

Technical Memorandum #6:  
**Additional Elements**  
August 2020



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

This technical memorandum was developed based on data and analyses during the time period from December 2019 through May 2020. Subsequently the Martin MPO Policy Board approved the Draft 2045 Cost Feasible Plan – *Martin in Motion* in June 2020. *The Final* 2045 Cost Feasible Plan was adopted by the Martin MPO Policy Board in October 2020.

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## 1. Introduction

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The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) collaborated with the Florida Department of Transportation (FDOT), the Metropolitan Planning Organization Advisory Council (MPOAC), and Florida's MPOs to identify and document their expectations related to meeting federal requirements for the Long Range Transportation Plans (LRTPs). The FHWA's expectations are stated in the Federal Strategies for Implementation Requirements for LRTP Updates for the Florida MPOs date January 10, 2018. To address FHWA's expectations the Martin MPO's 2045 Long Range Transportation Plan's (LRTP) – *Martin in Motion* includes *Additional Elements* to incorporate freight, sustainability, and livability as well as travel and tourism component. The purpose of Technical Memorandum #6 (TM 6) is to discuss *Additional Elements* – freight movement, complete streets, resiliency and climate change impacts and travel and tourism factors to identify transportation improvements that could serve as an input into the 2045 Needs Assessment.

This technical memorandum is organized as described below:

**Chapter 1: Introduction** – summarizes the purpose of the technical memorandum and report organization.

**Chapter 2: Freight Movement** – discusses existing goods and freight movement in Martin County, future and emerging trends in the freight industry as well as identifies freight projects from *FDOT's Strategic Intermodal System (SIS) Cost Feasible Plan and Multimodal Unfunded Needs Plan, 2019, Florida Mobility and Trade Plan (FMTP), April 2020* and Martin MPO's *Freight and Goods Movement Study, June 2020*.

**Chapter 3: Complete Streets** – identifies complete streets projects based on Martin MPO's Access to Transit Study that could be included in the 2045 Needs Assessment as well as references FDOT, District Four's land use context classification, which should be used to develop context sensitive solutions.

**Chapter 4: Resiliency and Climate Change Impacts** – discusses various data sources and tools for identifying and addressing climate change, extreme weather events, previous studies as it relates to resiliency, findings and strategies as well as projects to be included in the 2045 Needs Assessment.

**Chapter 5: Enhancing Travel and Tourism** – provides a snapshot of tourism industry and its impact on the local economy and identifies projects that could be considered to enhance tourism.

**Chapter 6: Next Steps** – summarizes how information included in this memorandum will be used to develop the 2045 LRTP as the project advances further in the planning process.

## 2. Freight Movement

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The safe, efficient, and reliable movement of goods (raw materials, intermediate inputs, and finished products) is one of transportation's primary contributions to economic development in metropolitan areas. This chapter discusses existing goods movement in Martin County as well as future and emerging trends in the freight industry. Relevant freight projects from other relevant plans and programs are identified and incorporated by reference into *Martin in Motion*.

### 2.1 Existing Goods and Freight Movement

The federally mandated National Highway Freight Network and FDOT Strategic Intermodal System (SIS) are higher level facilities that are essential to goods movement within Martin County and at the state level and beyond. The largest volumes of trucks in Martin County are located on:

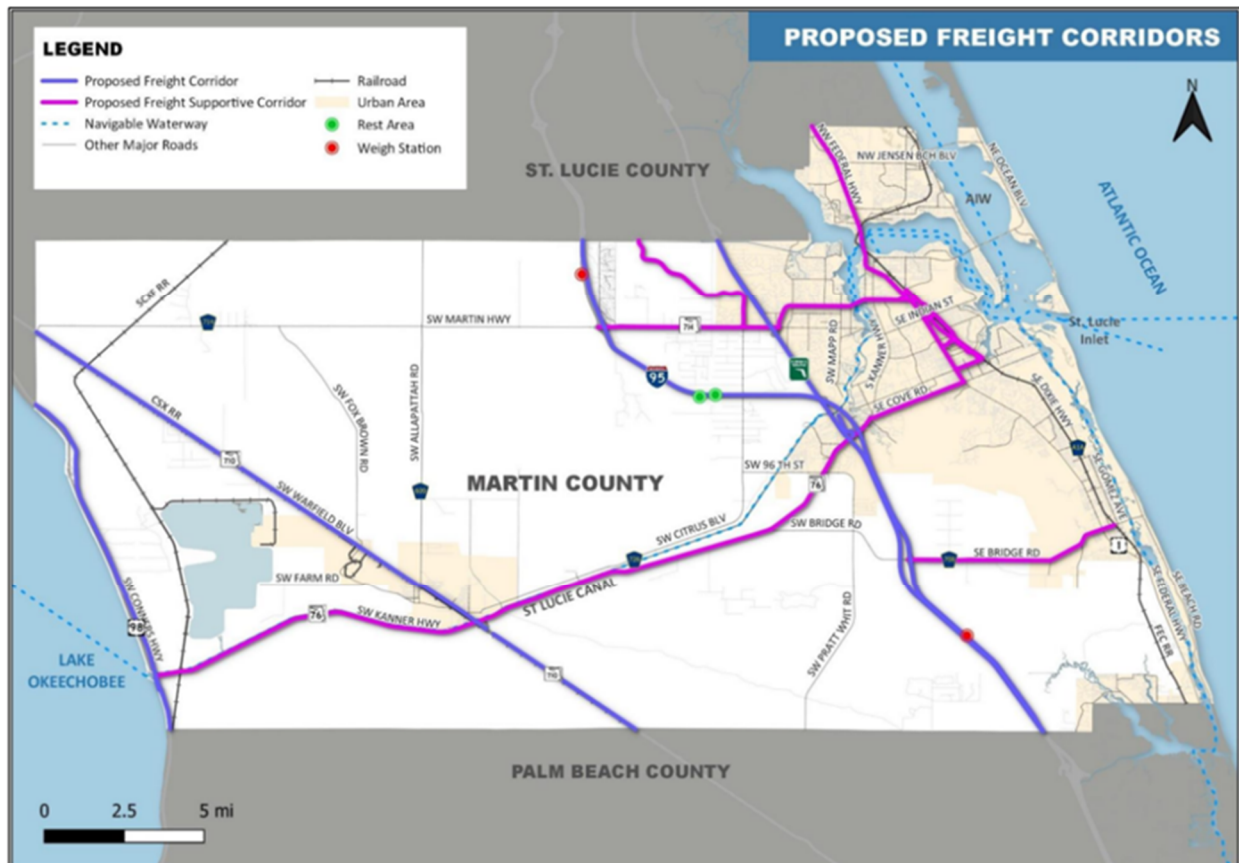
- I-95
- Florida's Turnpike
- SR-714/Martin Highway
- US-1/Federal Highway
- SR-710/Warfield Boulevard
- US-98
- SR-76/Kanner Highway from US-98 and SR-710/Warfield Boulevard
- Pomeroy Street in eastern Martin County

In addition to these major roadways, three private freight rail operators provide service within Martin County: Florida East Coast Railroad (FEC), CSX Transportation (CSX), and the South Florida Central Express (SCXF). Combined, approximately 30 freight trains – locomotives and rail cars (e.g., boxcars, flat cars, tankers, etc.) – traverse Martin County per day with FEC trains comprising the majority of these. These trains along with trucks on the roadways listed above and ships using the Atlantic Intracoastal Waterway (AIW), St Lucie River, St Lucie C-44 Canal, and Okeechobee Waterway serve the larger multi-county freight network.

To form a functional network that connects the highways, rail lines, and marine facilities discussed above, a local, freight-supportive network was identified in the *Martin County Freight & Goods Movement Plan* to serve the needs of shippers, receivers, and carriers in Martin County. Freight-supportive corridors include:

- Bridge Road from I-95 to US-1/Federal Highway
- Kanner Highway (SR-76) from US-98 to Cove Road
- Cove Road from Kanner Highway (SR-76) to Dixie Highway
- Monroe Street from US-1/Federal Highway to Commerce Avenue
- Indian Street from US-1/Federal Highway to Dixie Highway
- SR-714/Martin Highway/Martin Downs Boulevard/Monterey Road from I-95 to Dixie Highway
- Citrus Boulevard from St. Lucie County Line to Martin Highway

- US-1/Federal Highway from Cove Road to St. Lucie County
- Commerce Avenue from Salerno Road to Indian Street
- Dixie Highway from Salerno Road to SR-714/Martin Highway



Source: *Martin County Freight & Goods Movement Plan – Draft Final, June 2020*

**Figure 2-1: Martin County Proposed Freight Corridors**

The proposed freight network in Martin County (**Figure 2-1**) is critical to serving three types of land uses that require access to markets within and outside the county. These include:

- **Agricultural** – Located primarily in the southern and western portions of the County, approximately 220,000 acres are utilized for agricultural purposes. The three primary types of agriculture in the County by land use are pasture grazing (69%), sugar cane (13%), and cropland (9%) according to the University of Florida Institute of Food and Agricultural Services.
- **Commercial** – Located along the US-1/Federal Highway corridor, commercial uses intensify around potential customers in the more densely populated areas from approximately Cove Road to St. Lucie County. SR-714/Martin Highway and Martin Downs Boulevard, SR-710 through the Village of Indiantown, and Jensen Beach Boulevard in northern Martin County represent the other commercial corridors in the County.

- **Industrial** – Industrial land uses represent storage, warehousing, distribution, manufacturing, and marine industries. The main industrial area including: The Village of Indiantown; the SR-714 Martin Highway/Florida’s Turnpike area; the area located off of SR-76/Kanner Highway between I-95 and the Florida’s Turnpike; the southern Commerce Avenue area and on Bridge Road west of US-1/Federal Highway.

Three primary multimodal goods movement plans of relevance to Martin County were reviewed to identify key projects and initiatives for inclusion in Martin in Motion.

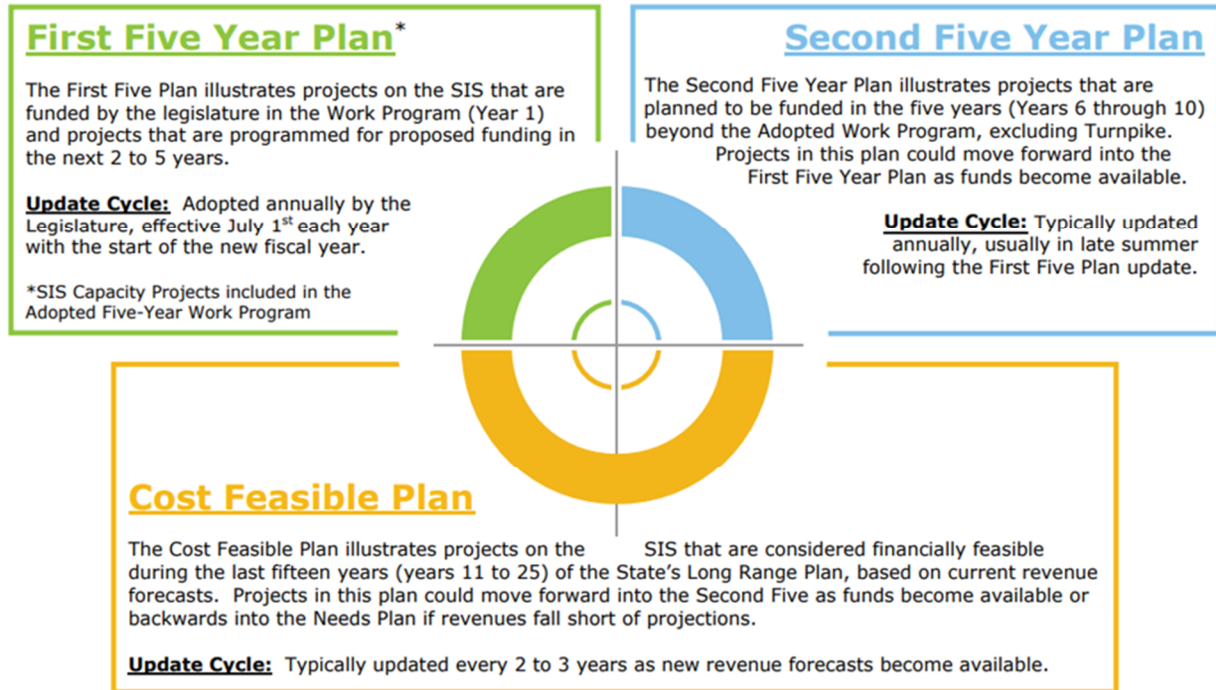
## 2.2 Strategic Intermodal System (SIS) Plan, FDOT

In 2003, the SIS was established by the Governor and Legislature for the purpose of establishing and investing in transportation facilities that are vital to Florida’s economy. The projects included in the SIS are intended to improve interregional connectivity (efficient and reliable connectivity within Florida and between it and other states and nations), intermodal connectivity (expanded choices and integration of modes), and economic development (support trade, tourism, talent, innovation, business, and investment).

The planning and programming of the SIS is accomplished through the development of a plan and funding strategy. The current version of the *SIS Policy Plan* was completed in March 2016 and is consistent with the Policy Element of the *Florida Transportation Plan (FTP)*. It provides information on trends shaping the SIS, how the SIS can improve interregional connectivity, intermodal connectivity, and economic development, example projects, and steps related to implementation. The *SIS Policy Plan* includes five implementation emphasis areas, one of which is “freight mobility and trade development” to support “public and private efforts to expand trade and logistics activity in Florida, aligning with the *Freight Mobility and Trade Plan*.”

The *SIS Funding Strategy* identifies capacity improvement projects over a 25-year period (**Figure 2-2**). It is split into the “First Five Year Plan” (years one through five, adopted annually), “Second Five Year Plan” (years six through 10, updated annually), and “Cost Feasible Plan” (years 11 through 25, updated every two to three years). Projects included in the *SIS Funding Strategy* are financially feasible based on projections of reasonably expected current and future revenues. The *SIS Funding Strategy* is flexible in that if additional revenues beyond those forecasted become available, projects can be accelerated into an earlier plan (e.g., project(s) can be advanced from the Second Five Year Plan into the First Five Year Plan). Conversely, if revenues are less than expected, projects can be deferred (e.g., project(s) can be moved from the Second Five Year Plan into the Cost Feasible Plan), as well as moved from the Cost Feasible Plan into the Unfunded Needs Plan.





Source: Florida DOT Strategic Intermodal System Funding Strategy – FY 2020/2021 through 2024/2025

**Figure 2-2: Strategic Intermodal System Funding Strategy**

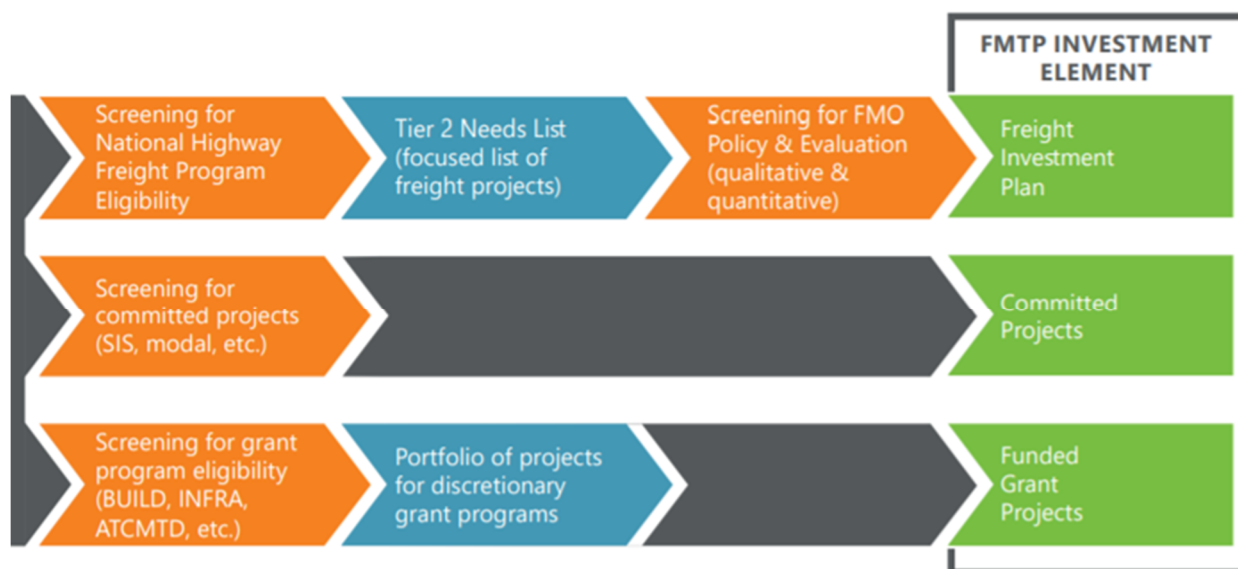
### 2.3 Florida Mobility and Trade Plan (FMTP)

The FMTP, completed in April 2020, is a comprehensive multimodal freight plan for Florida. It also serves as the plan required for states to obligate FHWA National Highway Freight Program funds (NHFP). The goals of the FTP are incorporated to provide a lens for identifying and evaluating freight projects to ensure investments meet the needs of freight-related stakeholders and other users of the system in a comprehensive manner. Statewide trends in population, economics, modal choices, and technology form the foundation for the determination of issues and challenges as determined through analysis and stakeholder outreach. Recurring and non-recurring highway congestion that created truck bottlenecks is identified as an issue in the FMTP. While no truck bottlenecks, as defined in the FMTP, exist in Martin County, there are ones located to the north and south of the county along I-95 in St. Lucie County and Palm Beach County, respectively. Truck parking (the second most critical issue in the trucking industry by the American Transportation Research Institute) and empty backhauls (trucks returning to their point of origin without hauling cargo back) were highlighted as other primary challenges in the FMTP. A series of other issues and challenges across all modes were also documented as part of the development of the FTMP.

To address uncertainty and risk, three separate scenarios (i.e., sets of assumptions) were defined as part of the FMTP: resiliency, technology, and economy. Associated freight implications and potential strategies/actions were developed for each scenario. Needs were established and projects were prioritized. Project prioritization was guided by two principles:

1. “It must be objective, consistent, data-driven, and transparent to all involved in the process.”
2. “It needs to have flexibility to align with diverse freight system needs.”

A call for projects was issued and submissions were classified by funding status (currently funded or unfunded), potential to be awarded funds from federal discretionary programs, and eligibility for programming with NHFP funds apportioned to the state. Projects were assigned to an *FMTP* Investment Element according to their classification and projects not currently funded or deemed the strongest candidates for federal discretionary programs were evaluated and quantitatively and qualitatively (**Figure 2-3**).



Source: Florida Mobility and Trade Plan, April 2020

**Figure 2-3: FMTP Project Prioritization Process**

This prioritization is reflected in a five-year Freight Investment Plan that is fiscally constrained and, as with the *SIS Funding Strategy*, provides the flexibility to advance and defer projects based on changes in committed funding levels. A series of non-project recommendations were created to complement the projects in the Freight Investment Plan. A policy implementation framework – short-term, medium-term, long-term, and continuous – was produced to integrate projects with those recommendations that require “legislative action and/or organizational changes.”

## 2.4 Goods and Freight Movement Study, Martin MPO

The Martin MPO recently completed the *Martin County Freight & Goods Movement Plan*. This plan was developed to 1) engage stakeholders; 2) identify, plan, and develop a reliable system to transport goods into, out of, and through the county; and 3) integrate goods movement into community design. It provides a perspective tailored to Martin County in consideration of recent freight planning conducted at the federal, state, regional, and multi-county levels. The *Martin County Freight & Goods Movement Plan* establishes the goals and objectives shown in **Figure 2-4**.



Source: *Martin County Freight & Goods Movement Plan*, July 2020

**Figure 2-4: Martin County Freight & Goods Movement Plan Goals and Objectives**

A Stakeholder Advisory Committee met three times and direct outreach, including site visits and interviews, were held to gather input on key issue areas including:

- Roadway Conditions/Design
- Truck Parking
- Incident Management
- Local Policy
- Public Outreach/Education
- Autonomous Vehicles
- Cargo Theft
- Railroad Crossings
- Waterways

System performance measures include those that are federally-required and included in *Martin in Motion* along with others such as highway bottleneck rankings (**Table 2-1**) with Traffic Management Channels [TMC], which are FDOT roadway segmentations), railroad crossing bottleneck rankings, commercial vehicle crashes, and future FEC rail activity.

Table 2-1: Top 10 Highway Bottlenecks in Martin County, FL

	Bottleneck Location	Starting TMC Code	Avg. max length	Avg. daily duration	Total duration	All events/ incidents	Vol Est.	Total Delay
1	I-95 N @ CR-708/EXIT 96	102P05502	9.47	16 m	1 d 1 h 6 m	987	35,545	11,782,069
2	I-95 S @ CR-708/EXIT 96	102N05502	5.33	6 m	9 h 42 m	527	33,692	8,595,700
3	SR-76 W @ SE COVE RD	102-07516	3.09	59 m	3 d 16 h 56 m	0	15,549	7,909,486
4	FLORIDA'S TPKE N @ CR-714/EXIT 133	102P05542	4.12	4 m	6 h 54 m	361	18,028	3,726,126
5	SR-76 E @ SE INDIAN ST	102P07518	3.12	28 m	1 d 18 h 18 m	0	15,463	3,662,025
6	I-95 N @ CR-714/EXIT 110	102P05505	8.58	4 m	6 h 56 m	555	26,116	3,407,244
7	SR-76 E @ SE COVE RD	102+07516	0.58	1 h 3 m	3 d 21 h 51 m	0	15,742	2,810,871
8	I-95 N @ SR-76/EXIT 101	102P05503	6.41	2 m	3 h 42 m	1,028	36,475	2,724,482
9	SR-714 W @ US-1/SE FEDERAL HWY	102N07493	0.27	3 h 10 m	11 d 18 h 7 m	0	11,426	2,662,882
10	CR-707A W @ NE PINEAPPLE DR/NE WEST END BLVD	102N17399	0.16	8 h 37 m	31 d 23 h 16 m	0	5,093	2,517,511

Source: *Martin County Freight & Goods Movement Plan*, July 2020

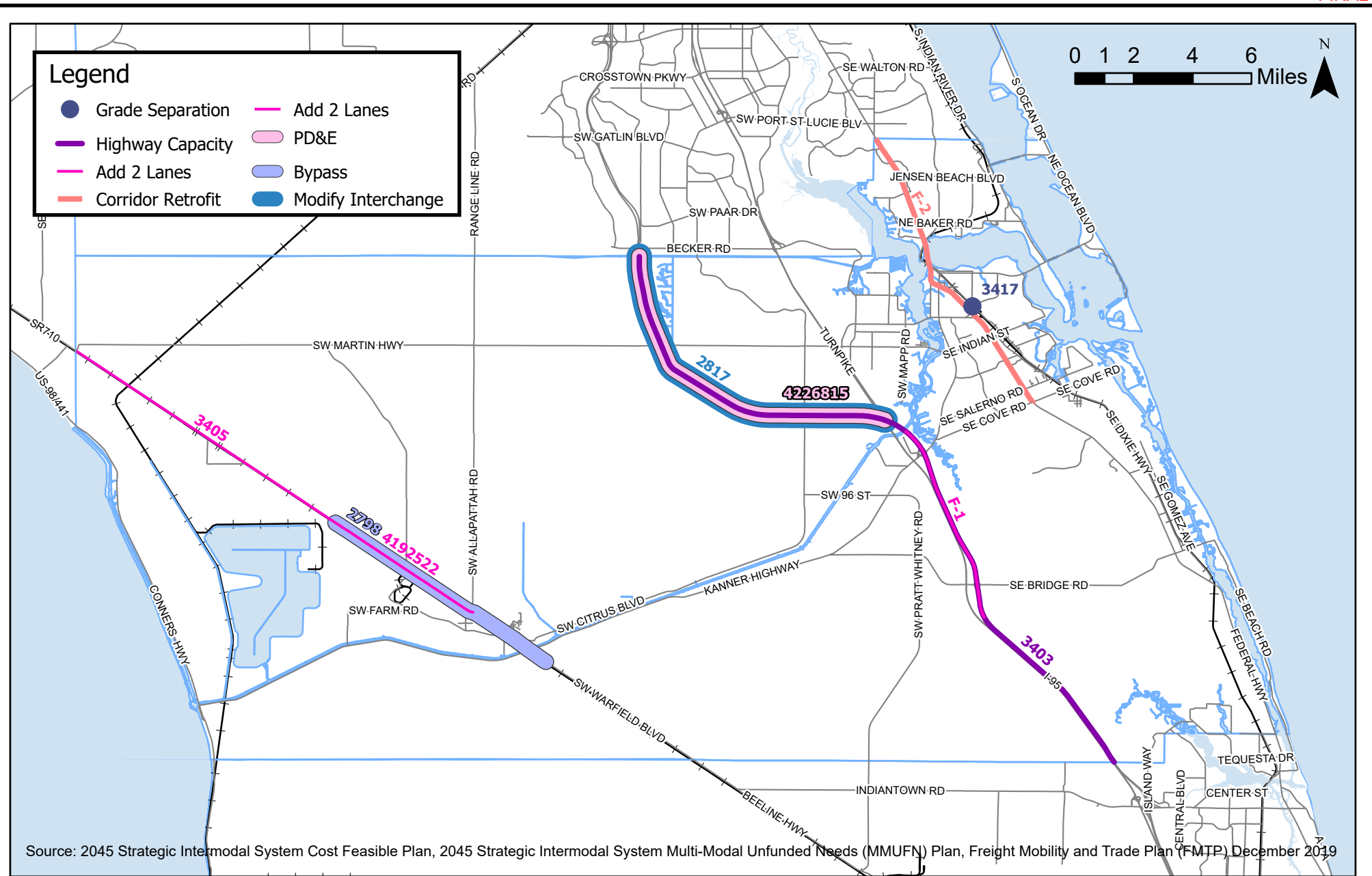
The *Martin County Freight & Goods Movement Plan* both identified altogether new projects to improve the safe, efficient, and reliable movement of goods to improve economic competitiveness and enhance public space and compiled those included in other plans. Policy recommendations supplement the projects and include freight roadway design contexts for a typology of areas (Community-Oriented, Diverse-Activity, Freight-Oriented, and Low-Activity), implementing an ongoing Freight Stakeholders Advisory Committee, and sponsoring educational events. In addition, there is a discussion of key emerging technological trends that will impact the movement of freight in Martin County.

## 2.5 Needs Plan Freight Projects in *Martin in Motion*

Recommended projects from the plans discussed above were considered in the development of the 2045 Needs Assessment and ultimately in the 2045 Needs Plan *Martin in Motion* (Table 2-2).

**Table 2-2: Freight Projects in the *Martin in Motion* 2045 Needs Plan**

Map ID	Facility	From	To	Project Description
4192522	SR-710/Warfield Blvd.*	Martin FPL Power Plant	CR-609/SW Allapattah Road	Add 2 to Build 4 Lane Divided Roadway
4226815	I-95*	High Meadow Avenue	Martin/St. Lucie County Line	Project Dev. & Env.
3403	I-95*	Martin/Palm Beach County Line	Becker Road	Highway Capacity
3405	SR-710*	Martin/Okeechobee County Line	Martin Powerplant Road	Add 2 to Build 4 Lanes
3417	SR-714/Monterey Road*	at Florida East Coast Railway		Grade Separation
F-1	I-95***	S of Bridge Road	S of High Meadow Avenue	Widen 6 to 8 Lanes
n/a	Strategies for Reducing Railroad Trespassing (SRRT) Pilot Project	Florida East Coast (FEC) Railway Corridor		Enhanced Safety Improvements per Brightline/Virgin USA Trains and Martin County Agreement
				Dynamic Envelop project (Additional Striping) at all Railroad Crossings on State Roads in Martin County
2798	SR-710*	Martin Powerplant Road	SR 76 Connector Ramps	Bypass (New Facility)
2817	I-95*	High Meadow Avenue	Becker Road	Modify Interchange
F-2	US-1/Federal Highway1	Cove Road	St. Lucie County Line	Corridor Retrofit
n/a	Connected Freight Priority System Deployment			To Be Determined (Automated/Connected Vehicle)



Source: 2045 Strategic Intermodal System Cost Feasible Plan, 2045 Strategic Intermodal System Multi-Modal Unfunded Needs (MMUFN) Plan, Freight Mobility and Trade Plan (FMTP) December 2019



TYLIN INTERNATIONAL

# 2045 Needs Assessment

## Freight

### Martin County



Figure 2-5

## 2.6 Freight Industry: Emerging Trends and Technologies

The movement of goods continues to adapt to meet the evolving preferences of businesses and end consumers. The ability of “big data” to shed light on both stated and unstated preferences (what people and businesses say they’ll do and what they actually do) coupled with advances in technology to respond to these preferences is occurring at an accelerating rate. Like individuals, businesses make transportation choices based primarily on cost and convenience. In some cases, other values such as environmental friendliness are considered but the majority of mode choice is determined by answering the two questions of “how much will it cost?” and “how long will it take?”.

Three of the most prominent emerging trends and technologies that are projected to alter the goods movement landscape internationally, nationally, in Florida, and in Martin County include the following:

- Internet of Things (IoT) – 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 double by 2030<sup>1</sup>. Some of the most important transportation devices connected by IoT include vehicles, traffic signals, streetlights, dynamic messaging signs on highways, 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. 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<sup>2</sup>. It is easy to see the opportunities for public agencies to better plan and operate their transportation infrastructure and services, as well as for businesses to streamline their logistics and delivery processes to ship, receive, and store goods more efficiently.
- Automated, Connected, Electric, and Shared vehicles (ACES) – ACES represent the largest inflection point for the transportation industry. In terms of freight, 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. At one point, automated trucks were projected to be using highways in Florida by the end of 2020.<sup>3</sup> 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 varied array 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

<sup>1</sup> Statista, *Number of internet of things (IoT) connected devices worldwide in 2018, 2025 and 2030(in billions)*, viewed July 30, 2020 at <https://www.statista.com/statistics/802690/worldwide-connected-devices-by-access-technology/>.

<sup>2</sup> British Telecommunications, PLC, *What does 1GB of data equate to?*, viewed July 10, 2019 at [https://btbusiness.custhelp.com/app/answers/detail/a\\_id/13213/~/what-does-1gb-of-data-equate-to%3F/c/5198/](https://btbusiness.custhelp.com/app/answers/detail/a_id/13213/~/what-does-1gb-of-data-equate-to%3F/c/5198/)

<sup>3</sup> 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>.

fully human-powered or have electric assist, and delivery robots such as those currently deployed by Starship Technologies, Marble, and others.

- 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. Transportation agencies should expand their capabilities in two foundational elements of TSM&O:
  1. Cybersecurity: CVs and 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.
  2. Big Data: 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 Martin MPO capital programming and project development processes.

The current pandemic significantly changed travel patterns from prior to mid-March 2020. While there is variation across the country, there were some key changes resulting from the responses of people and businesses to COVID-19 that were common to almost all metropolitan areas. Immediately following the mandated reduction in social and economic activities in March 2020, vehicle miles traveled dropped precipitously particularly for employment-related commuting as layoffs, furloughs, and work from home policies took effect. This reduced congestion on interstates and allowed freight to travel more efficiently and over longer periods of the day (as opposed to avoiding traditional morning and evening peak periods), resulting in more interregional truck trips. Reduced trips to work combined with increases in e-commerce and decreases in dining out have likely resulted in changes to origin-destination pairing. Most notably, more potential for trips from distribution centers directly to residences and less trips from home to offices and retail/commercial/ entertainment districts.

In the long term, it is impossible to determine what the fundamental changes to freight transportation will be and to what degree. According to McKinsey & Company, “there is no economic rule of thumb that freight growth will track economic growth after a crisis.”<sup>4</sup> *Martin in Motion* provides a framework that allows for existing and yet to be determined

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<sup>4</sup> McKinsey & Company, *US freight after COVID-19: What's next?* June 2020



mobility options to contribute to economic development and quality of life while minimizing harmful unintended consequences. This approach acknowledges that automation, connectivity, and electrification will bring about significant changes. A continued focus on actions that improve safety, decrease delay, and increase reliability under various levels of market penetration of emerging technologies and trends is warranted rather than expending effort in an attempt to guess or select which ones will be successful at what point in time.

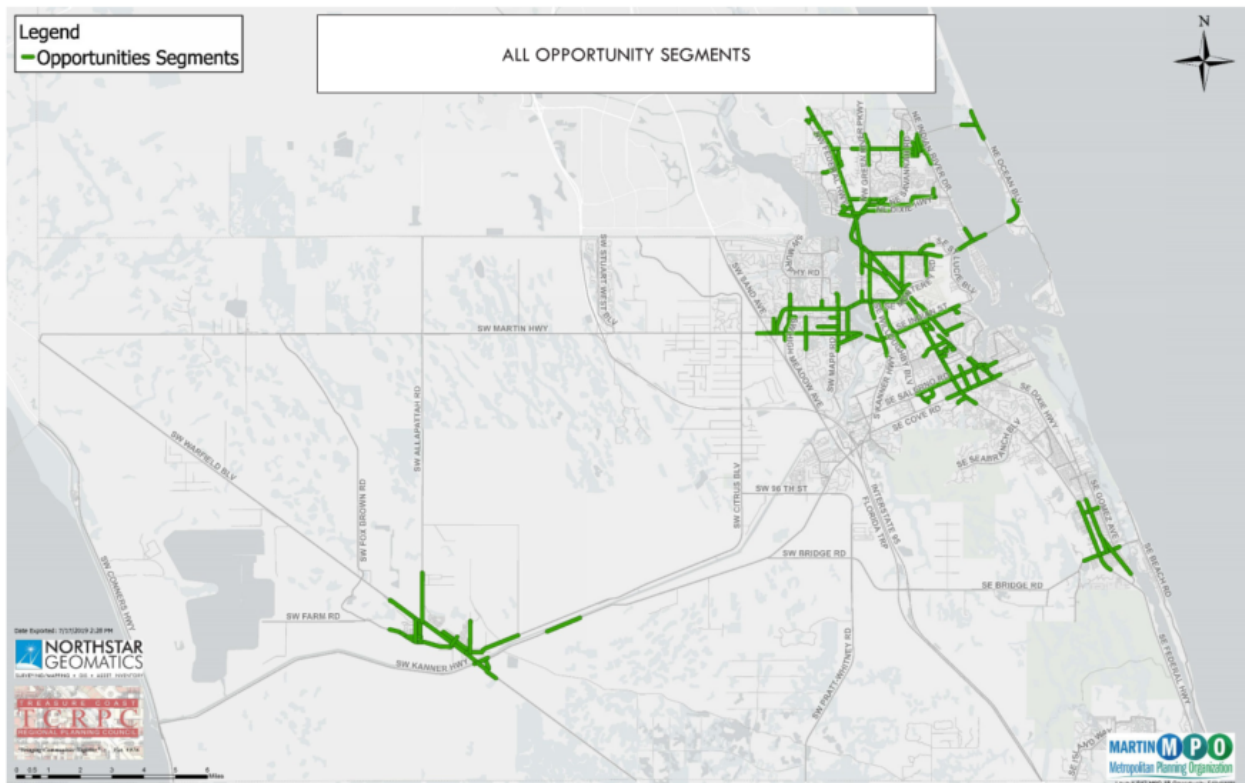
### 3. Complete Streets

This chapter identifies complete streets projects based on Martin MPO's *Complete Streets: Access to Transit Study* that could be included in the 2045 Needs Assessment as well as references FDOT, District Four's land use context classification, which should be used to develop context sensitive solutions

#### 3.1 Access to Transit Study, Martin MPO

The Martin MPO completed a comprehensive assessment in May 2020 – a multi-year effort to engage stakeholders and public review as well as technical analyses, which is documented in the MPO's *Complete Streets: Access to Transit Study*. The purpose of this study was to improve efficiency, effectiveness, and safety for transit users; enhance safety, functionality, and quality of life; and expand the economic benefits to the community.

The countywide study area included an extensive roadway network that spans more than 1,200 miles across the MPO service area. Based on robust criteria that included transit stop accessibility, population density, employment density, educational and recreational destinations, safety (crash data), economic development potential, and land use context, 164 "Opportunity Segments" were identified through the *Complete Streets: Access to Transit Study* (**Figure 3-1**).



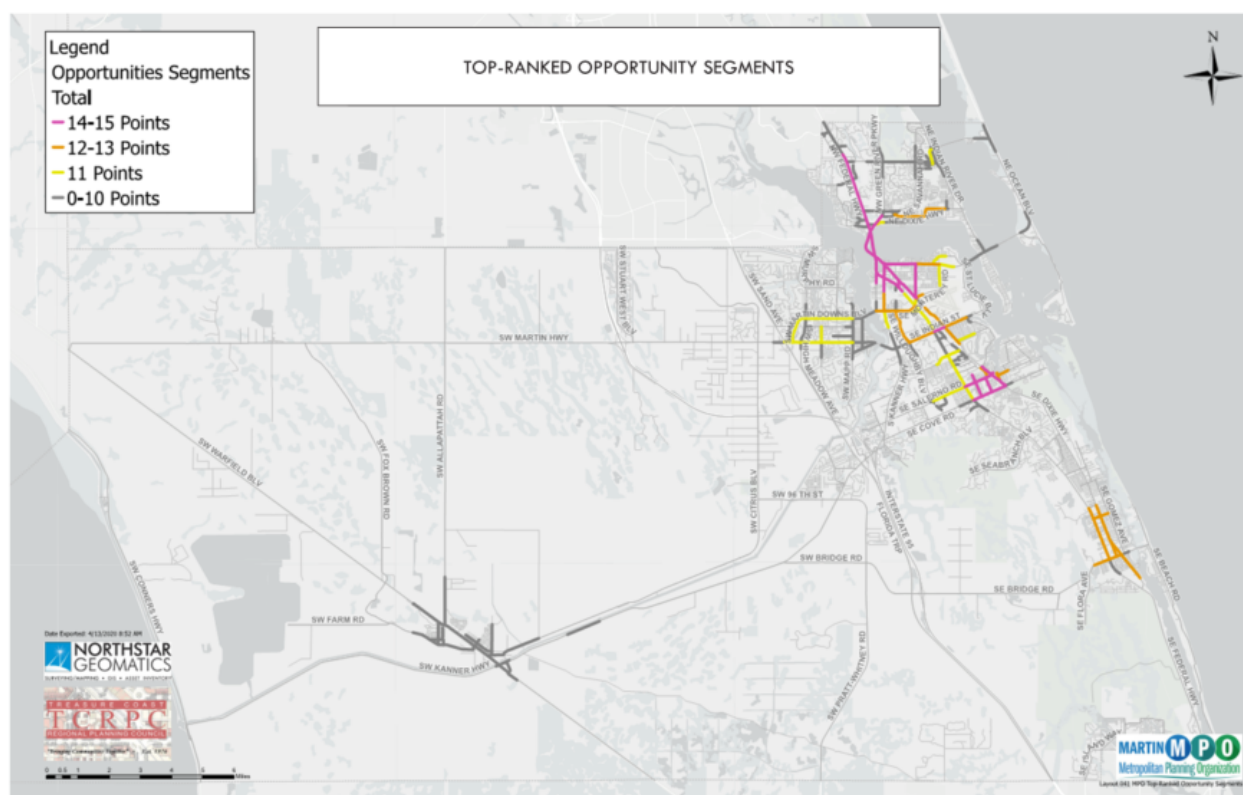
Source: Complete Streets: Access to Transit Study, May 2020

Figure 3-1: All Opportunity Segments

A complete list of the 164 opportunity segments is included in the MPO's final report. These opportunity segments were prioritized into three tiers, Tier 1, Tier 2, and Tier 3 using of data-driven evaluation process. This assessment used eight criteria related to transit, population and employment density, proximity to schools and/or parks, crashes, access to vehicle and proximity to Community Redevelopment Area (CRA). Each segment was assigned points relative to individual criterion, which were then summed up to develop a total point score. The maximum points available for any individual segment was 15.

Out of 164 opportunity segments, 108 segments received a total of 10 point or below. These segments were not considered for funding. The remaining 58 opportunity segments were stratified into three tiers based on total points received as noted below and shown in **Figure 3-2**:

- Tier 1 – segments scoring 14-15 points (a total of 19 segments)
- Tier 2 – segments scoring 12-13 points (a total of 19 segments)
- Tier 3 – segment scoring 11 points (a total of 18 segments)



Source: Complete Streets: Access to Transit Study, May 2020

**Figure 3-2: Top-Ranked Opportunity Segments**

Table 3-1: Top-Ranked Opportunity Segments

SEGMENT DETAILS							SEGMENT SCORING									
THIR	SEGMENT NAME	START POINT	END POINT	GENERAL LOCATION	SEGMENT LENGTH (MILES)	ROW WIDTH (FEET)	TOTAL SCORE	EXISTING TRANSIT	PROPOSED TRANSIT	POP'N DENSITY	EMPLOYEE DENSITY	ACCESS TO VEHICLES	BIKE/PED CRASHES	CRA	SCHOOL +/-OR LIBRARY	PARK
	S COLORADO AVE	CONFUSION CORNER	SR 5 (US 1)	Stuart	0.42	90	15	5	0	1	1	2	2	2	1	1
	NW DIXIE HWY (SR 707)	NW GREEN RIVER PKWY	CONFUSION CORNER	Stuart	1.98	100	15	5	0	1	1	2	2	2	1	1
	SE DIXIE HWY & S COLORADO AVE	SE MONTEREY RD	CONFUSION CORNER	Stuart	1.58	50	15	5	0	1	1	2	2	2	1	1
	SE PALM BEACH RD	SE OCEAN BLVD (SR A1A)	SE MONTEREY RD	Stuart	1.09	80	15	5	0	1	1	2	2	2	1	1
	SE CHRISTIE WAY	SE DIXIE HWY	SE PALM BEACH RD	Stuart	0.08	50	15	5	0	1	1	2	2	2	1	1
ONE	SE COVE ROAD	SR 5 (US 1)	SE DIXIE HWY	Salerno	1.11	75	15	5	0	1	1	2	2	2	1	1
	SE JACK ST	PORT SALERNO ELEMENTARY	SE COVE RD	Salerno	0.76	70	15	5	0	1	1	2	2	2	1	1
	SR 5 (US 1)	NW SUNSET BLVD	S END OF ROOSEVELT BRIDGE	Stuart	3.57	150	15	5	0	1	1	2	2	2	1	1
	SR 5 (US 1)	SW JOAN JEFFERSON WAY	600 FEET SOUTH OF SE TRESSLER DR	Stuart	1.42	150	15	5	0	1	1	2	2	2	1	1
	SE INDIAN ST	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Stuart	0.36	100	14	5	0	1	1	2	2	2	0	1
	S KANNER HWY (SR 76)	SR 5 (US 1)	SW MANOR DR	Stuart	0.44	110	14	5	0	1	1	2	2	2	0	1
	SE SALERNO RD	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Salerno	0.93	65	14	5	0	0	1	2	2	2	1	1
	SE SALERNO RD	SE DIXIE HWY (SR A1A)	SE DE SOTO AVE	Salerno	0.08	60	14	5	0	1	1	2	2	2	0	1
	SE CUTOFF RD	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Stuart	0.23	110	14	5	0	0	1	2	2	2	1	1
	SE DIXIE HWY	CONFUSION CORNER	SE PALM BEACH RD	Stuart	1.07	90	14	5	0	0	1	2	2	2	1	1
	SE DIXIE HWY (SR A1A)	SE SALERNO RD	SE COVE RD	Salerno	0.61	90	14	5	0	1	1	2	2	2	0	1
	SE DIXIE HWY (SR A1A)	PORT SALERNO CRA (NORTH BOUNDARY)	SE SALERNO RD	Salerno	0.39	90	14	5	0	1	1	2	2	2	0	1
	SE EBBTIDE AVE	SE SALERNO RD	SE COVE RD	Salerno	0.5	65	14	5	0	1	0	2	2	2	1	1
	SR 5 (US 1)	SR 5 (US 1)	400 FEET NORTH OF SW INDIAN GROVES DR	Stuart	0.33	80	14	5	0	1	1	2	2	2	0	1
	TWO	SE COMMERCE AVE	RIO CRA (NORTH BOUNDARY)	SE SALERNO RD	Salerno	0.37	65	13	5	0	0	1	2	2	2	0
S KANNER HWY (SR 76)		900 FEET NORTH OF SW S CAROLINA DR	SW MONTEREY RD	Stuart	0.56	110	13	5	0	1	1	2	2	0	1	1
SE DIXIE HWY (SR A1A)		SE DHARLYS ST	HOBE SOUND CRA (SOUTH BOUNDARY)	Hobe Sound	2.75	35	13	5	0	1	1	2	0	2	1	1
SE OCEAN BLVD		SE PALM BEACH RD	SE MONTEREY RD	Stuart	0.76	100	13	5	0	1	1	2	0	2	1	1
SE MONTEREY RD		SW PALM CITY RD	SE WILLOUGHBY BLVD	Stuart	0.64	90	13	5	0	1	1	2	2	0	1	1
SE PETTWAY ST		SR 5 (US 1)	SE GOMEZ AVE	Hobe Sound	0.51	25	13	5	0	1	1	2	0	2	1	1
SE INDIAN ST		SE DIXIE HWY (SR A1A)	SE ST LUCIE BLVD	Golden Gate	0.77	110	12	5	0	1	1	0	2	2	0	1
SE INDIAN ST		SE WILLOUGHBY BLVD	SR 5 (US 1)	Stuart	0.87	110	12	5	0	1	1	2	2	0	0	1
SE MONTEREY RD		SE DIXIE HWY (SR A1A)	SE OCEAN BLVD	Stuart	0.26	140	12	5	0	1	1	2	2	0	0	1
NE DIXIE HWY (SR 707)		NE SAVANNAH RD	PALMER ST	Rio	1.83	60	12	5	0	1	1	2	0	2	0	1
SE ANCHOR AVE		SE OVERLOOK TER	SE DIXIE HWY (SR A1A)	Rocky Point	0.28	65	12	5	0	1	1	0	2	2	0	1
SE BRIDGE RD		SE PLANDOME DR	SE GOMEZ AVE	Hobe Sound	0.94	70	12	5	0	0	1	2	0	2	1	1
SE DIXIE HWY (SR A1A)		SE INDIAN ST	SE MONTEREY RD	Golden Gate	0.89	100	12	5	0	1	1	0	2	2	0	1
SE DIXIE HWY (SR A1A)		SE INDIAN ST	300 FEET SOUTH OF SE KENSINGTON ST	Golden Gate	0.73	90	12	5	0	1	1	0	2	2	0	1
SE HORSESHOE POINT RD		SE ANCHOR AVE	SE MANATEE COVE RD	Rocky Point	0.37	60	12	5	0	1	1	0	2	2	0	1
SE LARES AVE	SE DIXIE HWY	SE BRIDGE RD	Hobe Sound	0.49	35	12	5	0	0	1	2	0	2	1	1	
SE MONTEREY RD	SE WILLOUGHBY BLVD	SR 5 (US 1)	Stuart	0.69	110	12	5	0	1	1	2	2	0	0	1	
THREE	SR 5 (US 1)	HOBE SOUND CRA (NORTH BOUNDARY)	SE BRIDGE RD	Hobe Sound	1.77	225	12	5	0	0	1	2	0	2	1	1
	WILLOUGHBY BLVD	SE MONTEREY RD	SE INDIAN ST	Stuart	1.14	150	12	5	0	1	1	2	2	0	0	1
	SR 5 (US 1)	SE SALERNO RD	SE SPRINGTREE PL	Stuart	0.55	225	11	5	0	1	1	2	2	0	0	0
	SW MARTIN HWY	FLORIDA TURNPIKE (SR 91)	SW MAPP RD	Palm City	2.2	110	11	0	3	1	1	0	2	2	1	1
	SE MONTEREY RD	SE OCEAN BLVD (SR A1A)	MARTIN COUNTY AIRPORT	Stuart	0.69	100	11	5	0	1	1	2	0	0	1	1
	NE PINEAPPLE AVE	NE INDIAN RIVER DR	NE JENSEN BEACH BLVD	Jensen Beach	0.51	55	11	0	3	1	1	2	0	2	1	1
	NW ALICE ST	NW DIXIE HWY	650 FEET WEST OF NE GREEN LAWN DRIVE	Rio	0.27	60	11	5	0	0	1	2	0	2	0	1
	SE SALERNO RD	SE WILLOUGHBY BLVD	SR 5 (US 1)	Stuart	1.12	100	11	5	0	1	1	0	2	0	1	1
	SE JEFFERSON ST	SE DIXIE HWY (SR A1A)	SE HEMLOCK AVE	Golden Gate	0.6	90	11	5	0	0	1	0	2	2	0	1
	SE MARKET PLACE	1200 FEET EAST OF SE EDISON AVE	SE COMMERCE AVE	Stuart	0.87	70	11	5	0	1	1	2	2	0	0	0
	SE MONTEREY RD	SR 5 (US 1)	EAST OF SE DIXIE HWY (SR A1A)	Stuart	0.23	90	11	5	0	0	1	2	2	0	0	1
	SE MONTEREY RD EXT	SE MONTEREY RD	SR 5 (US 1)	Stuart	0.33	80	11	5	0	1	1	2	2	0	0	0
	SR 5 (US 1)	SE SALERNO RD	SE POMEROY ST	Stuart	0.59	225	11	5	0	1	1	2	2	0	0	0
	SR 5 (US 1)	SE SALERNO ROAD	SE COVE RD	Stuart	0.5	225	11	5	0	1	1	2	2	0	0	0
	SR 5 (US 1)	150 FEET NORTH OF SE CONTRACTOR WAY	SE INDIAN STREET	Stuart	1.55	150	11	5	0	1	1	2	2	0	0	0
S KANNER HWY (SR 76)	SW CABANA POINT CIR	SE MONTEREY RD	Stuart	0.55	110	11	5	0	1	1	2	0	0	1	1	
SE OCEAN BLVD (SR A1A)	SE MONTEREY RD	2800 FEET EAST OF SE MONTEREY RD	Stuart	0.47	110	11	5	0	1	1	2	0	0	1	1	
SE ST. LUCIE BLVD	SE MONTEREY AVE	SE OCEAN BLVD	Stuart	0.52	80	11	5	0	1	1	2	0	0	1	1	
SW BERRY AVE	SW SUNSET TRAIL	SW MARTIN DOWNS BLVD	Palm City	0.5	55	11	0	3	1	1	0	2	2	1	1	
SW MARTIN DOWNS BLVD	SW MARTIN HWY	SW MAPP RD	Palm City	2.49	225	11	0	3	1	1	2	0	2	1	1	

Source: Complete Streets: Access to Transit Study, May 2020

Except for two segments, S Colorado Avenue from Confusion Corner to US-1/SR-5 (Federal Highway) and SE Dixie Highway from SE Monterey Road to Confusion Corner, that were implemented through recent construction projects, all the other Tier 1 segments were considered as Complete Streets projects in the Needs Assessment and included in the 2045 Need Plan (**Figure 3-3** and **Table 3-2**).

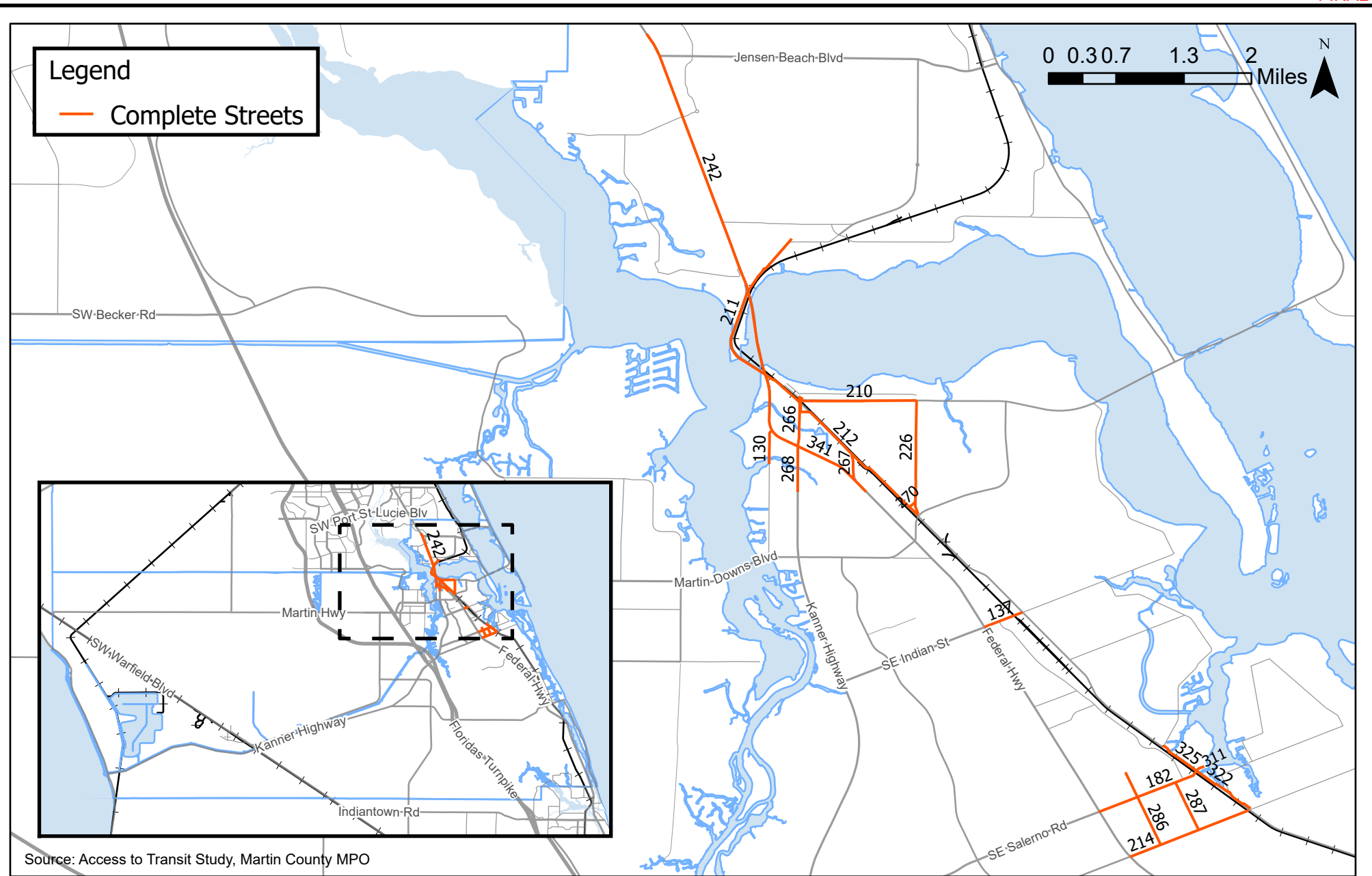


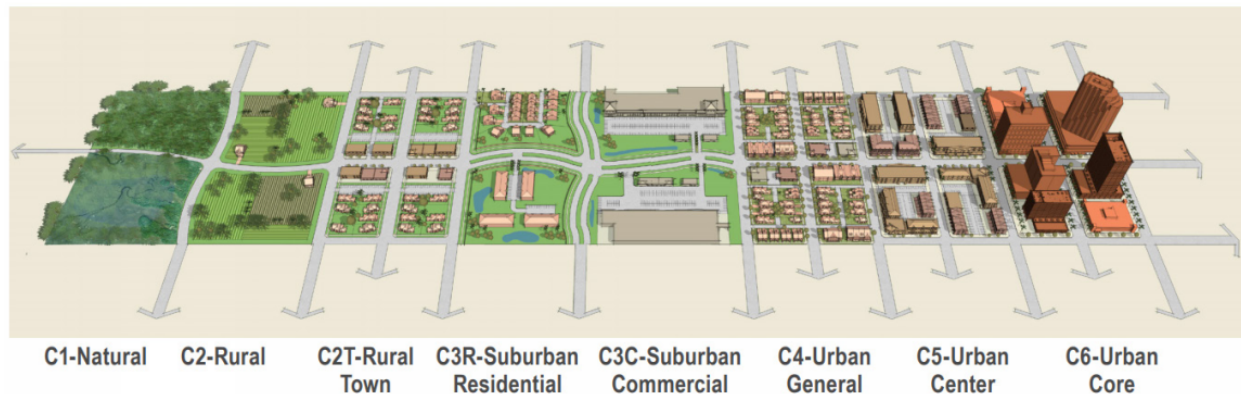
Table 3-2: Complete Streets Projects

Project ID	Map/Segment ID <sup>1</sup>	Facility/Segment Name	From	To	General Location	Length (miles)	ROW Width (feet)	Project Description
CS-2	211	NW DIXIE HWY (SR 707)	NW GREEN RIVER PKWY	CONFUSION CORNER	Stuart	1.98	100	Four 12.5' travel lanes with center turn lane replaced with four 10'-11' travel lanes with landscaped median. Addition of protected bike lanes in both directions. Addition of shade trees & streetlights adjacent to bike lanes.
CS-4	226	SE PALM BEACH RD	SE OCEAN BLVD (SR A1A)	SE MONTEREY RD	Stuart	1.09	80	Addition of raised bike lanes in both directions. Addition of shade trees. Conversion of 5' sidewalks on both sides to 10' multi-use path on east side & 6' sidewalk on west side. 2' furnishing zones adjacent to sidewalk/paths.
CS-5	270	SE CHRISTIE WAY	SE DIXIE HWY	SE PALM BEACH RD	Stuart	0.08	50	Conversion of 6' sidewalks on north side to 8' multi-use path. Addition of shade trees and streetlights adjacent to existing sidewalk on south side.
CS-6	214	SE COVE ROAD	SR 5 (US 1)	SE DIXIE HWY	Salerno	1.11	75	Addition of bike lanes in both directions. Addition of shared used path on northern side. Plant Cypress Trees in existing swale. Two 12' traffic lanes shift to south and become 11'. (FM #441701.1)
CS-7	286	SE JACK AVENUE	PORT SALERNO ELEMENTARY	SE COVE RD	Salerno	0.76	70	New curb & gutters. Addition of shade trees & streetlights adjacent to new 10' shared use path. Project assumes improvements same as SE Palm City Road (CS-19)
CS-8	242	SR 5 (US 1)	NW SUNSET BLVD	S END OF ROOSEVELT BRIDGE	Stuart	3.57	150	Addition of markings for existing bike lanes. Addition of sidewalks, shade trees & street lighting.
CS-9	341	SR 5 (US 1)	SW JOAN JEFFERSON WAY	600 FEET SOUTH OF SE TRESSLER DR	Stuart	1.42	150	Resurfacing (FM # 446110.1)
CS-10	137	SE INDIAN ST	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Stuart	0.36	100	Convert 5 lane urban roadway including center turn lane to 4 lane divided facility with separated bike lanes. (FM # 438071.1)
CS-11	268	S KANNER HWY (SR 76)	SR 5 (US 1)	SW MANOR DR	Stuart	0.44	110	Resurfacing (FM # 443995.1)
CS-12	182	SE SALERNO RD	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Salerno	0.93	65	Addition of streetlights & landscaping on south side. Conversion of 6' sidewalk with 2' landscape to 8' multi-use path on north side. (FM #440242.1)
CS-13	311	SE SALERNO RD	SE DIXIE HWY (SR A1A)	SE DE SOTO AVE	Salerno	0.08	60	Project assumes continuation of improvements/cross section between SR 5 (US 1) and SE Dixie Hwy. (CS-12)
CS-14	267	SE CUTOFF RD	SR 5 (US 1)	SE DIXIE HWY (SR A1A)	Stuart	0.23	110	Shared use path on one side. Shade trees and lighting.
CS-15	212	SE DIXIE HWY	CONFUSION CORNER	SE PALM BEACH RD	Stuart	1.07	90	Addition of buffered bike lanes in both directions. Addition of shade trees & bioswales. Addition of sidewalk & streetlights.
CS-16	322	SE DIXIE HWY (SR A1A)	SE SALERNO RD	SE COVE RD	Salerno	0.61	90	New markings along travel lanes and on-street parking lanes. New shade trees. Parklet options available.
CS-17	325	SE DIXIE HWY (SR A1A)	PORT SALERNO CRA (NORTH BOUNDARY)	SE SALERNO RD	Salerno	0.39	90	Project assumes continuation of improvements/cross section between SE Salerno Road and SE Cove Road. (CS-16)
CS-18	287	SE EBBTIDE AVE	SE SALERNO RD	SE COVE RD	Salerno	0.5	65	Addition of buffered bike lanes in both directions. Addition of shade trees & bioswales. Addition of sidewalk & streetlights.
CS-19	130	SW PALM CITY RD	SR 5 (US 1)	400 FEET NORTH OF SW INDIAN GROVE DR	Stuart	0.33	80	Two 12' travel lanes become two 11' travel lanes. New curb & gutters. Addition of shade trees & streetlights adjacent to new 10' shared use path.

<sup>1</sup> Segment ID cross references top-ranked segments identified in Martin MPO's *Complete Street: Access to Transit Study, May 2020*

### 3.2 Land Use Context Classification, FDOT District Four

While the *Complete Streets: Access to Transit Study* used FDOT's context classification system, which comprises eight zones as one of the inputs to identify "Opportunity Segments", the Systemwide Provision Context Classification (SPCC) will help guide the development and implementation of Complete Streets projects on the State Highway System (SHS). **Figure 3-4** shows FDOT's Context Classification System.



**Figure 3-4: Context Classification System, FDOT**

**Appendix 1** provides refined smoothed roadway segments based on future year 2040 in a tile map format. The SPCC provides a common frame of reference for all partners to understand the intent of context classification and how it relates to roadway design decisions.

The Florida Design Manual (FDM) sets forth geometric and other design criteria, as well as procedures, for FDOT projects. The design criteria included in the FDM are based on functional classification, design speed, and context classification. The context classification will determine key design criteria elements for arterial and collector roads, such as, lane widths, border width, turn lane widths, traffic data, median width and bicycle marking on paved shoulders amongst other things.

The FDOT uses Multimodal Scoping Checklist (MMSC) to identify transit, railroad, aviation, freight, bicycle and pedestrian facility characteristics and needs within the limits of the projects for consideration early in the design process. Context classification for projects are identified based on an assessment of the primary and secondary measures described in the FDOT Context Classification guide. With input received from local jurisdiction the context classification is adjusted to match the communities' anticipated growth patterns, transportation networks, and visions for livability and sustainable development.



## 4. Resiliency and Climate Change Impacts

This chapter discusses various data sources and tools for identifying and addressing climate change, extreme weather events, previous studies as it relates to resiliency, findings, and strategies as well as projects to be included in the 2045 Needs Assessment.

### 4.1 Planning Context

#### 4.1.1 Sea Level Rise (SLR)

Sea level rise is a growing concern of coastal communities. Recent trends in data have shown a global rise in sea level elevations. According to tidal gauge data, sea level has risen 5.5 inches in the past 50 years (1963-2012) in the Treasure Coast and Southeast Florida. Although there are a range of future projections of rates of sea level rise, sea levels are anticipated to continue to rise and pose threats to coastal communities. Future projections from different entities are illustrated in **Table 4-1**.

**Table 4-1: Global Sea Level Rise Projections**

Agency	Range of SLR (in feet) by 2100
Intergovernmental Panel on Climate Change AR5	0.85 – 2.7
U.S. Army Corps of Engineers (2013)	0.66 – 5.0
National Oceanic and Atmospheric Administration//3 <sup>rd</sup> National Climate Assessment (2012)	0.66 – 6.6
National Oceanic and Atmospheric Administration (2017)	1.0 – 8.2

In early 2020, the Southeast Florida Climate Change Compact updated their unified sea level rise projection estimates. These estimates increased since their previous projections released in 2015. Utilizing data from the IPCC and NOAA, they estimated sea level rise in Southeast Florida to increase by 10 to 17 inches by 2030, 21 to 54 inches by 2070, and 40 to 136 inches by 2120.

Sea level rise poses many risks to transportation facilities. Transportation impacts due to sea level rise include more frequent flooding of transportation facilities, more temporary road closures due to flooding, saturation of roadbeds leading to the increased potential for collapse, increased damage to infrastructure from storm surge and waves, and eventual permanent inundation or submersion. Roads are often lower than surrounding lands in low-lying communities, causing water from adjacent lands to drain into the streets. These streets are more prone to flooding events. Low-lying streets on barrier islands can flood during high tide events.

Sea level rise poses a higher risk to coastal communities due to their proximity to waterbodies and increased exposure to tidal flooding and rising sea surface elevations. However, sea level rise does not only affect coastal areas. As seawater intrudes into the porous limestone bedrock along South Florida's coast due to sea level rise, a wedge of seawater under the Biscayne Aquifer is pushed landward. Groundwater floats above the deeper saltwater and is pushed towards the surface of the ground. Freshwater environments are threatened by this saltwater intrusion landward, and inland flooding is exacerbated as groundwater elevations increase and the ground's ability to absorb storm water is reduced.

### 4.1.2 King Tides

Spring tides occur twice a month when the Earth, sun and moon align, and the combined gravitational pull of the sun and moon exerts a greater force on Earth's oceans. High tides are slightly higher than normal, and low tides are slightly lower than normal. When a new or full moon occurs when the moon is at its closest point to Earth, the range of tides is even greater. These tides are called perigean spring tides, or king tides. Tides are exacerbated and are above the highest water level reached at high tide on an average day. King tides occur three to five times every year, usually between September and November. As sea levels rise, the frequency of king tides is expected to increase to nearly 50 times per year by 2030 and over 200 times per year by 2045 (*Dahl et al, 2017*).

### 4.1.3 Storm Surge

In addition to the effects of sea level rise and tidal variations, Martin County is also vulnerable to storm surge. Storm surge is the abnormal rise of water generated by a storm and is produced by water being pushed toward the shore by winds. This rise in water levels can cause extreme flooding during storm events in coastal areas, particularly when it coincides with high tides. These flooding events will be even more exacerbated in the future due to sea level rise, king tides, and increase in hurricane strength. As hurricane strength increases, a greater portion of inland property is susceptible to storm surge. As sea levels rise, it is predicted that a greater portion of the property will be affected by lower strength storms.

## 4.2 Martin County Resiliency Program

In 2017, Martin County was awarded a grant (#CM933) From the Florida Department of Environmental Protection (FDEP) as part of the Florida Resilient Coastlines Program (FRCP) to develop a climate and resiliency plan. The work performed built on previous efforts initiated by Martin County to establish a comprehensive technical basis to understand and develop mitigation practices for sea level rise, coastal/tidal flooding, coastal erosion and shifting ecosystems.

The first phase of this resiliency program funded by the FRCP provided the foundation for a proposed vulnerability assessment and resiliency plan, in which Martin County received grand funding (#R1911) for in 2019. This phase of the program will guide Martin County's capital improvements planning and will include an implementation strategy with recommendations that focus on strategies that may be implemented by the Comprehensive Plan, Code, and policy recommendations. The work will use mapping tools created during the first phase to model future conditions in coastal communities, low lying western communities, natural area, areas with significant capital projects, vital infrastructure, mosquito prone areas and chronic flooding areas.

Martin County has established a resiliency program to adapt to changing conditions. The County understands the need for making plans and infrastructure investments based on both current and future conditions to adapt to future stressors. Taking resiliency and climate change impacts into account will help identify transportation improvements that could be included in the 2045 Needs Assessment and should be prioritized in the Cost Feasible Plan to proactively develop a more resilient transportation network for the future.

### 4.3 Land Use

Martin County is one of 35 coastal counties in Florida. Martin County has many miles of direct ocean, estuarine, river coastlines and marsh habitats, with direct access to Indian River Lagoon, Loxahatchee River, St. Lucie River, and the Atlantic Ocean. Martin County is characterized as having low-lying topography. According to the National Wetlands Inventory, estuarine and marine wetlands and freshwater forested/shrub wetlands are located within the northern portion of the South Fork of the St. Lucie River, north of St. Lucie Inlet, along the Intracoastal waterway, and the northern portions of Loxahatchee River. St. Lucie Inlet Preserve State Park and Hobe Sound National Wildlife Refuge are located within the north end of Jupiter Island. The Loxahatchee River runs through Jonathan Dickinson State Park, a 11,500-acre park within the southeast portion of the County. According to Martin County's Future Land Use map, most of the County's land is classified as agricultural, agricultural ranchette, and public recreation area. Developed land is concentrated in the eastern portion of the County east of Florida's Turnpike and in Indiantown, within the western portion of the County near the intersection of SW Kanner Highway (SR-76) and SW Warfield Boulevard (SR-710).

### 4.4 Purpose

Global sea level rise has been a persistent trend and continues to influence coastal developments. As such, it is often necessary to review and carefully consider future trends to recognize potential vulnerabilities and to develop resiliency strategies. In developing the 2045 LRTP, Martin MPO is taking a proactive approach to understand the impacts of extreme weather events, king tides, and sea level rise on the County transportation network and to identify facilities susceptible to these impacts. Data gathered will be used in developing the 2045 Needs Plan and the Cost Feasible Plan to prioritize projects which are most vulnerable to sea level rise. Further, it will also allow the MPO and its partner agencies to integrate sustainable strategies in the planning, designing and construction of various transportation improvements located in areas that are vulnerable to impacts arising from extreme weather events.

### 4.5 Evaluation and Assessment Methods

Data on sea level rise, king tides, and storm surge was gathered from previous studies done in Southeast Florida, as well as from GIS layers. Relevant plans and studies evaluated are summarized in Section 4.6. Sea level rise projection maps which were developed for the FRCP #CM933 were also studied and are included in **Appendix 1**. Transportation improvements projects identified as part of the 2045 Needs Assessment and included in the 2045 Needs Plan were evaluated based on their location in areas prone to inundation due to storm surge, king tides, and sea level rise, and were prioritized based on their proximity to vulnerable areas. FEMA Flood Zone maps were also evaluated to identify areas that were within the 100-Year floodplain.

### 4.6 Relevant Plans and Studies

#### 4.6.1 Martin County King Tide Observation Plan

In October of 2018, Martin County carried out an observation plan to record water levels and observations from king tide events. Surveys were conducted at various monitoring sites along coastal regions of Martin County during predicted king tide events. High water

levels, elevations of debris lines, date and times of measurements, and nearby finished floor elevations and seawall elevations were recorded. The findings of these monitoring sites are included in **Appendix 2**. High water elevations were observed in coastal residential areas. Water levels were observed higher than seawall and dock elevations during king tide events, rising into nearby properties and roadways. It was noted that flooding also occurred during non-peak hours of tides. King tides are indicators for areas which may be more susceptible to the effects of sea level rise in the future. As sea levels continue to rise, these coastal residential areas will experience sustained tidal variations and flooding.

#### **4.6.2 Treasure Coast Regional Planning Council, Sea Level Rise in the Treasure Coast Region, December 2005**

This study was conducted to examine sea level rise within the Treasure Coast Region. The report identified shores that are likely to be protected from erosion, inundation and flooding, and shores where natural shoreline retreat is likely to take place. The goals of the study were to encourage long-term thinking required to deal with issues associated with sea level rise, and to ultimately diminish losses of life and property from coastal hazards and ensure long-term survival of coastal wetlands. It was determined that Martin County had the largest acreage of lands that are unlikely to be protected or had no protection from erosion, inundation, flooding, and natural shoreline retreat. Approximately 8,713 acres of the regional total of 12,768 acres of protection unlikely were within Martin County. The upland areas most likely to be affected by sea level rise represent approximately 7.2 % of the total area of Martin County. The main areas of impact are expected on the barrier islands; shorelines of the Indian River Lagoon, St. Lucie, and Loxahatchee Rivers; and within islands in the lagoon and river systems.

#### **4.6.3 U.S. Army Corps of Engineers South Atlantic Coastal Study Tier 1 Assessment**

This regional analysis identifies potential coastal risks throughout the U.S. Army Corps of Engineers (USACE) South Atlantic Division Area of Responsibility. The composite risk assessment mapping tool generates a Composite Risk Index, which is composed of a Population Infrastructure Index, Environmental, Cultural, Habitat Index, Social Vulnerability Index, and the annual chance probability of a flooding hazard. The composite risk assessment mapping tool shows potential high-risk areas along coastal regions of Martin County and along the South Fork of the St. Lucie River.

#### **4.6.4 Treasure Coast Vulnerability Analysis for Post-Disaster Redevelopment, April 2012**

Indian River, Martin, Palm Beach and St. Lucie Counties conducted an analysis to identify where vulnerable structures, critical facilities and populations are located throughout the Treasure Coast. The information was compiled to make recommendations for action strategies for regional long-term redevelopment issues that have arisen from natural disasters and environmental stressors. Vulnerabilities were analyzed for wind, flood and storm surge, socio-economic, sea level rise and wildfires. 84% of Martin County properties are considered most or moderately vulnerable to wind. Over 30% of structures are in the FEMA Special Flood Hazard Area (SFHA) and approximately 55% of these

have an increased likelihood of sustaining damage during a flood event. Approximately \$52 billion of structure value is located within storm surge zones, over 50% of which are single family homes. Older populations may be more vulnerable in disaster situations due to financial or health regions. A substantial number of census blocks with high populations for residents older than 65 live on the coast or on the barrier islands of Martin County. Census blocks with high percentages of minority populations live in Stuart and western Martin County. Under a 2-foot rise in sea level, there would be 12,464 properties within Martin County that are vulnerable. An additional 8,987 properties were vulnerable to a Category 3 storm surge under the 2-foot scenario, and an additional 4,848 properties were vulnerable to a Category 5, 2-foot scenario. Approximately 6.8% of Martin County is considered as a high wildfire risk area, with the highest risk areas located in the western portion of the County and north-eastern corner.

#### **4.6.5 Storm Surge, Sea Level Rise, and Transportation Network Disruption, November 2016**

This study was funded by the Florida Department of Transportation and built upon the previously prepared Florida Climate Change and Vulnerability Assessment and Adaptation Pilot Project. This study provided additional details to understand the potential of sea level rise and storm surge impacts on regional mobility and infrastructure, including from an emergency management standpoint. Transportation modeling analysis was conducted to evaluate the performance of the transportation network in the region of six storm surge scenarios.

#### **4.6.6 Sea Level Scenario Sketch Planning Tool**

The Sea Level Scenario Sketch Planning Tool was created by the University of Florida GeoPlan Center with funding from the Florida Department of Transportation. The tool was developed to identify transportation infrastructure vulnerable to current and future flood rises. The tool analyzes and visualizes current flood risks (100-year and 500-year floodplains and hurricane storm surge zones) as well as future flood risks using sea level rise scenarios. Five sea level rise projections from the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration for seven decades (2040-2100) can be used to map inundation surfaces across Florida's 36 coastal counties.

#### **4.6.7 Martin County Storm Surge Evacuation Zones**

Storm Surge Evacuation Zones are determined by the National Hurricane Center and indicate areas within Martin County that will be affected by storm surge. Evacuation zones in Martin County are classified as zones AB, CD and E. Zone AB includes the barrier islands and most low-lying areas along the coast and are likely to be inundated by storm surge of up to 6 feet. The zones progress inland as you get further from the coast and higher in elevation. Zone CD is likely to be inundated by storm surge of up to 13 feet, and Zone E is likely to be inundated by storm surge of up to 16 feet. Homes within these zones are more susceptible to sea level rise. However, homes outside of evacuation zones can still be susceptible to flooding because of nearby bodies of water and low-lying elevations.

## 4.7 Summary of Findings

### 4.7.1 Project Prioritization and Extreme Weather Events

To incorporate impacts of sea level rise and other extreme weather events in the 2045 LRTP, the Martin MPO developed specific goals, objectives, and performance measures relative to this subject matter. Further, these evaluation criteria and performance measures were applied to prioritize 2045 Needs Plan projects for inclusion in the Cost Feasible Plan.

Non-Strategic Intermodal System (SIS) highway projects were prioritized using a set of 15 different performance measures and evaluation criteria relative to the 2045 LRTP – *Martin in Motion's* goals and objectives. These evaluation criteria included rating a projects' performance corresponding to travel time reliability, safety, environment, environmental justice, accessibility to jobs, community support and so on. Projects were assigned points on a scale of 1 to 4, where 1 indicated lowest performance while 4 suggested highest performance. In addition, projects received a one (1) point bump if they were affected a Community Redevelopment Area (CRA) or were in an area vulnerable to inundation from sea level rise and other extreme weather events or overlapped with a hurricane evacuation route. **Table 4-1** and **Figure 4-1** show highway/roadway (non-SIS) included in the 2045 Needs Assessment.

Table 4-2: Roadway/Highway Projects (Non-SIS)

Map ID	Facility	From	To	Project Description	Existing Lanes	Future Lanes	Length (miles)	Total Score	Ranking	Priority
R-1	SR-714/Martin Highway	CR-76A/Citrus Boulevard	Martin Downs Boulevard	Highway Capacity	2	4	0.88	Under Construction	TIP	Currently Funded
4196693	Willoughby Boulevard	SR-714/ Monterey Road	SR-5/US-1/Federal Highway	PD&E Study	-	-	0.84	Funded	TIP	
4417001	Cove Road	SR-76/Kanner Highway	SR-5/US-1/Federal Highway	PD&E Study	2	4	4.32	Funded	TIP	
4416991	CR-713/High Meadow Avenue	I-95	CR-714/Martin Highway	PD&E Study	-	-	2.64	Funded	TIP	
R-3	Village Parkway Extension	SR-714/Martin Highway	St. Lucie County Line	New 4 Lane Road	0	4	3.00	Privately Funded	2	Not Applicable
R-5	Cove Road	Willoughby Boulevard	SR-5/US-1/Federal Highway	Widen from 2L to 4L	2	4	1.07	39	1	Tier 1
R-6	Cove Road	SR-5/US-1/Federal Highway	CR-A1A	Widen from 2L to 4L	2	4	1.12	39	1	
R-4	Cove Road <sup>1</sup>	SR-76/Kanner Highway	Willoughby Boulevard	Widen from 2L to 4L	2	4	2.13	35	2	
R-15	SR-5/US-1 <sup>2</sup>	at SW Joan Jefferson Way		Intersection Modification	-	-	-	-	-	
R-16	CR-714/Martin Highway <sup>3</sup>	Approximately 1200 feet east of SR-710	SE126th Blvd. (Okeechobee County)	Roadway Realignment	-	-	-	-	-	
R-2	Willoughby Boulevard	SR-714/ Monterey Road	SR-5/US-1/Federal Highway	New 2 Lane Road	0	2	0.84	36	2	Tier 2
R-7	CR-713/High Meadow Avenue	I-95	CR-714/Martin Highway	Widen from 2L to 4L	2	4	2.64	36	2	
R-8	Federal Highway/US 1	SE Seabranh Blvd	SE Osprey St	Widen from 4L to 6L	4	6	1.15	36	2	
R-10	SE Bridge Rd	Powerline Ave	US-1/Federal Highway	Widen from 2L to 4L	2	4	2.00	33	3	Tier 3
R-11	SE Green River Pkwy	NW Wright Blvd	NW Dixie Hwy	Widen from 2L to 4L	2	4	0.37	33	3	
R-13	SW Martin Downs Blvd	SW Matheson Ave	SW Palm City Rd	Widen from 4L to 6L	4	6	1.33	33	3	
R-14	SW Murphy Rd	Whisper Bay Terrace	North County Line	Widen from 2L to 4L	2	4	0.35	32	4	Tier 4
R-9	S Ocean Dr	North County Line	NE Causeway Blvd	Widen from 2L to 4L	2	4	1.40	30	4	
R-12	Martin Highway	SW Mapp Rd	Kanner Hwy	Widen from 4L to 6L	4	6	1.42	29	4	

## Notes:

<sup>1</sup> Moved from Tier 2 to Tier 1 since the project, R-4 is contiguous with R-5. Further, construction projects on Cove Road and would be implemented in synchronization.

<sup>2</sup> SR-5/US-1 at SW Joan Jefferson Way (FM # 4383452) included in Martin MPO's TIP, FY 2020/21 - FY2024/25 is one of top priority projects (Tier 1).

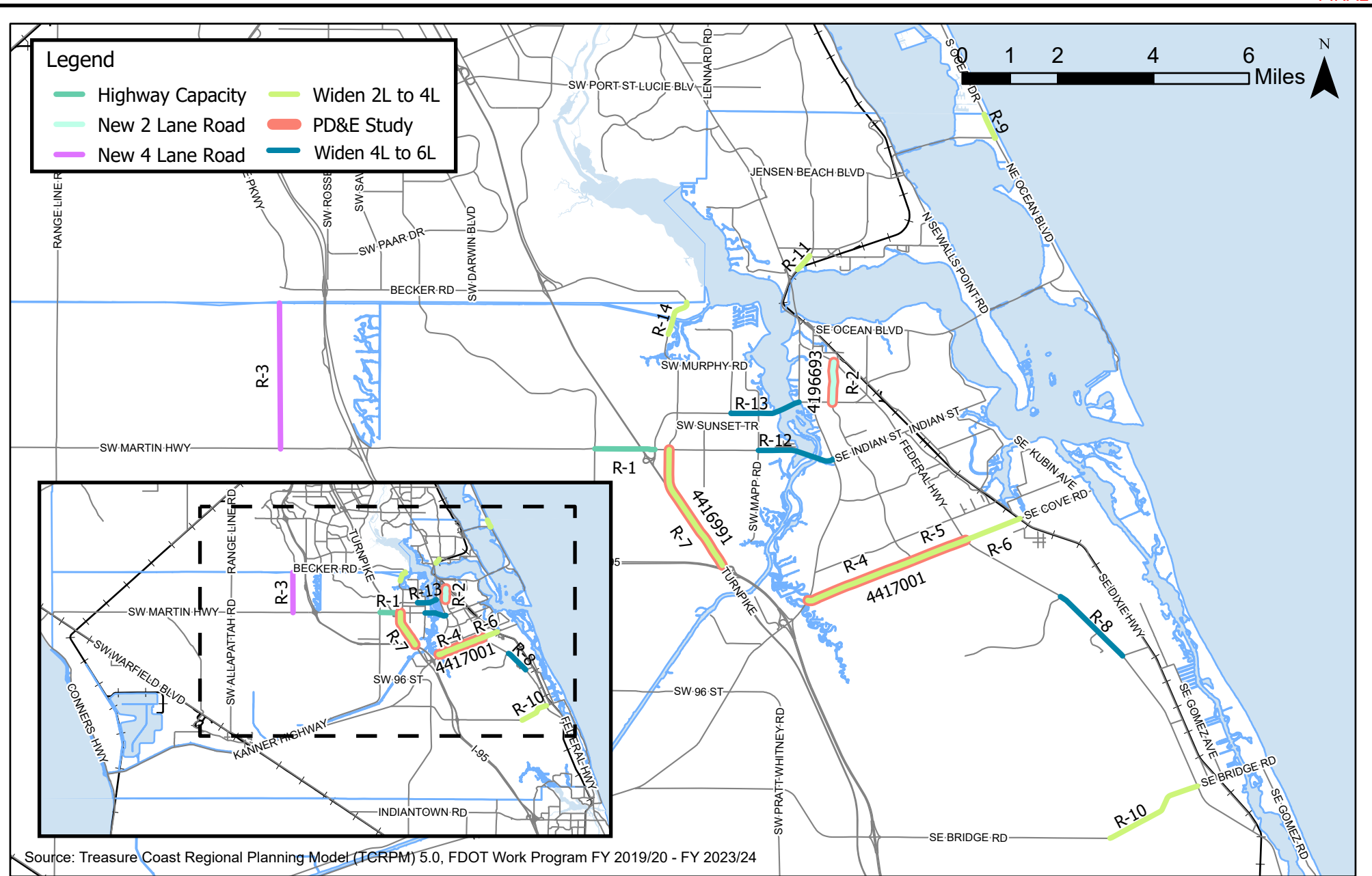
<sup>3</sup> CR-714/Martin Highway realignment project to enhance safety is one of top priority projects (Tier 1)for Martin MPO. Florida Department of Transportation (FDOT), District One completed SR-710 PD&E Study from US 441 to SW Martin Highway in Okeechobee and Martin Counties in 2010 and amended in Nov. 2018.

Prioritization Methodology

1. Project prioritized using a total 15 criteria relative to the goals and objectives of the 2045 LRTP.

2. Each project was assigned points on a scale of 1 to 4, with 1 being the lowest and 4 indicating the highest. In all cases a higher score indicated better performance compared to a lower score.

3. Projects overlapping with hurricane evacuation route(s), located in vulnerable areas as it relates to extreme weather events, King tides and sea level rise (SLR), and affecting Community Redevelopment Areas (CRAs) were assigned extra points.



Source: Treasure Coast Regional Planning Model (TCRPM) 5.0, FDOT Work Program FY 2019/20 - FY 2023/24



# 2045 Needs Assessment Roadway/Highway Projects (Non-SIS)



TYLIN INTERNATIONAL

Martin County

Figure 4-1



#### 4.7.2 Proactive Planning for Sea Level Rise and Extreme Weather Events

Transportation projects which scored highest due to their location within vulnerable areas included the widening projects along South Ocean Drive (R-9), Southeast Green River Parkway (R-11), Southwest Murphy Road (R-14), Martin Highway (R-12), and Southwest Martin Downs Boulevard (R-13).

Proposed improvements along South Ocean Drive (R-9) include widening 1.4 miles of roadway from two lanes to four lanes. This portion of South Ocean Drive extends from NE Causeway Boulevard to the northern County line. This portion of roadway is within low-lying elevations on the barrier island in close proximity to the Atlantic Ocean to the east, and the Jensen Beach to Jupiter Island Aquatic Preserve to the west. Three Environmentally Sensitive Lands are located in close proximity to R-9: a sea turtle conservation area along Jensen Beach directly east of R-9, Dutcher conservation lands approximately 1,350 feet west of R-9 along the aquatic preserve, and Jensen Beach (West) conservation lands directly southwest of R-9. R-9 is located along a hurricane evacuation route and is within the Storm Surge Evacuation Zone AB. Zone AB is likely to be inundated by storm surge of up to six feet. R-9 is also located in the FEMA Flood zone AE, with a base flood elevation of five feet. Floodzone AE is within the 100-year floodplain. According to the Sea Level Rise Projection chart using the USACE High Scenario, R-9 is located within the Year 2100 Hazard Zone and will experience 61 inches of inundation. R-9 is adjacent to land within the Year 2030 Hazard Zone which will experience 10 inches of inundation. These characteristics define R-9 as being in a low-lying coastal area which is highly vulnerable to sea level rise and extreme weather events.

Proposed improvements along Southeast Green River Parkway (R-11) include widening 0.37 miles of roadway from two lanes to four lanes. This portion of Southeast Green River Parkway extends from Northwest Wright Boulevard to Northwest Dixie Highway. Rio Nature Park/Daskas conservation lands are located to the south of R-11 along the St. Lucie River and is an Environmentally Sensitive Land. R-11 is located along a hurricane evacuation route and is within the Storm Surge Evacuation Zone CD and E. Zone CD is likely to be inundated by storm surge of up to 13 feet, and zone E is likely to be inundated by storm surge of up to 16 feet. R-11 is in the FEMA Flood zone AE, with a base flood elevation of five feet. According to the Sea Level Rise Projection chart using the USACE High Scenario, R-11 is located within the Year 2100 Hazard Zone and will experience 61 inches of inundation. R-11 is adjacent to land within the Year 2030 Hazard Zone which will experience 10 inches of inundation. These characteristics define R-11 as being in a low-lying coastal area which is highly vulnerable to sea level rise and extreme weather events.

Proposed improvements to Southwest Murphy Road (R-14) include widening 0.35 miles of roadway from two lanes to four lanes. This portion of Southwest Murphy Road extends from Whisper Bay Terrace to the north County line. It carries traffic over the C-23 canal. R-14 is located within the Storm Surge Evacuation Zone E, which is likely to be inundated by storm surge of up to 16 feet. A portion of R-14 is located within FEMA Flood Zone AE, with a base flood elevation of five feet. Although R-14 is not shown as being inundated due to sea level rise by 2100, adjacent lands along the C-23 canal and Bessey Creek are

within hazard zones. R-14's higher elevation than surrounding lands provides some safety from rising sea levels. However, R-14 is partially within and adjacent to the coastal floodplain and is susceptible to storm surge, indicating that it may be vulnerable to sea level rise especially during periods of compounded stressors, such as king tide and extreme weather events.

Proposed improvements to Martin Highway (R-12) include widening 1.42 miles from four lanes to six lanes. This portion of Martin Highway extends from Southwest Mapp Road to Kanner Highway and carries traffic over the south fork of the St. Lucie River. Two Environmentally Sensitive Lands are located adjacent to R-12: Kiplinger conservation lands to the southeast and Danforth Park to the southwest. R-12 is located within all three Storm Surge Evacuation Zones. The majority of R-12 is located within Flood Zone AE. Portions of land underneath the approaches to the bridge along R-12 will experience inundation by the year 2030 due to sea level rise. R-12 is within an area that is vulnerable to sea level rise.

Proposed improvements to Southwest Martin Downs Boulevard (R-13) include widening 1.33 miles of roadway from four lanes to six lanes. This portion of Southwest Martin Downs Boulevard extends from Southwest Matheson Avenue to Southwest Palm City Road and carries traffic over the south fork of the St. Lucie River. R-13 is located along a hurricane evacuation route. R-13 is within all three storm surge evacuation zones, the majority of which is within Zone E. R-13 is partially within Flood Zone AE with base flood elevations of five and six feet. Although the bridge along R-13 is elevated higher than surrounding lands, land underneath the approaches to the bridge and the westernmost portion of R-13 are within areas of lower elevations. A small portion of these lands are expected to be inundated by the years 2030 and 2100 according to the USACE High Sea Level Rise Projection. R-13 is within an area that is vulnerable to sea level rise.

In addition to the roadway projects, an extensive network of non-motorized projects is included in the 2045 Needs Plan as well as Cost Feasible Plan. The MPO and its partners would consider various mapping tools summarized in this technical memorandum to assess vulnerability of these facilities relative to different extreme weather events and incorporate design features and construction materials to build resiliency into various improvement projects.

#### **4.7.3 Resiliency Projects**

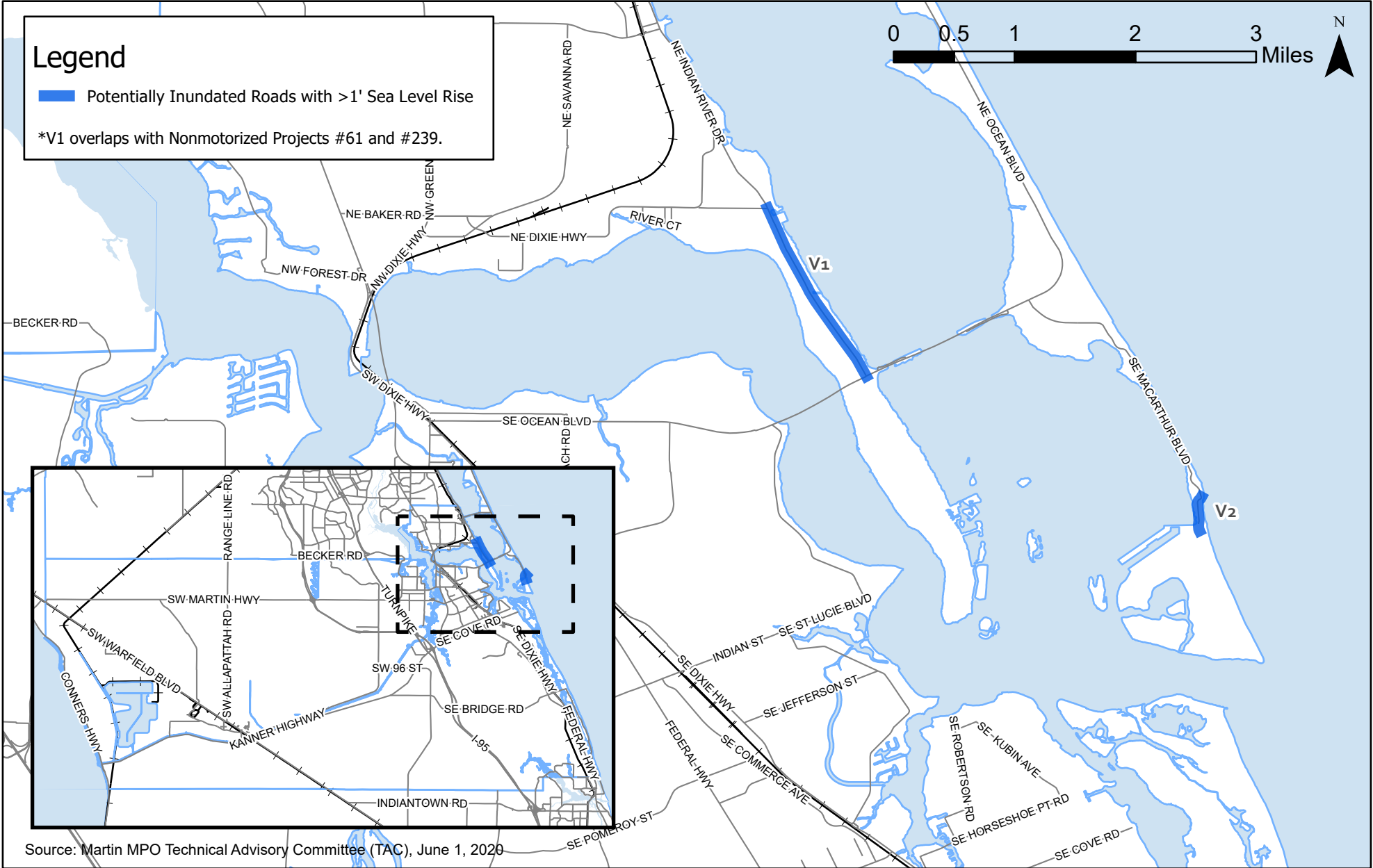
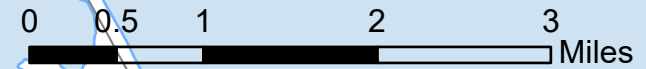
Based on input received from Martin County at the Martin MPO's Technical Advisory Committee (TAC) on April 29, 2020, the following two roadway segments were included as resiliency projects (**Figure 4-2**).

- N Sewalls Point Road from SR-A1A/NE Ocean Blvd. to SE Palmer Street
- SE MacArthur Blvd. from SE South Marina Way to approximately 1500 feet North

# Legend

■ Potentially Inundated Roads with >1' Sea Level Rise

\*V1 overlaps with Nonmotorized Projects #61 and #239.



Source: Martin MPO Technical Advisory Committee (TAC), June 1, 2020



## 2045 Needs Assessment Resiliency Projects Martin County



Figure 4-2

## 4.8 Strategies/Recommendations

As sea levels rise, more frequent flooding of roadways and subsequent temporary closures are anticipated. Saturation of roadbeds and lands adjacent to roadways which provide support for bridge approaches lead to the increased potential for collapse. Increased frequency of storms and flooding can lead to increased damages to infrastructure. Strategies for resiliency are necessary to improve and protect vulnerable infrastructure within Martin County.

Martin County's resilience projects address climate and sea level rise impacts by protecting the County's vulnerable shorelines, natural habitats, and water resources. Some of the recent projects undertaken by Martin County provide a glimpse of the County's initiatives to address resilience related issues, such as, shoreline protection, nuisance flooding reduction and sea level rise adaptation. Transportation improvements projects completed in the recent past include *Cove Point Street Tequesta*, *Rising Tides & SW Dyer Point Road* in Palm City,

From design and construction standpoint, potential strategies to consider for roadway projects (R-9 and R-11), which are highly vulnerable to sea level rise include raising the elevation of the roadways. However, due to their proximity to environmentally sensitive lands and low-lying elevations, it is important to consider improvements to storm water infrastructure to prevent water runoff being directed to and flooding adjacent lands. Recommendations for avoiding these effects include utilizing permeable pavement and installing bioswales.

Recommendations for roadways R-12, R-13 and R-14 include raising elevations of roadways along the approaches of bridges and raising seawall and revetment elevations underneath the bridges. It is important to consider the structural integrity of bridges as inundation of lower elevations cause increased erosion, elevated groundwater levels, and saturated soils.

## 4.9 Conclusions

With sea levels potentially increasing by 10 to 17 inches by the year 2030, along with more frequent extreme weather and king tide events, it is extremely important to incorporate resiliency strategies into the 2045 LRTP. Martin County is already seeing effects of sea level rise along its coastal communities, and the effects are expected to continue in the future. Transportation impacts due to sea level rise include more frequent flooding of transportation facilities, more temporary road closures due to flooding, saturation of roadbeds leading to the increased potential for collapse, increased damage to infrastructure from storm surge and waves, and eventual permanent inundation or submersion. Transportation projects which scored highest in this sea level rise analysis due to their location within vulnerable areas included the widening projects along South Ocean Drive (R-9), Southeast Green River Parkway (R-11), Southwest Murphy Road (R-14), Martin Highway (R-12), and Southwest Martin Downs Boulevard (R-13). Recommendations for improving these vulnerable areas include raising the elevations of roadways, improving nearby stormwater infrastructure, utilizing permeable pavement, installing bioswales, and raising seawall and revetment elevations.

## 5. Enhancing Travel and Tourism

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This chapter provides a snapshot of tourism industry in Martin County, its impact on the local economy and identifies project that could be considered to enhance travel and tourism.

Through Martin County's Tourist Development Council (TDC) and County Office of Tourism and Marketing, the County takes a proactive approach to promote travel to various local destinations, attractions, and support tourism. The TDC is also responsible for making recommendations to the Board of County Commissioners (BOCC) on matters relating to the Tourist Development Tax

According to conservative estimates based on hotel occupancy provided by Martin County Office of Tourism and Marketing, approximately 720,000 tourists visited various local attractions in 2018. Hotel demand in Martin County grew in 2018, it was up 9.4% from 2017. Hotel revenue were up 17.8% in 2018.

Based the *Economic Impact of Travel & Tourism in Martin County*, a study commissioned by the TDC in 2019, the County witnessed the highest year-over-year growth rate (from 2017 to 2018) for visitor spending of any county in Florida. Further, the report states that of every dollar spent by visitors to Martin County, 65¢ in economic impact is returned to the local area. Approximately 9.3% of all jobs in Martin County are supported by tourism. Tourism is the 3<sup>rd</sup> largest industry, behind health and social services and retail trade. If tourism did not exist, each of the 160,912 households in Martin County would have to pay an additional \$383 per year in taxes to maintain current state and local tax levels.

Since early 2020, the coronavirus disease (COVID-19) global health emergency<sup>5</sup> is having an unprecedented impact on the travel industry and the entire economy. The tourism economy has been heavily hit by the COVID-19 pandemic, and measures introduced to contain its spread. Destination Marketing Organizations across Florida are working to understand the impact of COVID-19 on the tourism economy so that we will have consistent data on a statewide basis. Based on a variety of data COVID-19 tourism data available on Visit Florida dashboard, it is evident that hotel demand, vacation rentals bookings, hotel revenue, visitor arrivals as well as other key metrics show a sharp decline. Depending on the duration of the crisis, which is uncertain, it is difficult to forecast the timeframe for travel industry to get back to pre-pandemic levels.

In the short term, the Governor's Office has developed *Safe, Smart, Step-By-Step* plan to provide guidance to reopen the State of Florida and revive economic activity. At federal level, Congress passed the Coronavirus Aid, Relief, and Economic Security Act (CARES

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<sup>5</sup> Coronavirus disease 2019 (COVID-19) is defined as illness caused by a novel coronavirus now called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; formerly called 2019-nCoV), which was first identified amid an outbreak of respiratory illness cases in Wuhan City, Hubei Province, China. It was initially reported to the WHO on December 31, 2019. On January 30, 2020, the WHO declared the COVID-19 outbreak a global health emergency. On March 11, 2020, the WHO declared COVID-19 a global pandemic, its first such designation since declaring H1N1 influenza a pandemic in 2009. (Source: [www.cdc.gov](http://www.cdc.gov))

Act) to support households and businesses. Several provisions have been made for travel and tourism industry at state and federal level through these plans and programs.

Martin County's website [www.discovermartin.com](http://www.discovermartin.com) promotes various modes of transportation including bicycle and pedestrian facilities and routes, Marty routes as well as Historic Stuart Tram. The bicycle and pedestrian facilities map provides information on various types of bicycle facilities, bicycle regulations, safety information as well as a graphic shown the bicycle and sidewalk network to access various destinations.

The Marty fixed route bus service provides connections to popular shopping destinations, such as, the Treasure Coast Mall, Stuart Center, and Pineapple Commons (Route 1). Route 3 provides service within the City of Stuart stopping at the Sailfish Splash Waterpark and downtown Stuart. Route 2 takes riders to the Village of Indiantown in the western part of Martin County where a stop is located within walking distance of the Historic Seminole Inn. In addition, Route 20X Express provides a regional connection to the Gardens Mall in Palm Beach County.

Through input received from the Martin County Office of Tourism and Marketing, Stuart/Martin Chamber of Commerce as well as the Project Steering Committee, the following two projects were identified to enhance travel and tourism.

- Water taxi service to St. Lucie Inlet State Park from Sandsprit Park to St. Lucie Inlet Preserve and
- New Jensen Beach transit route from Treasure Coast Square to Jensen Beach Park serving Hoke Library, Jensen Beach Park, Hutchinson Island and Kiwanis Park-and-Ride.

Both these above projects were included in the 2045 Needs Assessment.

## 6. Next Steps

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The project team will use information and transportation improvements identified in this technical memorandum to inform the 2045 Needs Assessment as the LRTP development process advances. If appropriate, transportation improvements included under various Additional Elements will be carried into the 2045 Needs Plan and ultimately in the cost constrained plan. It should be noted that the SIS projects will be included in the Martin MPO's 2045 LRTP as separate line items to maintain consistency with the SIS Cost Feasible Plan and Multimodal Unfunded Needs Plan. Non-capacity projects and other short- to mid-term freight improvements that are part of the Martin MPO's Goods and Freight Movement Study will be referenced as appropriate. Finally, the Martin MPO will continue to stay abreast of the emerging trends and technologies in the freight industry and proactively identify needed improvements with input from internal and external stakeholders.

