to bicycle fatalities even at levels below legal intoxication (NHTSA, 2021).[92] Targeted safety measures, such as high-visibility crosswalks, protected bicycle lanes, and reduced speed limits, have been demonstrated to decrease pedestrian crashes by approximately 8% to 13% annually (FHWA Pedestrian and Bicycle Safety Reference Tool, 2014).[93]

[91] Zegeer, Charles et al. 2008. "Evaluation of Miami–Dade Pedestrian Safety Demonstration Project" Transportation Research Record: Journal of the Transportation Research Board, No. 2073, Transportation Research Board of the National Academies, Washington, D.C., pp. 1–10. DOI: 10.3141/2073-01

[92] Traffic Safety Facts. 2023. https://crashstats.nhtsa.dot.gov/Api/Public/Publication/813484. Accessed July 21, 2025.

[93] FHWA Pedestrian and Bicycle Safety Reference Tool Database. https://highways.dot.gov/media/9936. Accessed July 21, 2025.

Chapter 3: Health Impact Assessment and Benefit-Cost Analysis

This section presents a Health Impact Assessment (HIA) estimating the potential health and economic benefits of increased walking and cycling in Miami-Dade County. An HIA is a systematic process that evaluates the potential health effects of a policy, program, or project on a population, especially vulnerable groups, and provides recommendations to enhance health outcomes and mitigate adverse effects.[94] This analysis builds on a public health modeling approach originally developed using the National Household Travel Survey and case study data from Raleigh, North Carolina (Mansfield and Gibson, 2016). It has been adapted with Miami-Dade-specific inputs (see Section 1.5.8 for details on the original study) to assess the potential benefits of shifting more trips to active transportation, particularly walking and biking. The updated model evaluates how increased active transportation can contribute to improved public health outcomes, including reductions in chronic disease risks, enhancements in community well-being, and overall mortality-related cost savings.

This methodology, expanded upon the Appendix to this report, integrates baseline assumptions about transportation-related physical activity (TPA) with a dose-response function that correlates with increased TPA reductions in all-cause mortality. To quantify these health benefits, the approach applies economic valuation based on the U.S. Department of Transportation's Value of a Statistical Life (VSL), set at $13.7 million.[95] Physical activity is measured in MET-hours (Metabolic Equivalent Task-hours), which account for both intensity and duration. For example, one hour of moderate-intensity walking (approximately 3.5 METs) equals 3.5 MET-hours.

3.1 Health Impact Assessment

Five hypothetical scenarios of increased active transportation were modeled in this section. These include general increases of 1%, 3%, and 5% in walking and biking across the adult population, as well as mode shifts in which 1% or 2% of solo car commuters switch to cycling. For each scenario, the model estimates the number of premature deaths avoided and monetizes the resulting health benefits using VSL values.

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[94] National Research Council. (2011). *Improving health in the United States: The role of health impact assessment*. National Academies Press.

[95] Departmental Guidance on Valuation of a Statistical Life in Economic Analysis | US Department of Transportation. Accessed May 8, 2025.

In this analysis, health benefits of pedestrian and bicycle safety improvements are quantified using only the VSL, rather than including both VSL and the monetized value of avoided injuries. This decision is grounded in several methodological considerations aimed at ensuring conceptual clarity and analytical consistency, which are discussed further in the Appendix.

The VSL is a well-established economic measure used to value small reductions in the risk of fatality, based on individuals' willingness to pay for those risk reductions. It captures not only the expected value of life saved but also the broader disutility associated with the risk of death, including pain, suffering, and risk aversion. As such, VSL serves as a comprehensive welfare-based measure of the benefits associated with fatality risk reductions.

One of the key reasons for excluding separate injury cost estimates is to avoid the risk of double-counting benefits. In many real-world contexts, especially in studies where VSL estimates are derived from data that include both fatal and severe nonfatal risk contexts (such as worker compensation or travel risk), the valuation may already reflect concerns about serious injuries. Adding injury-related costs to a benefit stream that already includes VSL can therefore inflate total benefits unless the underlying methodologies are clearly separable, which is rarely the case in transportation safety studies.

A second consideration is the variability and uncertainty associated with injury data and cost estimates. Injury reporting is often inconsistent, and severity levels can be difficult to assign with confidence, particularly in non-motorized crash datasets. In contrast, the VSL follows U.S. DOT guidance, offering a standardized and policy-relevant measure that enhances comparability across projects and over time. The methodology involved several key steps.

Baseline Assumptions:

- The adult population of Miami-Dade County (2025) was estimated at 2,673,300.[96]
- Baseline transportation physical activity (TPA) was assumed to be 1.2 MET-hours per week per adult, consistent with the Raleigh case study by Mansfield and Gibson (2016).
- Annual premature deaths were estimated at 218 per 100,000 adults, resulting in approximately 4,650 deaths annually countywide.[97]
- The dose–response relationship between active transportation and reduced mortality risk was modeled using the Relative Risk (RR) function: RR(TPA) = 0.90^(TPA/11.25).[98]
- The U.S. Department of Transportation's VSL was set at $13.7 million to quantify economic benefits.

Scenarios Analyzed:

Scenarios 1-3: Adult age (18-64) increases in walking and cycling of 1%, 3%, and 5% for all adults. **Scenarios 4-5:** A targeted mode shift scenario where 1% of Miami-Dade County commuters switched from driving to cycling (Scenario 4) and a 2% mode shift (Scenario 5).

Table 3.1 presents the health and economic benefits associated with increased active transportation under five distinct scenarios analyzed for Miami-Dade County. Scenarios 1 through 3 illustrate broad-based increases in physical activity levels among all adults aged 18-64, modeled at incremental enhancements of 1%, 3%, and 5% in weekly walking and cycling habits. Under these scenarios, the incremental rise in activity, quantified in Metabolic Equivalent Task-hours per week (MET-h/week), results in progressively higher reductions in mortality rates, from approximately 0.5 avoided deaths annually in the 1% scenario to 2.6 deaths annually in the 5% scenario.

As such, these improvements translate into annual economic benefits ranging from $6.9 million at the lowest increment to $35.6 million at the highest. In contrast, Scenarios 4 and 5 explore targeted commuting mode shifts, specifically the replacement of driving trips with cycling commutes among Miami-Dade workers. Even modest shifts produce substantial impacts, with a 1% transition from driving to cycling, yielding 5.2 avoided deaths per year and annual economic gains estimated at $71.2 million. Doubling this shift to 2% further amplifies the benefits to 10.4 avoided deaths annually and $142.5 million in yearly economic value.

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[96] bebr.ufl.edu/wp-content/uploads/2024/01/projections_2024.pdf. 2025 estimate. Accessed May 8, 2025.

[97] Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death, 1999–2022 Request. CDC WONDER Online Database. Released 2023. https://wonder.cdc.gov/ucd-icd10.html. Accessed April 12, 2025.

[98] Mansfield and Gibson, 2016.

Table 3.1: Active Transportation Impact Scenarios on Avoided Deaths and Economic Benefits

Active Transportation Scenario	Δ TPA/adult	Avoided Deaths/year	Economic Benefit/year
All adults (+1%) Walk/Cycle	0.012 MET-h/week	0.5 deaths	$6.9 M
All adults (+3%) Walk/Cycle	0.036 MET-h/week	1.6 deaths	$21.9 M
All adults (+5%) Walk/Cycle	0.060 MET-h/week	2.6 deaths	$35.6 M
1% Commuters Switch to Cycling	0.12 MET-h/week	5.2 deaths	$71.2 M
2% Commuters Switch to Cycling	0.24 MET-h/week	10.4 deaths	$142.5 M

Source: SFRPC adaptation of the Manfield and Gibson (2016) methodology, 2025.

Findings:

Modest increases in active transportation yielded incremental reductions in mortality risk and corresponding economic benefits. Specifically:

- A 1% increase resulted in approximately 0.5 fewer premature deaths annually, valued at $6.9 million.
- A 3% increase prevented roughly 1.6 deaths per year, translating to an economic benefit of $21.9 million annually.
- A 5% increase avoided about 2.6 deaths annually, equivalent to $35.6 million per year.

On the other hand, the targeted shift of 1% of commuters from driving to cycling generated more substantial health benefits due to significantly increased physical activity for a subset of the population. This scenario resulted in an estimated 5.2 fewer premature deaths per year, valued at approximately $68.1 million annually. More ambitiously, if 2% of commuters shift to cycling, benefits double.

Applying this approach to Miami-Dade County, it is estimated that implementing walkability improvements throughout the county could increase the average daily walking time by 17 minutes among residents who already walk for transportation (estimated at 59% of the population based on the Raleigh study).

The total economic value of these health benefits from added walking and cycling can reach **$862 million** over 25 years, with the largest share coming from avoided premature deaths. If just 1% of drive-alone commuters shifted to cycling to commute, the 25-year savings would be over **$1.7 billion**. However, there are limitations to this analysis, including:

- It only accounts for existing residents who already walk some amount for transportation
- It does not estimate impacts on residents who currently do not walk at all
- The estimates are based on the full implementation of bicycle and pedestrian improvements countywide

While hypothetical, this analysis demonstrates the substantial potential health and economic benefits that could result from policies and infrastructure investments to promote active transportation in Miami-Dade County. Further Miami-Dade specific data on mode choice and walking behaviors would be needed to produce more precise local estimates.

3.2 Economic Impacts of Avoided Premature Deaths

Using REMI PI+, an econometrically driven dynamic modeling tool, this analysis estimates the long-term economic gains associated with reductions in premature mortality in Miami-Dade County due to increased active transportation. Avoided deaths generate measurable benefits as surviving individuals contribute to ongoing economic activity, reflected in increased personal and disposable income over time. More information on the methodology is available in the Appendix.

As shown in **Table 3.2**, even modest shifts in active transportation, such as a 1% increase in cycling among adults, produce significant cumulative impacts, including $149.5 million in benefits over 25 years under the +1% scenario. Larger shifts, such as 2% of commuters switching to bicycles, yield more substantial gains, with an estimated $3.1 billion in 25-year benefits and annual job-equivalent increases of nearly 388 positions. These results underscore the economic value of public health improvements achieved through active transportation.

Table 3.2: Active Transportation Impact on Jobs, Personal Income, and Net Present Value

Active Transportation Scenario	Annual Average Job-Equivalents	Annual Average Personal Income	Annual Average Disposable Personal Income	25 Year Benefits ($2025 dollars)	Net Present Value (3% Discount Rate)
All adults (+1%)	18.7	$3.0 M	$2.7 M	$149.5 M	18.7
All adults (+3%)	59.9	$9.9 M	$8.9 M	$478.0 M	59.9
All adults (+5%)	97.4	$16.0 M	$14.5 M	$777.0 M	97.4
1% commuters switch to bike	193.4	$31.8 M	$28.7 M	$1,542.8 M	193.4
2% commuters switch to bike	388.4	$63.9 M	$57.7 M	$3,096.4 M	388.4

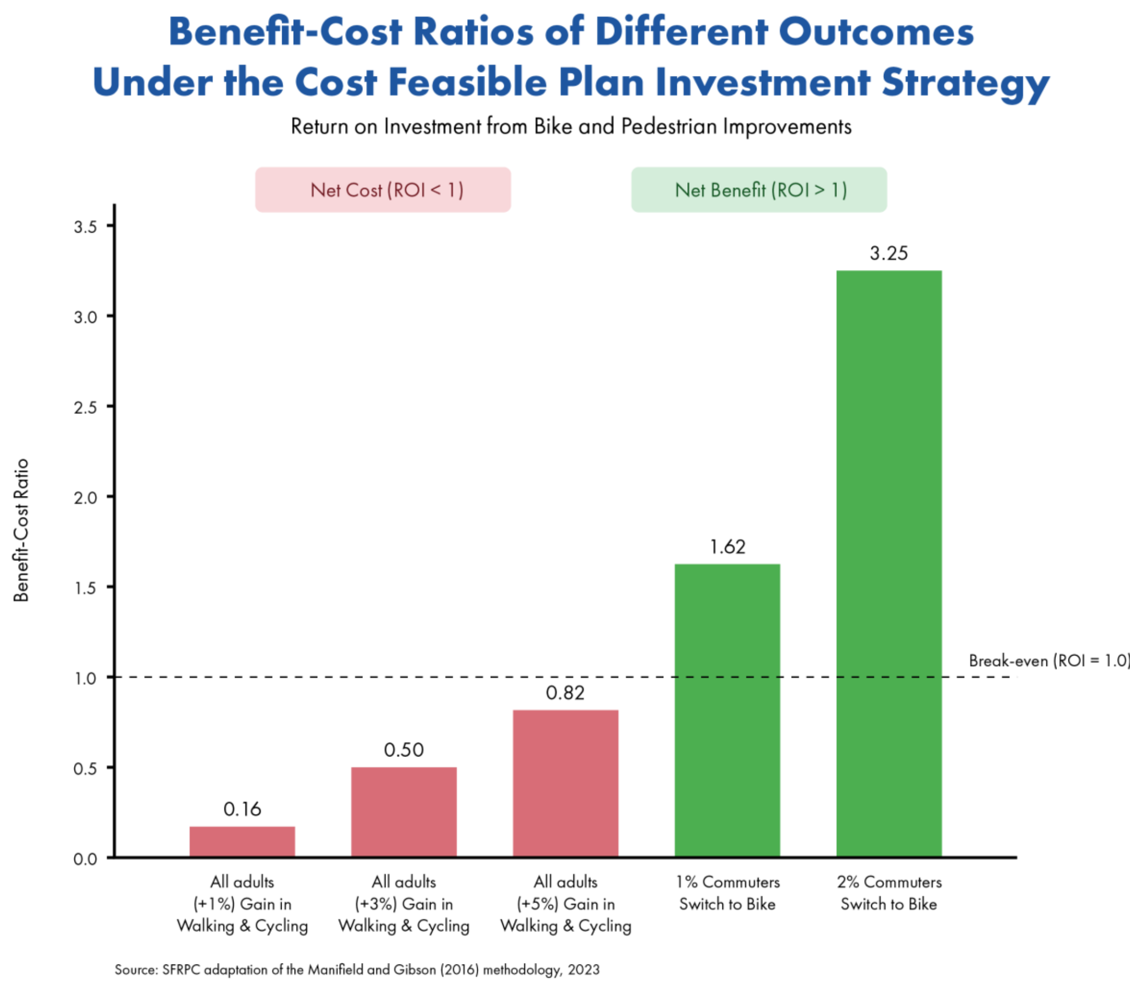
Source: SFRPC adaptation of the Manfield and Gibson (2016) methodology, 2025.

3.3 Benefit-Cost Analysis

Benefit-cost analysis (BCA) is an important tool for informed public sector decision-making. By systematically comparing the anticipated benefits and costs of proposed projects, BCA enables policymakers to prioritize initiatives that offer the greatest return on investment. This approach is particularly pertinent to the County's 2050 Long-Range Transportation Plan, which outlines a $1.367 billion investment in bicycle and pedestrian infrastructure over the next 25 years.[99] Discounted over the same period at 3%, the net present value of infrastructure investment costs is $952 million.

A Benefit Cost Analysis was conducted to compare the discounted cumulative benefits of active transportation investment in Miami-Dade County through 2025. **Figure 3.1** depicts the results of the Benefit-Cost Analysis scenarios.

Figure 3.1: 25-Year Benefit-Cost Ratios of Active Transportation Scenarios in Miami-Dade County.



Source: South Florida Regional Planning Council Analysis, 2025.

[99] miamidadetpolrtp2050.com/wp-content/uploads/2024/09/Fact-Sheet-5-2050-LRTP-DRAFT-COST-FEASIBLE-PLAN_Fact-Sheet_V4.pdf

The benefit-cost analysis reveals that investments in bicycle and pedestrian infrastructure can generate substantial health and economic returns, particularly under scenarios that assume significant shifts in commuting behavior. While modest increases in walking and cycling among all adults yield lower benefit-cost ratios, ranging from 0.12 to 0.63, more targeted and ambitious scenarios, such as a 1% or 2% mode shift from driving to cycling, produce positive economic returns. Specifically, the 2% commuter shift scenario yields a benefit-cost ratio of 2.50, indicating that for every dollar invested, the County could realize $2.50 in economic benefits just from avoided premature deaths.

Together, the ratios provide guidance on performance goal setting for infrastructure investment. If the overall performance goal is to provide a network that facilitates the increase of current levels of walking and biking by 1% over baseline conditions, then the investment may be worthy of reconsideration, from a VSL perspective. The analysis does support the view that using bicycle and pedestrian infrastructure investment to enable a small and credible commuter mode shift to bicycles will pay for itself, even with only minimal impacts on the overall performance of all modes across the County transportation system.

Chapter 4: Findings and Analysis

The findings of this study make a compelling case for continued and expanded investment in bicycle and pedestrian infrastructure in Miami-Dade County. Across four key areas, safety, mobility, health, and economic development, evidence demonstrates that non-motorized transportation infrastructure is both a public good and a cost-effective tool for advancing community well-being.

Safety impacts are perhaps the most urgent and measurable. Miami-Dade's pedestrian and cyclist fatality rates remain among the highest in the country, with Miami experiencing a 31% increase in pedestrian deaths between 2013–2017 and 2018–2022. However, the analysis also confirms that proven safety interventions, such as protected bike lanes, smart signals, and enhanced intersection designs, can reduce crash rates by up to 90%. Public perception data reinforce these findings: when users feel safer, they are more likely to choose walking or biking as a regular mode of travel. Design innovations like separated intersections, traffic-calming measures, and visual cues not only prevent injuries and deaths but also build public trust in the County's transportation system.

Mobility outcomes are equally clear. Enhanced bike and pedestrian access has improved first- and last-mile connectivity to transit hubs like the Golden Glades Multimodal Transportation Facility, has expanded safety through the construction of new bicycle paths, sidewalks, and walkways, linked neighborhoods to parks, recreational areas, the Tri-Rail, Broward County Transit (BCT), and the Miami-Dade Metrobus. These network effects are especially significant in communities with limited transportation options. By adding infrastructure within a half mile of schools, transit stops, and commercial centers, the County can substantially improve access for populations who rely on active transportation, including children, the elderly, and lower-income residents. The result is a safer transportation system that meets both utilitarian and recreational needs.

Health benefits are substantial and quantifiable. Regular walking and cycling are strongly associated with reduced rates of chronic illnesses such as cardiovascular disease, type 2 diabetes, and obesity. Even modest increases in physical activity can avert premature deaths and reduce healthcare costs. For example, shifting just a small portion of trips to cycling could prevent hundreds of annual deaths and yield millions in medical savings. These benefits accrue over time and scale with user adoption, positioning active transportation as a cost-effective public health intervention.

Finally, the economic impacts are both immediate and long-term. Investments in bicycle infrastructure generate measurable returns through increased property values, higher retail sales, and job creation. Retailers along safe cycling corridors report sales increases of up to 30%, and properties located within ¼ mile of advanced bike facilities have been shown to appreciate in value. Infrastructure construction and maintenance also support local employment. At the regional scale, enhanced accessibility created by these projects contributes to economic resilience by improving mobility for workers and reducing household transportation costs.

In sum, the integrated benefits of safety, mobility, health, and economic development affirm the rationale behind Miami-Dade's growing commitment to active transportation. These findings validate a shift toward designing transportation infrastructure that is safer, healthier, and more inclusive. By continuing to invest in and strategically deploy bike and pedestrian improvements, especially in areas with community investment needs, the County can realize long-term gains in equity, resilience, and prosperity. As the data show, bikeconomics is not merely an aspirational framework but a practical pathway to transform the built environment and enhance the quality of life for all Miami-Dade residents.

Chapter 5: Recommendations

This chapter offers a strategic roadmap for Miami-Dade County and its partners to advance the safety, health, and economic goals identified in this study. These recommendations reflect a synthesis of local data, national best practices, and the empirical findings detailed in preceding chapters. They focus on actionable steps across three domains: policy and investment, implementation strategies to maximize multi-dimensional benefits, and the future research and engagement efforts needed to sustain momentum and equity in planning.

5.1 Policy and Investment Recommendations

To support a robust and equitable active transportation network, Miami-Dade County should adopt the following policy and investment measures:

Prioritize Infrastructure in High-Injury Areas

Direct capital investments toward neighborhoods identified in the High Injury Network (HIN) and those with elevated social vulnerability scores. This includes Liberty City, Little Haiti, Opa-locka, and areas adjacent to transit-dependent populations.

Expand the Protected Bicycle Facility Network

Accelerate implementation of the 2050 Bicycle-Pedestrian Master Plan goal to construct 438.5 miles of protected or separated bike facilities. Prioritize connections to schools, transit hubs, parks, and employment centers to ensure infrastructure supports both commuting and recreational needs.

Institutionalize Policies for All Transportation Modes

Require all transportation projects, new construction and retrofits, to incorporate multiple modes of transportation such as biking, walking, and transit, ensuring safety and accessibility for all users regardless of age, ability, or mode of transport.

Create a Dedicated Non-Motorized Infrastructure Fund

Establish a permanent funding stream to support maintenance and expansion of bicycle and pedestrian facilities. Leverage public-private partnerships (PPPs) and developer contributions in rapidly growing districts to supplement funding.

Integrate Health Metrics into Project Evaluation

Adopt health impact metrics, such as avoided premature deaths, DALYs, and chronic disease risk reduction, into benefit-cost analysis frameworks used for infrastructure prioritization and capital planning.

5.2 Strategies to Maximize Safety, Health, and Economic Benefits

To ensure that the built environment delivers on its full potential across all benefit domains, the County and its municipal partners should consider the following implementation strategies:

Deploy Context-Sensitive Safety Enhancements
Implement protected intersections, raised crossings, and pedestrian-activated signals at high-crash corridors and intersections. Tailor design features to road context (urban vs. suburban) and user vulnerability (children, elderly, people with disabilities).

Enhance First/Last Mile Connections
Provide safe and secure facilities linking neighborhoods to major transit hubs, including secure bicycle parking, midblock crossings, and wayfinding. Expand bike-share integration at Metrorail, Metromover, Brightline, Tri-Rail, and existing and future SMART Program stations.

Target Business Districts for Economic Revitalization
Prioritize bike lane and pedestrian upgrades in commercial corridors (e.g., Downtown Miami, Coral Gables, South Miami) where foot traffic can generate strong returns for small businesses. Promote these investments through business improvement districts and merchant associations.

5.3 Recommendations for Further Research and Stakeholder Engagement

As the County moves toward implementation, additional research and engagement are essential to monitor outcomes, build public support, and refine approaches:

Develop a Countywide Bicycle and Pedestrian Performance Dashboard
Track and publicly report safety, health, and economic metrics (e.g., crashes, user counts, retail sales, VMT reductions) by corridor. Integrate with Vision Zero and Capital Improvements dashboards to promote transparency.

Pilot Active Travel Surveys and User Behavior Studies
Conduct recurring intercept and household travel surveys to better understand non-motorized trip purposes, barriers to use, and willingness to shift from car travel. Partner with universities and health departments for data analysis.

Study Housing Impacts of Infrastructure Investments

Conduct hedonic price modeling and risk assessments to evaluate the effects of new trails and bike lanes on property values and rents. Develop strategies and coordinate with residents to avoid potential adverse impacts.

Update the Health Impact Assessment at Five-Year Intervals

Incorporate new user data, health outcomes, and mortality reduction statistics to quantify how infrastructure changes are impacting public health over time. Use these findings to recalibrate planning priorities.

Appendix: Methodologies

Health Impact Assessment

The health impact assessment (HIA) developed by Mansfield and Gibson (2016) offers a robust and replicable framework for quantifying the health benefits of increased walking and cycling for transportation. Designed with transportation planning applications in mind, the methodology links changes in travel behavior, such as those induced by new infrastructure or land use patterns, to measurable changes in premature mortality. By integrating transportation data, epidemiological risk models, and demographic distributions, this HIA approach provides planners and policymakers with a powerful decision-support tool grounded in empirical evidence.

At its core, the assessment begins by establishing baseline levels of “transportation physical activity” (TPA), that is, walking and biking undertaken for utilitarian, rather than recreational, purposes. Drawing on the National Household Travel Survey (NHTS) and the American Community Survey (ACS), the authors model how daily TPA varies across individuals based on commute mode, demographic characteristics (such as age, race, and sex), and built environment features (like population density and rental housing share). These behavioral estimates are generated through a sequence of three linked regression models: a zero-inflated Poisson model for predicting how many trips people make by walking or biking; a multinomial logistic model to estimate the purpose of those trips; and a set of duration models that calculate how long each trip is likely to be, depending on its purpose and the person’s characteristics.

With these inputs, the model calculates total daily minutes spent walking and cycling and converts these into MET-hours, a standardized unit that reflects the energy cost of physical activity. Walking is assigned a value of 3.5 METs, and cycling 6.8 METs, allowing comparisons across modes. Importantly, the method differentiates between activity done by people who walk or bike to work and those who do not, capturing the substantial differences in travel behavior between these groups.

To evaluate the health implications of increased TPA, the model then simulates alternative scenarios, or “counterfactuals”, in which walking and biking are increased across the population. These scenarios might include, for instance, a 1%, 3%, or 5% increase in walking and cycling among all adults, or a targeted change such as shifting 1% of car commuters to bicycle commuting. For each of these scenarios, the new level of average weekly TPA is calculated.

Health benefits are then estimated using a continuous dose–response function linking physical activity to reductions in all-cause mortality. The function, derived from a large meta-analysis, indicates that every 11.25 MET-hours of TPA per week corresponds to a 10% reduction in mortality risk. While seemingly modest, even small gains in weekly physical activity can translate into significant public health benefits at the population scale, especially when targeted at previously inactive individuals, such as car commuters.

In the final step, the model applies the mortality risk reductions to the total number of premature deaths expected annually in the region. For example, using Miami-Dade County as a case study, and assuming a baseline of approximately 4,650 premature deaths annually among adults, the model estimates that a 1% increase in walking and cycling could prevent about 0.5 deaths per year. A 5% increase would prevent around 2.6 deaths, and a 1% shift from driving to biking, because of the much greater intensity and duration of activity for the individuals making that switch, could avert as many as 5 deaths annually.

These health impacts can also be monetized using the US DOT's Value of a Statistical Life (VSL), currently set at $13.2 million per life saved. By this measure, a modest 1% increase in walking and cycling across the entire Miami-Dade population could yield $6.6 million in economic value per year. A 5% increase could deliver $34.3 million, while a 1% mode shift from driving to cycling could result in annual benefits approaching $68 million.

Crucially, this methodology is transparent and reproducible. It can be adapted to other regions using publicly available data, and it can be extended to evaluate a broader range of outcomes, including disease incidence, health care cost savings, and social equity impacts. In its current form, the HIA provides a compelling case for active transportation investment: even small shifts in daily behavior, when scaled across large urban populations, can save lives and produce measurable economic returns.

Crash Trends and Safety Data Analysis

In this analysis, relative crash risks experienced by bicyclists across five major facility types in Miami-Dade County during 2024 were estimated, using a standardized exposure metric: **crashes per 1,000 trip-miles,** from Signal 4 data. This metric adjusts for bicycle travel occurring on each type of facility and allows for meaningful comparisons across infrastructure designs, particularly between day and night conditions at non-intersection locations.

The analysis began by linking individual crash records to specific facility segments based on geographic location and facility type attributes. Only crashes that occurred away from intersections or junctions were retained, to isolate performance differences that are attributable to the facility itself, rather than to traffic control or turning conflicts. Each crash record was categorized by time of occurrence, day or night, based on light conditions reported in the dataset.

Exposure was estimated using the number of trips recorded or inferred for each segment, multiplied by the segment's length in miles. This yielded a measure of total bicycle trip-miles per segment. Crash rates were then calculated by dividing the number of crashes by the corresponding trip-miles and scaled to a per-1,000 unit for interpretability. For example, a facility with two crashes and 1,000 trip-miles would yield a rate of 2 crashes per 1,000 trip-miles.

The crash rates were then averaged across all segments within each facility type and disaggregated by light condition. These averages were visualized in a horizontal bar chart, with separate bars for daytime and nighttime conditions. Facilities included in the comparison were: **Buffered Bike Lanes, Unprotected Bike Lanes, Shared Roadways, Separated Paved Paths, and Wide Curb Lanes**.

This exposure-adjusted approach reveals stark contrasts in performance across facility types. Buffered Bike Lanes and Separated Paved Paths consistently exhibited low crash rates, reinforcing their role as safer infrastructure. In contrast, Wide Curb Lanes and Shared Roads were associated with significantly higher crash rates at night, pointing to potential deficiencies in design or visibility.

While the analysis adjusts for exposure, it does not account for all contextual factors, such as ambient lighting, traffic speed, or enforcement patterns, which could also influence crash likelihood. Nevertheless, the use of trip-mile normalization provides a strong methodological foundation for prioritizing investments in bicycle infrastructure and for identifying facilities where design interventions could yield meaningful safety improvements.

Benefit-Cost Analysis

The Benefit-Cost Analysis (BCA) conducted as part of the Miami-Dade Transportation Planning Organization's (TPO) assessment of pedestrian and bicycle infrastructure utilized a systematic approach to quantify and evaluate the economic returns of investments in non-motorized infrastructure. This analysis aimed to provide comprehensive evidence supporting decision-making related to infrastructure projects, demonstrating financial gains and broader community benefits associated with cycling and pedestrian pathways.

The methodology began by clearly defining the scope and objectives, establishing the types of benefits and costs to be included. Direct costs, such as infrastructure construction and maintenance expenses, were accounted for alongside indirect economic and societal benefits. These benefits encompassed enhanced public health outcomes, reduced healthcare expenditures, decreased mortality, improved environmental conditions, and increased local economic activity.

For the benefit calculations, a multifaceted approach was adopted. This report estimates the potential health and economic benefits of increasing active transportation in Miami-Dade County by applying methodologies from a published health impact assessment (HIA) conducted in Raleigh, North Carolina (Mansfield and Gibson, 2016). The Raleigh study used a statistical model to link improvements in neighborhood walkability to changes in walking behavior and associated health outcomes. That study established a statistical framework for estimating health impacts from changes in transportation-related physical activity. This methodology converts walking and cycling time into metabolic equivalent of task (MET) hours, applies a dose-response function to calculate mortality risk reduction, and then estimates avoided premature deaths based on local mortality rates.

By adapting this approach to local transportation data, the analysis demonstrates that even modest increases in walking and cycling can yield significant health gains and substantial economic value when monetized using standard Value of Statistical Life (VSL) estimates.

Costs associated with implementing and maintaining pedestrian and bicycle infrastructure were detailed and systematically compiled. These included initial capital expenditures for construction, annual operation and maintenance costs, and periodic enhancement expenditures. These expenses were documented in year-of-expenditure dollars to accurately reflect their financial impact and were annualized over the lifecycle of the infrastructure, typically estimated at 25 years, to facilitate direct comparisons with the benefits.

The analysis employed discounted cash flow techniques, applying a standard discount rate of 3%, aligning with established practices for public infrastructure investments. This approach allowed for the calculation of the net present value (NPV) of all future benefits and costs, providing an accurate representation of their current economic worth. Additionally, the Benefit-Cost Ratio (BCR) was computed by dividing the total present value of all quantified benefits by the total present value of all incurred costs. This ratio provided a clear, concise metric for evaluating economic viability and comparative effectiveness across scenarios and infrastructure types.

Sensitivity analyses were conducted to test the robustness of results against uncertainties inherent in long-term forecasts. Variations in key assumptions, such as the rate of increase in bicycle and pedestrian usage, infrastructure longevity, maintenance costs, and health benefits valuation, were systematically explored. These analyses ensured the reliability of the results, confirming that the projected economic returns remained favorable across a range of plausible future conditions.

Finally, the outcomes of the BCA were synthesized into clearly communicated findings, highlighting the economic and community benefits of proposed investments. This information was structured to guide policymakers and stakeholders, assisting in prioritizing infrastructure projects based on their demonstrated economic and social returns, and ultimately supporting informed, data-driven infrastructure planning and policy development across Miami-Dade County.

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