

02

Existing Conditions

Mercer County lies in central New Jersey, midway between New York City and Philadelphia. Despite covering only 226 square miles, the Greater Mercer area includes a wide range of development patterns, communities, and constituencies. Suburban development surrounds U.S. Route 1 while Trenton and its immediate surroundings have much higher densities. Moving out from Trenton, Route 1, and the Northeast Corridor Rail Line, communities become less dense, and more rural. The study area also includes the adjacent communities of Montgomery Township in Somerset County, and Plainsboro Township in Middlesex County, encompassing the Greater Mercer Area.

Development of the Greater Mercer Bike & Trails Plan began with the assessment of existing conditions, and mobility, safety, and access needs. This effort included the following:

- Compiling the base maps to support technical assessment
- Investigating previous studies and recommendations to build upon and leverage previous planning efforts
- Preparing the crash data assessment to evaluate trends and identify areas of need and risk
- Completing a bicycle network assessment to identify barriers to mobility and connectivity, and target potential improvements to where they are needed most
- Mapping existing bicycle infrastructure to establish the baseline, and identify multimodal trip generators and attractors
- Developing a composite demand model using demographic data and related metrics to support assessment of need and prioritization

The previous studies include hundreds of individual bicycle and pedestrian recommendations. Although many of these studies were prepared prior to development of the New Jersey Complete Streets Design Guide; they reflect the priorities of the municipal partners and stakeholders organizations, and were based on applicable standards and guidance at the time they were prepared.

Base Mapping

The planning process started with compilation of detailed base mapping, using the GIS platform and data layers from municipal, county, and institutional sources to guide the identification and assessment of candidates for new and enhanced facilities. GIS analytical methodologies and comprehensive data resources are particularly useful to identifying need, opportunities for improvement, and potential constraints and impediments to facility design, construction, and use.

Previous Studies

The team reviewed numerous planning studies and plans for the study area to build upon the existing knowledge base.

These resources provided valuable information and a starting point for this plan. This synergy will produce a more comprehensive and expansive bicycle and pedestrian system. Proposals for bicycle infrastructure on contiguous routes reveal the need for cooperation and collaboration on a region-wide scale. The breadth of these resources speaks to the interest throughout the study area in improving bicycle and pedestrian infrastructure and mobility.

The following reports, plans, and studies were among those consulted:

- Downtown Trenton Bicycle and Pedestrian Plan (2016)
- East Windsor Township Bicycle and Pedestrian Circulation Study (2016)
- Hamilton Township Bicycle & Pedestrian Circulation Study (2011)
- Hopewell Circulation Plan Element (2006)
- Lawrence Township Bicycle and Pedestrian Planning Assistance Study (2009); Master Plan Circulation Element-Bicycle and Pedestrian Plan (2019)
- Montgomery Township Bicycle and Pedestrian Plan (2019)
- Plainsboro Circulation Plan (2015)
- Princeton Bicycle Mobility Plan (2017)
- Robbinsville Land Preservation Map (2008 rev. 2015)
- West Windsor Bicycle and Pedestrian Plan (2004); Circulation Element (2009)
- Mercer County Bicycle Master Plan (2019)
- Crosswicks Creek-Doctors Creek Greenway Feasibility Study (2007)
- Capital-to-Coast Trail Plan-Monmouth County Planning Board (2004 rev. 2010)

The nature and scope of recommendations was typically dependent on the location. For example, most recommendations in the Downtown Trenton Bicycle & Pedestrian Plan involved installing dedicated bike facilities

on urban streets. Recommendations in East Windsor Township's Bicycle and Pedestrian Study included constructing ADA-compliant curb ramps, restriping crosswalks and installing pedestrian refuge islands at key high-volume intersections. The Hamilton Bicycle & Pedestrian Circulation Study recommended installing bike lanes on a number of corridors including Klockner Rd and Nottingham Way. Throughout the study area, recommendations also included installing sidewalks along busy corridors where walking is otherwise dangerous. The Princeton Bicycle Mobility Plan recommended a comprehensive bicycle network consisting of about 70 total miles of new or improved bike infrastructure. A detailed corridor plan for Nassau Street was also provided.

Recommendations provided in each of these municipality-specific reports mainly focused on providing connections within the municipality. Analyzing each of the reports together will result in better regional bike connections.

Reports published by the Regional Plan Association and Delaware Valley Regional Planning Commission looked at providing more regional, inter-county and inter-state bicycle connections though these improvements were more general in nature.



Crash Data Assessment

The following analysis utilizes pedestrian and bicyclist crash data (2014-2016) obtained in June 2018 from the New Jersey Department of Transportation (NJDOT), using the Safety Voyager Tool to illustrate crash statistics and trends within the Greater Mercer Trail Network study area. Crash data findings have been grouped by theme to aid in efforts to improve pedestrian and bicyclist safety throughout the study area.

Crash Data Overview

There were 492 pedestrian crashes and 214 bicyclist crashes within the study area between 2014-2016. The 492 pedestrian crashes involved 518 total pedestrians. The annual distribution of crashes by mode is displayed to the top right.

Crashes by Municipality

More than half (242 of 443) of the study area pedestrian crashes were in Trenton. Many other pedestrian crashes were concentrated in areas of Ewing and Hamilton near Trenton, and downtown Princeton.

Bike crashes are more geographically dispersed. Trenton has more bike crashes than any other study area municipality, although significant numbers also exist in Hamilton, Princeton, Hightstown, East Windsor and Plainsboro. Trenton is the study

area's most densely populated community with the densest street network. This high concentration of narrow streets and conflict points can lead to more crashes, but Trenton's relatively low speeds indicate these crashes are frequently less severe.

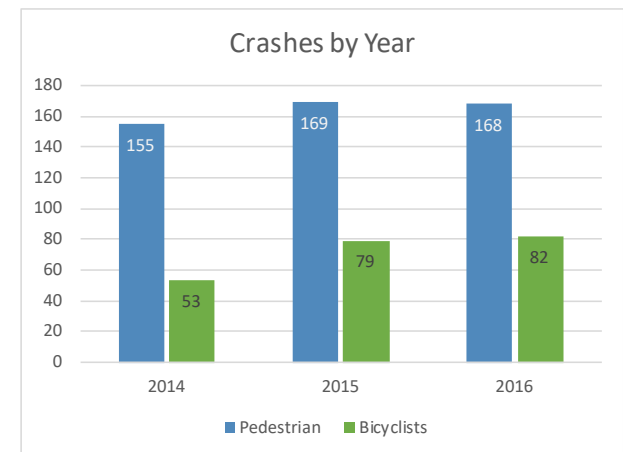
Crash Severity

Of the 492 pedestrian crashes, 22 of the crashes (4.5%) were fatal and resulted in 23 pedestrian deaths. Additionally, 11 (2.2%) crashes caused incapacitating injuries to 13 pedestrians, and 139 (28.3%) resulted in moderate injury.

From 2014-2016 there were 214 bicyclist crashes reported in the study area. Of these 214 bicyclist crashes, 2 (0.9%) were fatal and 75 (35.0%) resulted in moderate injury. There were no reported incapacitated cyclists.

Temporal Factors

About 35% of pedestrian crashes occurred between October and December, with October having the highest concentration of crashes at 13.6%. More than a third of the bicyclist crashes occurred during the summer months (June - August), with the highest concentration of bicyclist crashes in July with 17.3%. October had the highest combined number for both pedestrian and bicyclist crashes with 83 total crashes representing 11.8% of all crashes.



While the majority of pedestrian crashes took place during daylight conditions (56%), roughly 36% of crashes occurred during dark conditions with street lights on, including 60% of the 22 fatal crashes. Of the 214 bicyclist crashes, 75% occurred in daylight while 19% occurred during dark conditions with street lights on. These findings suggest that lighting levels may not adequately illuminate crosswalks and roadways in these areas, especially for pedestrians.

Roadway Characteristics

In terms of environmental factors, roughly 80% of pedestrian crashes and around 91% of bicyclist crashes took place on dry roads and over 81% of pedestrian crashes and roughly 92% of bicyclist crashes occurred during clear weather conditions.

Of the 492 pedestrian crashes, more than

60% occurred on municipal roads while 20% occurred on County roads. Similarly, 47% of bicyclist crashes occurred on municipal roads and another 32% on County roads. This is shown in the graphs to the top right.

More than 70% of pedestrian crashes and roughly 50% of bicyclist crashes occurred on streets with a posted speed limit of 25 mph. Among pedestrian crashes, 44.7% occurred at an intersection compared to 51.4% of bicyclist crashes as shown in the graphs to the bottom right.

High-Crash Corridors

Table 1 shows the study area road corridors with the highest concentrations of pedestrian crashes. Together, these 15 corridors account for 36.6% of the total 492 crashes within the study area from 2014-2016. US 206 had the highest concentration of crashes with 8.3% of the total pedestrian crashes. NJ 33 and Liberty St. (Hamilton Township) had the highest number of fatal crashes with 2 each.

Table 2 shows the study area road corridors with the highest concentrations of bicyclist crashes. Together, these 14 corridors account for 40.4% of the total 214 crashes within the study area from 2014-2016. US 206 had the highest concentration with 8.4% of the total bicyclist crashes. NJ 33 and Mercer County 622 had the highest number of fatal bicyclist crashes with 1 each.

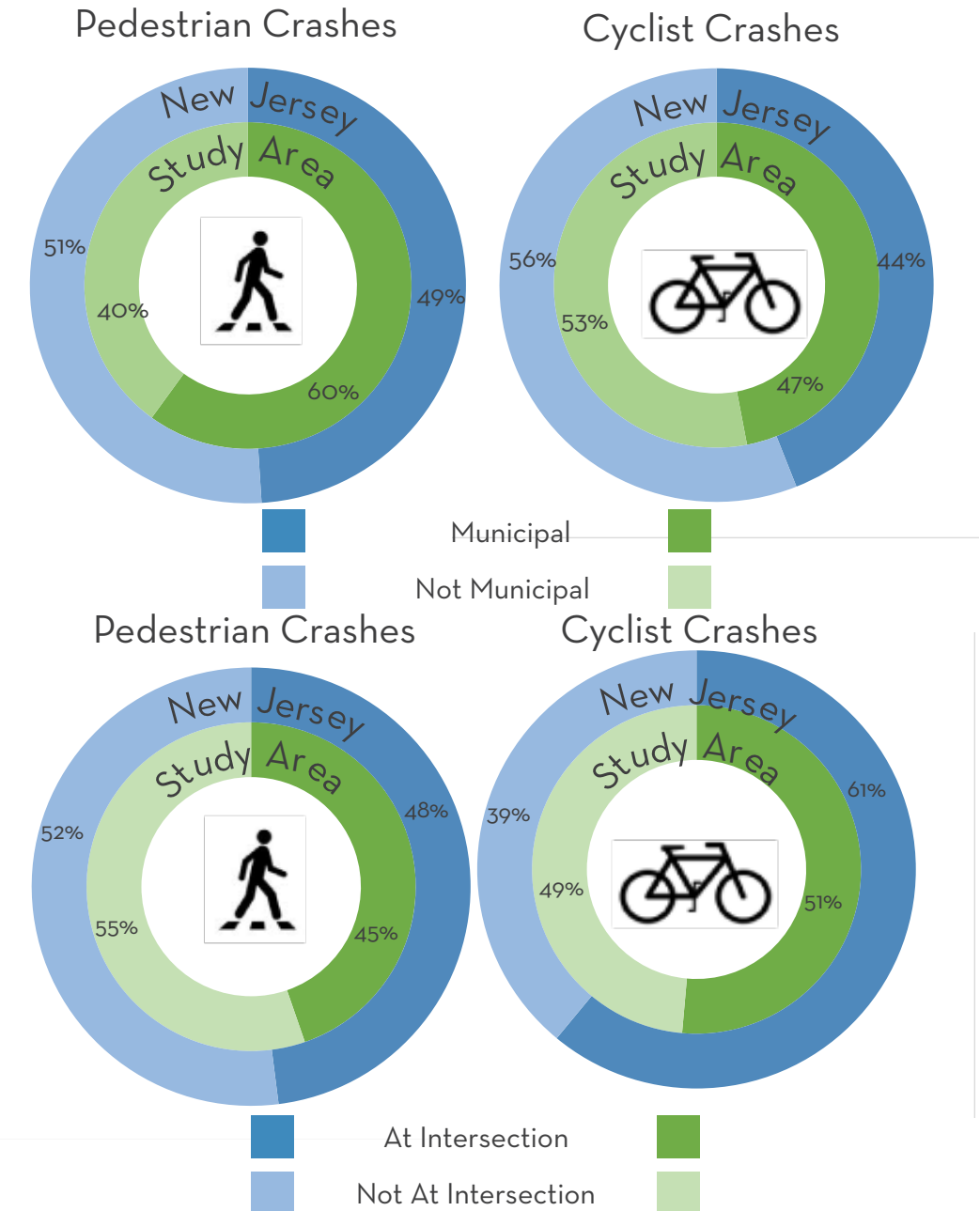


Table 1: High Pedestrian Crash Corridors (2014-2016)

Corridor	Road System	Killed	Severe Injury	Moderate Injury	Complaint of Pain	Property Damage	Total	Percent
US 206	State Highway			17	22	2	41	8.3%
MERCER CO. 606	County	1		3	13	3	20	4.1%
MERCER CO. 622	County			7	9	4	20	4.1%
NJ 33	State Highway	2	2	6	6	3	19	3.9%
S CLINTON AVE	Municipal			1	10		11	2.2%
NJ 31	State Highway		1	2	4	3	10	2.0%
NJ 27	State Highway			5	4		9	1.8%
LIBERTY ST	Municipal	2		1	5		8	1.6%
MERCER CO. 636	County	1	1	3	2		7	1.4%
MERCER CO. 635	County				6		6	1.2%
MERCER CO. 653	County			2	4		6	1.2%
PERRY ST	Municipal				6		6	1.2%
ROUTE 571	County		1	2	3		6	1.2%
STUYVESANT AVE	Municipal			2	2	2	6	1.2%
US 130	State Highway			3	1	2	6	1.2%
N CLINTON AVE	Municipal			1	4		5	1.0%
ROUTE 535	County	1		2	2		5	1.0%
ROUTE 583	County	1		2	2		5	1.0%
W STATE ST	Municipal			2	3		5	1.0%
WALNUT AVE	Municipal				2	3	5	1.0%
Total Crashes		8	5	61	110	22	206	41.9%

Table 2: High Bicyclist Crash Corridors (2014-2016)

Corridor	Road System	Killed	Severe Injury	Moderate Injury	Complaint of Pain	Property Damage	Total	Percent
US 206	State Highway			6	10	2	18	8.4%
NJ 33	State Highway	1		4	5	1	11	5.1%
MERCER CO. 622	County	1		3	2	1	7	3.3%
ROUTE 571	County			1	4	2	7	3.3%
US 130	State Highway			2	1	3	6	2.8%
ROUTE 535	County			1	4		5	2.3%
MERCER CO. 606	County			2	2		4	1.9%
MERCER CO. 634	County				4		4	1.9%
MERCER CO. 636	County				4		4	1.9%
MERCER CO. 638	County				2	2	4	1.9%
NJ 27	State Highway			3	1		4	1.9%
NJ 31	State Highway			2	1	1	4	1.9%
ROUTE 526	County			2	2		4	1.9%
ROUTE 539	County			1	2	1	4	1.9%
ALEXANDER RD	Municipal			2		1	3	1.4%
MERCER CO. 653	County			2	1		3	1.4%
MIDDLESEX CO. 614	County			1		2	3	1.4%
ROUTE 533	County			2	1		3	1.4%
S CLINTON AVE	Municipal				2	1	3	1.4%
US 1	State Highway			2		1	3	1.4%
Total Crashes		2	0	36	48	18	104	48.6%



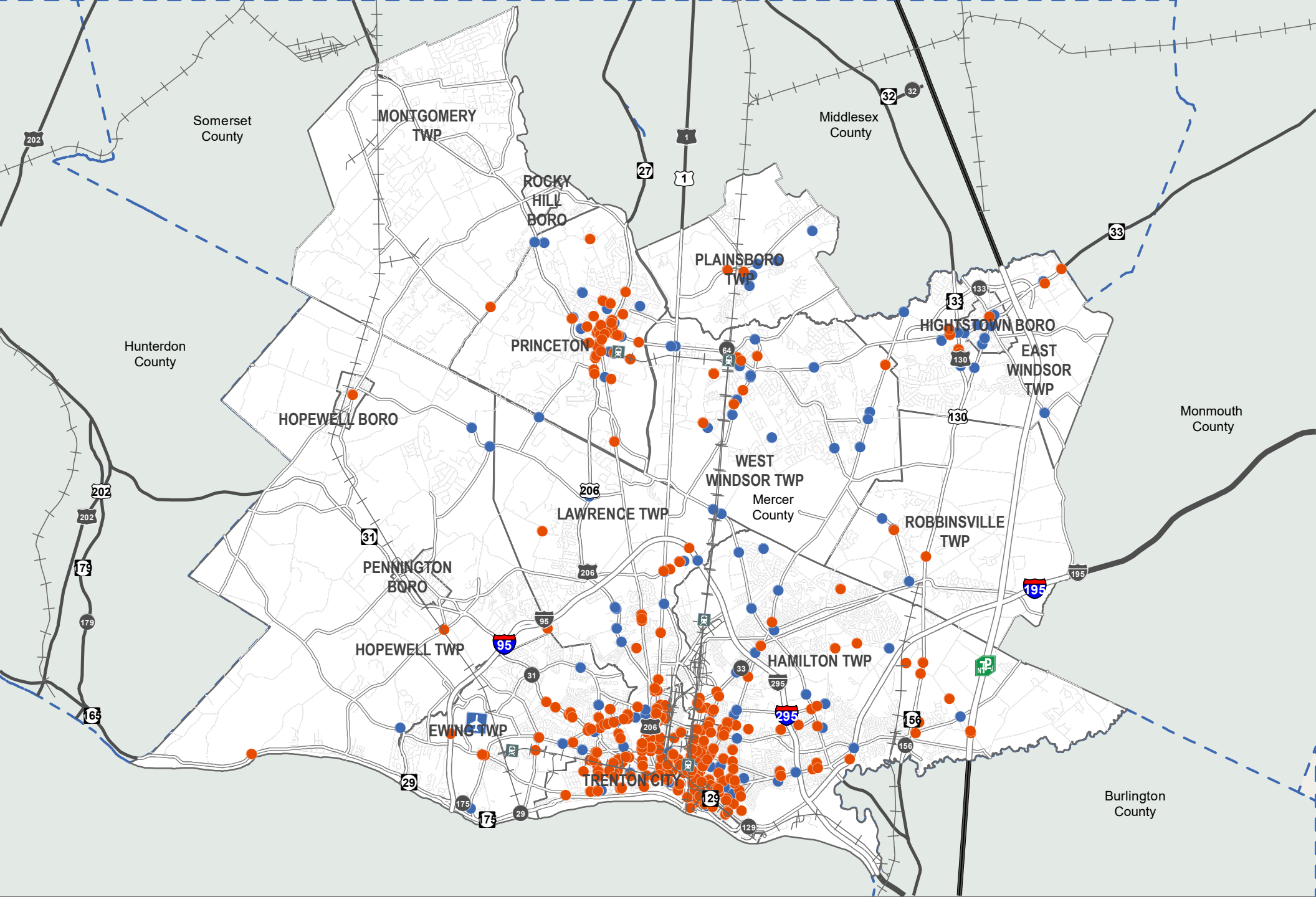
BIKE ROUTE
← PLAINSBORO VILLAGE

PLAINSBORO RD



25




NO
RIGHT
TURN





Bicycle and Pedestrian Crashes (2014-2016)

-  Bike Crashes
-  Ped Crashes

-  Rail
-  Rail Station
-  Airport

0 1.5 3 6 Miles



Bicycle Network Assessment

Bicycle facilities and infrastructure were inventoried and evaluated using innovative metrics and methodologies including Bicycle Level of Traffic Stress and the Island Effect.

Bicycle Level of Traffic Stress

Each bicyclist has unique and personal ability to tolerate the stress created by the volume, speed, and proximity of automobile and truck traffic.

Bicycle level of traffic stress (LTS) measures a cyclist's expected comfort given the current conditions of the roadway. The LTS metric evaluates the bicycle network from the user's perspective. As such, it accounts for the ability of a user to move between points unimpeded by higher stress environments.

The LTS metric is based on the Dutch concept of low-stress bicycle facilities. In general, lower stress facilities provide increased separation between cyclists and vehicular traffic and/or lower speeds and traffic volumes. Higher stress environments generally involve cyclists riding in close proximity to traffic, multi-lane roadways, and higher speeds or traffic volumes, a condition undesirable for most cyclists.

High stress roads, often arterials and primary connectors, can reduce bicycle network connectivity, impeding a user's ability to travel to a desired destination, and discouraging wider cycling use. One goal of this plan is to provide low-stress bike connections by addressing key

deficiencies on high stress roadways.

Based on an analysis of the LTS criteria, the LTS for a given roadway segment is classified into one of four categories:

Level of Traffic Stress 1: conditions are acceptable for even the most vulnerable users who often have limited mobility (including children, seniors, and those with disabilities)

Level of Traffic Stress 2: conditions acceptable for most adults among the general population

Level of Traffic Stress 3: "enthusiastic" riders who can tolerate most roadways but might still prefer dedicated facilities away from traffic

Level of Traffic Stress 4: tolerated by only the most experienced riders

The LTS assessment is supported by a variety of data sources, including base mapping, GIS data files, NJDOT Straight Line Diagrams, and traffic data. DVRPC conducted an LTS analysis for their region and preliminary results from that analysis were used for Mercer County. The team also conducted field evaluations to make measurements and verify the various roadway features, character, parameters, and user behavior. For many local roads in the study area, basic assumptions were made for their typical features and characteristics.

The overall breakdown of LTS designations

for the Greater Mercer study area is presented below; maps for each are presented across the following pages

Most roads within the study area have an LTS of 1. Many of these are local, low-volume, low-speed residential streets. Despite this finding, the prevalence of long stretches of LTS 4 corridors impedes many riders from making their desired local and regional trips and limited mobility and access. The study area has many busy, high-speed roads lacking adequate bicycle infrastructure.

LTS 1

- 66% of Greater Mercer study area roadway network mileage
- Includes many low-speed residential streets found throughout the study area

LTS 2

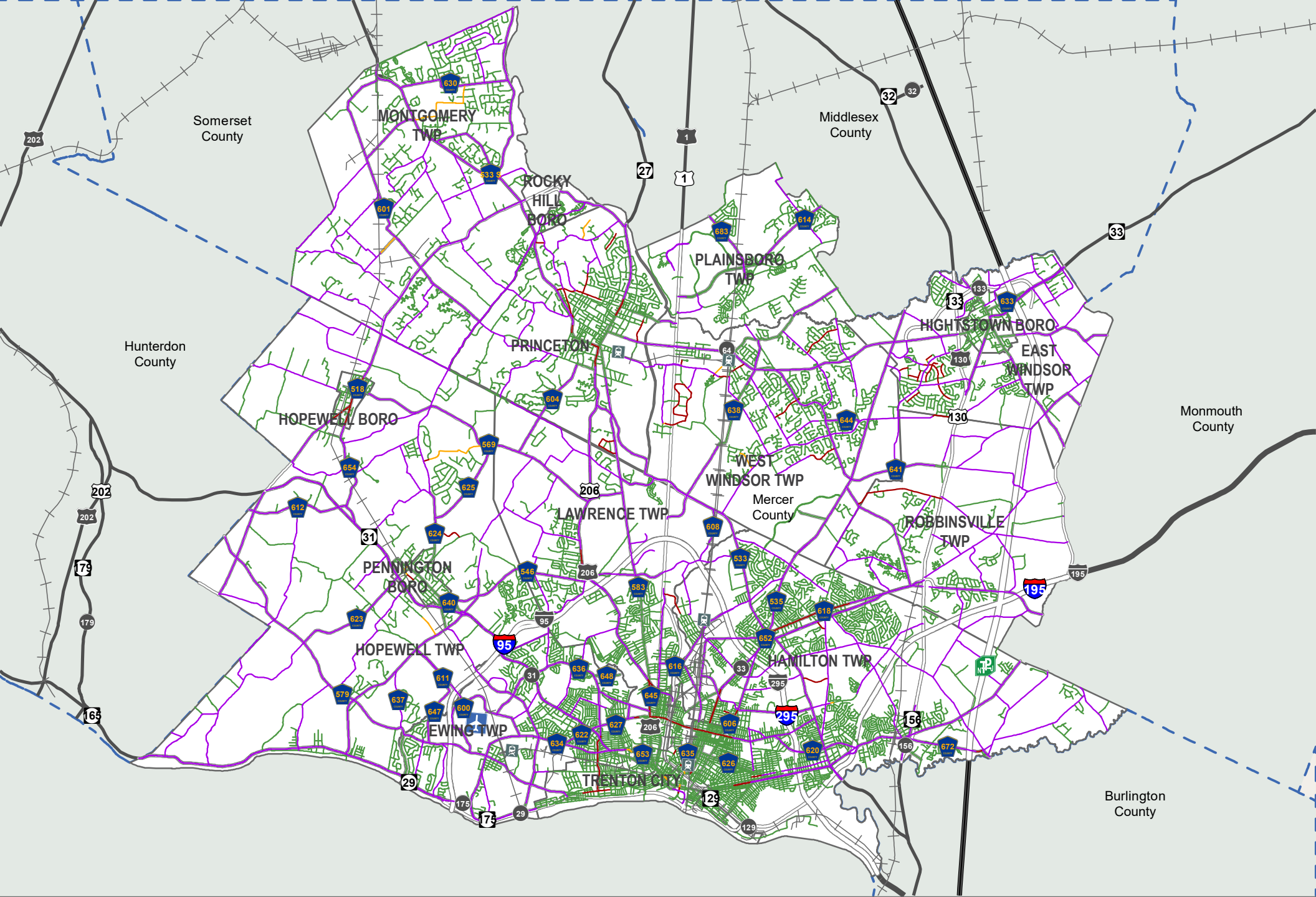
- 3% of network
- Found mostly in Trenton

LTS 3

- 3% of network
- Found mostly in Trenton

LTS 4

- 29% of network, including most County and State Highways
- Typically these are high-volume, high-speed, or wide roadways



Bicycle Level of Traffic Stress (LTS)

- LTS 1
- LTS 2
- LTS 3
- LTS 4

- Rail
- Rail Station
- Airport

0 1.5 3 6 Miles



Island Effect

The team also conducted a connectivity analysis to determine the extent of the “Island Effect”. The Island Effect methodology helps identify where significant barriers and gaps exist and focuses on the need to mitigate and overcome these shortcomings to reconnect the islands.

Gaps in connectivity caused by high-stress roadways and other natural and man-made barriers create isolated pockets with good internal mobility, but which are isolated from nearby areas and destinations, effectively creating a series of adjacent but disconnected mobility-limited islands.

Although most streets in the study area are LTS 1, these are primarily residential streets with limited connectivity to the overall region, and isolated from other neighborhoods by barriers such as high-volume, and high-speed LTS 4 streets and arterial roadways.

Assuming each LTS level cyclist only rides on roads matching their comfort level, the existing conditions assessment can reveal a fragmented system of disparate islands, separating riders from their neighbors and the adjacent communities.

The display of the islands effect on the following map is not an exact science, but rather is intended to illustrate the isolating impact of high-speed corridors and other natural and man-made barriers to “low-stress” mobility and connectivity.

Looking only at LTS 1 streets, numerous gaps exist within the Greater Mercer study area. LTS 1 islands within and across many study area communities, including large swaths Princeton, Hopewell Borough, Pennington, Ewing, Trenton, Hamilton, and West Windsor.

The figure to the right indicates a significant island effect and more than 11 individual islands across the study area.



Bicycle Level of Traffic Stress (LTS) 1 "Islands"



LTS 1 "Islands"

Rail



Rail Station



Airport



Existing Bike Network

The existing network of on- and off-road trails and bike facilities include

- Facilities currently built and in-use

The existing network features a mix of trails, paths, and on-street facilities of various design and uses.

Points of Interest

Points of interest include a collection of trips generators, destinations, and amenities that generate, accommodate, and support walking and biking activity.

The points of interest were identified and mapped to better pinpoint demand for biking and walking trips, consistent with Plan goals to expand access to local and destinations.

These points of interest included:

Public and Private Schools

More than 160 K-12 schools are located throughout the Greater Mercer area. In addition to numerous public schools, large private schools exist in Lawrenceville, Princeton, Pennington and Hightstown.

Higher Education Institutions

Higher education institutions include Thomas Edison State University (Trenton), the College of New Jersey (Ewing), Rider University (Lawrence), Mercer County Community College (West Windsor and Trenton) and Princeton University (Princeton), with more than 40,000 students and more than 10,000 employees.

Hospitals and Health Care

Five regional hospital and many related facilities are located in the study area.

Retail Destinations

Popular commercial areas include the Quaker Bridge Mall in West Windsor and downtown the Princeton hub centered on Nassau Street, as well as many local main streets.

Public Transit

Many NJ TRANSIT bus routes traverse the study area, providing both local service and commuting options to New Brunswick, New York and Philadelphia. Intercity bus service is also available in Princeton. NJ TRANSIT train stations include Princeton Junction (West Windsor), Hamilton, Princeton, and Trenton. Trenton and Princeton Junction have Amtrak service.

Museums

Highly frequented museums in the area include Grounds for Sculpture (Hamilton), the New Jersey State Museum (Trenton) and Princeton University Art Museum (Princeton).

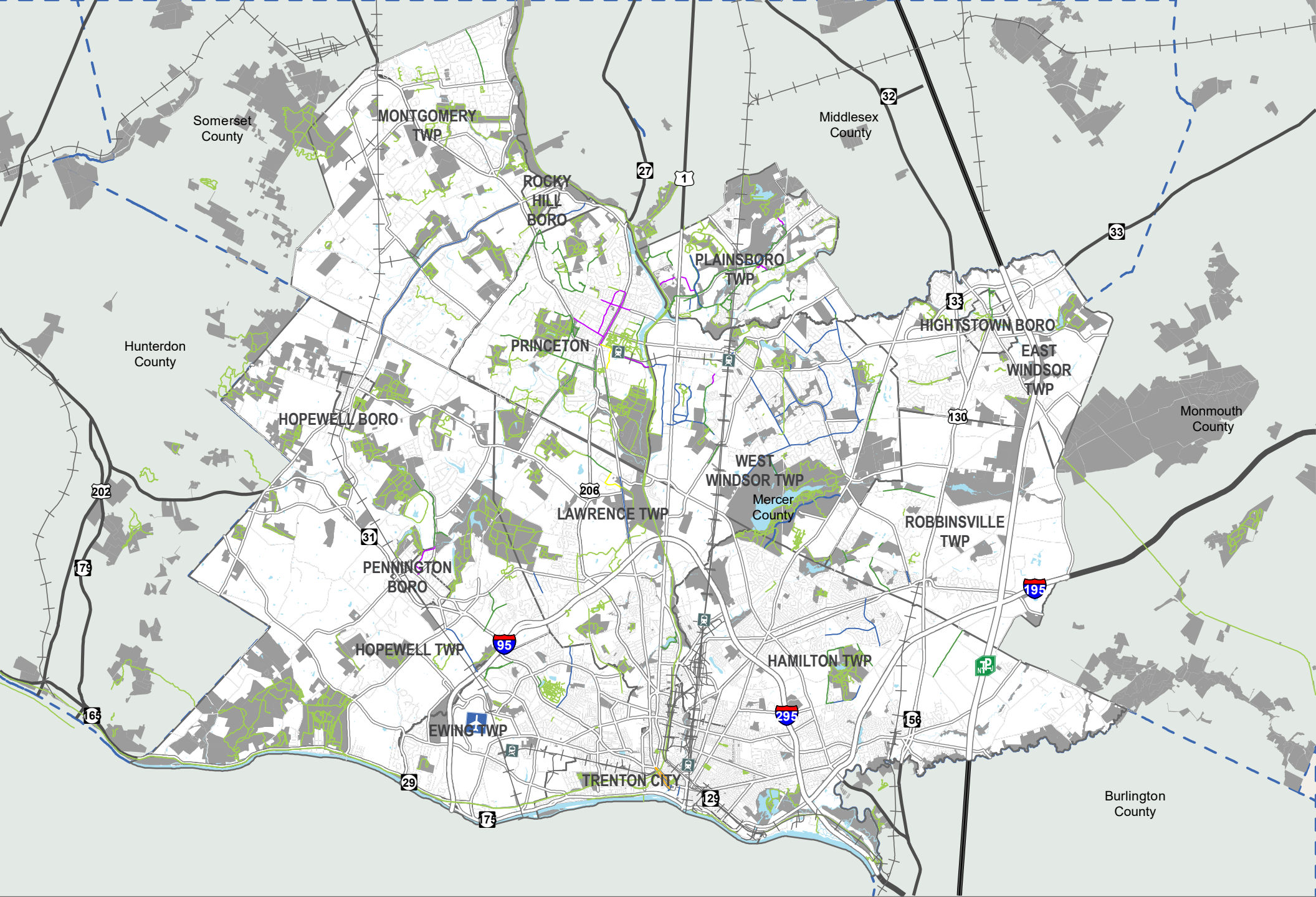
Recreation and Open Space

Large recreational facilities exist throughout Mercer County, and include Mercer County Park (West Windsor), Assunpink Wildlife Management Area (Robbinsville), Mercer County Park Northwest & Rosedale Park (Lawrence/Hopewell) and Washington Crossing and Baldpate Mountain Parks (Hopewell).

Major Employers

Major employers in the study area include:

- Carnegie Center
- Princeton Forrestal Center
- Princeton Pike Corporate Center
- Bristol Myers Squibb (BMS)
- Educational Testing Service (ETS)
- NJM Insurance Group
- Janssen Pharmaceutical Company



Existing Facilities

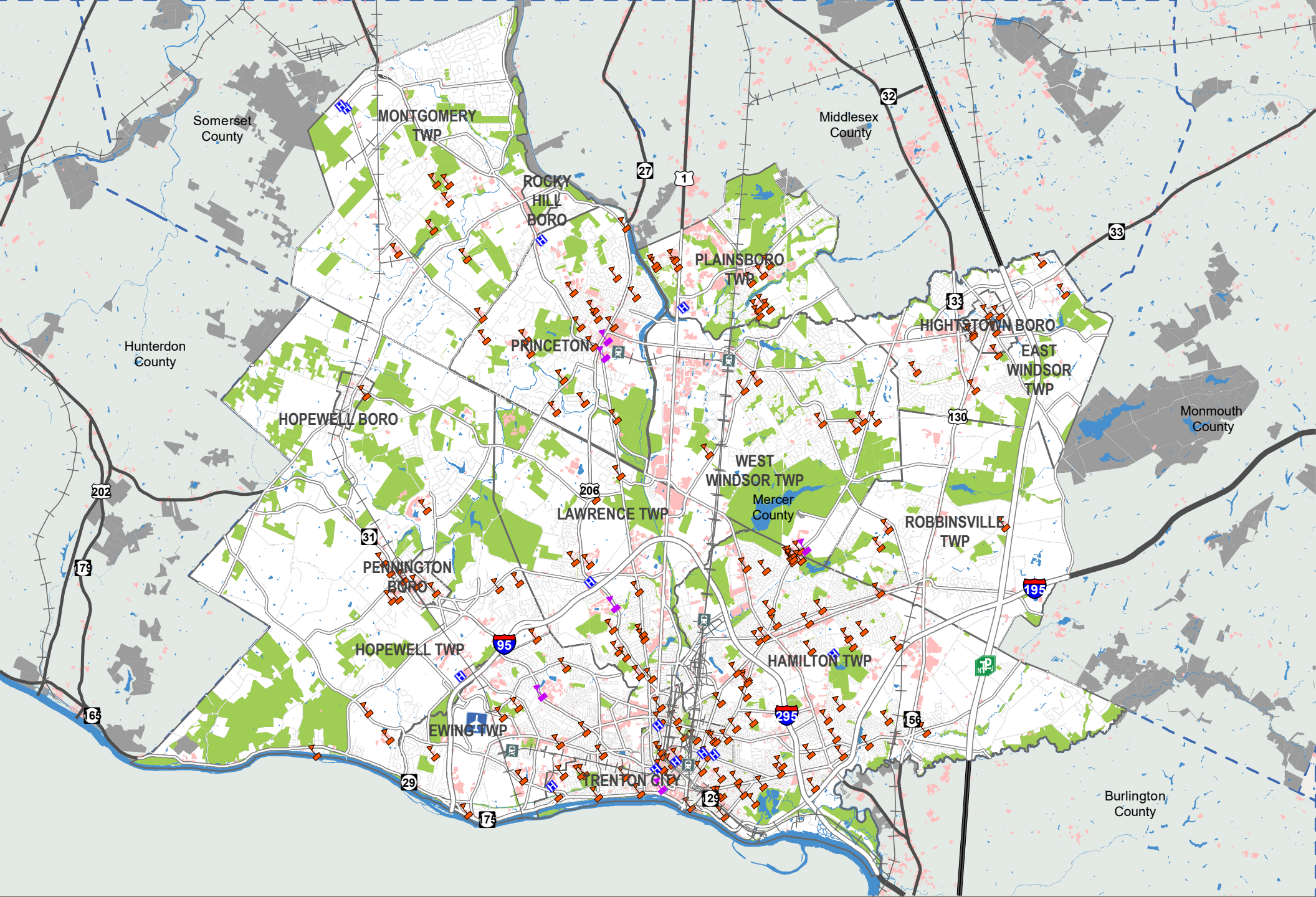
- Trail
- Shared Use Path
- Bike Boulevard
- Buffered Bike Lane
- Bike Lane
- Shared Roadway

- Rail
- Rail Station
- Airport

- Open Space
- Water

0 1.5 3 6 Miles





Study Area Points of Interest

- | | | |
|---|-----------|---------------------|
| H | Hospitals | Commercial Land Use |
| A | Schools | Open Space |
| P | Colleges | Water |

- | |
|--------------|
| Rail |
| Rail Station |
| Airport |

0 1.5 3 6 Miles



Demand Assessment

The Greater Mercer Trails Plan aims to develop a comprehensive multimodal network serving residents throughout the study area, efficiently and conveniently connecting them with destinations.

Measures of existing bicycle usage, such as bicycle counts do not fully reflect the potential, or latent demand, for bicycle travel. These traditional metrics do not capture those who would be more interested in bicycling if appropriate facilities were available: the “interested, but concerned” cyclists who comprise most of the population. Commuting trips to work are often overemphasized, as only 15 percent of daily trips are taken for commuting (Bureau of Transportation Statistics, 2017). Additionally, people frequently make multiple trips per day using different modes.

Some trips are more amenable to driving while others are more attractive for biking and walking and these factors can change across the course of a day or week (weather, visibility) as well as across an individual’s lifetime (physical ability to bike). Improving the ability and attractiveness of bicycle travel broadens peoples’ options and allows them to travel in the manner they wish.

Bicycle and walking travel demand are influenced by a variety of factors, including

the locations of population centers, jobs, key destinations, and demographic factors. In order to quantify this latent demand, the plan includes a comprehensive bicycle demand analysis. The analysis helps demonstrate the need for bicycle accommodations, identify potential routes, and guide the development of a suitable and accessible network.

Population Density

The objective of the bicycle network is to connect residents from where they live to where they need to go. Residential neighborhoods are the origin for most trips, whether by foot, bike, transit, or car. An analysis of population density identifies the most populous neighborhoods of Mercer County, indicating higher potential bicycle demand. In addition to identifying the greatest concentrations of potential bicyclists, more developed neighborhoods and development patterns are also more conducive and convenient for alternative modes of transportation – including walking, biking, or transit.

The study area population density (1525 persons per sq.mi.) is higher than the State as a whole (1210). Within the Greater Mercer area, higher density areas include Trenton and portions of Ewing, Lawrence and Hamilton close to Trenton, downtown Princeton, Hightstown and eastern Plainsboro.

Job Density

While residential areas are a significant generator of trips, employment areas are a major trip attractor, or destination for walk and bike trips. An analysis of job density data (2015 U.S. Census data) identifies the large employment hubs within the Study Area, such as the U.S. Route 1 Corridor, downtown areas of Princeton and Trenton, and Scotch Road in Hopewell Township.

The following variables were included in the demand assessment.

[Population Density](#)-residents per square mile

[Job Density](#)-jobs per square mile

[School Access](#)-proximity to elementary and secondary schools

[University Access](#)-proximity to an institution of higher education

[Park Access](#)-proximity to public parks, play grounds, and open space areas

[Commercial Access](#)-proximity to retail land uses

[Bus Access](#)-proximity to bus stops

[Train Access](#)-proximity to a train station

[Under 18 Density](#)-proportion of population under 18 years of age

Over 64 Density-proportion of population over 64 years of age

Zero Car Household Density-proportion of population without access to a vehicle

Income-Poverty Ratio < 1.25-proportion of population living below 125% of the poverty line

Bike to Work Density-proportion of people who currently bike to work

Walk to Transit or Work Density-proportion of people who walk or take public transit to work

Composite Demand Metric

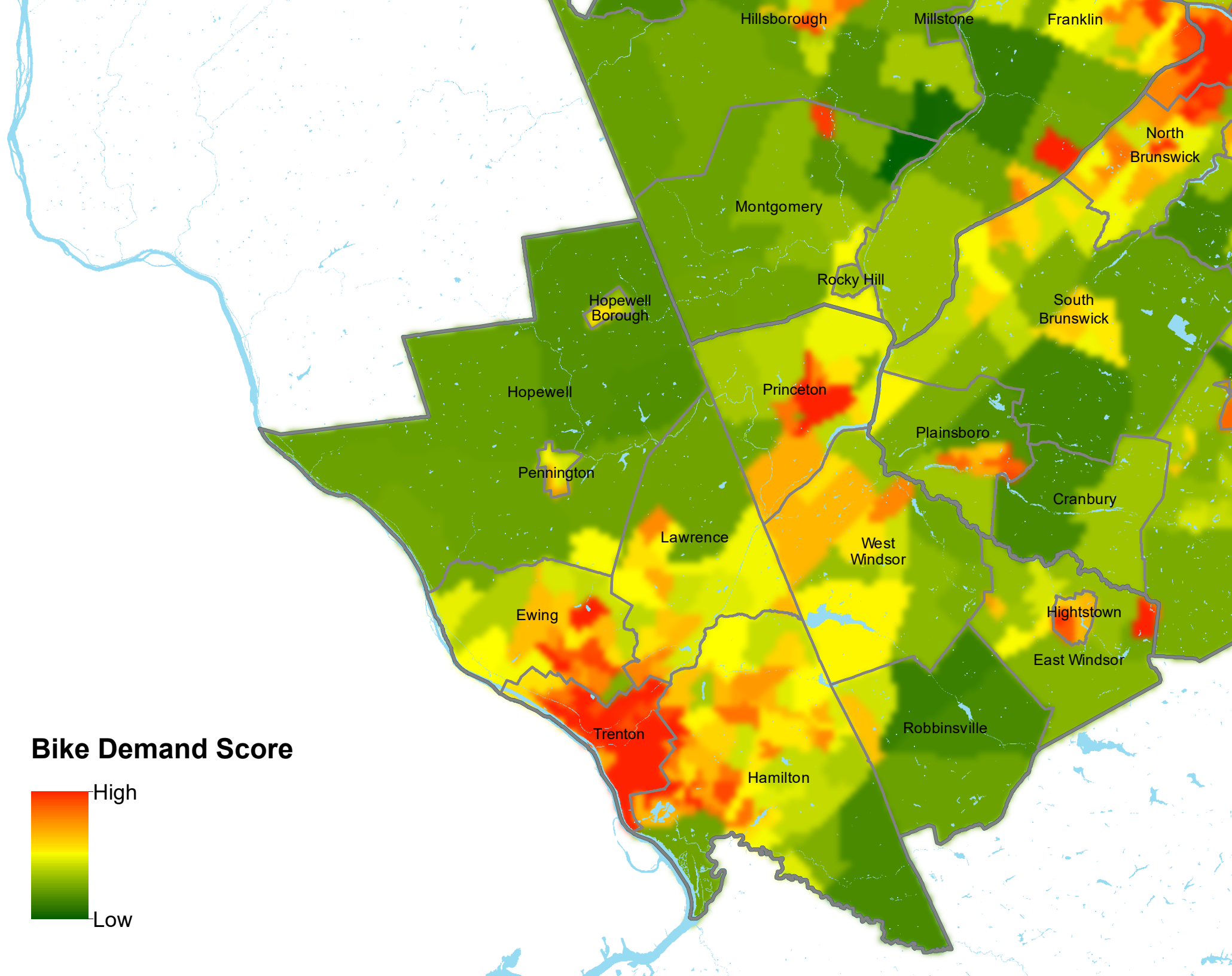
These socioeconomic factors all indicate populations for whom bicycle access may be a preferred or necessary means of travel to work, school, or other destinations. They capture residents who cannot afford or choose not to own a car, who may see cycling as a more affordable or accessible means of transportation, who already bike to work, or for whom cycling might be a suitable alternative for getting to work.

The different factors of the bicycle demand analysis were aggregated at the U.S. Census block group level, and demographic factors were normalized to the block group area to account for differences in block group size. Each factor was assigned a weight to give

greater influence to different factors and balance factors representing or associated with trip generators (origins) and those representing trip attractors (destinations).

Areas of moderate to high demand are located throughout the study area, and represent important nodes to link the proposed bicycle network. Communities in the study area with the highest bicycle demand tend to be those with the highest population densities and economic opportunities, namely Trenton and central Princeton, (formerly Princeton Borough). Areas with high bicycle demand also include central Plainsboro, eastern East Windsor and portions of Lawrence, Ewing and Hamilton near Trenton. Many of these high demand areas are connected by wide, highly used, high-speed roads posing a barrier to comfortable bike travel.





Bike Demand Score

