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Technical Memorandum #2:

Data Compilation, Review and Summary

November 2019

MARTIN IN MOTION 2045

MARTIN MPO
Metropolitan Planning Organization

Martin Metropolitan Planning Organization (MPO) 2045 Long Range Transportation Plan (LRTP)

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1. Introduction

The purpose of Technical Memorandum #2 (TM 2) is to provide a consolidated summary of various data sets, relevant studies and Martin Metropolitan Planning Organization's (MPO) adopted planning documents as well as initial review and analysis findings from existing data. Data and information compiled in TM 2 will support the development of 2045 Long Range Transportation Plan (LRTP) – *Martin in Motion*.

This technical memorandum is organized as described below:

Chapter 1: Introduction - explains the purpose of TM 2 and report organization.

Chapter 2: Data Collection and Development Methodology – discusses data sources, data collection process and methodology.

Chapter 3: Summary Findings – provides a summary of analysis findings, existing conditions and trends based on Martin MPO's adopted planning documents as well as relevant state, regional and local transportation studies and comprehensive plans.

Chapter 4: Emerging Technologies – summarizes the current state of the industry, potential impacts of automated, connected, electric and shared-use vehicles (ACES) on land use development patterns, travel behavior and fiscal impacts relative to funding transportation improvements. Further, it describes Martin County's intelligent transportation systems (ITS) network and discusses the Florida Department of Transportation's (FDOT) guidance on incorporating emerging technologies in the MPO's LRTP process as well as introduces initial assumptions for scenario planning exercise.

Chapter 5: Next Steps – includes a summary discussion on how the data and information compiled in TM 2 will be used to support development of the 2045 LRTP.

2. Data Collection and Development

The following datasets, maps, existing studies and Martin MPO adopted planning documents were reviewed as part of the data compilation and review for the 2045 LRTP.

- Existing transportation plans and studies
- Environmental justice and Title VI, US Census
- Existing and future land use
- GIS datasets for highway and transit system, sidewalks, bicycle facilities, environmental resources
- Maps for roadway functional classification and federal-aid eligible facilities
- Local comprehensive plans
- Performance measures
- Health-related transportation statistics
- Emerging technologies literature review

Data Collection: Majority of the datasets were collected from online sources including Martin MPO, Martin County, Florida Department of Transportation (FDOT), Florida Geographic Data Library (FGDL).

Data Development: Data development included processing and mapping census data to understand existing travel patterns in Martin County, and identify environmental justice and Title VI populations. Environmental resources data was mapped using ArcGIS to identify environmental constraints. Performance measures data obtained from adopted planning documents was reviewed and reported to inform project evaluation criteria and prioritization in the later stages of the LRTP development process. The health-related transportation data was primary obtained from South Florida Commuter Services (SFCS), Walk Score and Martin County.

Literature research related to emerging technologies included review of available industry data on automated, connected, electric and shared use vehicles, FDOT's guidance for incorporating ACES in the LRTP process, as well as FDOT's Transportation Systems Management and Operations (TSM&O) Master Plan and Martin MPO's and Martin County's Advanced Traffic Management System (ATMS) Status Report.

3. Summary Findings

3.1 Existing Plans and Studies

The following is a summary discussion of relevant transportation planning studies and Martin MPO's adopted documents that will inform and support the development of the 2045 LRTP. The review of these documents provides background, planning context and ensures continuity of local and regional transportation improvement projects identified by the Martin MPO and its partner agencies.

3.1.1 Transportation Improvement Program, FY 2019/20-FY 2023/24, Martin MPO, June 2019

The purpose of the Transportation Improvement Program (TIP) is to provide a comprehensive and prioritized listing of transportation projects for FY 19/20-FY 23/24 that is consistent with the 2040 LRTP. The TIP is based on funding data contained within the FDOT Tentative Work Program. The TIP contains all transportation-related projects to be funded by Title 23 and Title 49 funds and regionally significant transportation projects planned for the upcoming five years and is updated annually with funding priority given to the highest ranked projects from the LRTP Cost Feasible Plan.

3.1.2 City of Stuart Tram Business Plan, Martin MPO, Spring 2019

In 2006, the City of Stuart Community Redevelopment Agency (CRA) purchased one fuel-powered Tram to relieve parking issues and, what has now become the Downtown Stuart Tram, was initiated using Tax Increment Funds (TIF). In 2010, the CRA adopted the Downtown Master Parking Plan and in 2012 the CRA purchased its second vehicle, an all-electric Tram. A third electric Tram was purchased by the CRA in 2013. In July 2016, the CRA received a Transit Development Grant from the FDOT District Four. The grant provided funding for the purchase of two more vehicles and operating costs through June of 2019. In 2017, the Tram was placed under the direction of the City Public Works Department.

As funding for the Tram is limited due to the FDOT grant expiring, the Martin MPO coordinated with the CRA and the City to develop a multi-year business plan to sustain and potentially expand Tram services over a five-year period. The goal of the Business Plan is to continue to plan, operate and maintain the Downtown Stuart Tram consistent with a vision of enhanced mobility and economic development for the Downtown Stuart Area. The goal is proposed to be accomplished by setting forth the following objectives to be achieved beginning Fiscal Year (FY) 2019 through FY 2025 with annual updates:

- Improve Tram reliability, efficiency and effectiveness
- Assure fiscal stability through five (5) year budgeting
- Create a distinct and recognizable brand for the Tram
- Seek out and apply for grants and private sector participation
- Increase transit ridership levels by capturing traditional and new transportation markets

- Continue intergovernmental coordination with regional transportation authorities and the private sector to foster strong partnerships.

3.1.3 Martin County Transit Operations Center Facility Feasibility Study, Martin MPO, April 2018

The Martin County Transit Operations Center Facility Feasibility Study was sponsored by the Martin MPO in cooperation with the Martin County Public Transit (MCPT). As part of the Martin County Transit Business Plan in 2017, the FDOT and MCPT recommended the initiation of a plan for a wholly owned maintenance and operations/dispatch facility in order to best maximize efficiency and increase effectiveness of the MCPT's operation. The feasibility study provided planning services for a conceptual operations plan of a full-service transit operations facility/customer service center and identified potential sites for development of that facility for MCPT. Further, the plan developed two illustrative, high-level concept drawings for the proposed center, which included building envelopes, parking and circulation, and potential connections to surrounding land uses and the surrounding transportation system. A GIS analysis was performed to select sites suitable for the facility when considering surrounding land use, existing utilities, traffic impacts, connectivity to transit, and eligibility for federal funding. The analysis identified 28 sites viable for potential development, and the top ten sites were further examined for environmental impacts.

3.1.4 Bicycle, Pedestrian and Trails Master Plan, Martin MPO, December 2017

The Martin MPO Bicycle, Pedestrian & Trails Master Plan identified recommendations for the County becoming a pedestrian and bicycle friendly, walkable and livable community. The Master Plan builds from the 2040 Non-Motorized Needs Plans identified in the 2040 LRTP, as well as other prior plans and studies. The Master Plan provided recommendation to enhance the County's recreational trail network through connectivity between existing trails in and around local, County and State parks and provided guidance to expand the non-motorized transportation network to connect residents to hotspots within the area. Some recommendations included shared use paths, buffered bike lanes, bike boxes at signalized intersections, pedestrian bridges and bridge improvements. The Master Plan also included coordination with the Florida Department of Environmental Protection (FDEP) Office of Greenways and Trails (OGT).

3.1.5 FEC Railroad Grade Separation Feasibility Study, Martin MPO, August 2017

The Martin MPO initiated the Florida East Coast (FEC) Railroad Grade Separation Feasibility Study to identify, evaluate and plan for potential roadway and non-motorized pedestrian/bicycle grade separations along the FEC Rail Line through Martin County. The study identified 11 different roadway locations for grade separation along the FEC and five (5) locations for potential non-motorized separations that have the potential need and justification for consideration in future planning and programming efforts by the MPO Board. Four (4) locations were selected for concept development for the purposes of analyzing and better understanding the impacts and benefits of implementing grade separations in Martin County.

3.1.6 Bicycle and Pedestrian Safety Action Plan, Martin County, Martin MPO, May 2016

The Martin County Bicycle and Pedestrian Safety Action Plan (BPSAP) was adopted by the Martin MPO Board on May 9, 2016. Martin County's BPSAP was established to meet FDOT's requirement that each MPO prepare a pedestrian safety action plan, identify bicycle and pedestrian safety problems and crash hot spots, develop strategies to enhance bicycle and pedestrian safety, and to assist local and state agencies in further enhancing their bicycle and safety programs and activities. Through a 12-month planning period with extensive community outreach and engagement efforts and quantitative and qualitative analysis, the BPSAP identified 68 crash hot spots within Martin County. Nearly 32 of these hot spots were matched up with the programmed projects in the FDOT's Five Year Work Program (FY 2017 – FY 2021) and the local plans that could potentially address bicycle and pedestrian issues in the County. The plan also identified location specific engineering countermeasures of six "representative" locations based on a corridor approach. The BPSAP also recommended enforcement and education and encouragement countermeasures as part of the project's "4Es – Engineering, Enforcement, Encouragement, and Emergency Medical Services (EMS)" approach to improve bicycle and pedestrian safety.

3.1.7 Martin Grade Scenic Corridor, Corridor Management Plan, Martin Grade Scenic Highway Corridor Advocacy Group (CAG), December 2014

The Martin Grade Scenic Corridor is an approximately 12-mile long two-lane, minor arterial roadway in western Martin County. The Corridor Management Plan (CMP) was developed under the Corridor Advisory Group (CAG) and with community input through Martin County agencies and the Martin MPO. The CMP's vision is that the "Martin Grade Scenic Corridor's rare Old-Florida ambiance, scenic beauty, and natural environment are preserved, maintained and enhanced for the enjoyment of countless generations." The CMP proposes to protect this resource through education, awareness and integration into the local tourism economy and addresses fundraising and sustained community support. The Plan seeks to preserve the canopy trees and other scenic resources along the corridor and envisions a greenway along the Grade, which helps to integrate the Scenic Corridor into the larger tourism economy in the area, and provides access to outdoor, low-impact recreational opportunities in publicly conserved lands. An objective of the CMP is to ensure that protection for the Martin Grade is included in the Martin County Growth Management Plan and Land Development Regulations.

3.1.8 Martin and St. Lucie Regional Waterways Plan, Martin MPO December 2014

The Waterways Plan was developed at the initiative of the Martin MPO and St. Lucie Transportation Planning Organization (TPO), with funding from and participation by the Florida Inland Navigation District (FIND). The purpose of the plan is to identify and prioritize waterway access needs and facilities of the regional waterways system to promote and maximize its economic vitality and public benefit. The plan was developed through a public process facilitated by the Treasure Coast Regional Planning Council (TCRPC) and was created with the guidance of a plan steering committee and with public input through a series of public forums, workshops, and a planning charrette, which were conducted from December 2013 through May 2014. This plan supports the continuation

of many of the counties' extensive, ongoing programs related specifically to the protection of natural systems, recreation and environmental enhancement, public access, and economic development. The plan also highlights a series of key activities that go beyond the ongoing restoration and enhancement activities and recommends that they be prioritized in the next five to ten years.

3.1.9 Martin County Transit Development Plan - 2014-2023 Major Update, Martin MPO, June 2014

The Transit Development Plan (TDP) is an FDOT required, 10-year horizon plan intended to support the development of an effective multi-modal transportation system for the State of Florida and serves as the basis for defining public transit needs as a prerequisite to receipt of state funds. Martin County's 2014-2023 TDP serves as both a blueprint for the operational and capital resources required to meet future transit needs, and a strategic vision plan developed with the general public and elected leaders for how transit service can help shape the transportation system. The TDP and its findings are based on a series of technical analyses and public involvement efforts conducted between August 2013 and July 2014. The vision for the public transportation system is "To enhance the overall quality of life of Martin County residents and workers by providing safe, accessible, reliable, interconnected, and attractive public transportation system that is effective and efficient in meeting their mobility and accessibility needs." The TDP defined five (5) goals and 24 objectives to establish this vision. The five goals are defined as follows:

- Develop a high-quality public transportation service to move people within Martin County and the Treasure Coast region
- Focus on improving the efficiency and effectiveness of transit services provided by Martin County Public Transit (MCPT)
- Increase ridership levels by capturing traditional and new transportation markets
- Create a brand for MCPT that is distinct and recognizable by existing and potential customers
- Continue building strong partnerships with community and private sector entities as well as transportation agencies in the region.

3.1.10 Martin County Airport/Whitham Airfield Master Plan Update, Martin County November 2010

The Martin County Airport/Witham Field Master Plan Update provides an approach to identify forecast aviation demand, determine anticipated facility requirements, and consider alternative development plans that will provide a more 'balanced' Airport system. The master plan update serves as guidance to help ensure that the Airport meets demand for aviation services and provides marketing and business development guidance. The plan identifies the general airport capacity and facility requirements necessary to meet the 20+ year forecast of aviation demand, and what refinements must be made for the airport to develop in a cohesive manner.

3.1.11 FDOT Five-Year Work Program

FDOT developed the Five-Year Work Program in accordance with Florida Statute Section 339.135, which shall include the department's proposed revenues and expenditures for

operational and capital needs for the following year, as well as a 5-year finance plan. The plan includes right-of-way, construction, preliminary engineering, maintenance and all grants and aids programs. FDOT coordinated with local governments, Metropolitan Planning Organizations, city and county officials, and the public. The Work Program is based on forecasts of costs and funding and multimodal transportation concepts, and FDOT has determined that it has the financial capacity to perform the tasks outlined in the Work Program. Projects mentioned in the Work Program for Martin County include a Project Development and Environmental (PD&E) Study along I-95, resurfacing of CR-707/SE Beach Road, bike paths/trails within Jonathan Dickenson State Park, replacement of Murphy Road Bridge and improvements to the Whitham Field Airport.

3.1.12 FDOT Transportation System Management & Operations (TSM&O) Master Plan

The Transportation System Management and Operations (TSM&O) Master Plan was developed by FDOT and build on input from MPOs and local partners to identify operation and management strategies to optimize performance outcomes. The TSM&O Plan highlights ways to increase capacity lost to congestion, incidents, construction, weather, and traffic control delay. The Plan focuses on improving vehicular mobility and identifies potential project locations and project types at a corridor level. Objectives are to improve safety, enhance travel reliability, and reduce delay. TSM&O projects are identified along Federal Highway, SW Martin Downs Boulevard, Kanner Highway and SR-714/SE Monterey Road in Martin County.

3.2 Existing Transportation Network and Travel Patterns

3.2.1 Existing Transportation Network

Martin County is located in South Florida and is bordered on the north by St. Lucie County, on the south by Palm Beach County, on the west by Okeechobee County, and on the east by the Atlantic Ocean. Very little of the county is incorporated as there are only four municipalities. Among these incorporated municipalities, the largest city, Stuart, has over 16,000 residents and is located in the northeastern quadrant of the county. The most populated place within the county is unincorporated Palm City, with a population of over 23,000 according to 2016 American Community Survey (ACS) estimates. **Figure 3-1** presents a physical representation of the county and the existing transportation and transit network.

Highways: Regionally significant transportation corridors in Martin County including designated Strategic Intermodal System (SIS) facilties are I-95, Florida's Turnpike, State Road 710 and US 98. Other roadway facilties that carry local traffic include all of the major and minor arterials, such as, State Road 76/Kanner Highway, US 1/Federal Highway, County Road A1A/Dixie Highway, State Road 714 /Martin Highway, Martin Downs Boulevard, County Road 76A/Citrus Boulevard, County Road 711/Pratt Whitney Road, County Road 708/Bridge Road, County Road 722/Salerno Road and Cove Road.

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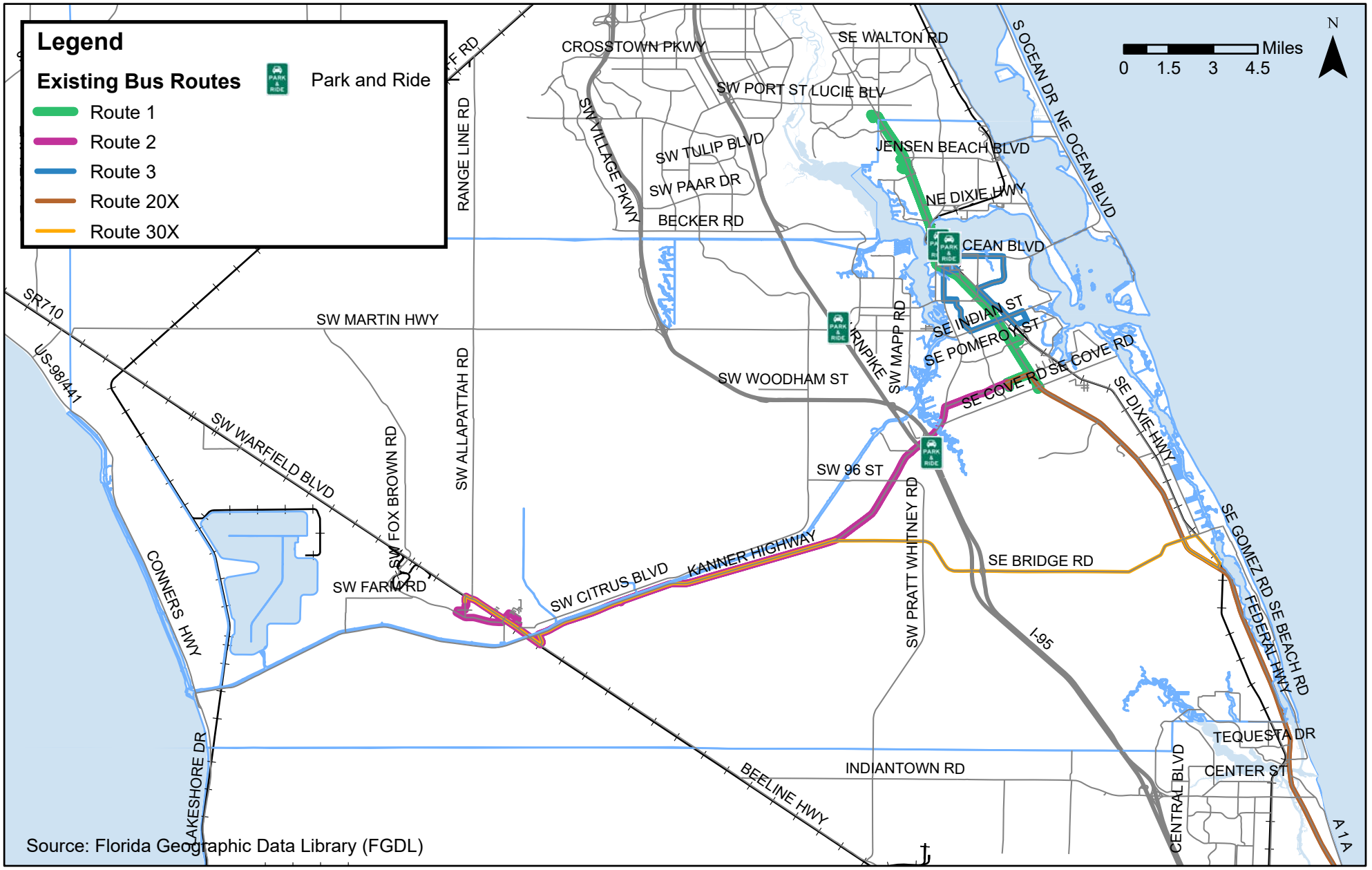

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Transportation Network
Martin County

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Figure 3-1

Transit: Martin County's public transit system, Marty, operates four routes. These routes comprising the Marty system include the following two fixed-routes, one deviated fixed route and one express route for commuters:

- Route 1, an intercounty route serving US 1 from the Port St. Lucie Walmart to Cove Road and providing connections to the Treasure Coast Connector in St. Lucie County. Service operates on weekdays (Monday- Friday) from 6:00 am to 8:00 pm.
- Route 2, a deviated fixed route primarily serving Indiantown. Service operates on weekdays (Monday- Friday) from 6:00 am to 8:15 pm.
- Route 3, primarily serving Stuart. Service operates on weekdays (Monday-Friday) from 6:00 am to 8:00 pm.
- Route 20x, an express route providing service from Stuart to Palm Beach County and providing connections to Palm Tran at Palm Beach Gardens Mall and the Veteran's Administration Medical Center (VAMC) in Palm Beach County. Service operates on weekdays (Monday- Friday) from 6:30 am to 7:35 pm.

ADA service is offered within a ¾-mile buffer of Marty's fixed-routes for individuals with disabilities. Other transit agencies with connecting opportunities to Marty routes include Palm Tran, which operates in Palm Beach County, the Treasure Coast Connector (TCC), which operates in St. Lucie County, and Stuart's downtown Tram route, which provides on-demand service and stops at key locations within the downtown area.

Freight: In Martin County, I-95 is included in the Primary Highway Network System (PHNS), which is a critical component of the freight transportation network. In addition, the County's designated SIS facilities that include Florida's Turnpike, State Road 710 and US 98 as well as Atlantic Intracoastal Waterway (AIW) are part of the regionally significant freight network. While Martin County has not designated any local roadways as truck routes, all the major and minor arterials comprise regionally significant freight network. Witham Field, located approximately one mile southeast of Stuart, does not have commercial or air cargo services but plays a significant role in the general aviation needs of the region. Key freight railroads that traverse Martin County include Florida East Coast Railway (FEC) and CSX Transportation (CSX).

Waterways: Martin County has an extensive network of waterways. The Intracoastal Waterway (ICW), also known as the Atlantic Intracoastal Waterway (AIW), spans roughly 44 miles through Martin and St. Lucie counties and provides connections to both the St. Lucie Inlets and Fort Pierce. The St. Lucie River, including its north and south forks, provides connections to the ICW, water access inland, and a connection to Lake Okeechobee via the St. Lucie Canal (C-44). Additionally, Martin County has a series of smaller creeks, canals, and tributaries, which provide additional waterway connections for residents, business owners, visitors, and marine life. Waterways in Martin County are primary used for recreational purposes by the marine industry and limited cargo service comprising barge traffic to specific industrial hubs (power plants).

3.2.2 Travel Patterns

This section describes the travel characteristics of Martin County. The focus is on work trips made by people that live in Martin County, as work trips make up more than 15% of the total daily traffic and are the single most important contributing factor to traffic congestion during peak hours. The analysis will be based on the 5-year (2012-2016) American Community Survey (ACS)/Census Transportation Planning Product (CTPP) data. CTPP is a data program sponsored by AASHTO with funding contributions from all state DOTs and some MPOs. The CTPP uses ACS samples for data tabulation and the dataset includes the following three parts:

- Part 1: Residence-based tabulations summarizing worker and household characteristics
- Part 2: Workplace-based tabulations summarizing worker characteristics
- Part 3: Worker flows between home and work, including travel mode

The 2012-2016 ACS/CTPP dataset was released in March 2019 and provides most current and most comprehensive information on socio-economic and commute characteristics at various geographic levels.

3.3.2.1 Places of Work for Martin County Residents

Figure 3-2*: Work Place Counties for Martin County Residents*

illustrates the counties and places where residents of Martin County work. Between 2012 and 2016, there were a total of 60,881 workers residing in Martin County. Close to two-thirds (65.2%) of the resident workers (39,690) in Martin County were employed within the County. Palm Beach County was the most popular workplace outside Martin County, employing 13,663, or 22.4% of the County's workforce. This was followed by the neighboring St. Lucie County where 5,045, or 8.3% of the Martin County resident workers traveled to work. There were 1,351 workers (2.2%) who commuted to work in other counties in Florida, while a small percentage of people (1.9%, or 1,132) were employed by companies located out of the State.

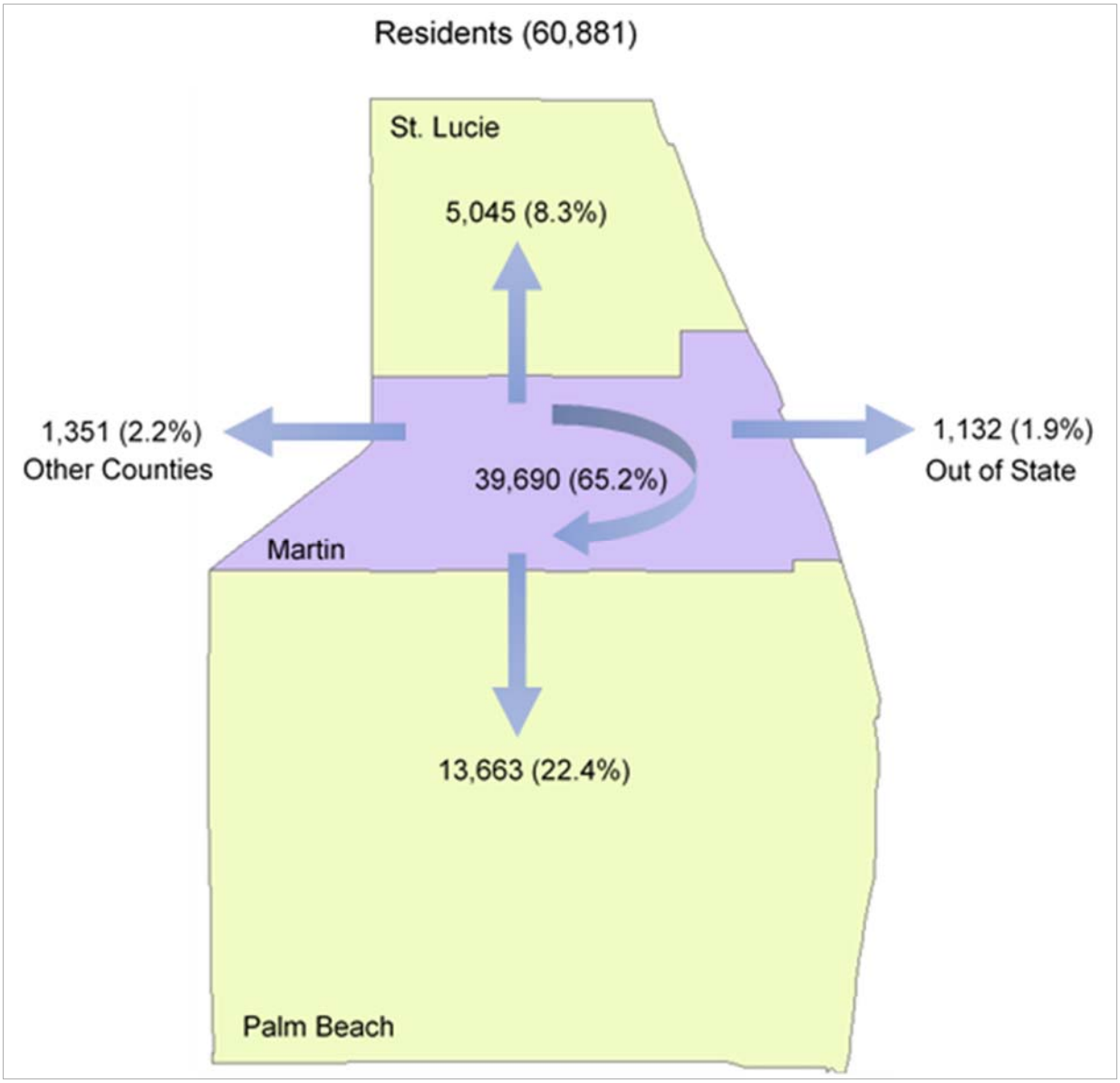


Figure 3-2: Work Place Counties for Martin County Residents

3.3.2.2 County of Residence for Martin County Workers

Figure 3-3*: Residence Counties for Martin County Workers*

shows where workers in Martin County live. Between 2012 and 2016, a total of 62,520 workers were employed in Martin County. Compared to the 60,881 workers living in Martin County, Martin County provided more employment opportunities than the County's workforce and had an employment surplus of 1,639 jobs. About 28.7%, or 17,925 workers in Martin County lived in St. Lucie County. A smaller percentage, 5.5%, or 3,428 workers in Martin County came from Palm Beach County. Two percent (2%) or 1,251 people were residents of other Florida counties. There were 226 people employed by companies located out of the State traveling to Martin County to work.

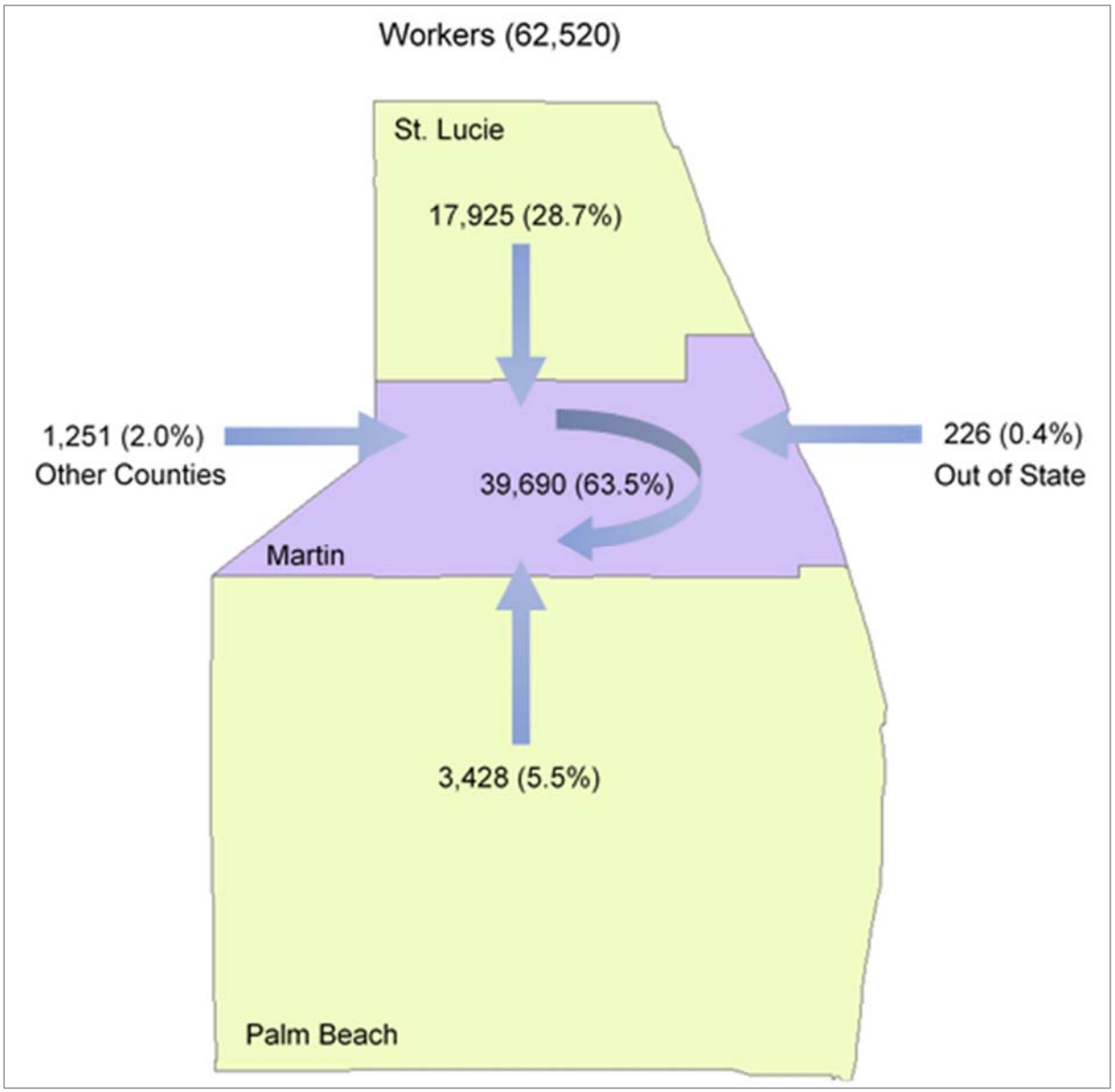


Figure 3-3: Residence Counties for Martin County Workers

3.3.2.3 Martin County Employment by Industry Sector

Figure 3-4*:* shows the employment in different industry sectors in Martin County in descending order between 2012 and 2016. "Education, health, and social services" was the largest industry sector, employing nearly 13,000 people. More than 8,000 people worked in "Professional, scientific, management, administrative, and waste management services" jobs. Close to 7,000 people were employed in "Retail trade" sector, and a similar number of people worked in "Arts, entertainment, recreation, accommodation, and food services". The "Construction" industry employed more than 5,000 people during the same time period, making it the 5th largest industry in the County.

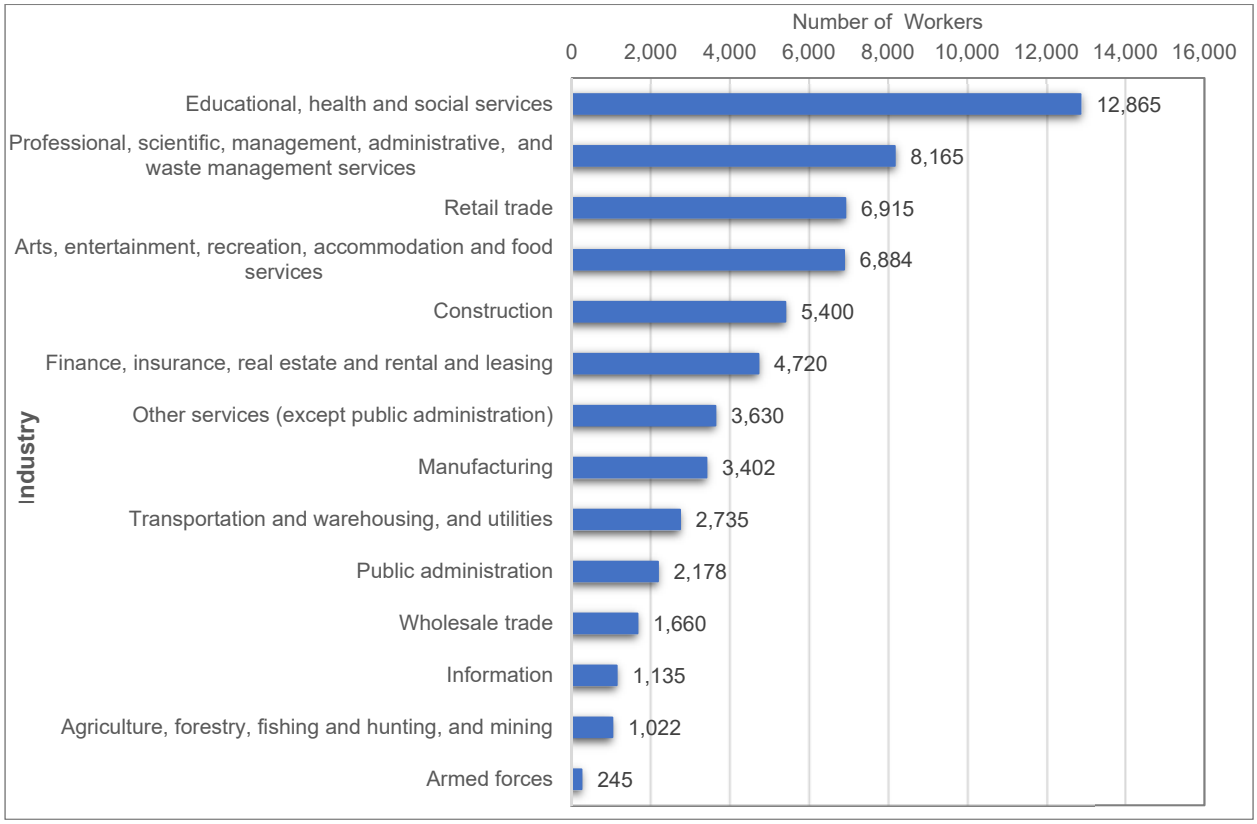


Figure 3-4: Martin County Employment by Industry Sector

3.3.2.4 Means of Transportation (MOT) to Work

Figure 3-5 depicts Means of Transportation distribution to work for workers that lived in Martin County between 2012 and 2016. “Drove Alone” was still the predominant mode of travel to work with 77.1%. Approximately 11% of workers commuted to work by carpool. Public Transportation made up about 0.4% of the mode shares, which was lower than the shares for Bicycle (0.9%) and Walk (1.6%). About 1.6% workers used “Other method” such as taxi or motorcycles to work. Nearly 8.0% of the employees worked from home.

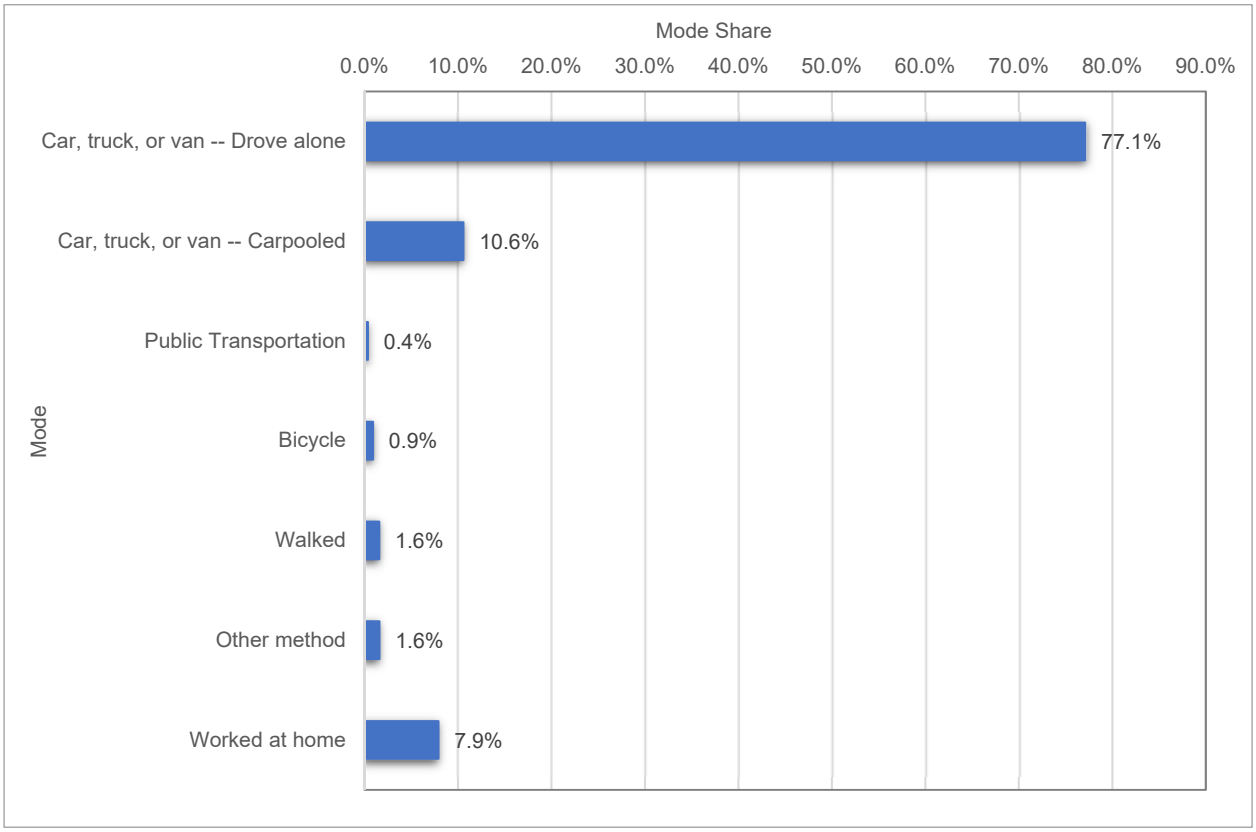


Figure 3-5- Martin County Resident Workers Means of Transportation to Work

3.3.2.5 Travel Time to Work

Figure 3-6*:* shows the travel time distribution for workers residing in Martin County between 2012 and 2016. Close to 25.7% of the workers took between 5 and 14 minutes to get to work. Another 21% took between 30 and 44 minutes to go to work. Over 16% people spent more than 45 minutes on the road to work. The average travel time for all employees that did not work from home was 27.8 minutes.

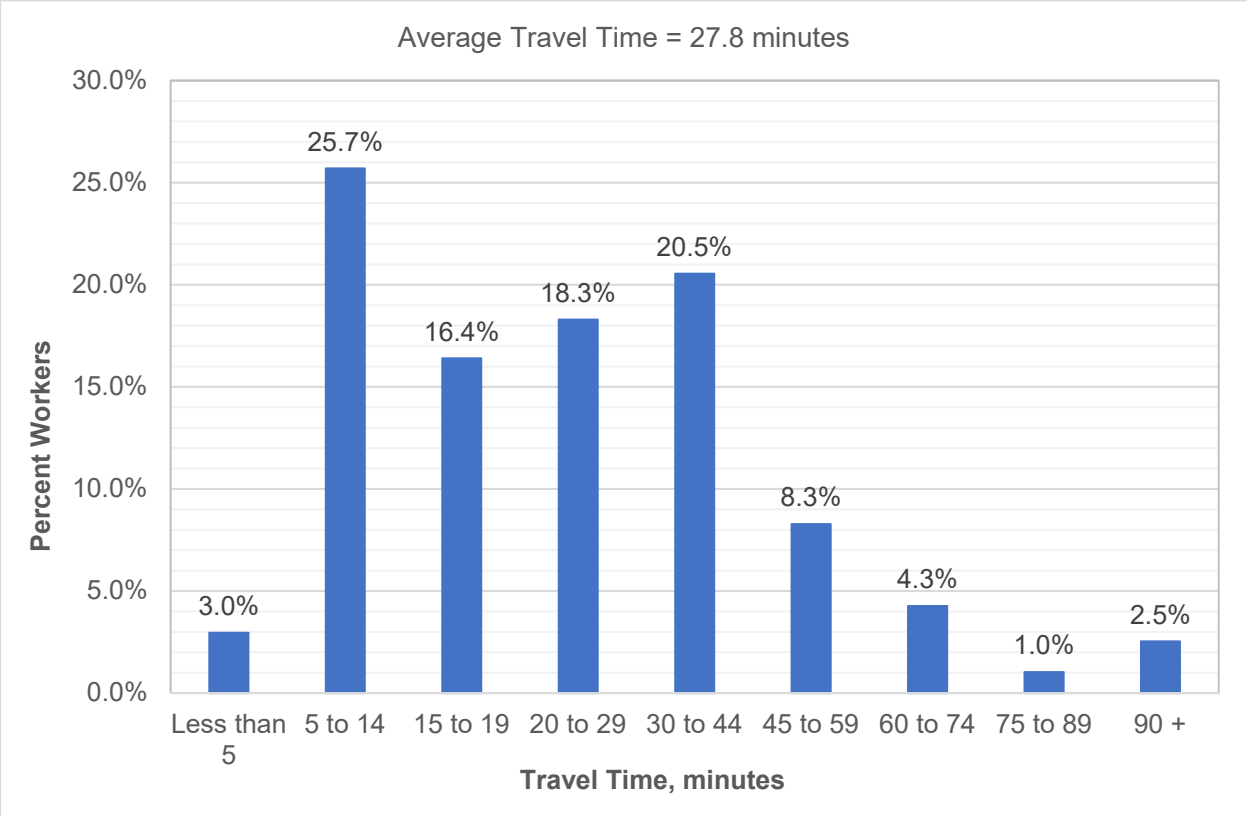
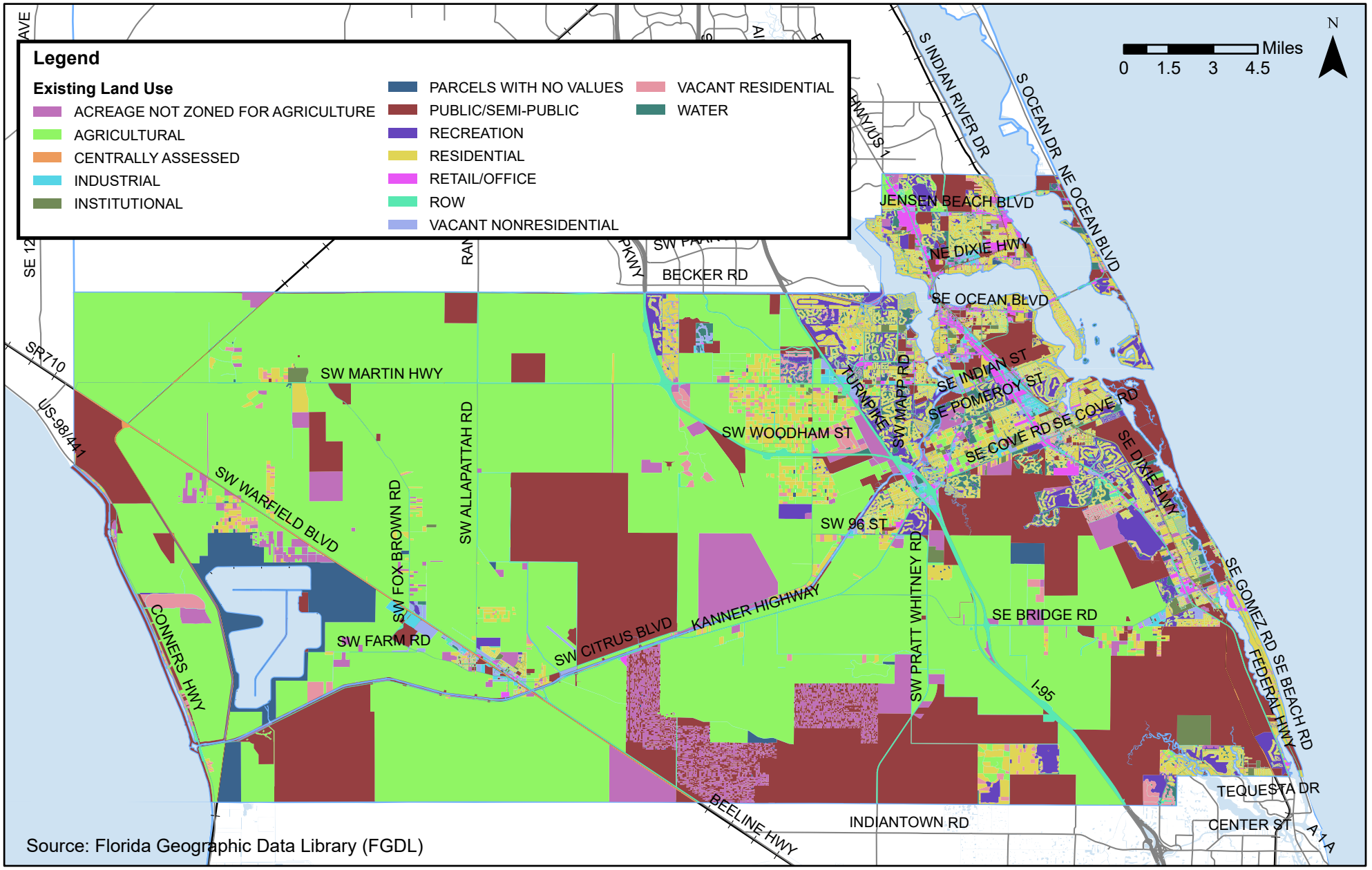


Figure 3-6: Martin County Resident Workers Travel Time to Work

3.3 Existing and Future Land Use

Martin County is centered around the Atlantic Ocean, St. Lucie Inlet, estuaries of the St. Lucie River, Indian River, Loxahatchee River, and Lake Okeechobee. Martin County's total land area consists of approximately 344,316 acres or 538 square miles. The urbanized area predominantly lies between the Florida Turnpike and Atlantic Ocean in the eastern portion of the county, and Stuart is the most urbanized portion of the county. A western urban core occurs in the Indiantown area along the State Road 710 corridor. The western portion of the county is largely agricultural, with older, rural residential developments. The top land uses within the county according to the Martin County Comprehensive Plan include agriculture land, state lands, single-family homes, and vacant acreage. **Figure 3-7,** 2010 Existing Land Use Map, shows existing land uses categorized by Department of Revenue Codes (DOR) and assigned by the Martin County Property Appraiser.



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Existing Land Use
Martin County

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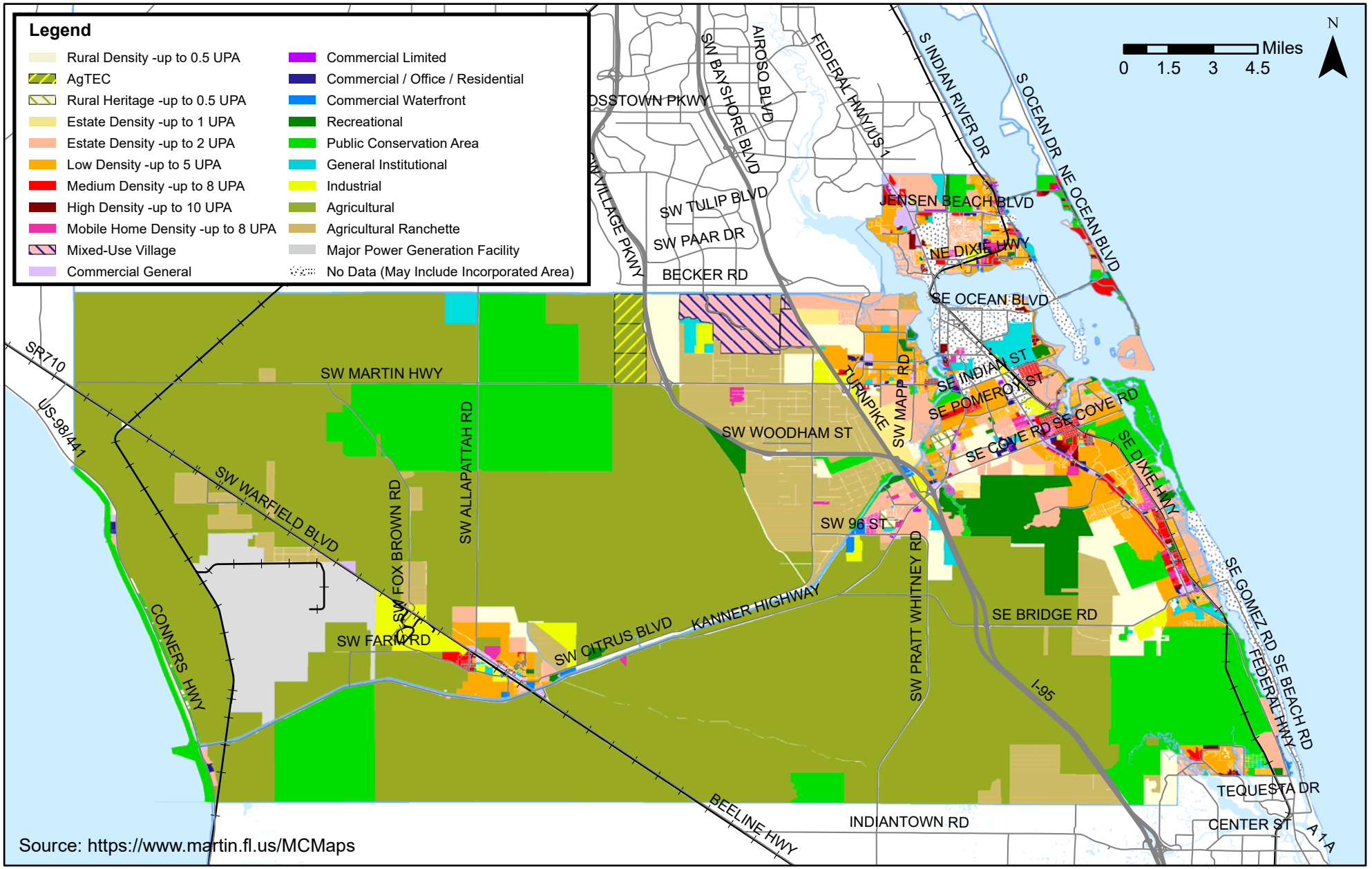
Figure 3-7

According to the future land use map, the majority of land uses includes agricultural land along with public conservation areas and a major power generation facility. 11,510 acres are designated for the public power plant operated by Florida Power and Light. Urban development will continue in the coastal area between the Turnpike and the Atlantic Ocean, concentrating in Stuart. Residential uses within the coastal area are encouraged to be integrated with mixed use redevelopment projects in order to conserve environmental resources, provide recreational opportunities, support tourism and redevelopment, and enhance the local economy. Agricultural lands are a vital part of the County's export industry and are to be protected as urbanization continues to threaten these lands through encroachment along the Coastal Ridge. Future land use designations listed 3,211 acres of land for commercial purposes, 5,933 acres for industrial use, and 49,000 acres as institutional use.



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Future Land Use
Martin County

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Figure 3-8

3.4 Environmental Justice

3.4.1 Low Income Households

Low income households were analyzed using data from the 2013-2017 American Community Survey 5-year Estimates. The percent of households below the national poverty level was examined by census tract within Martin County. Data was classified manually within four groups. According to the ACS data, the county average was 8.0% with a standard deviation of 8.8%. Highest percentages of low-income households were located in the westernmost portion of the county and along the southernmost portion of the City of Stuart (**Figure 3-9**).

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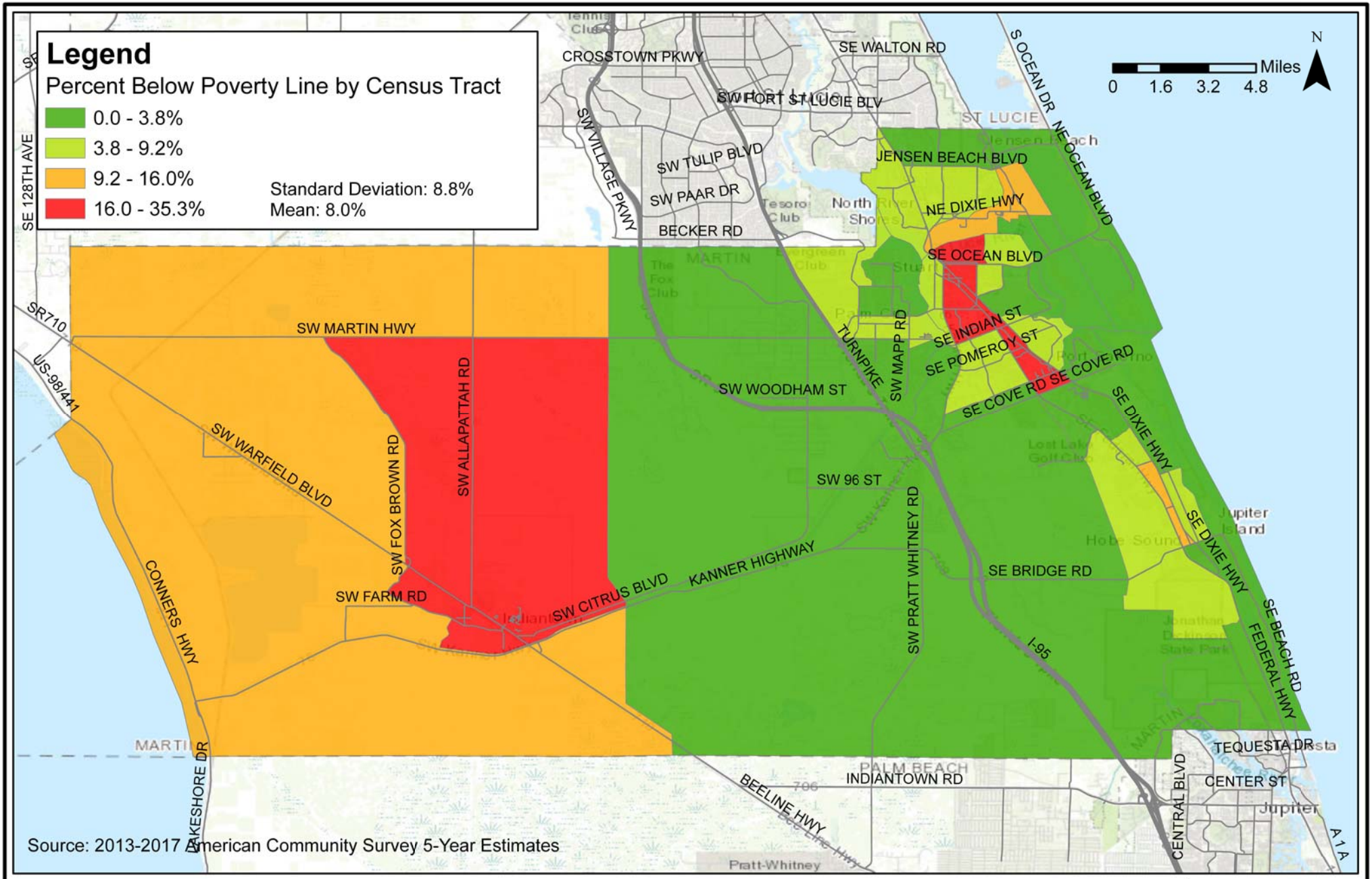

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Low Income Households
Martin County

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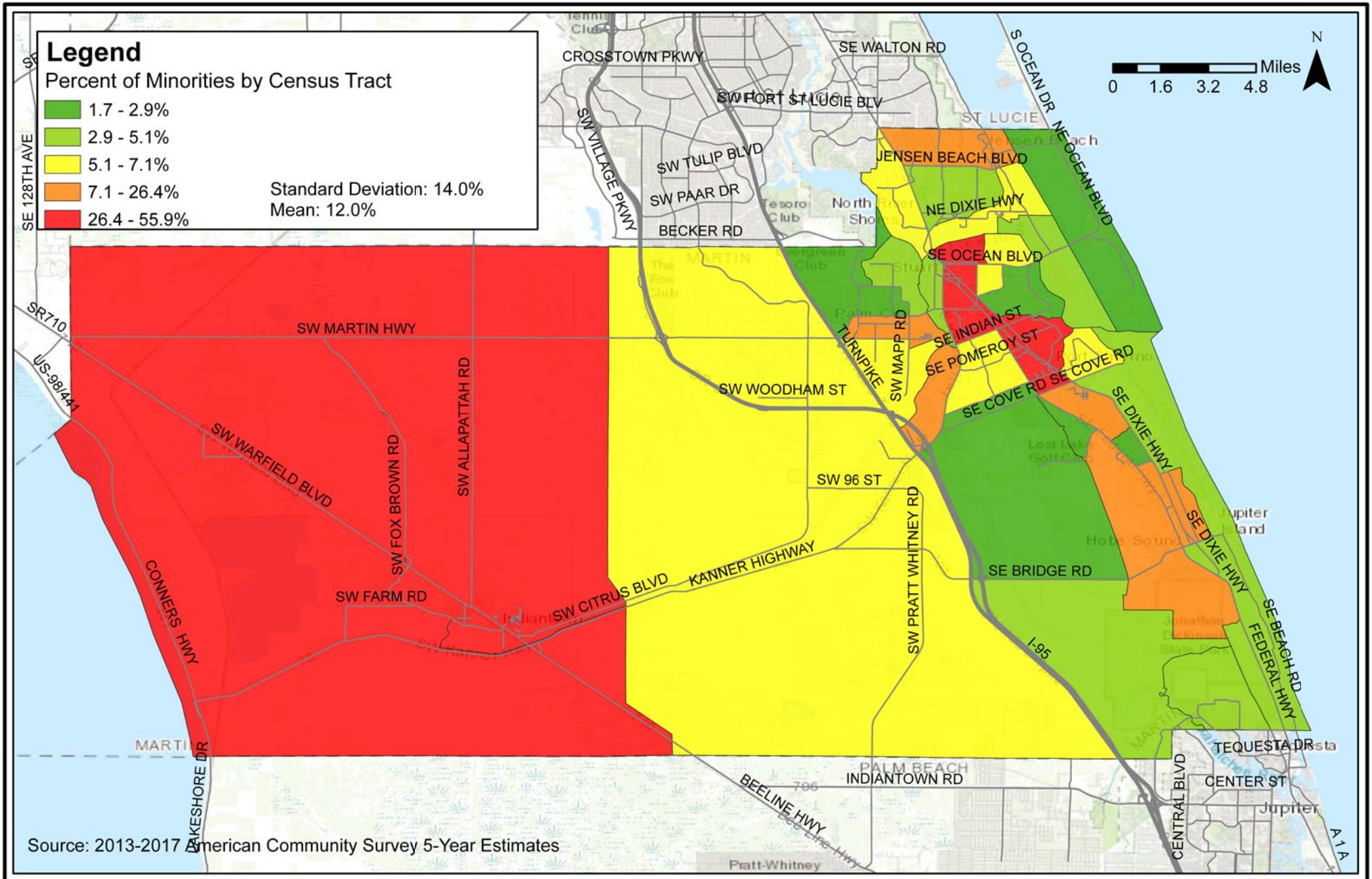
Figure 3-9

3.4.2 Minorities

Minorities were analyzed using data from the 2013-2017 American Community Survey 5-year Estimates. The percent of population that is a minority was examined by census tract within Martin County. Data was classified by quantile, with five classes containing an equal number of features. According to the ACS data, the county average was 12.0% with a standard deviation of 14.0%. Highest percentages of minorities are located within the westernmost portion of the county, west of I-95 where land use is majorly agricultural (**Figure 3-10**).



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Minority Population
Martin County

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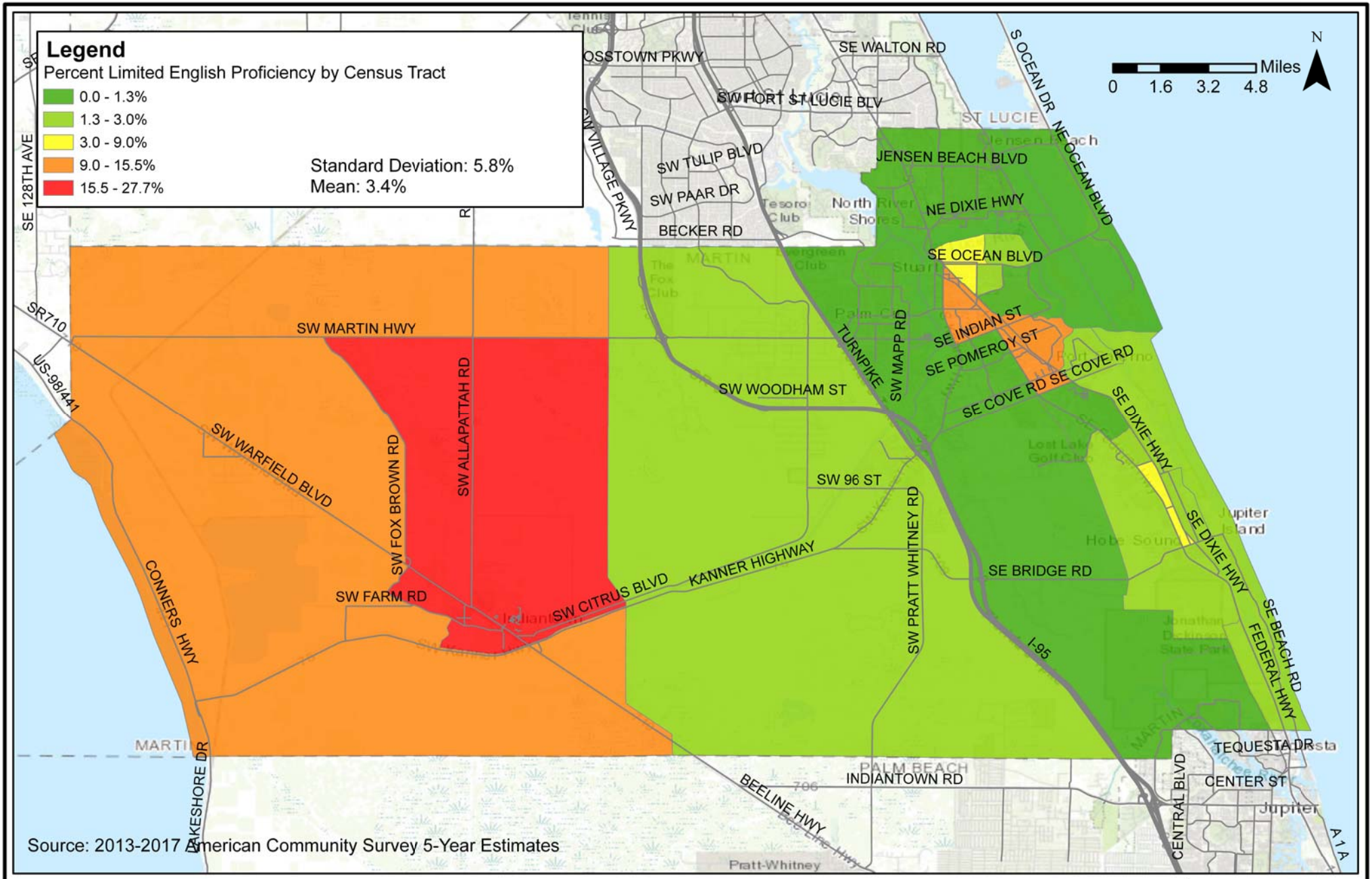
Figure 3-10

3.4.3 Limited English Proficiency (LEP)

Limited English proficiency (LEP) was analyzed using data from the 2013-2017 American Community Survey 5-year Estimates. The percent of population with LEP for census tracts within Martin County were classified manually within five groups. According to the ACS data, the County average was 3.4% with a standard deviation of 5.8%. Highest percentages of LEP are within the westernmost portion of the county, including the census tract that contains Indiantown (**Figure 3-11**).



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Limited English Proficiency Population
Martin County

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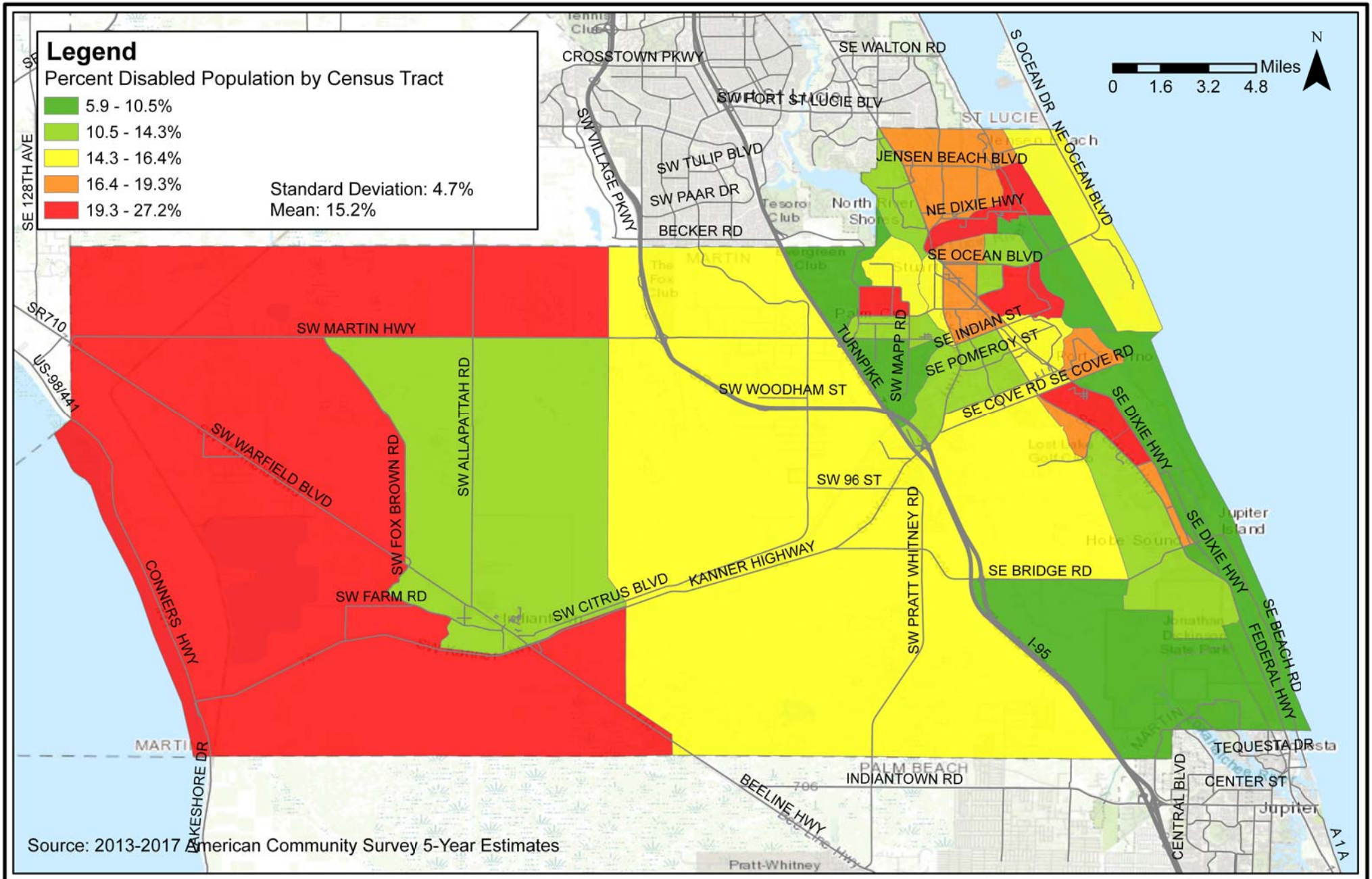
Figure 3-11

3.4.4 Disabled Population

Disabled population was analyzed using data from the 2013-2017 American Community Survey 5-Year Estimates. The percent of population with a disability was examined by census tract within Martin County. Data was classified by quantile, with five classes containing an equal number of features. According to the ACS data, the County average was 15.2% with a standard deviation of 4.7%. Highest percentages of disabled populations are located in the westernmost portion of the county west of Indiantown, the City of Stuart, and several country clubs including Monarch Country Club, Mariner Sands Country Club, Heritage Ridge Golf Club and The Yacht and Country Club (**Figure 3-12**).



MARTIN MPO Metropolitan Planning Organization

TY·LIN INTERNATIONAL

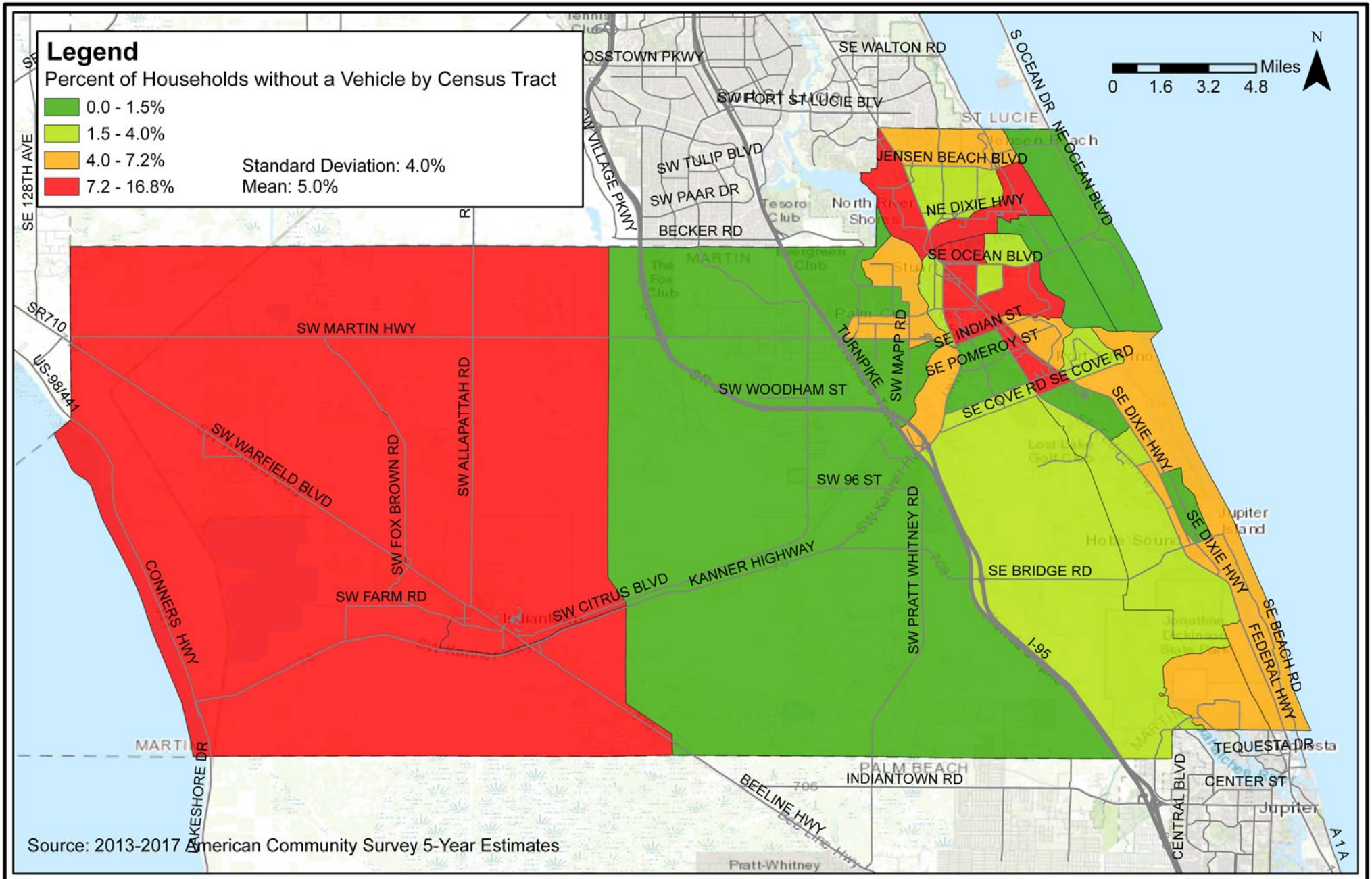
Disabled Population
Martin County

MARTIN IN MOTION 2045

Figure 3-12

3.4.5 Zero-auto Households

Zero-auto households was analyzed using data from the 2013-2017 American Community Survey 5-Year Estimates. The percent of households without a vehicle was examined by census tract within Martin County. Data was classified by quantile, with four classes containing an equal number of features. According to the ACS data, the county average was 5.0% with a standard deviation of 4.0%. Highest percentages of households without a vehicle are within the westernmost portion of the county and within census tracts along Federal Highway in the City of Stuart (**Figure 3-13**).



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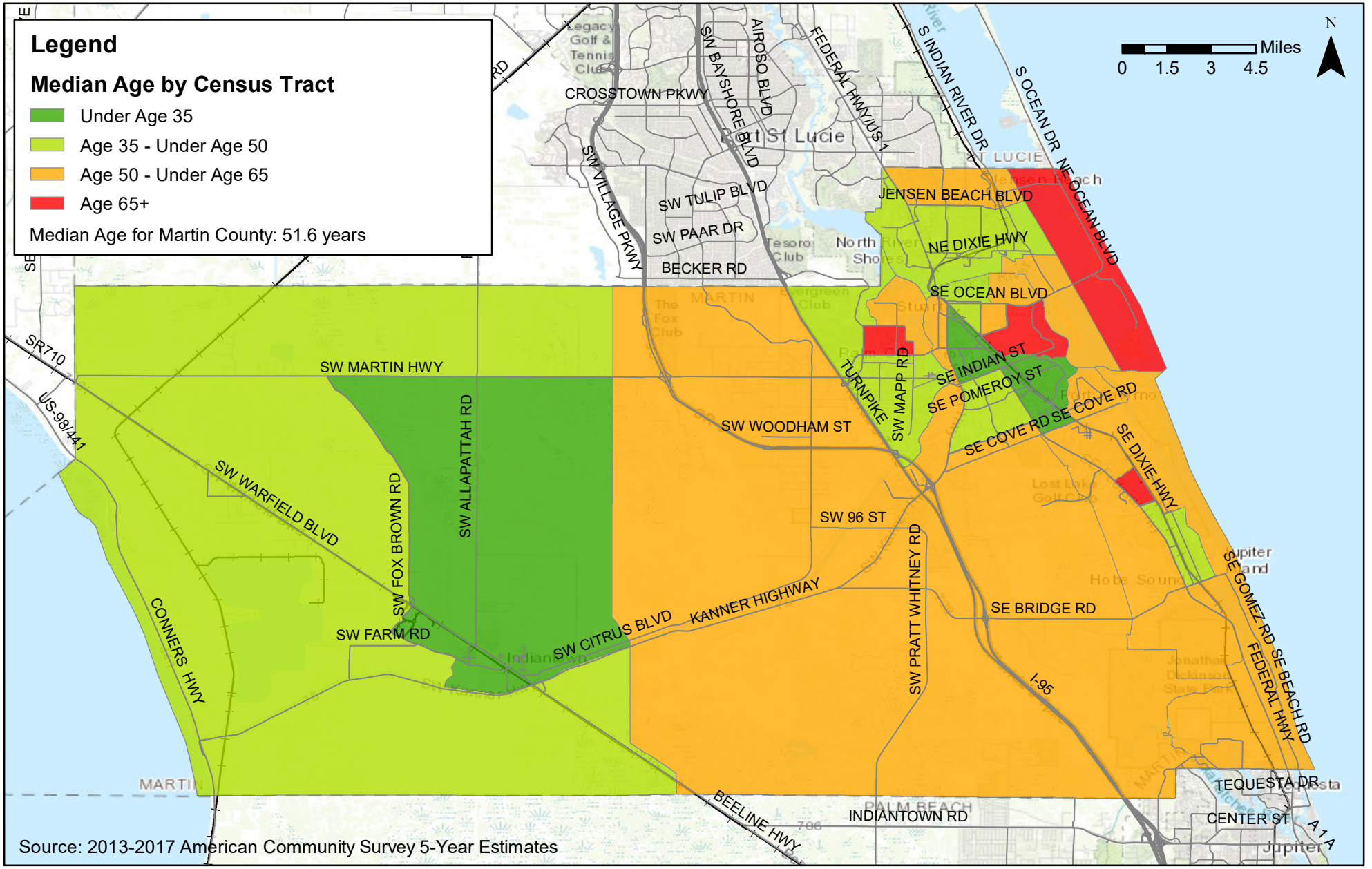
Zero Auto Households
Martin County

MARTIN IN MOTION 2045

Figure 3-13

3.4.6 Elderly Population

Elderly population was analyzed using data from the 2013-2017 American Community Survey 5-Year Estimates. Median age was examined by census tract within Martin County. Data was classified manually within four groups: age below 35, 35-50, 50-65, and 65 and up. According to the ACS data, the median age for the county was 51.6. Populations over the age of 65 are concentrated within the census tract along the barrier island north of St. Lucie Inlet, as well as several country clubs including Monarch Country Club, The Yacht and Country Club, and Heritage Ridge Golf Club (**Figure 3-14**).



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Elderly Population

Martin County

MARTIN IN MOTION 2045

Figure 3-14

3.5 Environmental Constraints

Within the Martin County Comprehensive Growth Management Plan, the Coastal Management Element provides guidelines for the preservation of the County's coastal and estuarine areas. A shoreline protection zone is established to be 75 feet laterally upland from the mean high-water line and includes mangrove species. Shoreline protection zones are protected from construction and building maintenance activities.

The Loxahatchee River is federally designated as a Wild and Scenic River and is protected. Other water bodies that are protected include aquatic preserves, outstanding Florida waters, class 1 waters, marine sanctuaries, estuarine sanctuaries, and manatee sanctuaries or areas of critical manatee habitat. The uplands of the Coastal Ridge and adjacent coastline along the Indian River from the south County line to the St. Lucie Inlet have been designated an aquatic preserve and manatee sanctuary by the Florida Department of Environmental Protection.

Chapter 9 of the Comprehensive Growth Management Plan includes the Conservation and Open Space Element to address the goals regarding the preservation and provision of the County's public open spaces. The County's Ecosystem Restoration and Management Division preserves, restores, maintains, and enhances environmental resources. The County manages approximately 35,000 acres of environmentally sensitive lands, which protect unique, rare or endangered habitat, assure survival of listed wildlife species, protect scenic water corridors, and provide public access and open space. Environmentally sensitive lands are illustrated in **Figure 3-15**. As an overall environmental constraint due to strict regulations for future land uses and to preserve wetland and upland habitats, all development must preserve wetlands and native uplands on-site, with relationship to off-site regional natural resources. Activities that adversely affect wetlands are extremely restricted or prohibited. According to the future land use analysis, of the 347,258 acres of land in 2017 in Martin County, 65,682 acres, or 18.9%, are wetlands.

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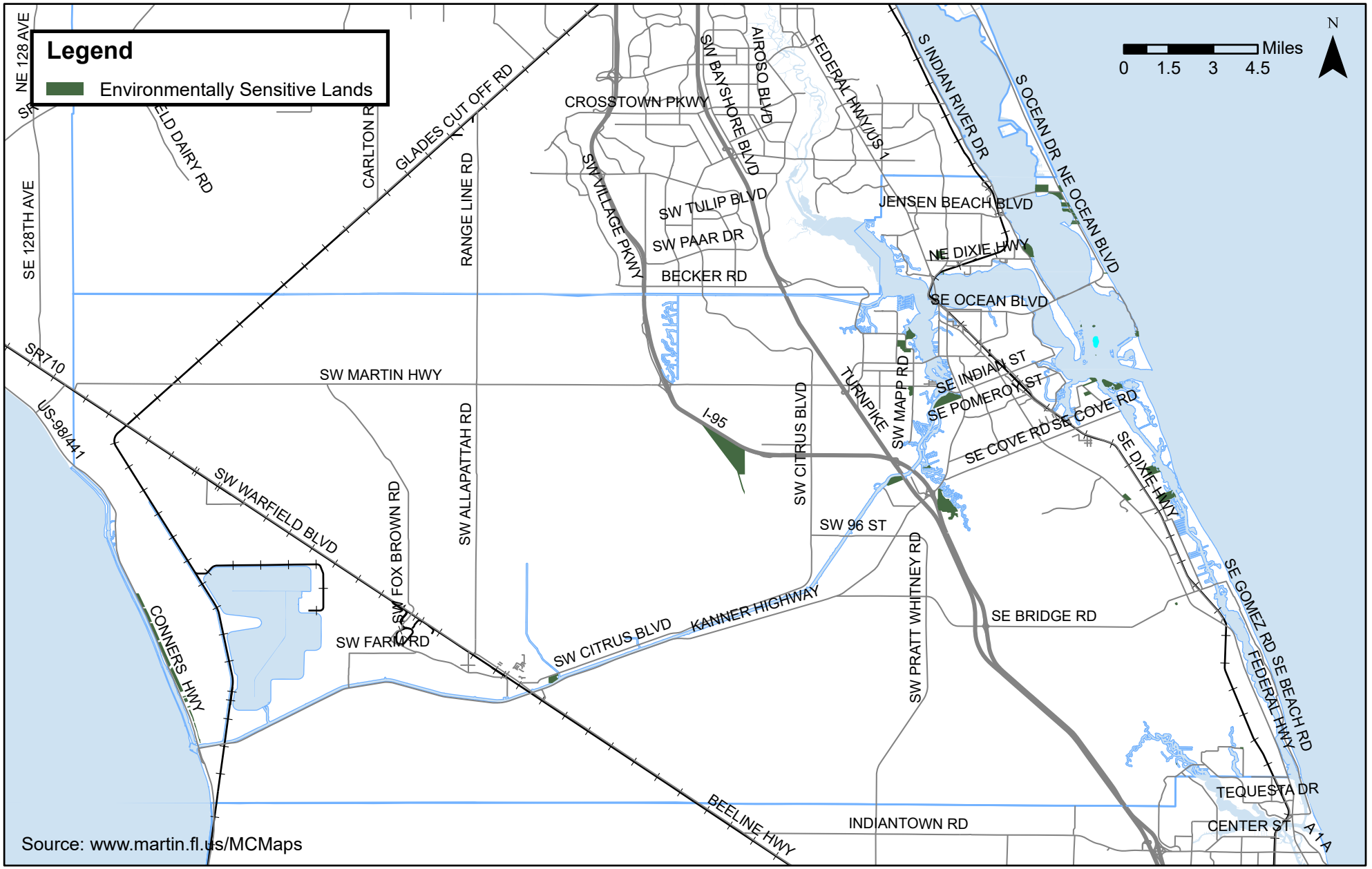

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Environmentally Sensitive Lands
Martin County

MARTIN IN MOTION 2045

Figure 3-15

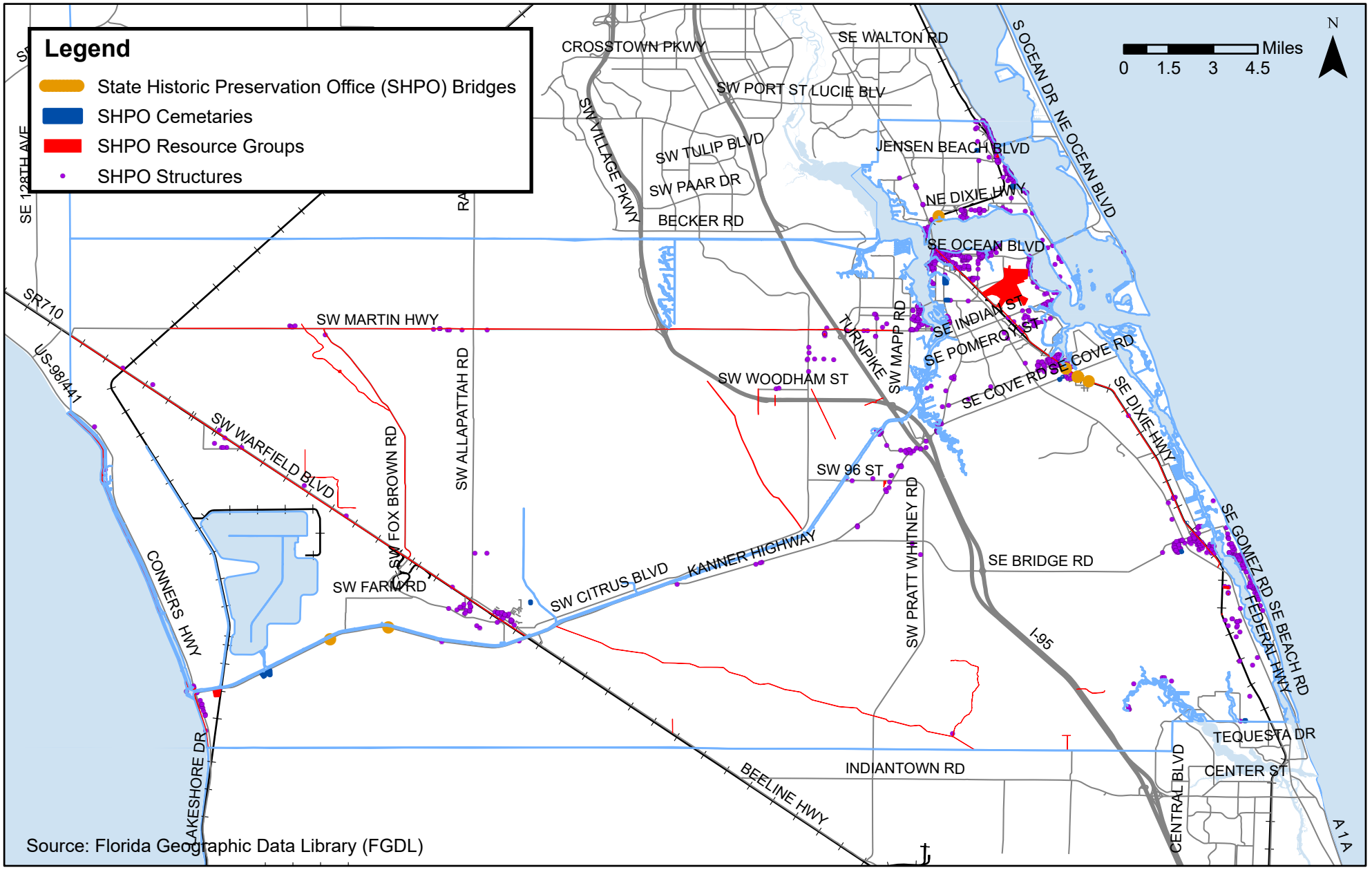
According to the National Register of Historic Places, there are14 historic places within Martin County. These historic sites are as follows:

- Burn Brae Plantation – Krueger house
- Cypress Lodge
- Gate House
- Georges Valentine Shipwreck Site
- Golden Gate Building
- House of Refuge at Gilbert's Bar
- Lyric Theatre
- Old Martin County Court House
- Mount Elizabeth Archaeological Site
- Olympia School
- Seminole Inn
- Stuart Welcome Arch
- Trapper Nelson Zoo Historic District
- Tuckahoe

The Florida Division of Historical Resources' Florida Historical Marker Program recognizes significant historic resources, persons and events with markers that tell the stories of significant places in Florida's cultural history. These markers identify the following within Martin County:

- Mount Elizabeth Mound
- Golden Gate Building
- Camp Murphy Site
- Jonathan Dickinson Shipwreck
- Jupiter Indiantown Road
- Stuart Welcome Arch
- Trapper Nelson Interpretive Site

Figure 3-16 shows the State Historical Preservation Office historical structure locations, historic bridges, and resource groups as recorded at the Florida Master Site File (FMSF). Resource groups include historical districts, archaeological districts and building complexes.



MARTIN MPO Metropolitan Planning Organization

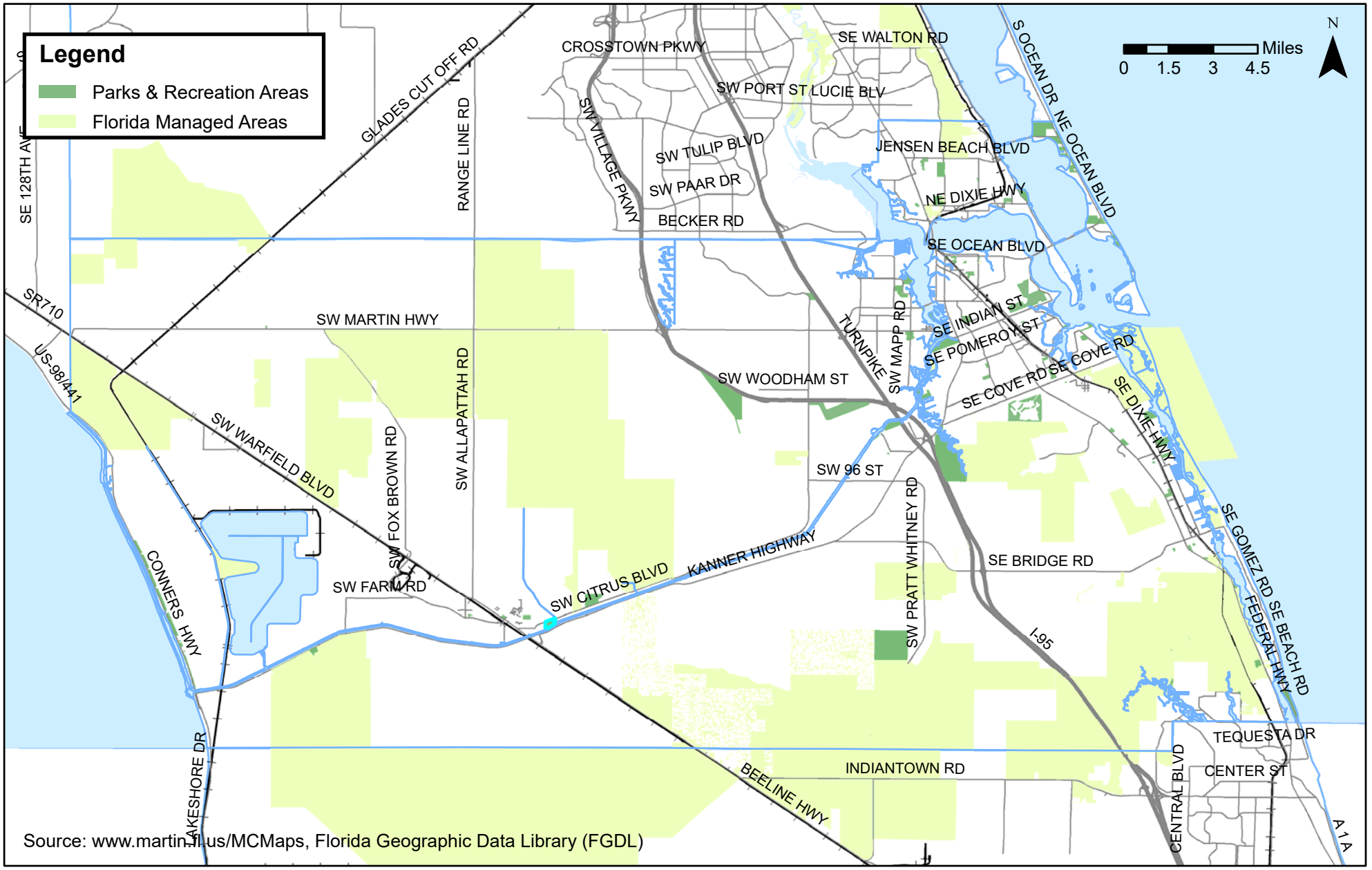
TY·LIN INTERNATIONAL

Historic Resources
Martin County

MARTIN IN MOTION 2045

Figure 3-16

Section 4(f) of the U.S. Department of Transportation Act of 1966 restricts FHWA and FDOT from using land from publicly owned parks, recreational area, wildlife and waterfowl refuges, or public and private historical sites. **Figure 3-17** also illustrates public parks and recreational areas maintained by Martin County as well as parks, sanctuaries and conservation areas maintained by the State.



Source: www.martin.fl.us/MCMaps, Florida Geographic Data Library (FGDL)

MARTIN MPO Metropolitan Planning Organization

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Public Parks, Recreation and Conservation Areas
Martin County

MARTIN IN MOTION 2045

Figure 3-17

3.6 Performance Measures

As required by Moving Ahead for Progress in the 21st Century Act (MAP-21) and Fixing America's Surface Transportation (FAST) Act, the USDOT has established performance measures through rulemaking process corresponding to the following seven national goals:

- Improving Safety;
- Maintaining Infrastructure Condition;
- Reducing Traffic Congestion;
- Improving the Efficiency of the System and Freight Movement;
- Protecting the Environment; and,
- Reducing Delays in Project Delivery.

Consistent with MAP-21 and FAST Acts, the FDOT in collaboration with Martin MPO and in coordination with Marty have established performance targets (PM1, PM2 and PM3 rules) for various performance measures. These performance targets serve as benchmarks to measure progress made toward achieving the national goals. The process, methodology and rationale for developing specific performance targets are documented in the Martin MPO's FY 2019/20-2023/24 TIP. Below is a summary description of relevant performance measures and targets:

3.6.1 Safety

Safety Performance Management Measures Final Rule (PM1) establishes the safety-related performance measures. The performance targets for safety established by FDOT and supported by Martin MPO are included in **Table 3-1**.

Table 3-1: Safety Performance Measures and Targets

Safety Performance Measures and Targets	Statewide Target (2019)	MPO Target (2019)
Number of fatalities	0	0
Rate of fatalities per 100 million vehicle miles traveled (VMT)	0	0
Number of serious injuries	0	0
Rate of serious injuries per 100 million vehicle miles traveled (VMT)	0	0
Number of non-motorized fatalities and serious injuries	0	0

Source: Martin MPO TIP, FY 2019/20-FY2023/24

3.6.2 Maintaining Infrastructure Condition – Pavement and Bridge

Pavement and Bridge Condition Performance Measures Final Rule (PM2), establishes the following six performance measures to assess the condition of the pavements and bridges on the National Highway System (NHS):

1. Percentage of pavements on the Interstate System in GOOD condition;
2. Percentage of pavements on the Interstate System in POOR condition;
3. Percentage of pavements on the non-Interstate NHS in GOOD condition;
4. Percentage of pavements on the non-Interstate NHS in POOR condition;
5. Percentage of NHS bridges by deck area classified as in GOOD condition; and
6. Percentage of NHS bridges by deck area classified as in POOR condition.

The FDOT has also developed a Transportation Asset Management Plan (TAMP) for all NHS pavements and bridges within the state. **Table 3-2** includes FDOT's statewide performance targets for the pavement and bridge measures, which are supported by Martin MPO.

Table 3-2: Pavement and Bridge Condition Performance Measures and Targets

Performance Measures and Targets	Current (2018) Statewide Conditions	Martin MPO 4-Year Target
% of pavements on the Interstate System in GOOD condition	66%	60%
% of pavements on the Interstate System in POOR condition	0.1%	5%
% of pavements on the non-Interstate NHS in GOOD condition	45%	40%
% of pavements on the non-Interstate NHS in POOR condition	0.4%	5%
% of NHS bridges by deck area classified as in GOOD condition	72%	50%
% of NHS bridges by deck area classified as in POOR condition	1%	10%

Source: Martin MPO TIP, FY 2019/20-FY2023/24

3.6.3 Reducing Traffic Congestion and Improving Efficiency of the System and Freight Movement - System Performance

System Performance Measures Final Rule (PM3) requires state DOTs and MPOs to establish targets for the following performance measures:

1. Percent of person-miles on the Interstate system that are reliable;
2. Percent of person-miles on the non-Interstate NHS that are reliable; and
3. Truck Travel Time Reliability Index (applicable only to Interstate system).

The Martin MPO agreed to support FDOT's statewide system performance targets shown in **Table 3-3**.

Table 3-3: System Performance Measures and Targets

Performance Measures and Targets	Current (2018) Statewide Conditions	Martin MPO 4-Year Target
% of person-miles traveled on the Interstate that are reliable	82%	70%
% of person-miles traveled on the non-Interstate NHS that are reliable	84%	50%
Truck Travel Time Reliability Index (TTTRI) on the Interstate	1.43	2

Source: Martin MPO TIP, FY 2019/20-FY2023/24

3.6.4 Asset Management: Transit Asset Performance

As required by Federal Transit Administration's (FTA) final Transit Asset Management (TAM) rule, Martin County in cooperation with Martin MPO developed a TAM plan, and established state of good repair standards and performance measures for four asset categories (**Table 3-4** and **Table 3-5)**).

Table 3-4: MARTY Annual TAM Goals

Criteria	Statewide Target (2019)	FY 2018 Goal	Actual
Safety Risks	Number of accidents per 100,00 revenue miles by mode (MB)	1	TBD
	Number of accidents per 100,00 revenue miles by mode (DR)	1	TBD
	Number of accidents per 100,00 revenue miles by mode (CB)	1	TBD
	Number of facility-accident related accidents to employees or customers	0	TBD
System Reliability	On-time performance (MB)	92%	TBD
	On-time performance (DR)	92%	TBD
	On-time performance (CB)	92%	TBD
Maintenance Resources	Number of vehicles out of service for 30 or more days by mode (MB)	1	TBD
	Number of vehicles out of service for 30 or more days by mode (DR)	1	TBD
	Number of vehicles out of service for 30 or more days by mode (CB)	1	TBD
System Performance	Missed runs due to major breakdown, as percentage of total runs by mode (MB)	<6	TBD
	Missed runs due to major breakdown, as percentage of total runs by mode (DR)	<6	TBD
	Missed runs due to major breakdown, as percentage of total runs by mode (CB)	<6	TBD

Source: Martin MPO TIP, FY 2019/20-FY2023/24

Table 3-5: TAM Performance Measures and Targets

Asset Category-Performance Measures	Asset Class	2019 Target	2020 Target	2021 Target	2022 Target	2023 Target
Revenue Vehicles						
Age - % of revenue vehicles within a particular asset class that have met or exceeded their Useful Like Benchmark (ULB)	BU - Bus	0%	0%	0%	0%	0%
	CU - Cutaway Bus	50%	50%	0%	0%	0%
	VN - Van	100%	100%	100%	100%	100%
Equipment						
Age - % of vehicles within a particular asset class that have met or exceeded their Useful Like Benchmark (ULB)	Non Revenue/Service Automobile	0%	0%	0%	0%	0%
Facilities						
Condition - % of facilities with a condition rating below 3.0 on the FTA Transit Economic Requirements Model (TERM) Scale	Administration	N/A	N/A	N/A	N/A	N/A
	Maintenance	N/A	N/A	N/A	N/A	N/A
	Parking Structures	N/A	N/A	N/A	N/A	N/A
	Passenger Facilities	N/A	N/A	N/A	N/A	N/A

Source: Martin MPO TIP, FY 2019/20-FY2023/24

3.7 Health Related Transportation Data

Transportation policy and planning decisions can have significant health impacts by influencing crashes (injuries and fatalities), physical activity, environmental pollution (emissions), basic access, and mental health. Traditional planning often overlooks these health impacts while emphasizes automobile speed, congestion delays, and operating costs. However, there has been a paradigm shift within the past few years in

transportation agencies across the country and industry. The new planning paradigm is more comprehensive, balances accessibility and mobility needs, integrates multimodal options and emerging technologies, and incorporates equity and smart growth principles.

While need for research to establish cause and effect relationship as well as quantify direct health benefits resulting from transportation planning and policy making is recognized, positive impacts of active living (walking and biking), enhanced safety and accessibility from traffic calming and improved multimodal facilities are some of major benefits acknowledged by transportation professional, policy makers and the public. To that end, the Martin MPO and FDOT have embraced various transportation strategies for improving public health, such as, safety, traffic calming and speed control, public transportation improvements, active transport (walking and cycling) improvements through their policies, plans and programs. Some of the examples include Complete Streets, Florida Design Manual (FDM), TSM&O Master Plan, South Florida Commuter Service (SFCS), Alert Today Alive Tomorrow campaign, Vision Zero, Bicycle and Pedestrian Safety Action Plan (BPSAP) amongst others.

3.7.1 Walk Score

The Walk Score (www.walkscore.com) website is a widely recognized resource and is used in transportation planning industry to quantify and characterize entire neighborhoods, cities and/or specific geographic areas as pedestrian and bicycle friendly. **Table 3-6** shows walk score and bike score for various cities in Martin County.

Table 3-6: Walk Score, Martin County

Geography[1]	Walk Score	Characteristics	Bike Score	Characteristics
Downtown Stuart	74	Very Walkable. Most errands can be accomplished on foot.	81	Very bikeable. Biking is convenient for most trips.
Hobe Sound	65	Somewhat walkable. Some errands can be completed on foot.	72	Very bikeable. Biking is convenient for most trips.
Sewall's Point	28	Car-dependent. Most errands require a car.	46	Somewhat bikeable. Minimal bike infrastructure.
Indiantown	35	Car-dependent. Most errands require a car.	41	Somewhat bikeable. Minimal bike infrastructure.
Palm City	42	Car-dependent. Most errands require a car.	50	Bikeable. Some bike infrastructure.
Jupiter Beach	6	Car-dependent. Almost all errands require a car.	33	Somewhat bikeable. Minimal bike infrastructure.
Ocean Breeze	51	Somewhat walkable. Some errands can be completed on foot.	55	Bikeable. Some bike infrastructure.
Port Salerno	54	Somewhat walkable. Some errands can be completed on foot.	64	Bikeable. Some bike infrastructure.

Source: www.walkscore.com

Note: [1]Does not represent administrative boundaries or census defined geography.

3.7.2 South Florida Commuter Services (SFCS) Online Tool:

The SFCS provides online dashboard type tools to quantify and promote health and environmental benefits of walking and biking as well as carpooling and vanpooling. According to SFCS' website, biking can burn anywhere from 300 to 500 calories in 30 minutes of pedaling, while walking 10,000 steps (approximately 5 miles) daily can help reduce and treat chronic illness. Further, biking and walking can also help build muscle, improve mental health and increase life expectancy.

In addition to monetary benefits of carpooling and vanpooling, according the SFCS website, significant environmental benefits can be realized by reducing single occupant vehicles (SOV) on the road. The carbon dioxide emissions produced by commuting just 10 miles (one way), five days per week for one year would be as follows:

- Small car (35 MPG fuel economy): 1.4 tons
- Midsize car (20 MPG fuel economy): 2.6 tons
- Full-size car/SUV (14 MPG fuel economy): 3.8 tons

Fewer automobiles would result is less carbon dioxide emissions. As an example, if only 5% of the New York City's drive alone trips were eliminated they would save about 75,000 tons of carbon dioxide emissions every year. That is roughly equivalent to planting 30 square miles of forest[1].

3.7.3 Community Health Improvement Plan (CHIP), Martin County, 2015

The Martin County Advisory Committee, established in March 2015, developed a Community Health Improvement Plan (CHIP) based on a Community Health Needs Assessment (CHNA) effort with the objective of enhancing the quality of life and health status of Martin County residents. The following are top health priorities identified in the CHIP:

- Education and awareness of existing health and human services
- School health
- Obesity

Further, the CHIP identifies an executable plan with goals, objectives, action strategies, and performance measures that aligns with community's strategic health issues. One of the three goals included in the CHIP is to increase access to healthy foods and physical activity opportunity. While the strategies in the CHIP are comprehensive, there is an opportunity to integrate transportation improvements and strategies that could directly or indirectly address Martin County's key health priorities. In addition, there may be potential to untap funding sources through such an integrated effort.

[1] https://1800234ride.com/your-options/carpool/why-carpool/

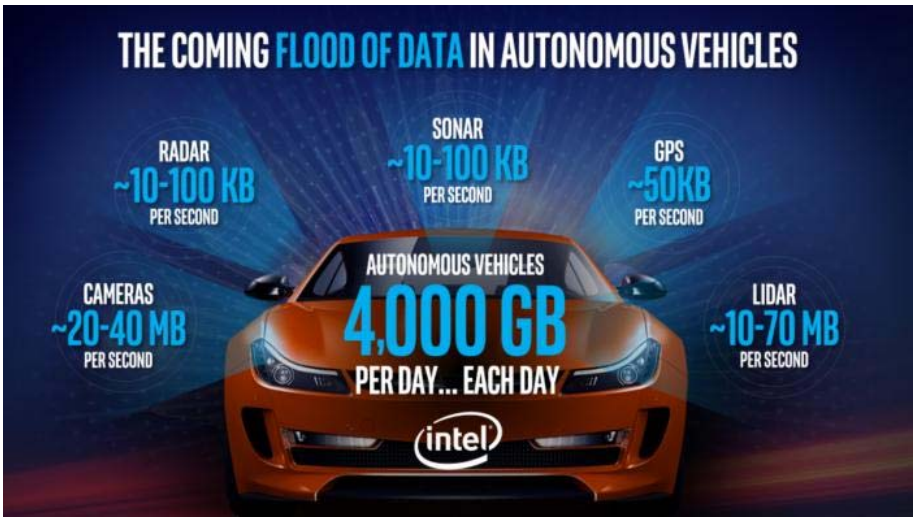
4. Emerging Technologies

Across the nation and the world, the proliferation of new technologies is impacting how people and businesses go about their day-to-day activities. The effects on transportation are profound as mobility and access are undergoing an accelerated rate of change with respect to the number of modes available, the connections between modes, and associated models of ownership. Long range planning for the Martin County transportation system requires a proactive, adaptive approach to embracing the benefits these new technologies bring while also ensuring that negative externalities do not compromise economic development, quality of life, and natural resources.

4.1 Background and Planning Context

The Internet of Things (IoT) is the connectivity of devices that can collect and share data with each other via the internet. It is currently estimated that there are over 25 billion connected devices in the world today, and this number is expected to nearly triple by 2025[2]. Some of the most important transportation devices connected by IoT include vehicles, traffic signals, street lights, dynamic messaging signs on highways, advanced traveler information signs at transit stops, electronic logging devices used by truck companies to track drivers' hours of service, and mobile phones. The information produced and able to be shared by these devices is part of what has been termed Big Data. As an example, Intel estimates that each autonomous car will generate 4,000 gigabytes (GB) of data every day (**Figure 4-1**). To put that volume of data into perspective, 1GB (or 1024MB) of data lets you send or receive about 1,000 emails and browse the Internet for about 20 hours every month[3]. It is easy to see the opportunities to better plan and operate the transportation system that IoT and Big Data provide. The key is developing an approach that harnesses this potential to improve safety, efficiency, and reliability for people and freight.

[2] Statista, *Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions),* viewed July 10, 2019 at https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/.
[3] Statista, *Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions),* viewed July 10, 2019 at https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/.



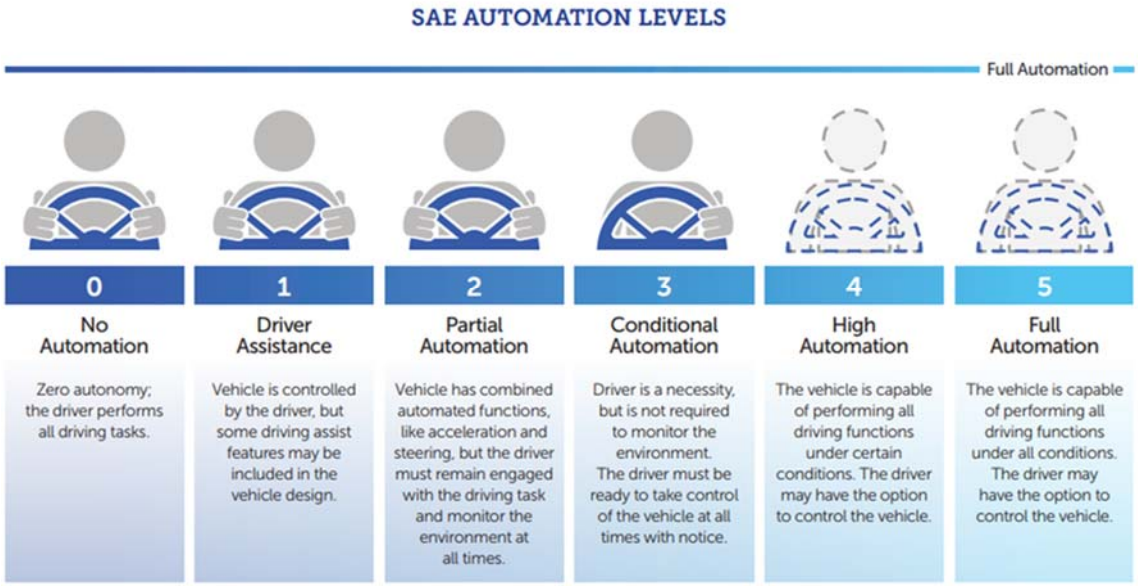
Source: Intel, 2016[4]

Figure 4-1: Autonomous Vehicles and Big Data

4.1.1 ACES: The Driving Force

Automated, ***C***onnected, ***E***lectric, and ***S***hared vehicles (ACES) represent the largest inflection point for the transportation industry. Each element has drawn significant attention via increasingly frequent mentions in popular culture. The automated vehicle (AV) concept has been around for nearly a century going back to the remote-controlled "phantom autos" of the 1920s. Vehicle automation covers a spectrum of operator assistance technologies from cruise control and lane departure warning systems to completely self-driving vehicles. SAE International (originally founded as the Society of Automotive Engineers) has created a range of vehicle automation (**Figure 4-2)** that is commonly cited, including by the U.S. Department of Transportation. Other ranges have been defined including one by the Center for Transportation Research at the University of Texas, Austin which is included in the FDOT *Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles*

[4] Network World from IDG, *Just one autonomous car will use 4,000 GB of data/day,* Network World from IDG, December 7, 2016, viewed July 10, 2019 at https://www.networkworld.com/article/3147892/one-autonomous-car-will-use-4000-gb-of-dataday.html.



Source: SAE via the National Highway Traffic Safety Administration, 2016[5]

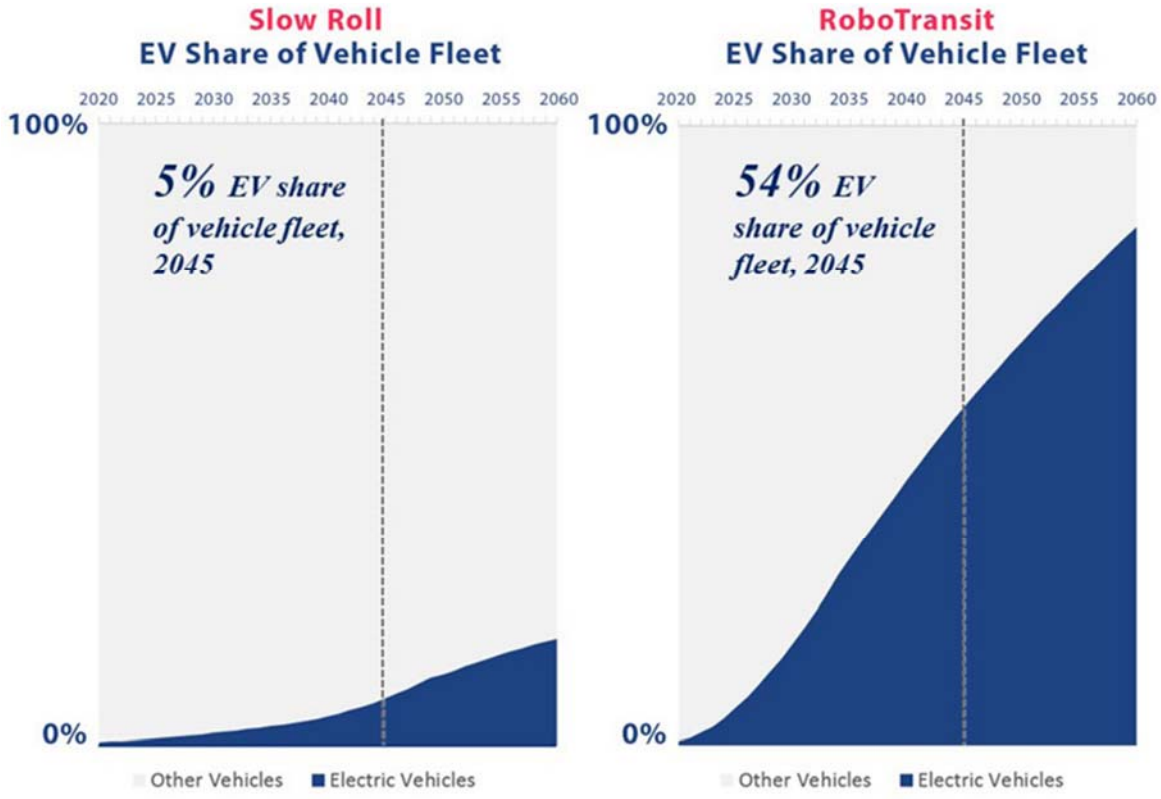
Figure 4-2: SAE Automation Levels

Technologies that allow vehicles to communicate with each other (V2V), the surrounding infrastructure (V2I), and other connected devices (V2X) are separate from but complement those used for automation and sharing. Connected vehicles utilize dedicated short-range communications (DSRC), which encompass standards and protocols specifically for automotive uses. At present, the Federal Communications Commission only allows the 5.9 GHz band to be used for DSRC and it is the only communication framework that is being used to send and receive Basic Safety Message transmissions. Future V2X communication options (such as Cellular V2X) are being investigated for their feasibility. Regardless of the forms of digital connectivity used by vehicles to communicate, they offer the promise of a safer and more efficient transportation network but require vigilance with respect to cybersecurity to protect personal safety and homeland security.

While the primary safety goal of transportation is reducing crashes and associated fatalities and injuries, improving public health over the long-term is also an important consideration. Electric vehicles (EVs) offer the opportunity to achieve reduced localized emissions of harmful pollutants and greenhouse gases. This will occur as the overall fleet transitions from fossil fuel only-powered and hybrid electric/fossil fuel-powered automobiles to fully electric (and clean fuel)-powered ones. A significant transition of the fleet is not necessarily anticipated to occur within the timeframe covered by the 2045 LRTP. Fleet turnover is only one factor in the transition to EVs and the time a current gasoline or diesel (internal combustion engine)-powered vehicle is expected to remain in the road is upwards of 20 years. The other key factor is the cost competitiveness of EVs without public subsidies, which can vary depending on changes in federal and state elected leadership. FDOT in its Guidance for Assessing Planning Impacts and

[5] National Highway Traffic Safety Administration, *Automated Driving Systems 2.0: A Vision for Safety*, 2016, viewed July 10, 2019 at https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles presents two scenarios of EV market penetration, representing between five and 54 percent of the overall vehicle fleet in 2045 **(Figure 4-3**).



Source: Florida Department of Transportation, September 2018[6]

Figure 4-3: Electric Vehicles (EV) Market Penetration Scenarios

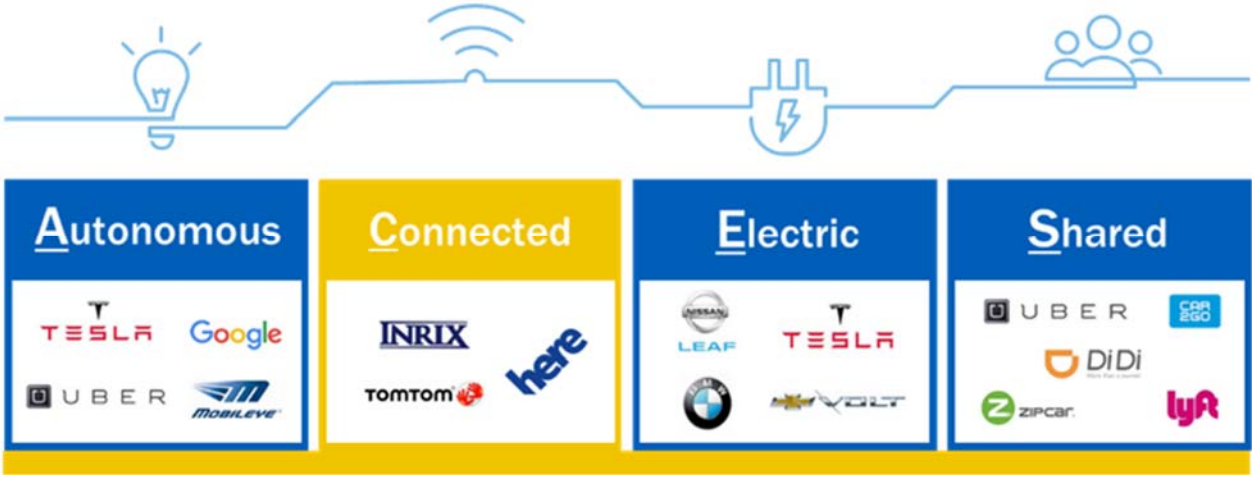
The final trend in addition to automation, connectivity, and electrification is the move towards mobility as a service (MaaS)[7] instead of a product. For the past 100-plus years, the vast majority of individuals in the U.S. have traveled by personally-owned automobiles. Based on the 2013-2017 American Community Survey 5-Year Estimates, 85 percent of employed residents of Martin County who did not work at home commuted to work by driving alone. Going forward, the majority of workers and other travelers in Martin County may continue to drive alone but it is possible they will do so via fleets of shared vehicles operated by ride-hailing companies (e.g., Uber, Lyft, etc.) and carsharing services (e.g., ZipCar, Enterprise, etc.). This will occur as the price of using shared vehicle

[6] Florida Department of Transportation, *Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles*, September 2018, viewed July 10, 2019 at https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/policy/metrosupport/resources/fdot_mpoguidebook_20181005.pdf?sfvrsn=7d194ed6_2.

[7] Mobility as a Service (MaaS): linked transportation systems developed by transit agencies that incorporate all modes of transportation to deliver people seamlessly to their destination. https://www.apta.com/research-technical-resources/mobility-innovation-hub/mobility-as-a-service/

services decreases as the result of AVs lowering the overall cost of trips by decreasing the largest current expense of shared mobility companies: driver labor.

The companies that are involved in the development and advancement of ACES include the most well-known auto manufacturers, technology companies, and Big Data providers in the world (**Figure 4-4**). Some are involved in multiple elements (e.g., automated and electric, automated and shared, etc.) and partnerships between them are common.



Source: INRIX, June 13, 2018[8]

Figure 4-4: ACES Marketplace

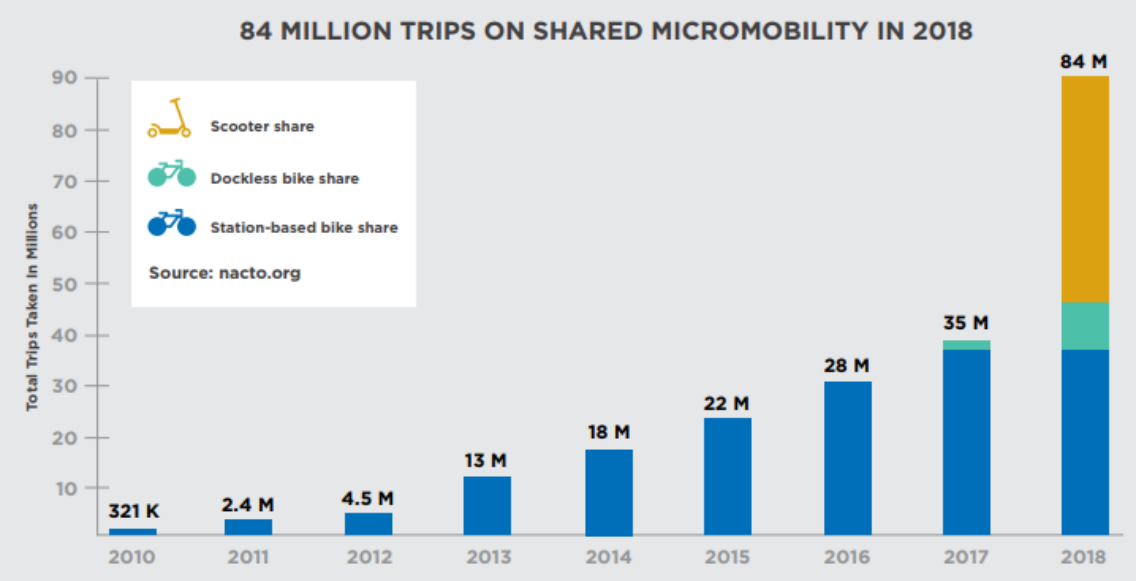
ACES are important and large components of the future trends that will impact transportation in Martin County over the next 25 years, but they are not the only ones. Others are underway that will change how people and freight move into, out of, and across Martin County through 2045.

[8] INRIX, *The Future of Mobility: The ACES*, June 13, 2018, viewed July 10, 2019 at http://inrix.com/blog/2018/06/aces/.

4.1.2 Diversification: More than Cars

Cars, whether owned or shared, will likely continue to be the primary means of transportation for the majority of Martin County residents through the 2045 LRTP horizon. This is particularly true for those living in the rural areas of the County. In the eastern portion of the County and Indiantown, denser development patterns that include commercial and other non-residential uses make trips (or portions of them) by bicycles and other lightweight devices such as electronic scooters (e-scooters) viable. Termed "micromobility," bikesharing and e-scooter rentals can be the first and last mile means of commuting, connecting residents and visitors to ride-hailing, carsharing, and transit services.

Micromobility options are typically shared and electric or human-powered. Locating the small, lightweight vehicles and paying for their use is done through mobile apps on smartphones. Acceptance levels vary by area but shared micromobility options for personal travel are expanding (**Figure 4-5**) and will continue to do so over the next 20-plus years. In addition to bikes and scooters, microtransit services that supplement existing bus service using smaller vehicles on both fixed and flexible routes with on-demand scheduling are projected to become more attractive as the costs of AVs continue to decline. Currently, driverless shuttles are operating in downtowns and on college and university campuses where routing is less complex (e.g., straight routes or basic loops).



Source: National League of Cities, 2019 [9]

Figure 4-5: Shared Micromobility Trends for Personal Travel, 2010-2018

In terms of freight, much of the discussion around ACES has been focused on cars but automated trucks that are connected to each other in a platoon represent an opportunity for more efficient long-haul movement of goods, lowering costs to shippers and receivers.

[9] National League of Cities, *Micromobility in Cities – A History and Policy Overview,* 2019 viewed July 10, 2019 at. https://www.nlc.org/sites/default/files/2019-04/CSAR_MicromobilityReport_FINAL.pdf.

Automated trucks are projected to be using highways in Florida by the end of 2020.[10] Deliveries will increasingly be made directly to residences on a more frequent basis due to the "Amazon Effect" and "Now Economy" (i.e., the public's propensity to purchase a more diverse set of goods via the internet and expect delivery in hours not days). These last mile trips will become more diversified as deliveries by two-axle single unit trucks such as those used by UPS and FedEx are supplemented by personal cars and vans that are automated or operated by independent contractors, cargo bicycles that are fully human-powered or have electric assist, and delivery robots such as those currently deployed by Starship Technologies, Marble, and others (**Figure 4-6**).

Sources: Starship Technologies via the Washington Post, November 1, 2018[11] and Marble, July 10, 2019[12]

Figure 4-6: Deliveries and Automation

Overall, the number of transportation options can be expected to increase, complementing automobiles and existing transit services. These options will rely on technology and offer some combination of automation, connectivity, electrification, and be shared. Mobility over the long-term will become more customer-oriented as these options compete against each other, resulting in more rapid responses to changing demand.

4.1.3 A Better Experience: Predictive and Customized

People and businesses make transportation choices based primarily on cost and convenience. In some cases, other values such environmental friendliness are considered but the majority of mode choice is determined by answering the two questions of "how much will I pay?" and "how long will it take me to get there?". Competition will drive an increased ability to anticipate what customers want with services and vehicles designed based more on prognostics (what *will* happen) and less on diagnostics (what *is* happening) to achieve the balancing of cost and convenience. It is worth noting that predictive analytics applies to more than forecasting the future operating characteristics

[10] South Florida Sun Sentinel, *Driverless big rigs could be hitting Florida highways next year. Are you ready, good buddy?,* June 13 2019 viewed July 10, 2019 at https://www.sun-sentinel.com/business/fl-bz-starsky-robotics-driverless-truck-operators-20190613-jp2kdgmm6be7bg5ognwg66nqc4-story.html.

[11] Washington Post, *Want to get your packages delivered via robot? Now there's an app for that*, November 1, 2018, viewed July 10, 2019 at http://inrix.com/blog/2018/06/aces/.

[12] Marble.io viewed July 10, 2019.

of the system and optimizing routing to reduce delay. Vehicles and infrastructure can be outfitted with sensors that can foresee breakdowns and deterioration, resulting in increased safety and reliability.

Personal mobility needs vary by location, age, physical ability, and income. The overall mix of services available to urban, suburban, and rural residents – including those who cannot access a private automobile – needs to be accounted for in long range planning. The ability of public, not-for-profit, and private transportation providers to adapt their services to customers' individual needs will become easier and able to occur at an accelerated rate. This customization is not a given though. Responsiveness to taxpayers and investors will drive decision making and this introduces the potential for an inequitable distribution of access to transportation services. Long range planning in the 2045 LRTP needs to not only recognize this but also formulate policies, strategies, and actions to ensure all residents and businesses have adequate opportunities to thrive socially and economically.

4.1.4 The Role of the LRTP: More "What" Than "How"

With respect to emerging technologies, the 2045 LRTP should create a framework that allows for existing and yet to be determined mobility options to contribute to economic development and quality of life while minimizing harmful unintended consequences. This approach acknowledges that automation, connectivity, and electric power will bring about significant changes that expand the diversity of transportation choices, and that these choices will involve increased participation by the private sector making greater use of shared fleets as a business model. It is important to recognize that the readiness of many technologies and corresponding services and products is overstated. Accordingly, a continued focus on actions that improve safety, decrease delay, and increase reliability under various levels of market penetration of these services and products is warranted rather than expending effort in an attempt to guess or select which ones will be successful at what point in time.

There are elements of emerging technologies and new mobility options that member agencies and communities within Martin County can control and others that they can influence to varying degrees. With the transition to MaaS[7] comes the need for new non-infrastructure actions that address regulatory issues such as licensing micromobility operators, protecting intelligent transportation systems from cyberattacks, and ensuring residents' privacy. At the same time, routine activities such as properly maintaining striping and roadway lighting take on greater importance as AVs' operation design domains have baseline requirements that will not allow the vehicles to provide service if these requirements are not met. The 2045 LRTP will serve its intended purpose by incorporating the value brought about by emerging technologies in a manner that advances the goals and objectives of the Martin MPO, not by proposing an inflated understanding of the future that relies on future technologies to address all needs.

4.2 Land Use Impacts

4.2.1 Parking

Private automobiles spend much more time being stored than operated. Hours of service rules for truck drivers also limit the amount of time trucks are in operation, requiring dedicated parking areas because of their size. In most cases, parking deficits for cars and trucks exist in specific locations at particular times of the day. This appears to be the case in some parts of Martin County based on the City of Stuart parking study that was completed in 2018 and FDOT's installation of signage on I-95 that presents real-time data on truck parking space availability at the Martin County Rest Area. The shift from trips using personal vehicles to those that are part of shared fleets has the potential to reduce the amount of land needed for parking garages, parking lots, and on-street spaces. This outcome is not guaranteed and will not be realized if the shift to shared fleets does not occur and/or growth in population and economic activity results in a greater number of private vehicles that exceed the spaces that would no longer be needed based on the shift to shared fleet.

4.2.2 Curb Space

If the need for on street parking is reduced, curb space will be freed up for a number of other uses. Assuming an increase in the use of shared mobility options, this space could be dedicated to picking up and dropping off passengers using ride-hailing services or freight deliveries, converted to space for bicyclists and/or pedestrians, or used for new through and turning lanes that increase roadway capacity. There is also the opportunity to repurpose this space for non-transportation uses such as parklets[13] and pop up retail. As noted above in parking, conversion and reuse of curb space will likely be done with location specific and time-of-day restrictions. Ultimately, curb space management should be determined as part of a comprehensive review of roadway purposes on a block-by-block basis to capitalize on opportunities to increase safety and efficiency and utilize the space for higher and better uses.

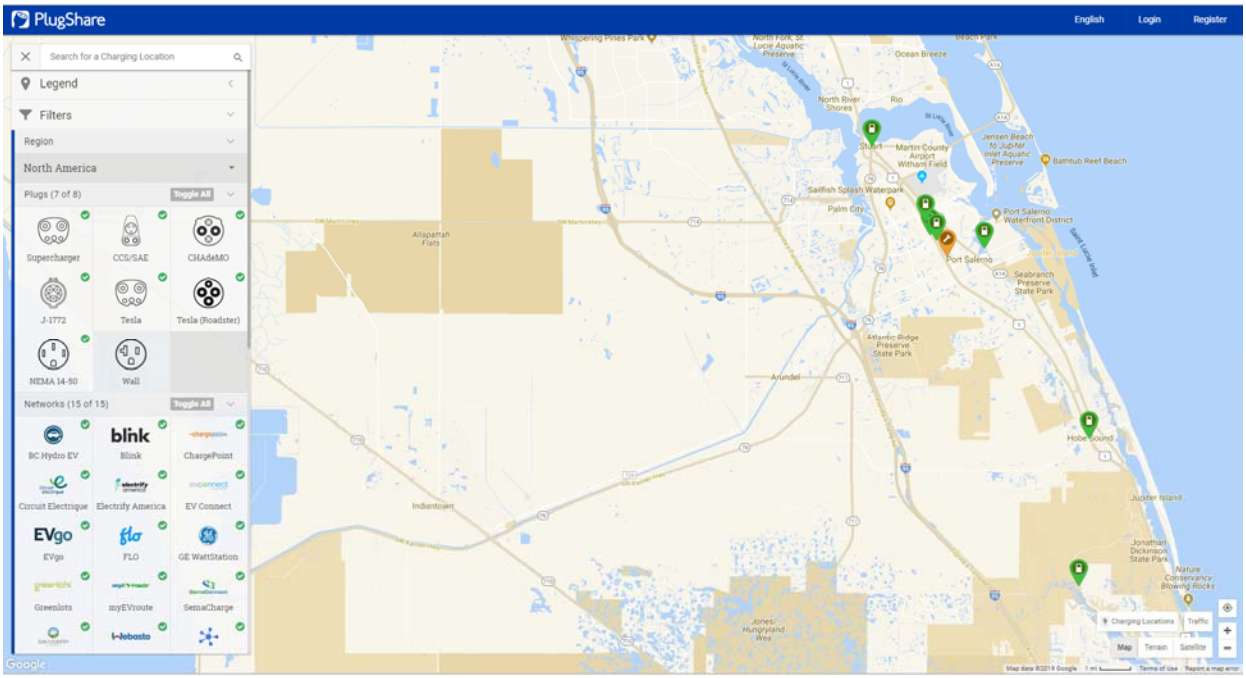
4.2.3 Location Decisions

On the personal travel side, time currently spent sitting in traffic while operating a vehicle would transition to time that could be spent for work or leisure in automated cars (either privately-owned or part of a shared fleet). Absent hours of service regulations for operators, automated trucks could deliver more freight over the same time period even if they have to travel further to do so. In both cases, accessibility to less expensive land is increased on a net-cost basis. One of the most common concerns related to the use of ACES is that they may induce people and businesses to locate in areas further away from their workplaces and customers as the cost of travel declines relative to other expenses. This is not a foregone conclusion as the same factors could increase the attractiveness of public transportation (including micromobility), maintaining trip lengths at similar levels or even decreasing them.

[13] Parklets are public seating platforms used as community spaces that have been converted from curbside parking spaces. https://nacto.org/publication/urban-street-design-guide/interim-design-strategies/parklets/

4.2.4 EV Charging Infrastructure

The distance electric-powered vehicles can travel on a single charge continues to increase and is expected to continue to do so as more efficient materials than lithium-ion are developed for use in batteries. These advancements are reducing "range anxiety" and the addition of charging points will quicken the increase in the number of electric-powered automobiles. Manufacturers, shared fleet operators, and communities recognize this need for additional charging points (**Figure 4-7**) for current electric charging points in Martin County). It is unlikely that the majority of new charging points will be located where gas stations are now. The charging points for shared fleets will be proximate to their customers and private vehicles will be charged at owners' residences with in-trip charges obtained at rest stops and other locations. Resiliency to weather events and other hazards will be major considerations in the siting and design of charging points.



Source: PlugShare, July 10, 2019[14]

Figure 4-7: EV Charging Infrastructure

4.2.5 Micromobility

As transportation options expand to include bicycles, e-bicycles, and scooters, physical space for their storage between trips will need to be planned and demarcated. This is true for both docked and dockless systems with the latter becoming more prominent. For these options to be attractive to potential users, the locations they can be picked up when beginning a trip and parked when the trip is completed must be conveniently located and properly signed. As mentioned above in Parking and Curb Space, areas previously used for privately-owned cars may be offer locations for this purpose. Without dedicated areas for micromobility vehicles, they can become clutter within public spaces. Sidewalks and

[14] https://www.plugshare.com/ viewed July 10, 2019.

curbs are the primary places that dockless shared bicycles, e-bicycles, and e-scooters are left. This more than an inconvenience for other users, representing accommodations violations of the Americans with Disabilities Act of 1990.

4.2.6 Mobility Hubs

As mobility options diversify, creating connections between locations at a single hub will create economies of scale and allow for seamless trips from origin to destination. Mobility hubs can integrate pick-up/drop-off points for ride-hailing[15], carsharing, transit, microtransit, bikesharing, scootersharing, and future modes as they are initiated (**Figure 4-8**). Real-time arrival and departure information signs, customer service kiosks, and (if consumer demand warrants them) retail stores can also be located at mobility hubs. Ideally, they can be sited and developed on unused or underutilized publicly-owned property as this reduces issues that arise when land assembly is required.

Source: SANDAG, 2019[16]

Figure 4-8: Mobility Hub Concept

4.3 Transportation Impacts

4.3.1 Safety

[15] Ride-hailing services include Uber and Lyft, which use online-enabled platforms for passengers to contact local drivers.

[16] SANDAG, *San Diego Forward,* https://www.sdforward.com/mobility-planning/mobilityhubs viewed July 11, 2019.

More than 37,000 people were killed in motor vehicle crashes in the U.S. in 2017 and the National Highway Safety Traffic Administration estimates that human error is responsible for approximately 95 percent of serious crashes. Accordingly, the most widely-touted benefit of automated and connected vehicles is the decrease in crashes proportional to vehicle miles traveled that will result from them being connected to each other, infrastructure, and the IoT. Existing elements such as rearview video systems, automatic emergency braking, lane departure avoidance, blind spot detection, rear cross-traffic cameras, and adaptive cruise control will be incorporated and improved upon in the future Automated Driving Systems. The same is not as certain for micromobility options. The introduction of more bicycles and electrically-assisted devices could create safety concerns if there is insufficient physical space available for them when added to the existing numbers of pedestrians and bicyclists.

4.3.2 Efficiency

The majority of ACES scenarios that have been theorized and tested result in an overall increase in vehicle miles traveled (VMT). Under certain levels of market penetration and with dedicated lanes, the ability of AVs to drive with less space between them results in more efficient use of existing physical space on roadways which resulted in increased throughput as measured by reduced vehicle hours traveled (VHT) and higher operating speeds during peak periods even as VMT increased. This is the case in two ("Ultimate Traveler Assist" and "Managed Automated Lane Network") of the six scenarios modeled using the Gainesville Urbanized Area Transportation Model (GUATS) that are presented in the FDOT *Guidance for Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles.* However, the opposite – increased VHT and higher operating speeds during peak periods – occurred in all six scenarios tested using the Central Florida Regional Planning Model. This indicates that increased VMT is highly likely (absent any major regional economic disruptions) when AVs reach a particular proportion of the fleet (regardless of if they increase the number of persons per vehicle) and there are actions that can be taken to mitigate resulting decreases in capacity.

4.3.3 Deterioration

Similar to VHT and operating speeds during peak periods, the impacts of increased VMT resulting from AVs on the deterioration of roads and bridges will also vary depending on two key factors: amount of VMT growth and the weights of vehicles. Currently, the curb weights (all of the elements needed for the vehicle to operate) of EVs exceed those of their fossil-fuel powered counterparts. This is primarily due to the weight of the battery. EVs will rely on reduced weight to extend their range on a single charge, which is key to their viability compared to fossil fuel-powered vehicles. The wear and tear occurring from a rise in VMT may be offset as the fleet transitions to a higher proportion of EVs if the materials from which the batteries are produced are lightweight.

4.3.4 Transit

Shared vehicle fleets are typically seen as competition to traditional public transportation services. Transit systems that do not include high-capacity service (rail or bus rapid

transit), including MARTY, are generally seen as vulnerable when cost per trip for shared fleet services decreases due to automation. Offering mobile ticketing and payment options and other features similar to those offered by ride-hailing and carsharing services are important elements for transit to be competitive. An approach to maintain and increase the viability of transit is for operators to focus on key corridors and integrate shared fleet services and micromobility into their future service plans (**Figure 4-9**). Transit agencies that assume the role of Mobility Manager and focus on utilizing the full suite of transportation services to meet each customer's needs will see greater success than those that rely solely on fixed-route, fixed schedule and associated paratransit services.

Source: Union Internationale des Transports Publics via American Public Transportation Association, 2019[17]

[17] American Public Transportation Association, *The Transformation of the American Commuter,* 2019 viewed July 11, 2019 at https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Transformation-of-the-American-Commuter.pdf.

Figure 4-9: Autonomous Vehicles and Public Transportation

4.4 Financial and Fiscal Impacts

4.4.1 Fuel Taxes

ACES are expected to bring significant societal benefits, including reduced fatalities and injuries resulting from crashes and pollution. Without changes in how states and localities charge for use of roadways and bridges, ACES will not have the same positive impacts on transportation funding. Most notably, the conversion of some portion of the fleet (whether private or shared) to EVs combined with fossil fuel-powered vehicles that continue to become more efficient means a reduction in the primary revenue source for transportation improvements, operations, and maintenance at the federal, state, and county levels: fuel taxes. As such, revenue from state fuel taxes (including the Constitutional Fuel Tax and County Gas Tax which are shared with Martin County) and Martin County fuel taxes (Local Option, 1 Local Option, 2 and the Ninth Cent Fuel Tax) should be expected to decline under scenarios where a more than minimal number of trips are provided by ACES.

4.4.2 Vehicle & Operator Fees

Like fuel taxes, revenue from motor vehicle registration and driver license fees collected by the Florida Department of Motor Vehicles are likely to decrease under a scenario where shared fleets reduce the total number of vehicles and AVs result in fewer human operators. Increased motor vehicle registration fees and driver license fees may encourage people to move toward ride-hailing and carsharing options, which could be solved with a separate higher vehicle registration fee for these shared options. The use of vehicle and operator fees to fully offset reduced fuel taxes under a scenario where a significant number of trips are made by ACES does not appear viable, and pricing needs to account for the elasticity of demand for ride-hailing and carsharing options.

4.4.3 Mileage-Based Fees

Mileage-based fees have drawn the most interest as a replacement for fuel taxes as both are based on use of roadways and bridges. These fees can incorporate both distance traveled and weight or other factors to recognize different rates of deterioration caused by various types of vehicles. Pilot programs are in place at the local (Twin Cities of Minnesota), state (Oregon, Nevada, etc.), and multi-state levels (I-95 Corridor Coalition). Mileage-based fees are viewed as being able to match fuel taxes in terms of revenue adequacy and appropriateness for transportation expenses, both key considerations. As with fuel taxes, mileage-based fees are viewed as regressive for rural users who typically travel longer distances. Collecting mileage-based fees and gaining public acceptance for them will be a challenge as privacy issues arise when transponders (such as those used for SunPass) are perceived as tracking all trips.

4.4.4 EV Charging Infrastructure

States and localities typically pay for the installation of EV charging infrastructure as a means for incentivizing the purchase of EVs. Florida recently announced the use of VW

Settlement funds to build more EV charging points along major roadways[18]. While most charging will be done at residences or fleet facilities, significant market penetration by EVs does make publicly-owned EV charging points a potential revenue source. Combined with vehicle fees, mileage-based fees, curb space charges, and other mechanisms, revenue collected at EV charging points could play a part in offsetting decreases in fuel tax receipts.

4.4.5 Ride-Hailing and Curb Space Charges

Multiple cities and states already charge transportation network companies fees for each ride-hailing trip they provide. These can be either a flat-rate per ride/per passenger or a percentage of the total fare. As noted above, reductions in the demand for on-street parking resulting from increased trips made by ride-hailing services allow for curb space to be used for other purposes. These can include passenger pick-ups and drop-offs and freight loading and unloading. This presents an additional opportunity for revenue generation from transportation network companies and deliveries even if no fees for on-street parking were charged before the conversion of the curb space to a shared use mobility zone or some other means for accommodating transportation network companies and couriers.

4.5 Martin County Transportation Network Readiness

Transportation System Management and Operations (TSM&O) will take on increased importance as emerging technologies will both provide data that can be valuable to the FDOT and Martin County traffic management centers (TMCs) and benefit from information provided to them by the TMCs in an effort to increase safety, efficiency, and reliability across the county. FDOT District 4 operates two regional TMCs (the Broward SMART *SunGuide* TMC and the Palm Beach SMART *SunGuide* RTMC, as well as the FDOT District 4 Traffic Incident Management Support Office, which serves as a back-up TMC). The Martin County TMC is located at Witham Field. Intelligent transportation systems (ITS) deployments that enable TSM&O at the TMCs in Martin County include, but are not limited to, closed circuit television cameras, traffic signals, vehicle detectors, dynamic message signs, and signal controllers and cabinets.

Per the FDOT District 4 & 6 Regional ITS Architecture, the ITS elements present in FDOT District 4 and Martin County include:

Table 4-1: ITS Architecture and Elements, FDOT District 4 and Martin County

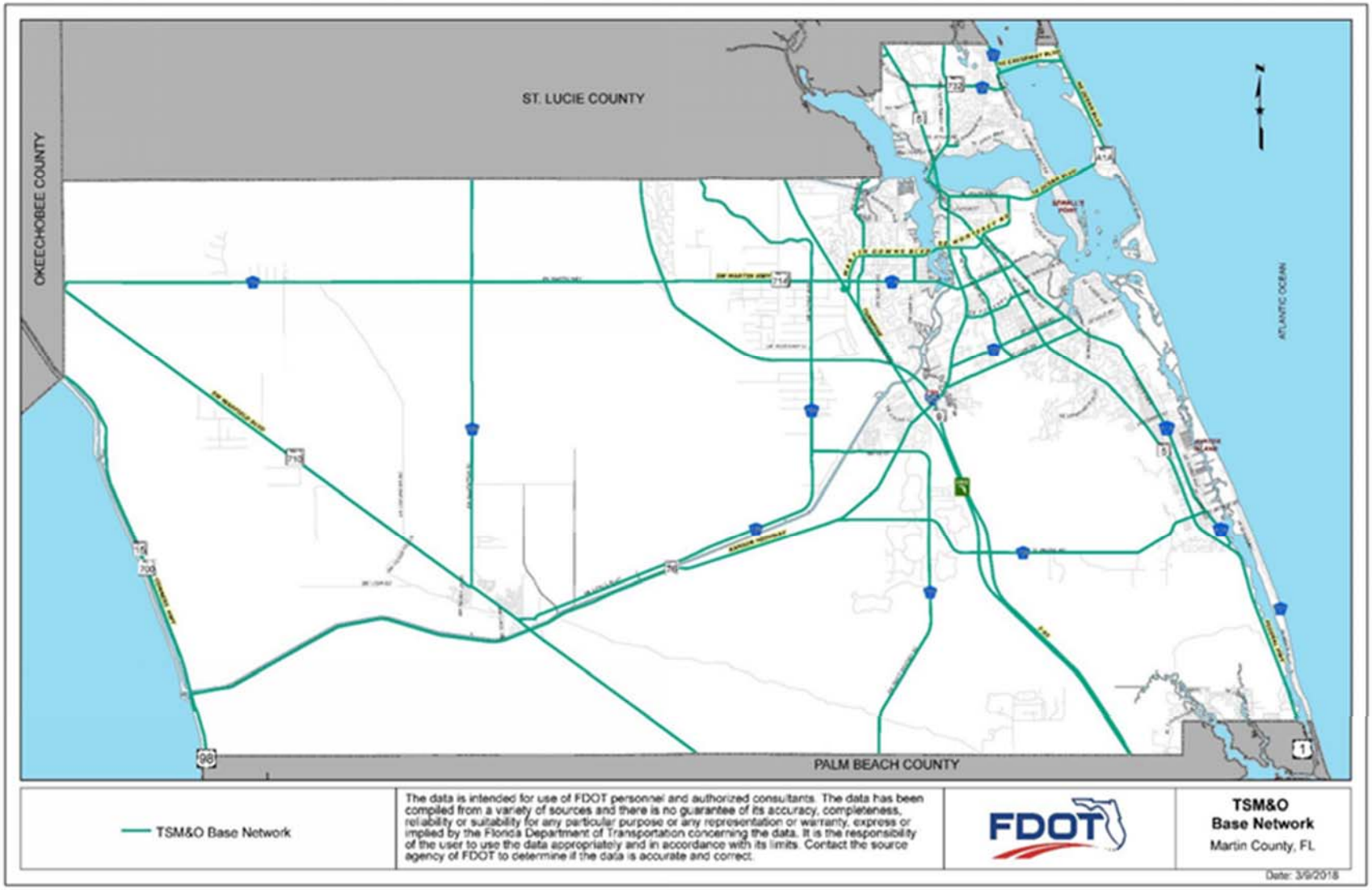
Element	Description
FDOT District 4 Field Equipment	Represents the ITS field equipment that operates in FDOT District 4, including vehicle detectors, CCTV cameras, dynamic message signs, etc., to control and monitor traffic.
FDOT District 4 FMS	Represents the Freeway Management System operated at the FDOT District 4 RTMC.

[18] Sarasota Magazine, DeSantis Announces Plan for Expansion of Florida's Electric Vehicle Infrastructure, July 24, 2019 viewed July 25, 2019 at https://www.sarasotamagazine.com/articles/2019/7/24/desantis-announces-plan-for-expansion-of-florida-s-electric-vehicle-infrastructure.

Element	Description
FDOT District 4 Infrastructure Monitoring Equipment	Infrastructure monitoring equipment including IR, cameras and motion detectors. These sensors and detectors are operated by FDOT District 4 to monitor and protect FDOT infrastructure and facilities, and not for traffic monitoring.
FDOT District 4 ITS Maintenance	Represents the maintenance systems and maintenance dispatch for ITS devices for FDOT District 4. Dispatches maintenance vehicles and equipment for maintaining the ITS equipment owned by the FDOT District 4.
FDOT District 4 Maintenance Vehicles	Represents the ITS-devices (i.e., mobile data terminals) onboard the maintenance and construction vehicle owned and operated by FDOT District 4. This may include vehicles currently operated or owned by private contractors but used for FDOT projects.
FDOT District 4 Public Information Office Systems	Systems operated by the public information office that provide long-range traveler information, such as road construction advisories, to the media, other organizations, and travelers in District 4. The information provided may include planned closures, maintenance activities, and other non-real time travel advisories.
FDOT District 4 Road Ranger Service Patrol Vehicles	Represents the ITS-devices (i.e., mobile data terminals) onboard the vehicles that provide roadside assistance to individuals traveling on FDOT District 4 highways.
FDOT District 4 TIMSO	The FDOT District 4 Traffic Incident Management Support Office (TIMSO) is located in Fort Pierce and is a back-up TMC to the FDOT District 4 RTMC in situations where the Broward RTMC is not able to be used.
Martin County ATMS	This represents the advanced traffic management system operated in Martin County.
Martin County Field Equipment	Represents the ITS field equipment operated by Martin County, including traffic signals, vehicle detectors, CCTV cameras, dynamic message signs, etc., to control and monitor traffic.
Martin County Transit Systems	The transit operations center that provides demand-responsive transit service countywide. The center provides operations, maintenance, customer information, planning and management functions for the transit property. Also represents other related transit systems, including transit security systems, and the fare management systems. In the future, Martin County will also run fixed-route service.
Martin County Transit Vehicles	Represents the ITS equipment installed on the transit vehicles that are owned and operated by Martin County. Capabilities include passenger counting, transit scheduling, and fare management.

Between now and 2045, new instrumentation will be deployed to expand current ITS elements and introduce new ones that expand TSM&O capabilities throughout Martin County (**Figure 4-10** for the current TSM&O Base Network). These deployments may occur as projects dedicated solely to ITS and TSM&O (like the Martin County Advanced

Traffic Management System initiative of 2008) or can be conducted as part of highway, bridge, and transit facility rehabilitation and reconstruction/replacement projects, as well as transit vehicle purchases.



Source: Florida Department of Transportation, District Four

Figure 4-10: TSM&O Base Network

Transportation agencies should expand their capabilities in two foundational elements of TSM&O: cybersecurity and Big Data. AVs could be prime targets for hackers who could gain access through the Bluetooth, cellular, or remote keyless entry and ignition systems. Access to AVs could result in breaches to systems they are connected to that store personal and financial data but more troubling is the potential for illegal activities such as terrorist attacks and drug trafficking. Automotive companies, original equipment manufacturers, and fleet operators will be the primary parties to address these issues. Public entities such as FDOT and Martin County will also need to bolster their IT systems as they collect and store more data for TSM&O.

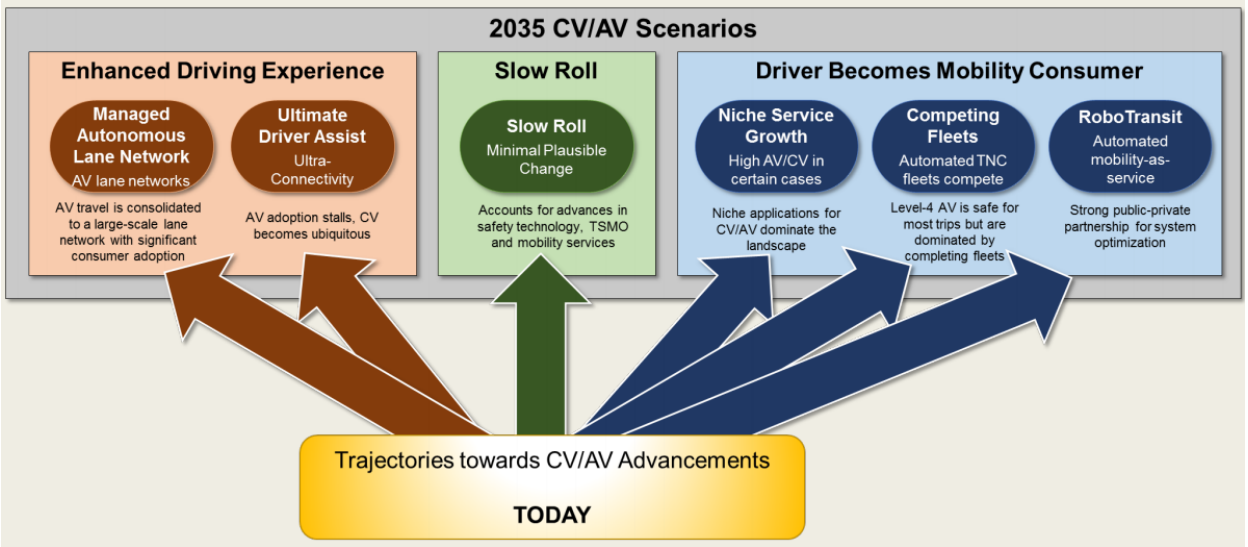
States and localities can require that private mobility companies provide certain data as part of their licensing agreements. Information on origins, destinations, times of departure, and other trip making elements can improve planning and operations. Enhanced data capabilities can also be used to increase transparency when making information available to the public during the capital programming and project development processes. While not discussed in "4.4 Financial and Fiscal Impacts," data collected by transportation agencies may be able to be monetized as private businesses across of wide spectrum of industries (e.g., marketing, automotive, etc.) can gain competitive insights.

4.6 Emerging Technologies Scenario

The proliferation of ride-hailing, bikesharing, microtransit, e-scooters, and (at some point) automated cars and trucks presents both challenges and opportunities for communities and public transit operators. The level of disruption and the impacts on land development, vehicle miles traveled, pollutant emissions, public transit ridership, and other key quality of life factors brings levels of uncertainty not see in transportation since the advent of the automobile.

It is impossible to forecast operating conditions with these new mobility options at the same level of certainty as a status quo scenario using travel demand, mesoscopic, and microsimulation models. However, the changes in travel that new mobility options bring requires that the planning process evolve to more fully consider their impacts using different methods. Employing a risk management framework to mitigate negative impacts is only one side of the equation. The other is a complementary "opportunity optimization" framework that identifies how the positive benefits can be accelerated and expanded.

Given the uncertainty of when ACES and other emerging technologies will come online, it is prudent to plan around thresholds in addition to timeframes. As an example, scenarios for a certain level of market penetration of AVs or EVs can be done for various years to evaluate the interplay between the technology and socioeconomic changes that impact VMT and other factors. FDOT in its Guidance for *Assessing Planning Impacts and Opportunities of Automated, Connected, Electric, and Shared-Use Vehicles* incorporates the six Connected Vehicle/AV Scenarios developed by the Federal Highway Administration (**Figure 4-11**).



Source: USDOT, November 2017[19]

Figure 4-11: Connected Vehicle (CV)/Automated Vehicle (AV) Scenarios

The specific emerging technology elements to be included in the travel demand forecasting scenarios will require discussion and definition to ensure that the results are meaningful to the planning process in that they provide the basis for determining future needs, evaluating proposed alternatives, and scoping recommended actions.

[19] USDOT 5th ITS PCB University Workshop, Role of Connected and Automated Vehicles in Planning, November 2017 viewed on July 16, 2019 at https://www.pcb.its.dot.gov/universityworkshops/Nov2017/Day1_Azizi.pdf.

5. Next Steps

The project team will use information included in this technical memorandum throughout the LRTP process to ensure consistency with existing adopted state, regional and local transportation plans and programs, comprehensive plans as well as provide continuity relevant with previous transportation planning studies. Further, it will assist the project team to develop vision, goal and objectives, project prioritization criteria, prepare a system performance report, conduct environmental justice analysis for projects included the cost feasible plan and inform scenario planning exercise.

FINAL