



**CITY OF SAN DIEGO
BICYCLE MASTER PLAN**

CHAPTER 4

Needs Analysis

The needs of people riding bikes are diverse and dependent on a person's level of experience, comfort, and confidence, among other factors. To better understand these needs, this chapter examines several data sources and analyses, including:

- **Level of Traffic Stress Analysis** to identify locations within the existing street network that may attract or deter people from riding bikes based on comfort.
- **Connectivity Analysis** to identify streets that provide access to common destinations for people riding bikes.
- **Network Gap Analysis** to identify potential missing connections in the existing citywide bikeway network.
- **Bicycle-Related Crashes** to identify locations for bicycle-related safety improvements to improve the existing bike environment.

Comfort and Connectivity

A successful bikeway network connects people to the places they need and want to go. Whether commuting to school or work, visiting family, or running errands, people are more likely to ride a bike when bikeways are safe, comfortable, and direct. At the same time, many people already depend on riding a bike to get to everyday places.

The City envisions a transportation system that enables everyone to travel safely, regardless of how they get around, while advancing the goal of zero traffic fatalities and serious injuries. To identify opportunities for bicycle improvements, the Bicycle Master Plan uses level of traffic stress and connectivity analyses to understand where people travel every day, how comfortable existing routes are for bicycling, and where short trips could potentially be made by bike instead of by car.

Understanding Bicycle Comfort: Level of Traffic Stress

Level of traffic stress is a framework for evaluating how comfortable a street or crossing feels for people to walk or bike. This framework recognizes that many people are unlikely to walk or bike along routes that feel stressful or unsafe due to factors such as the speed and number of cars, the number of travel lanes, and the absence of marked crosswalks. Understanding these conditions helps identify which streets and bikeways need improvements to provide a more comfortable experience for a wider range of users, including children, older adults, and people who are less confident walking or bicycling in car traffic.

Level of traffic stress scores are classified into four categories, ranging from level of traffic stress-1, which is the lowest level of stress (highest level of comfort), to level of traffic stress-4, which is the highest level of stress (lowest level of comfort), as shown in **Figure 4-1**.

Figure 4-1. Bicycle Level of Traffic Stress Categories

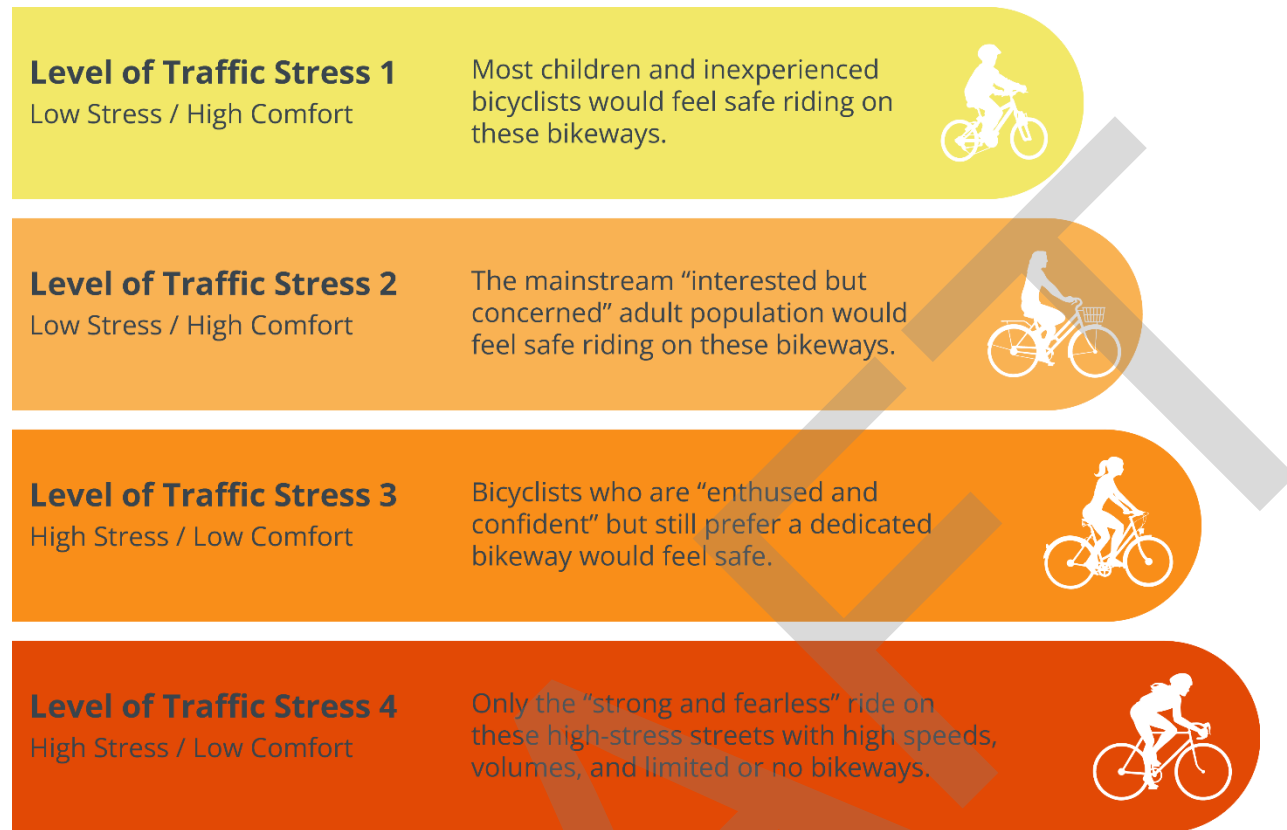


Figure 4-2 displays the proportions of types of roadways for the entire city network (left) and the high-stress network (right) by mileage. The majority of the high-stress streets are major arterials and highways. Some examples of major arterials are El Cajon Boulevard, Balboa Avenue, and Carmel Valley Road. Some examples of highways are Pacific Highway, Friars Road, and Nimitz Boulevard.

Approximately 58 percent of the street network is considered low-stress (level of traffic stress 2 or less). Much of this low-stress network consists of residential streets, which may not always provide direct connections to everyday places or between neighborhoods, as shown in **Figure 4-3**.

Major streets, including arterials and collectors, often provide these critical connections. However, these roads tend to carry higher traffic volumes and support higher car speeds, resulting in higher levels of traffic stress (less comfort) for people bicycling (level of traffic stress 3 or greater).

Figure 4-2. Proportion of Street Types for Citywide Roads Vs. High Stress/Low Comfort City Roads

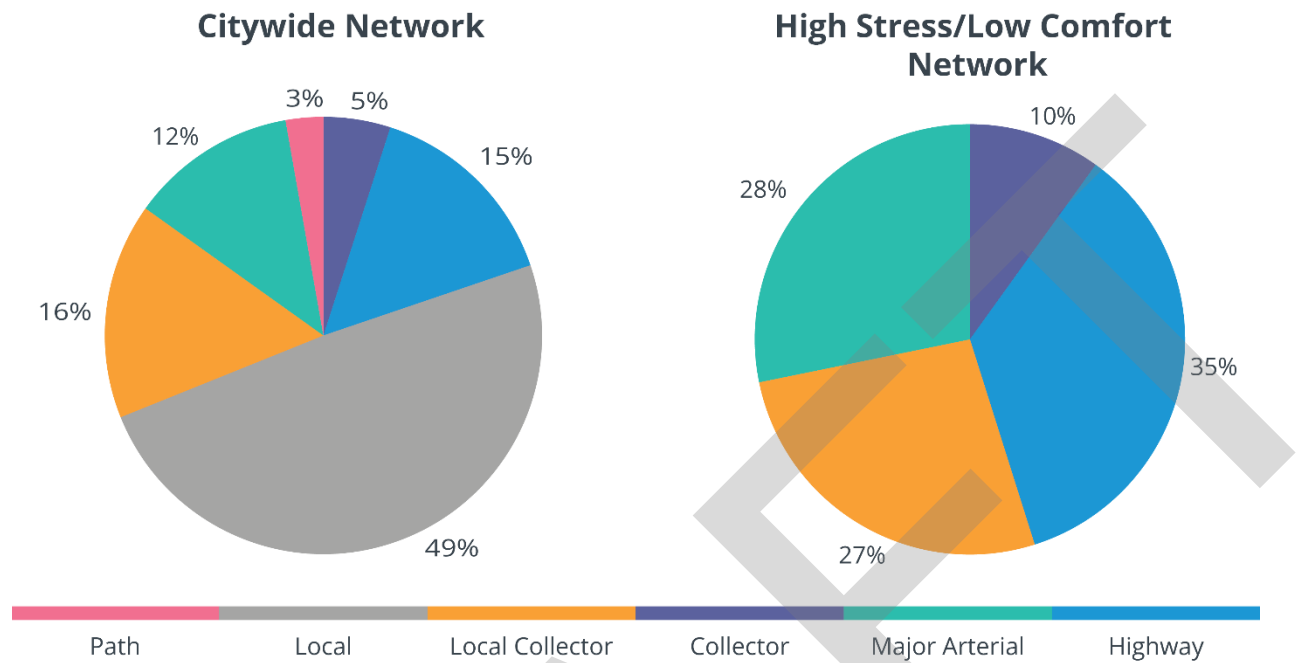
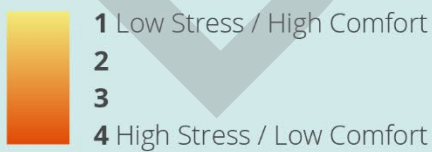


FIGURE 4-3

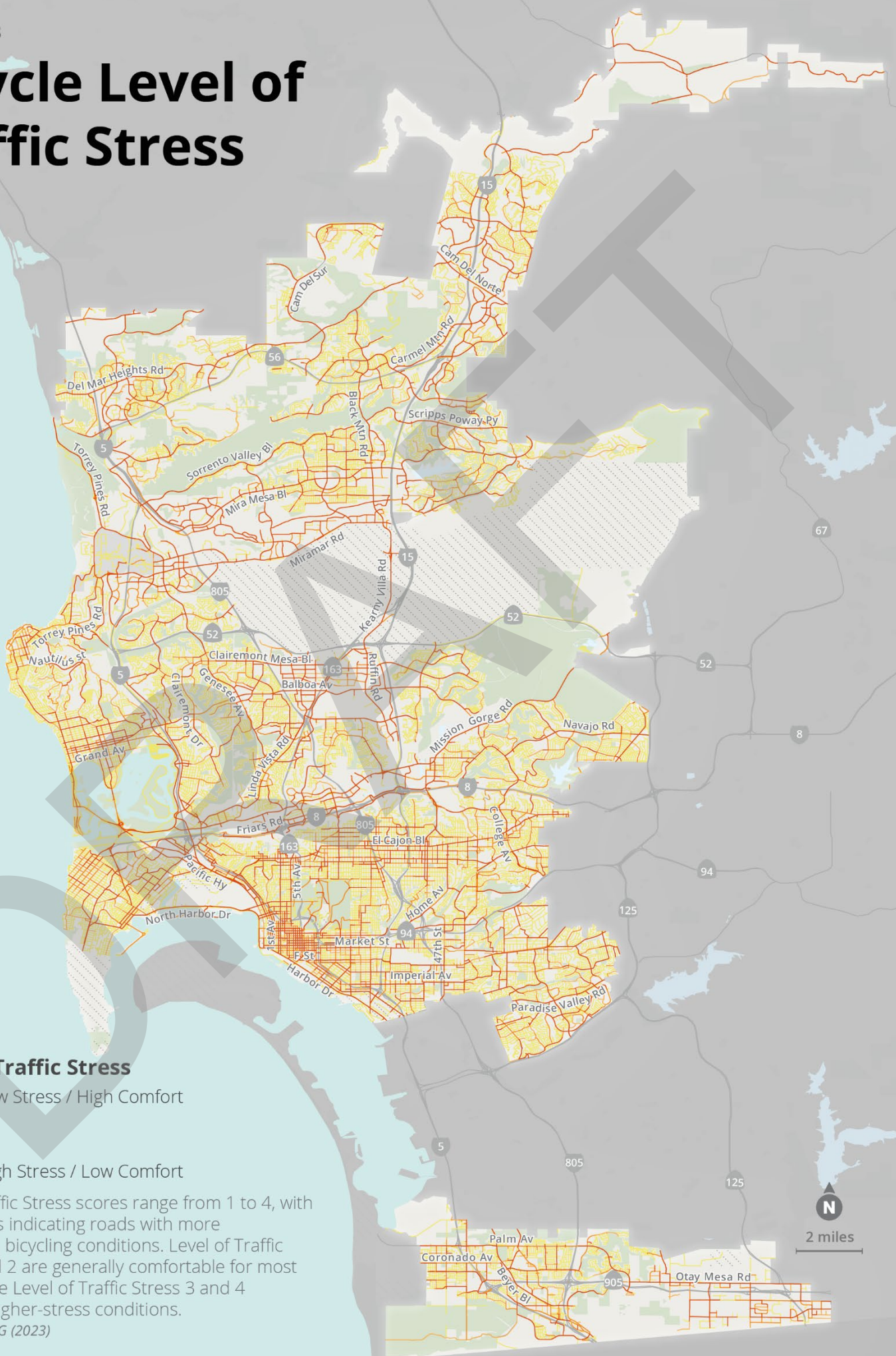
Bicycle Level of Traffic Stress

Level of Traffic Stress



Level of Traffic Stress scores range from 1 to 4, with lower scores indicating roads with more comfortable bicycling conditions. Level of Traffic Stress 1 and 2 are generally comfortable for most people, while Level of Traffic Stress 3 and 4 represent higher-stress conditions.

Source: SANDAG (2023)



Understanding Connectivity: Existing Access to Everyday Destinations

While the level of traffic stress measures how comfortable and accessible a bikeway feels for riding a bike, a low-stress bikeway provides more value when it connects people to the places they need to reach. Connectivity measures how well the bikeway network provides connections to places throughout the City. Scores range from one, representing the lowest connectivity, to four, representing the highest connectivity.

The following types of destinations help support daily travel needs and activities:

- **Schools:** Public and private K-12 grade schools as well as colleges and universities
- **Parks:** Access points to neighborhood and regional parks, beaches, and amusement parks
- **Transit Stops:** Bus, light rail, commuter rail, and regional rail stops and stations
- **Libraries:** Public libraries
- **Shopping Areas:** Group of stores, including grocery stores, convenience stores, drug stores, and other services, as well as Business Improvement Districts
- **Jobs:** Number of jobs per census block

Streets with multiple destinations have higher connectivity scores and play an important role in helping San Diegans bicycle between neighborhoods and reach everyday places.

Figure 4-4 displays the results of the bike connectivity scoring in the City.

Streets with the highest connectivity scores are concentrated in the more urbanized portions of the City, including Downtown, Barrio Logan, Southeastern, Golden Hill, Uptown, North Park, Normal Heights, Mid-City, and College Area. These communities contain a high concentration of jobs, schools, shopping destinations, community centers, and transit services, creating opportunities for bikeways to serve a wide range of everyday trips. The connectivity analysis is detailed in **Appendix F**.

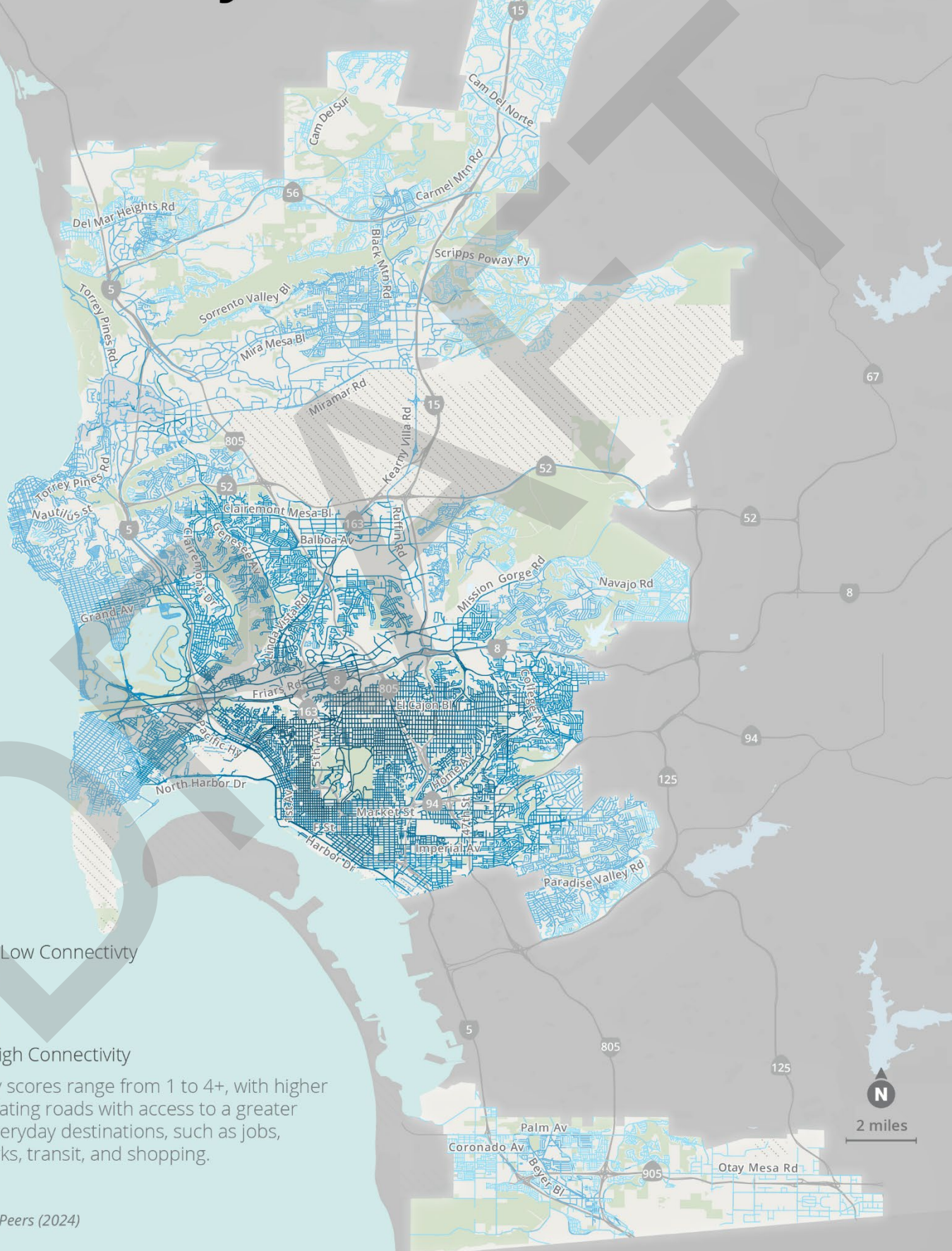
FIGURE 4-4

Bicycle Connectivity Score



Connectivity scores range from 1 to 4+, with higher scores indicating roads with access to a greater variety of everyday destinations, such as jobs, schools, parks, transit, and shopping.

Source: Fehr & Peers (2024)



Where Comfort and Connectivity Meet

Mapping comfort using the level of traffic stress alongside network connectivity reveals opportunities to make the bikeway network more responsive to existing roadway conditions while improving access to everyday places.

As shown in **Table 4-1**, four categories emerge from this assessment. Each category reflects a different set of roadway conditions. The citywide comfort and connectivity scores are shown on **Figure 4-5**. Streets with the highest comfort and connectivity levels are generally concentrated in the more urbanized portions of the City, including Downtown, Barrio Logan, Southeastern, Golden Hill, Uptown, North Park, Normal Heights, Mid-City, and College Area. The urban core is prominently shown in the figure given the close proximity to desirable destinations. As community plans are updated, low connectivity/ high stress roadways will be re-evaluated with additional local context.

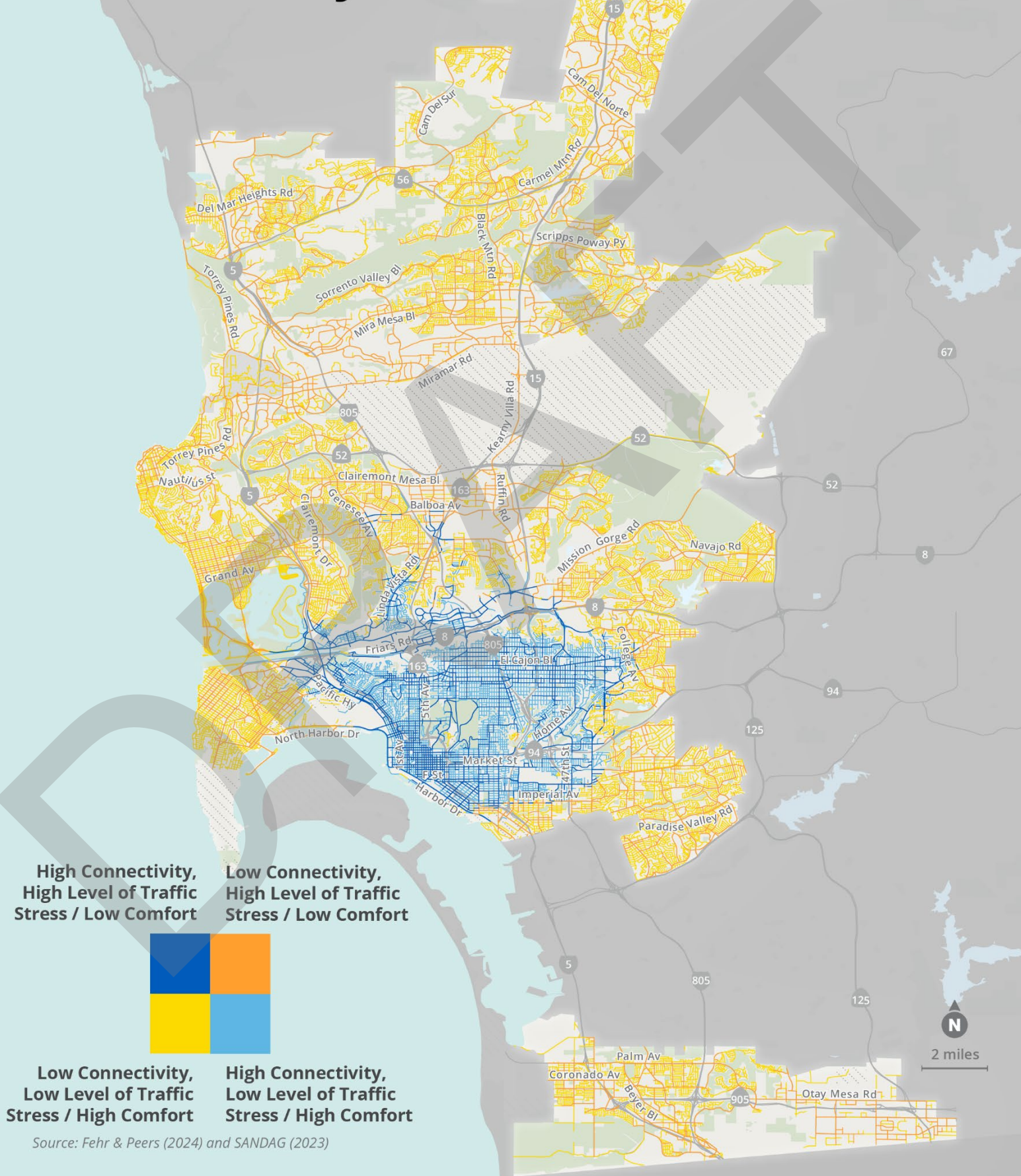
Corridors with both high connectivity and currently high level of traffic stress represent opportunities for bikeway improvements. These streets connect people to destinations but can be uncomfortable for people riding bikes. Separated bikeways or parallel low-stress bikeways can provide more comfortable and convenient connections. Adding traffic calming and better street crossings to streets with high connectivity and low level of traffic stress can help people cross busy intersections safely.

Table 4-1. Comfort and Connectivity Categories

	High Connectivity	Low Connectivity
High Stress	High Stress, Many Destinations Opportunity: Improvements to level of comfort could result in more people riding bikes to nearby destinations.	High Stress, Fewer Destinations Opportunity: Improvements to comfort could help existing bike riders but may not increase the number of people riding bikes due to few nearby destinations. Updates to community plans should re-evaluate these streets to identify opportunities for bicycling improvements to support future growth and development .
Low Stress	Comfortable, Many Destinations Opportunity: Existing bikeways and streets offer opportunities for further enhancements to continue supporting people riding bikes to nearby destinations.	Comfortable, Few Destinations Opportunity: Improvements would have limited ability to result in more people riding bikes since these locations already feel comfortable and do not connect to many destinations. However, these bikeways still function as vital connections between communities and regional destinations, and they may become opportunities for future destinations as community plans are updated.

FIGURE 4-5

Level of Traffic Stress & Connectivity Score



Area of Increased Biking Opportunity: Short Trips (Car Trips of 3 Miles or Less)

Nearly half of all car trips made in the United States are three miles or less.² This is about a 15-minute bike ride for most people. Also, according to the Oregon Transportation Research and Education Consortium³, half of short trips (3 miles or less) include a travel time difference between the bicycle and auto of less than five minutes. Converting these short car trips into bike trips represents a potential opportunity for the bikeway network to offer safe, comfortable trips for all ages and abilities.

To understand where that opportunity is greatest, **Figure 4-6**⁴ highlights street segments in the top 20 percent in terms of number of weekday short car trips (three miles or less). The street segments in orange represent streets with potential to shift some trips from driving a car to riding a bike. Most of these streets offer direct access to key destinations used as part of the comfort and connectivity analysis previously shown in **Figure 4-5**.

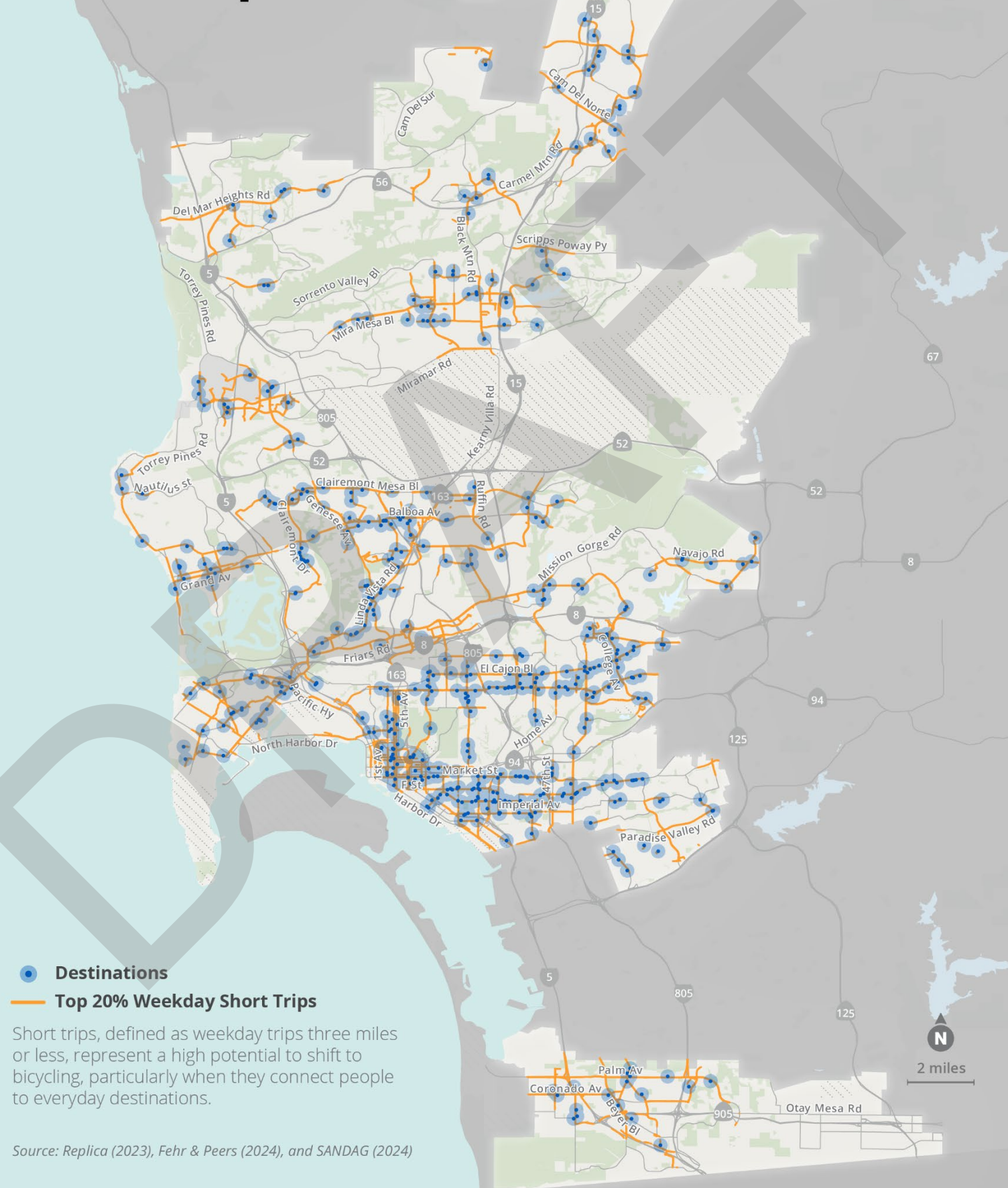
² Bureau of Transportation Statistics, 2021

³ [Oregon Transportation Research and Education Consortium – Understanding and Measuring Bicycling Behavior \(Page 3\)](#)

⁴ The data was developed using a nationwide travel model based on publicly available land use and census data and calibrated using both traditional and big data sources.

FIGURE 4-6

Top 20 Percent of Short Trips



Providing New Opportunity in Areas of Greatest Needs

For the Bicycle Master Plan, areas of greatest needs are defined as the combined area of the City's Climate Equity Index Communities of Concern⁵ (areas with very low, low, or moderate access to opportunity) and the Environmental Justice Communities identified in the General Plan Environmental Justice Element.⁶ These are underserved areas that lack access to quality, affordable, and reliable mobility options, as well as other essential resources. Additionally, they have historically experienced underinvestment mobility infrastructure.

Safe and convenient mobility choices are not equally available to all communities in San Diego. To understand where bikeway projects could provide the greatest benefit, **Figure 4-7** identifies where short car trips (three miles or less) occur in areas of greatest needs. These short car trips are overlaid onto the high-connectivity street network. The areas where the blue lines (high-connectivity streets) and orange lines (short trips) overlap on the figure are areas where bikeways could best connect people to everyday places and resources. By providing and connecting these areas with a continuous bikeway network, the comfort and safety of bike riders may be enhanced, and people may feel more comfortable riding their bikes. Additionally, a continuous bikeway network would make it easier for community members to get around the neighborhood by biking instead of driving which would reduce transportation costs for short trips and lessen the need to plan trips around transit schedules.

⁵ [City of San Diego - Climate Equity Index Scores](#)

⁶ [Environmental Justice Element of the City of San Diego General Plan](#)

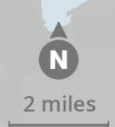
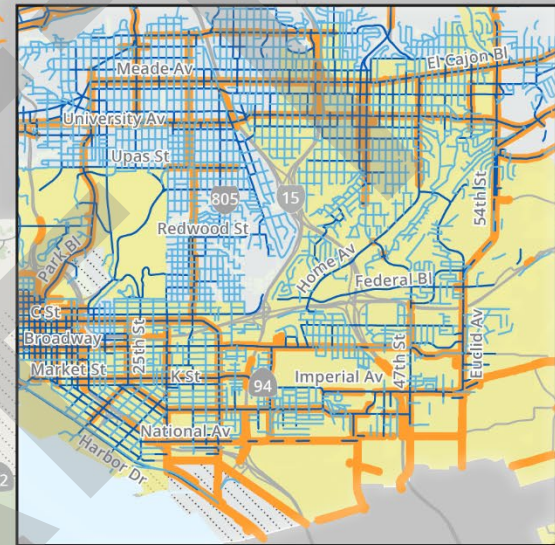
FIGURE 4-7

Opportunities in Areas of Greatest Needs

- Areas of Greatest Needs
- High Connectivity, Low Level of Traffic Stress
- High Connectivity, High Level of Traffic Stress
- Top 20% Weekday Short Trips

Areas of Greatest Needs include the City's Climate Equity Index Communities of Concern and the Environmental Justice Communities identified in the City's General Plan Environmental Justice Element.

Source: Replica (2023), Fehr & Peers (2024), and SANDAG (2024)



Barriers to Bicycling

Every day, people consider their options for getting around the City. Feedback received during public engagement identified traffic safety and gaps in the existing bikeway network as the greatest barrier to riding a bike, as summarized in **Appendix B**.

Bicyclist Crash Trends

Enhancing bicycle safety means a future in which every person riding a bike completes their journey safely, free from fatal or severe injury. Between 2019 and 2023, there were 92 police-reported crashes involving bicyclists that resulted in a severe injury or fatality in the City, as shown in **Table 4-2**. During this period, the City experienced an average of almost 15 severe-injury crashes per year and three fatal crashes involving people riding bikes each year. It is notable that every fatality involved a collision with a car. Additionally, the City reviews every fatality and severe injury crash for safety upgrades and looks at systemic characteristics associated with those crashes. This highlights the importance of creating a transportation network that separates bicycles from cars. A more detailed analysis of crash patterns, contributing factors, and locations is provided in **Appendix G**.

*A **fatal injury** results in fatality within 30 days of the crash*

*A **severe injury** results in broken bones, lacerations, or other serious injury*

Table 4-2. Bicyclist-Involved Crash History

Year	Fatal Crashes ¹	Severe Injury Crashes ¹	Total Bicyclist Crashes ²
2023	3	19	365
2022	2	16	323
2021	6	12	325
2020	3	9	324
2019	4	18	356
Total	18 (1.1%)	74 (4.4%)	1,693
Mean per Year	3.6	14.8	338.6

Source: ¹City of San Diego (2024), ²Statewide Integrated Traffic Records System (2024)

Network Gaps

Gaps in the bikeway network can disrupt otherwise safe and connected routes, creating challenges for people of all ages and abilities. Closing these gaps is essential to creating a continuous, connected network where people can bicycle safely and comfortably from their starting point to their destination. **Appendix E** identifies gaps in the existing bikeway network, highlighting key areas where new or enhanced bikeways can have the greatest benefit to the citywide network and improve bicycle connectivity.