SPACE COAST AREA TRANSIT BUS STOP ACCESSIBILITY STUDY

Final Report

November 28, 2018

Prepared by

Tindale Oliver

(This page intentionally left blank)

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Figures

List of Tables

List of Maps

Appendices (provided under separate cover)

Section 1

INTRODUCTION

The Space Coast Transportation Planning Organization (SCTPO) and Space Coast Area Transit (SCAT) are interested in improving access to and from, security at, and operations of SCAT's bus stops. To accomplish this objective and to ensure compliance with the Americans with Disabilities Act (ADA), the Space Coast TPO retained Tindale Oliver to conduct a comprehensive inventory and assessment of each bus stop.

The detailed information collected from the inventory was used to develop a system-wide set of prioritized accessibility and safety improvements needed at each bus stop. From this, order-of-magnitude costs and a phased implementation plan based on available funding estimates was prepared. Consideration for low-cost short-term improvements was considered.

This report details the data collection process, accessibility requirements considered during the assessment, development of a bus stop inventory and database, and steps used to analyze the data and prepare the implementation plan, including the process to prioritize the recommended accessibility improvements. A separate appendix document has also been prepared that includes a one-page summary of data collected and analysis results for each bus stop.

(This page intentionally left blank)

Section 2

INVENTORY PROCESS

This section describes the process used to develop the master bus stop inventory database, including the accessibility attributes collected, the field data collection effort, the ride check undertaken to understand passenger activity at each bus stop, and quality control measures used during the data collection and review process.

INVENTORY ATTRIBUTES

Prior to the field data collection process, a bus stop data collection framework plan was prepared to confirm the inventory format and bus stop attributes to be collected. The attributes align primarily with the data required to evaluate the accessibility of a bus stop using the ADA Accessibility Guidelines (ADAAG).

Four categories of inventory attributes were identified for field collection, as summarized below. A more detailed explanation of bus stop and accessible route standards used to guide the data collection effort is provided in Section 3.

1) **General attributes**
   a) Bus stop ID
   b) Nearest intersection
   c) Latitude/longitude
   d) Direction bus is traveling
   e) Ridership
   f) Nearby major trip generators
   g) Photographs of bus stop in each direction to capture stop and surrounding areas

2) **Location attributes**
   a) Stop location (e.g., in a travel-thru lane vs. in a right-turn lane)
   b) Intersection relation (e.g., nearside, farside, or mid-block bus stop)
   c) Potential traffic or safety hazards

3) **Bus stop attributes**
   a) Curb type/height
   b) Boarding/alighting area presence and characteristics (condition, slope, obstructions, barriers to having a boarding/alighting area, etc.)
   c) Signage and other amenities (benches, trash cans, lighting, etc.)

4) **Accessible route**
   a) Sidewalk connection (e.g., change in elevation, width, presence of cross markings)
   b) Curb ramp (slope, surface, transition, presence of detectable warnings, etc.)
   c) Shelter (condition, distance from curb, presence of accessible connection, etc.)

FIELD DATA COLLECTION PROCESS

Once the bus stop accessibility attributes were confirmed, a comprehensive checklist of each attribute was prepared and developed into a software application specifically configured for this study. First, a field data questionnaire was created and then used to configure the application (see Appendix A) to easily enable surveyors to enter data, answer consistent questions, and confirm that the required data items were collected at each bus stop. The application's interface was accessed by the surveyors using tablets and smartphones with wireless connectivity and built-in GPS. By using the most up-to-date mobile technology, surveyors could determine the bus stop's GPS coordinates, input data with prompted questions, and take photographs using a single tool. Finally, the application allowed the collected data to be exported into a database format for quality control and analysis.

The primary equipment used by each surveyor to conduct the inventory is illustrated in **Figure 2-1** and includes:

- Mobile tablet or smartphone
- Smart level
- Measuring wheel
- Safety vest

Figure 2-1: Field Data Collection Equipment

Following development of the software application, the inventory process was completed by Tindale Oliver staff trained to conduct ADA bus stop assessments. Field data collection occurred during specified days from November 27, 2017, through January 10, 2018.

QUALITY CONTROL MEASURES

During the data collection process, quality control (QC) measures were continuously conducted by the project team to ensure that the data collected were complete and accurate. As the database was compiled, records with missing or incorrect data were corrected by matching the record to its corresponding photographs. Corrected information in the database was marked to reveal any discernable patterns of incorrect information. Data elements with significant errors were closely analyzed to determine the source of the error (e.g., data entry mistakes, programming errors). Elements such as the presence of benches or shelters could be corrected by viewing the photographs, and elements that require measurement, such as slope or width, were determined in the field.

Ride Check

A key component in prioritizing bus stop improvements is understanding the level of passenger activity at each bus stop. This information was collected through a manual accounting of boardings and alightings (i.e., “ons” and “offs”) at each stop, also known as a ride check. The ride check was completed during the week of April 21–26, 2018, and passenger counts at each bus stop were collected using both a computer tablet and paper back-up counts for quality control measures. The ride check covered 100% of the fixed-route runs for each route for a weekday, Saturday, and Sunday of service. Prior to the ride check, detailed training with all persons conducting the ride check was completed to ensure consistency and accuracy. In some cases, the bus stop activity reported from the ride check was zero; riders may board and alight at that particular stop at other times, but did not when the counts were performed. In addition, ride checks should be completed annually to record a clear and accurate average ridership over time.

Table 2-1 summarizes the weekday, Saturday, and Sunday boarding/alighting data collected by route. Sunday service is offered only on Routes 4, 9, and 21; routes denoted with an asterisk (*) are not offered on those days.

Table 2-1: Summary of Ride Check Data by Route

Route	Weekday		Saturday		Sunday	
	Boarding	*Alighting*	*Boarding*	*Alighting*	*Boarding*	*Alighting*
1	1,065	1,065	334	334	*	*
2	192	192	83	83	*	*
3	159	159	146	146	*	*
4	1,091	1,091	717	717	167	167
5	135	135	40	40	*	*
6	826	826	352	352	*	*
7	75	75	50	50	*	*
8	89	89	70	70	*	*
9	723	723	621	621	220	220
21	374	374	231	231	52	52
22	213	213	103	103	*	*
23	244	244	115	115	*	*
24	206	206	314	314	*	*
25	525	525	249	249	*	*
26	151	151	85	85	*	*
27	294	294	161	161	*	*
28	73	73	145	145	*	*
29	469	469	310	310	*	*
33	5	5	*	*	*	*
Total	**6,909**	**6,909**	**4,126**	**4,126**	**439**	**439**

**Service not offered on these days.*

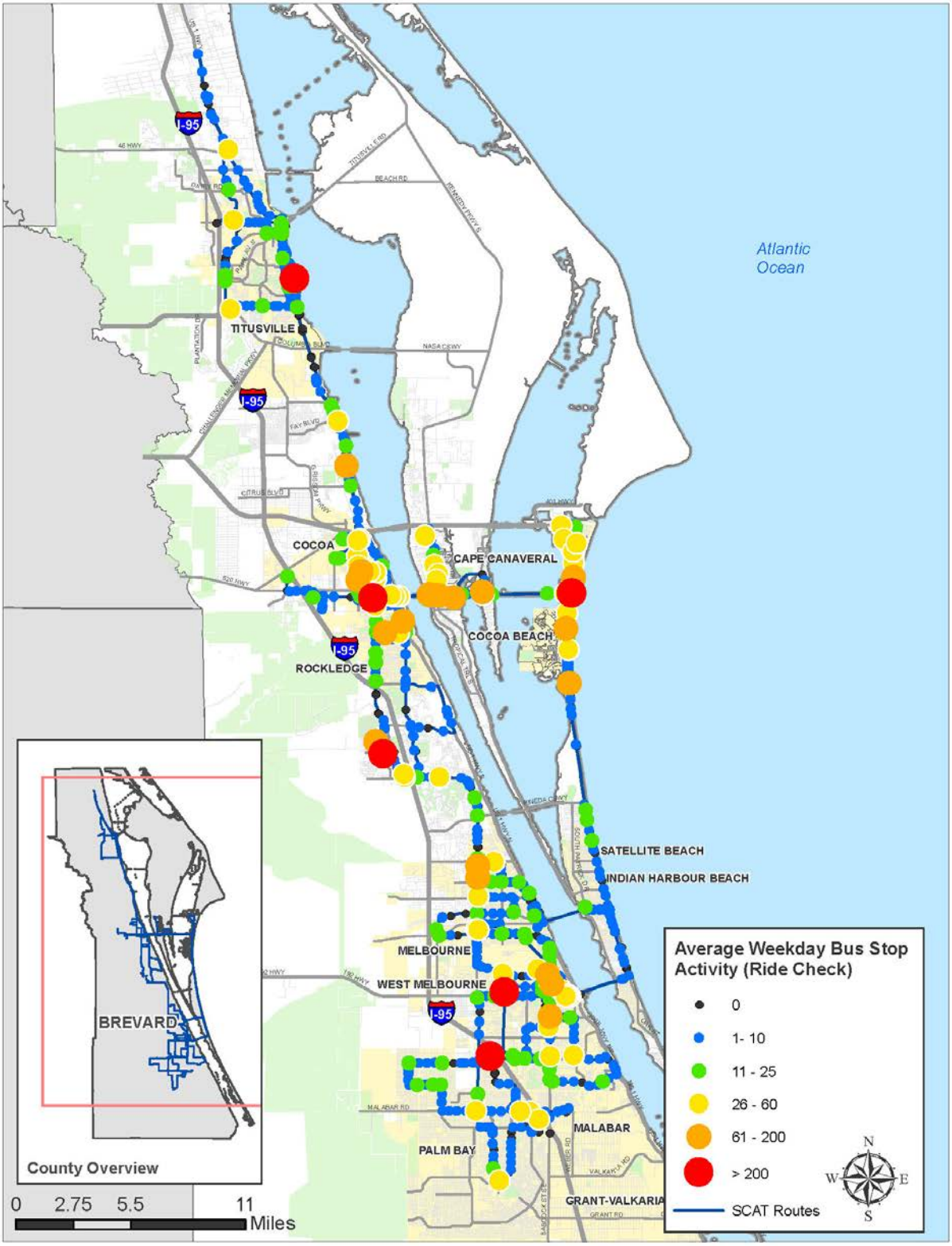
Table 2-2 lists the bus stops that had a weekday ride check activity of greater than 200 boardings and alightings.

Table 2-2: Bus Stops with Weekday Ride Check Activity Greater than 200

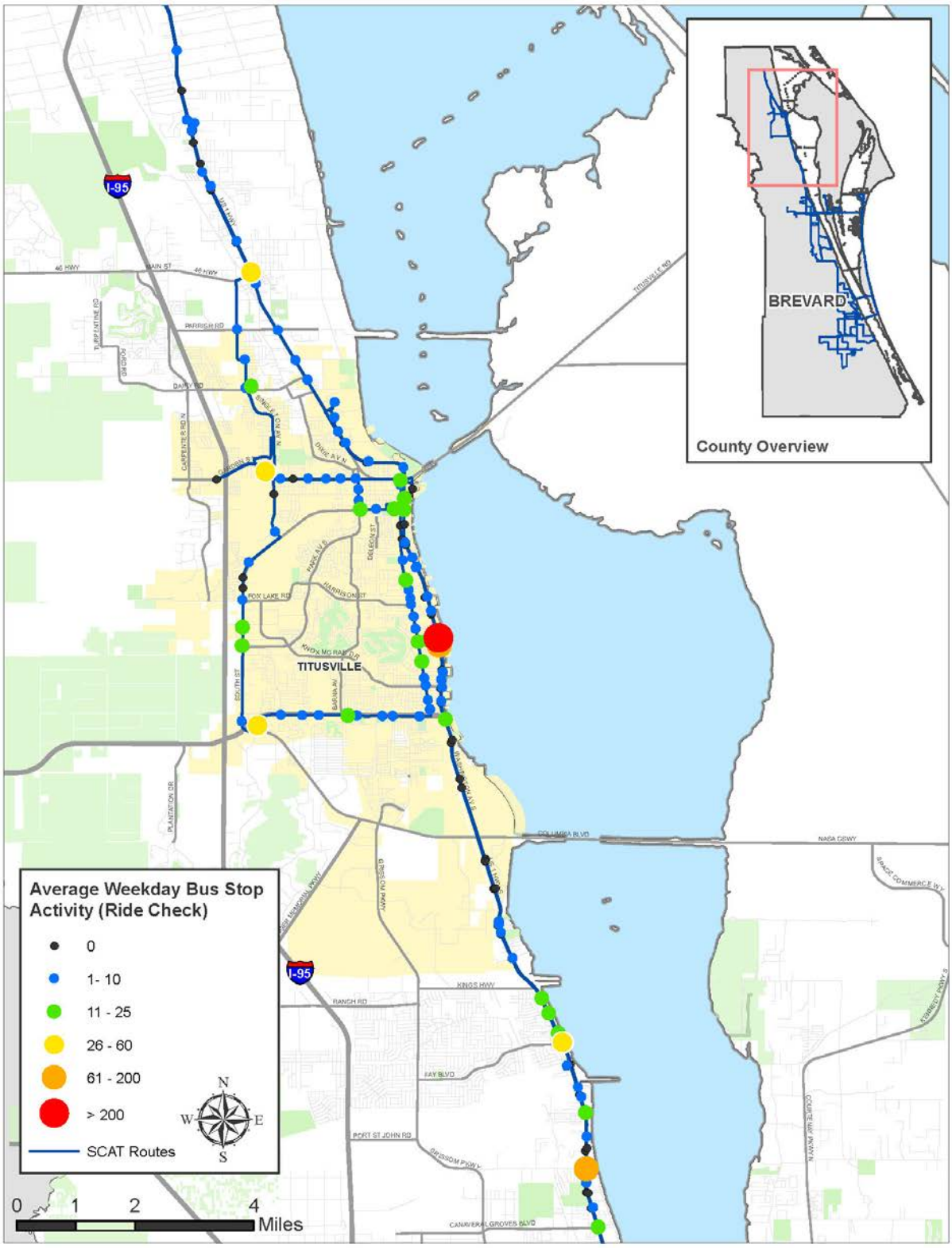
Location	*Weekday*	*Saturday*	*Sunday*
Cocoa Transit Center	1,747	830	48
Shepard Park	1,000	739	191
Hammock Landing	938	441	2
Melbourne Square Mall	933	518	2
Government Center	398	52	0
US 1 @ Searstown Mall	240	146	0

Map 2-1 illustrates the weekday bus stop activity collected during the ride check process for SCAT's entire service area, and **Maps 2-2** through **2-4** illustrate a closer view of the same data for geographic subareas of SCAT's service area (northern, central, and southern subareas, respectively). **Maps 2-5** through **2-8** present Saturday bus stop activity collected during the ride check in this same format, and **Maps 2-9** through **2-11** present this information for the Sunday bus stop activity.

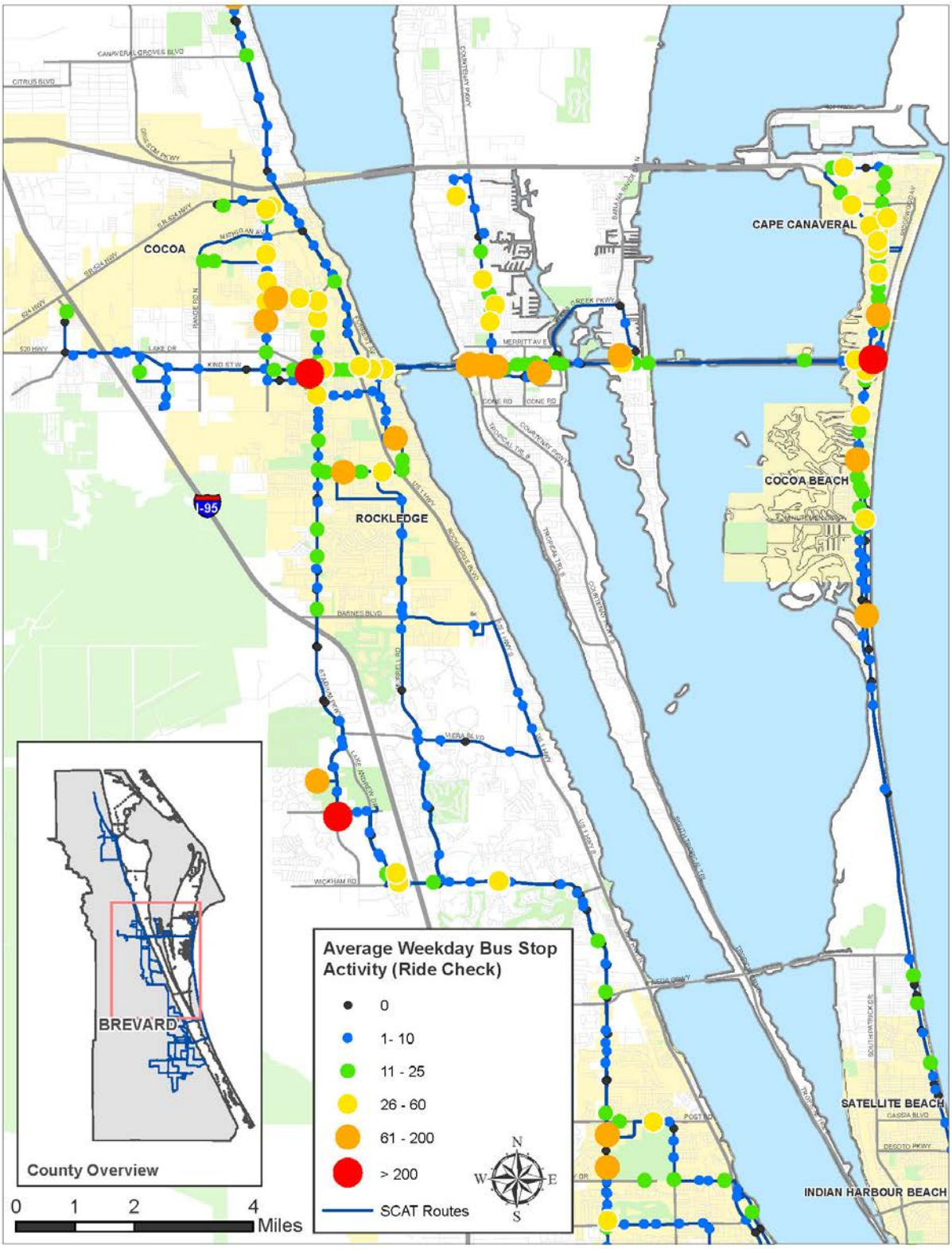
Map 2-1: Weekday Bus Stop Activity Levels (Entire Service Area)



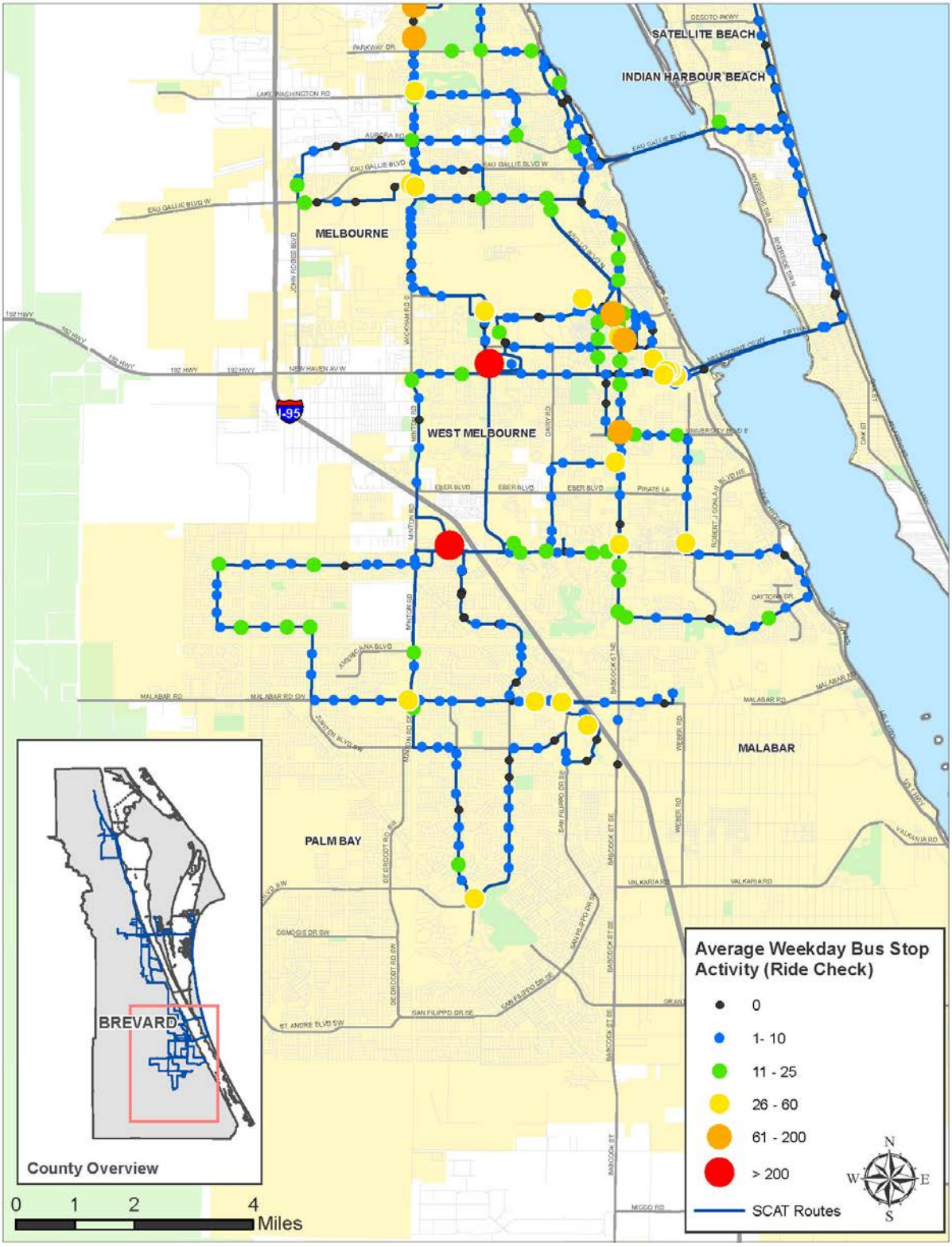
Map 2-2: Weekday Bus Stop Activity Levels (Northern Service Area)



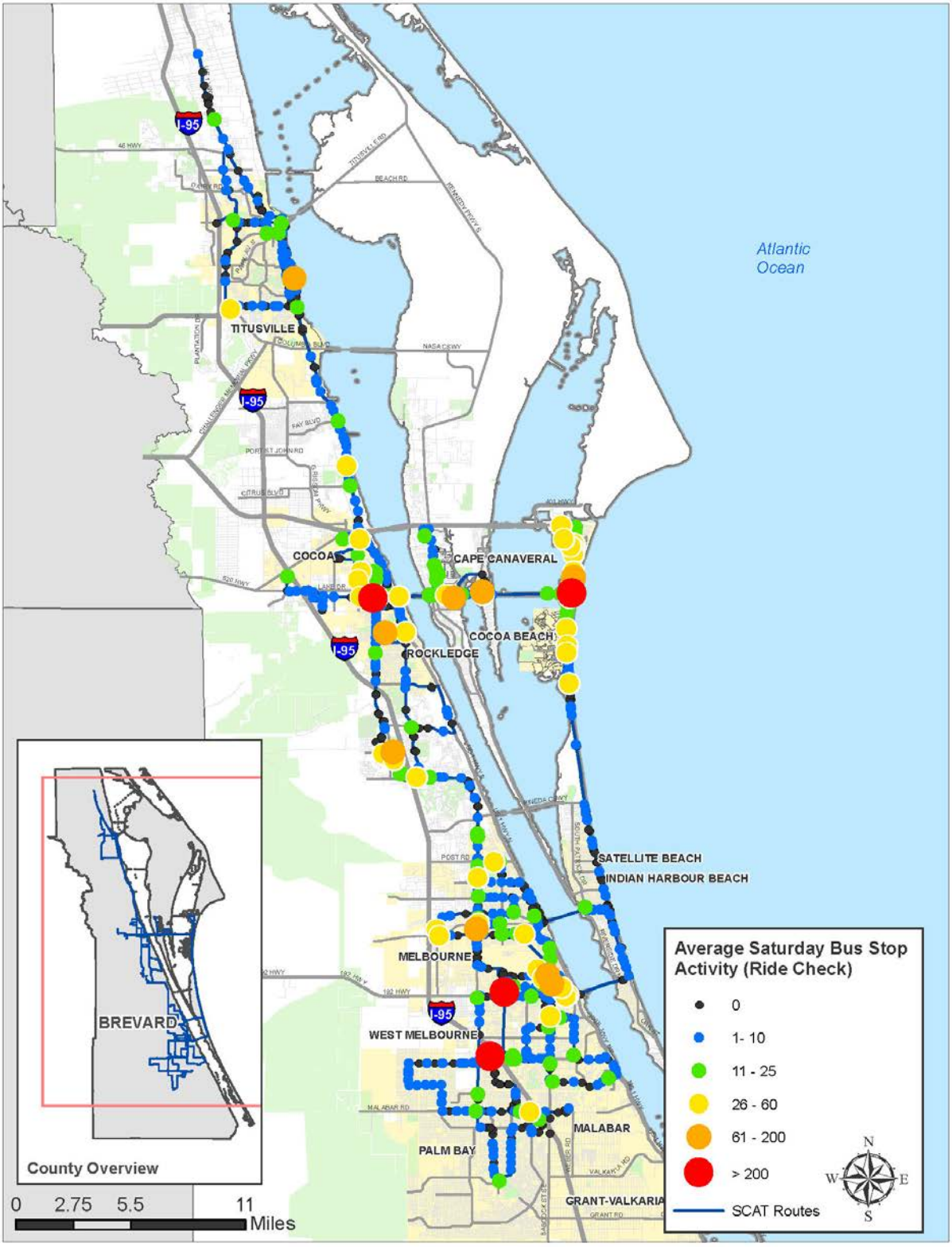
Map 2-3: Weekday Bus Stop Activity Levels (Central Service Area)



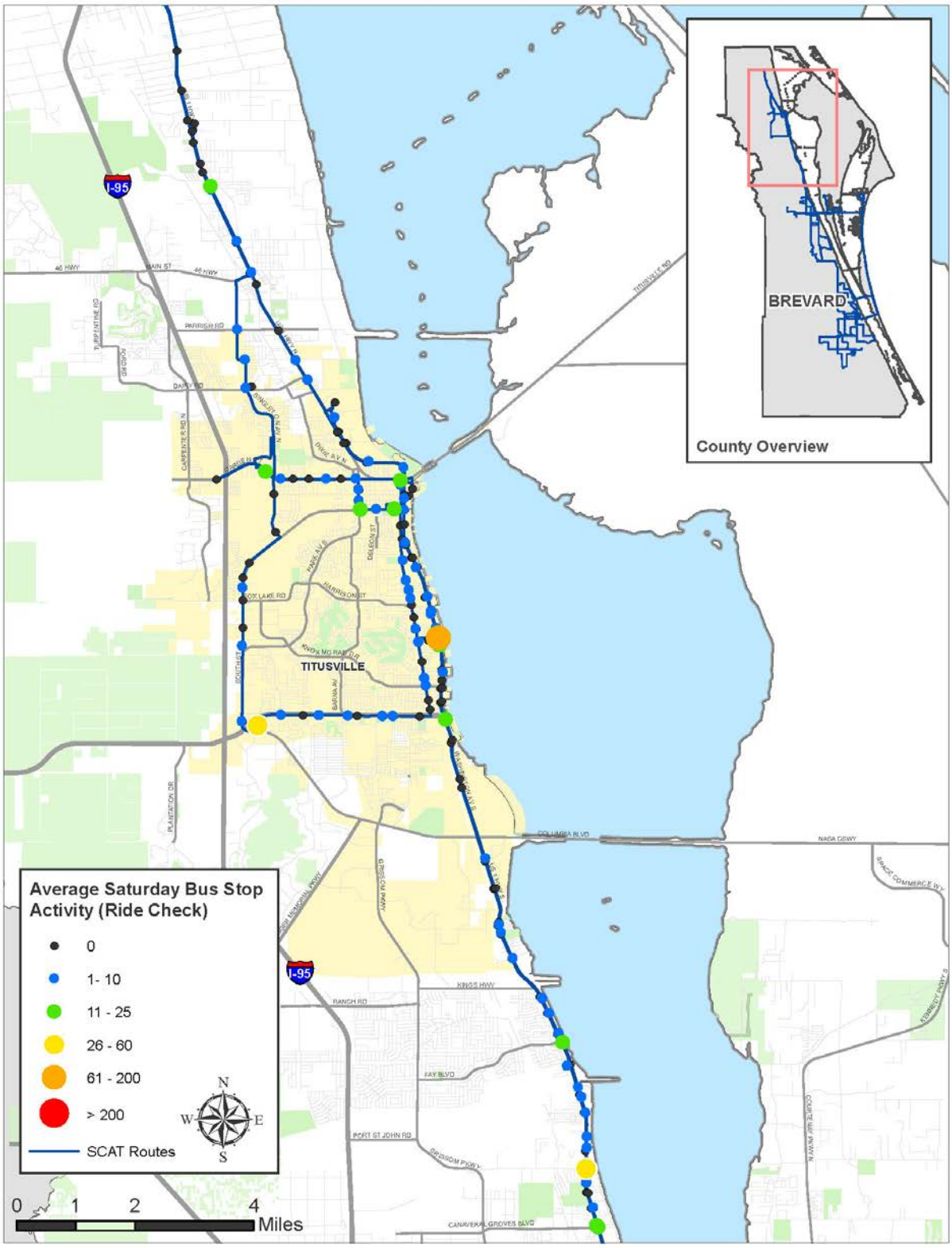
Map 2-4: Weekday Bus Stop Activity Levels (Southern Service Area)



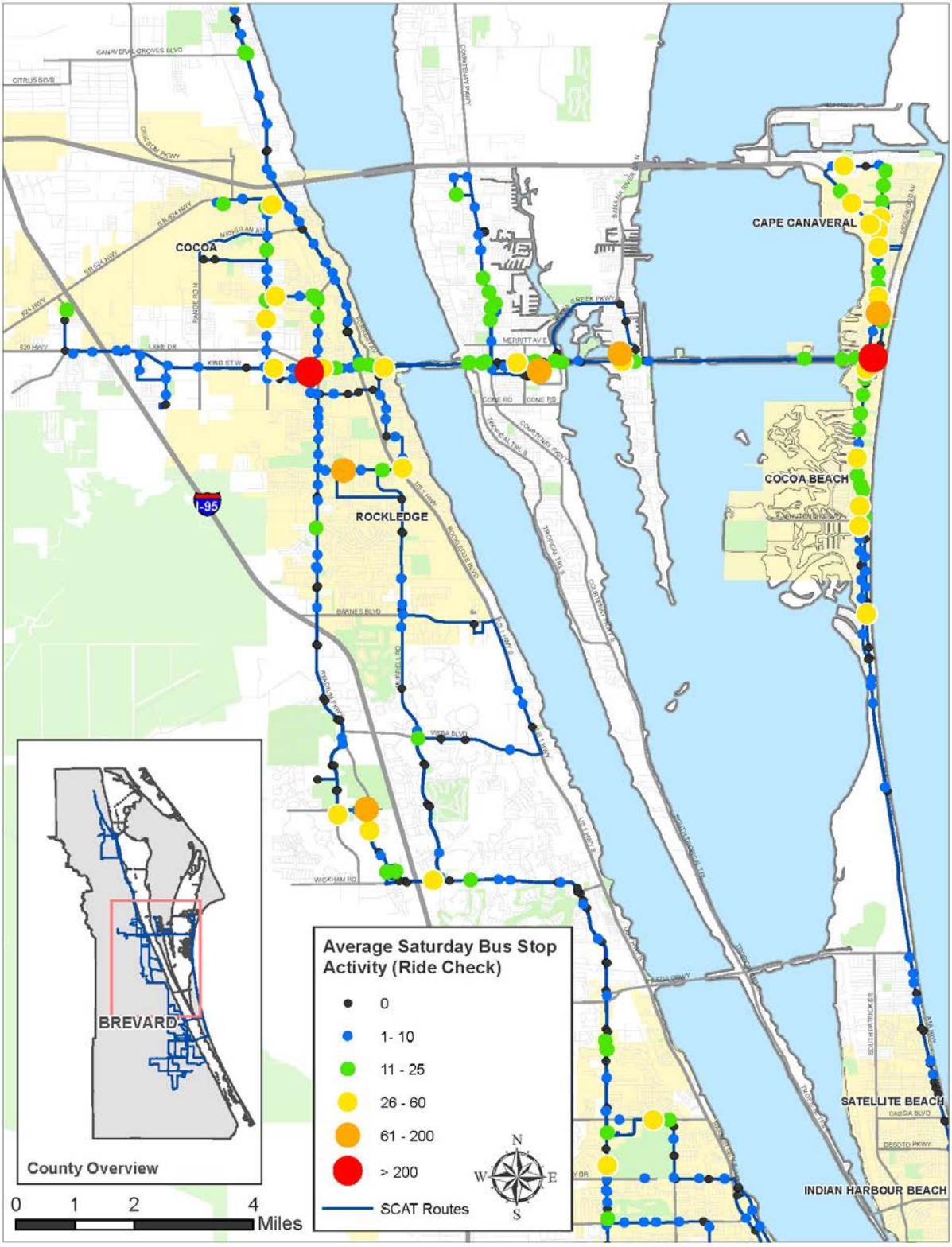
Map 2-5: Saturday Bus Stop Activity Levels (Entire Service Area)



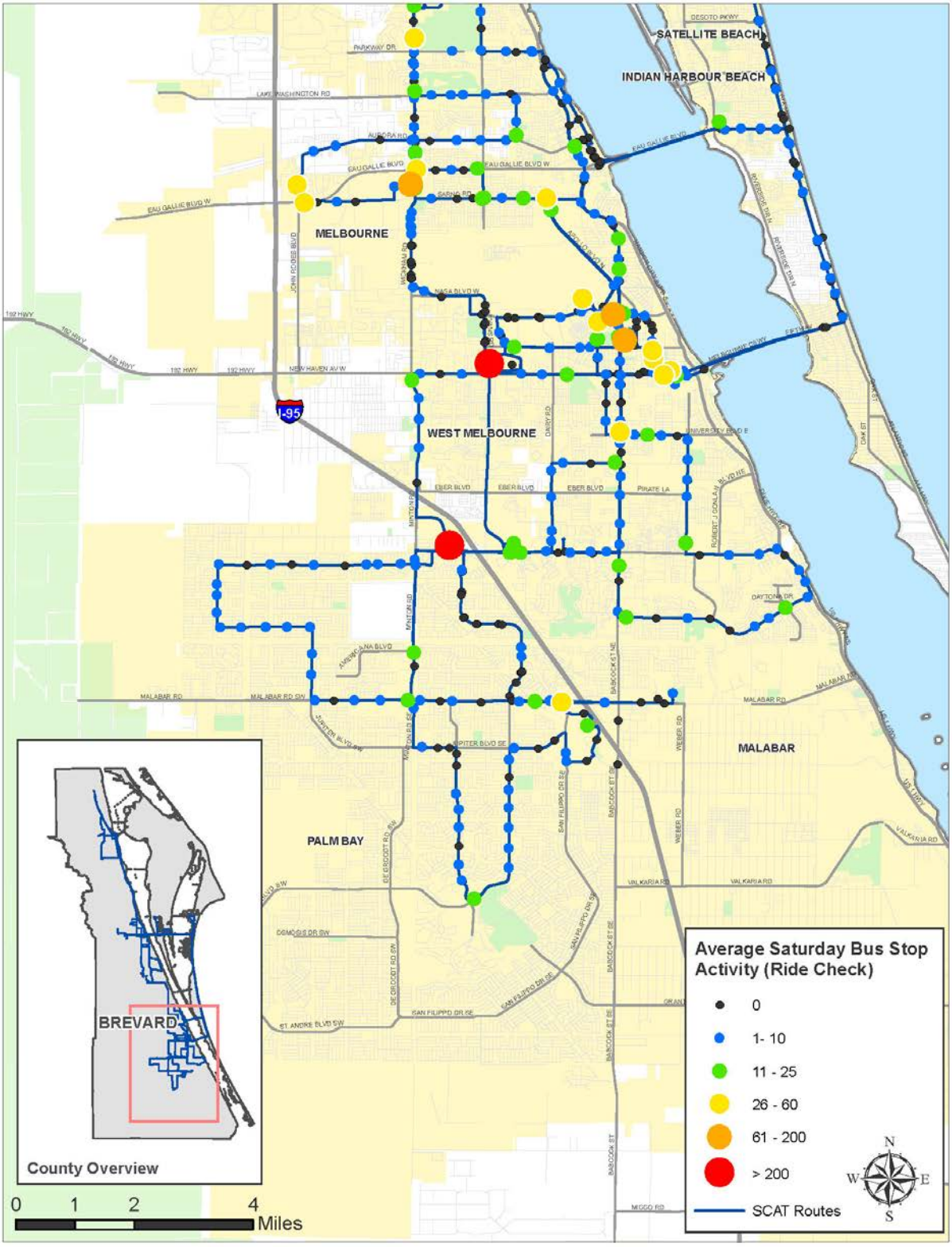
Map 2-6: Saturday Bus Stop Activity Levels (Northern Service Area)



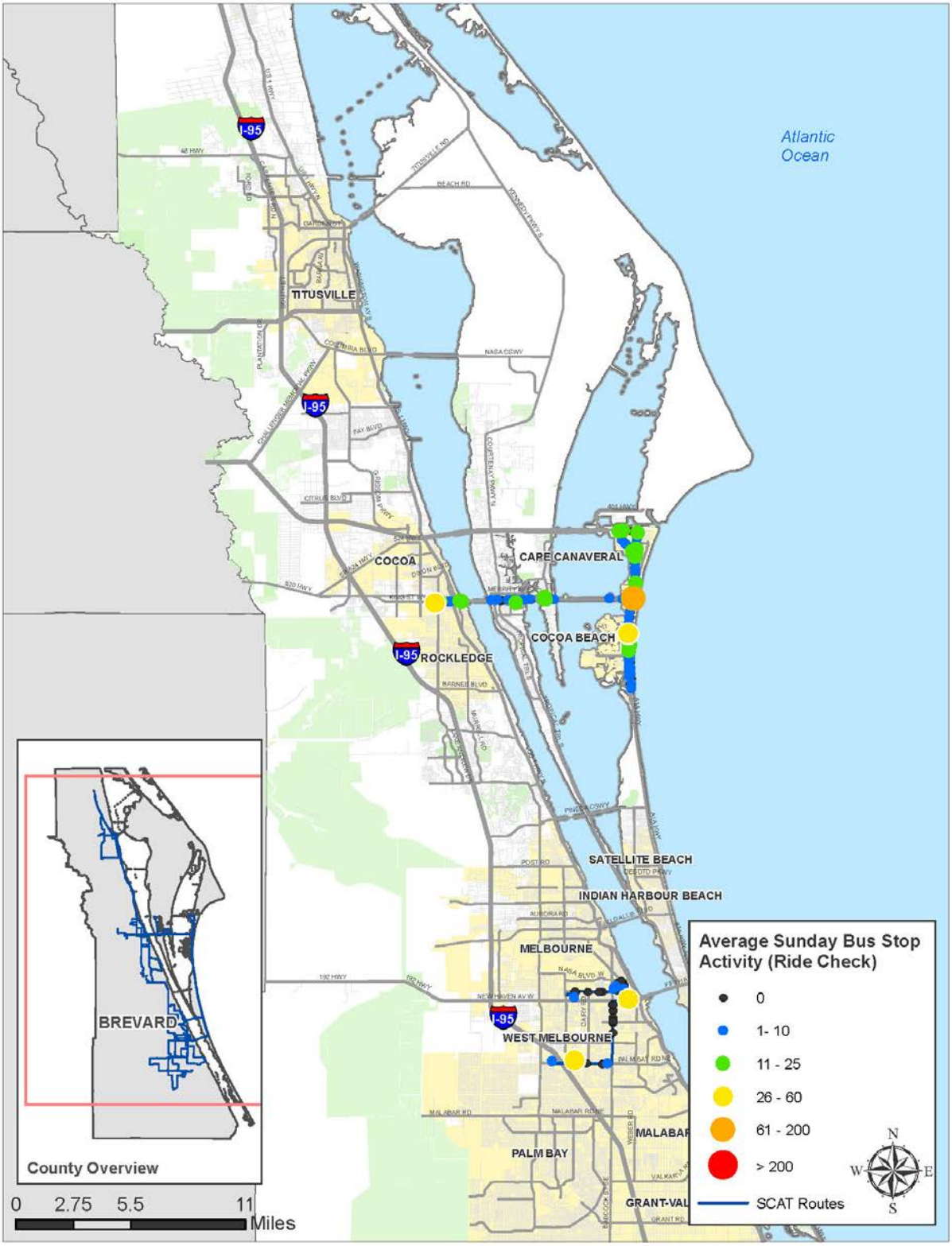
Map 2-7: Saturday Bus Stop Activity Levels (Central Service Area)



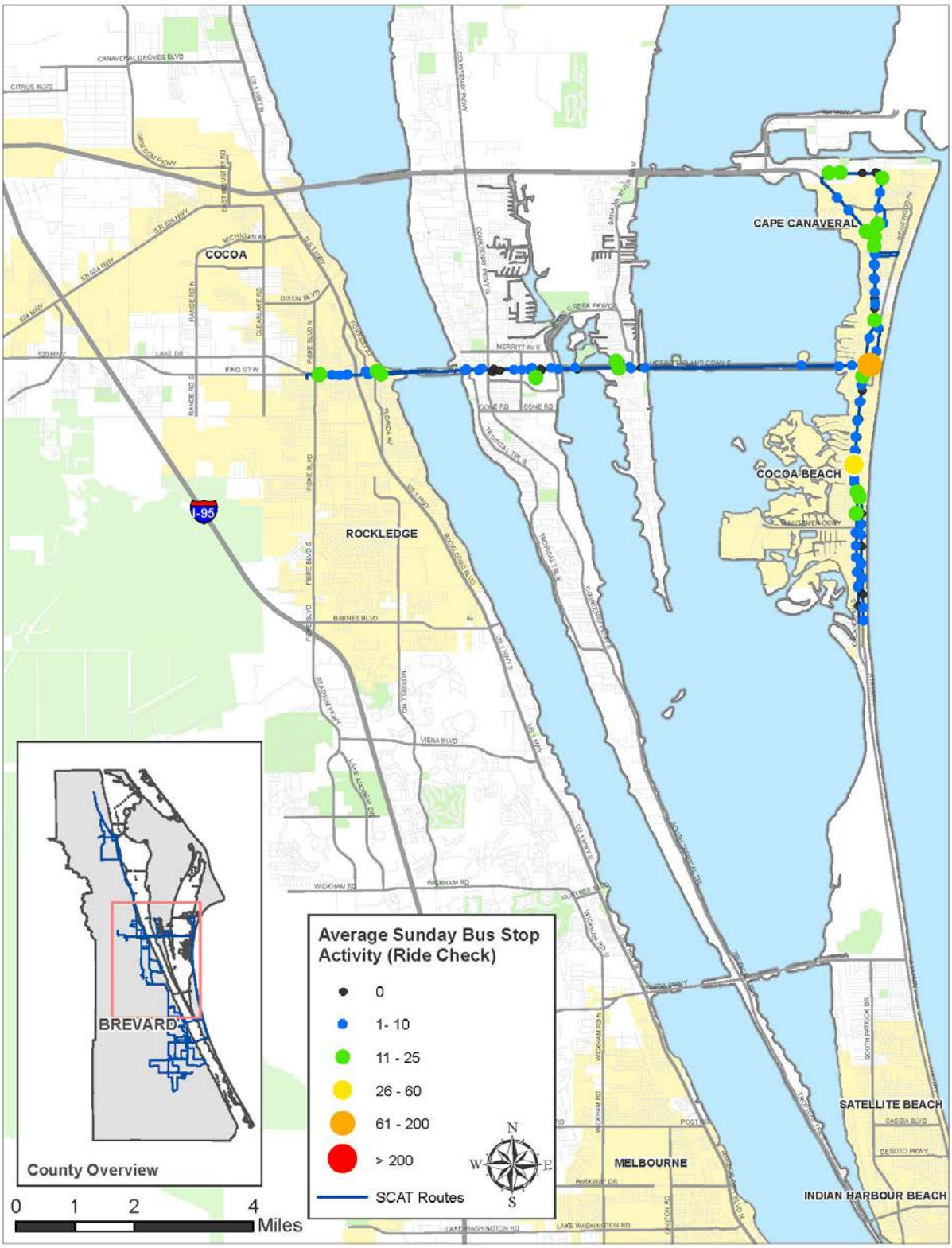
Map 2-8: Saturday Bus Stop Activity Levels (Southern Service Area)



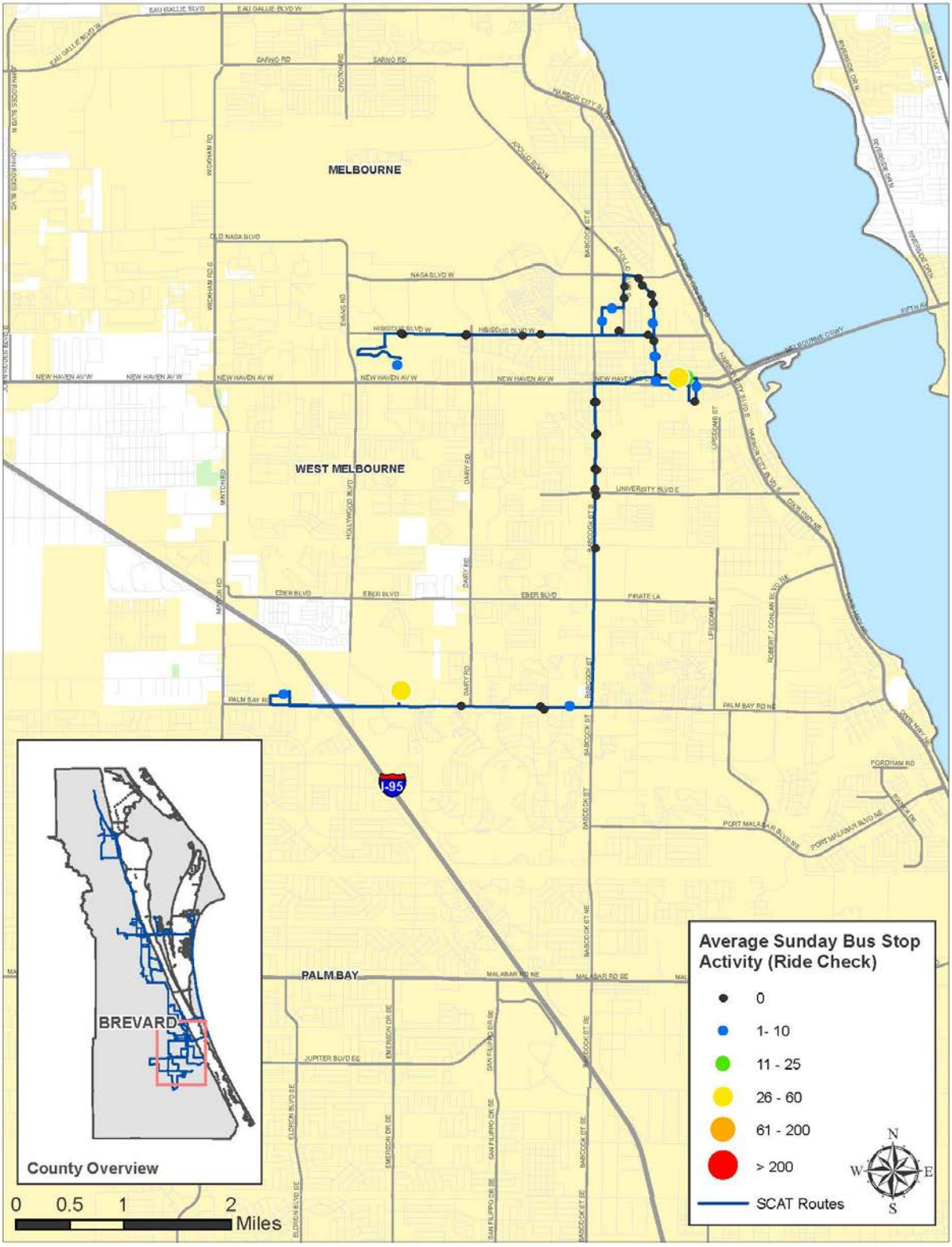
Map 2-9: Sunday Bus Stop Activity Levels (Entire Service Area)



Map 2-10: Sunday Bus Stop Activity Levels (Central Service Area)



Map 2-11: Sunday Bus Stop Activity Levels (Southern Service Area)



(This page intentionally left blank)

Section 3

ACCESSIBILITY REQUIREMENTS

Six major elements related to bus stops primarily impact their accessibility and/or compliance with ADA requirements:

- Boarding /alighting areas
- Bus stop shelters
- Bus stop signs
- Accessible routes and sidewalks
- Curb ramps
- Obstructions

Two primary documents were used to determine specific design and infrastructure requirements for these elements related to accessibility—ADAAG and the Florida Department of Transportation's (FDOT) *Accessing Transit Design Handbook for Florida Bus Passenger Facilities* (Version III, 2013), referred to hereinafter as the *Accessing Transit Handbook*.

Many standards that would apply to bus stops located in dense urban environments are not necessarily applicable to bus stops located in suburban or rural locations where curbs and sidewalks may not be present. Currently, some of SCAT's bus stops located in more suburban or rural areas have no more than a single bus stop sign staked in the grass. In these cases, SCAT is required to install only a raised boarding/alighting area and not necessarily a sidewalk connecting the bus stop to the surrounding area. At locations where there is no expectation of a sidewalk and the shoulder of the roadway may be considered the only usable pedestrian pathway, the boarding/alighting area is required only to connect to the shoulder of the roadway to be considered compliant.

BOARDING/ALIGHTING AREAS

Boarding/alighting areas are critical for passengers to safely access, enter/exit the bus, and operate a wheelchair lift.

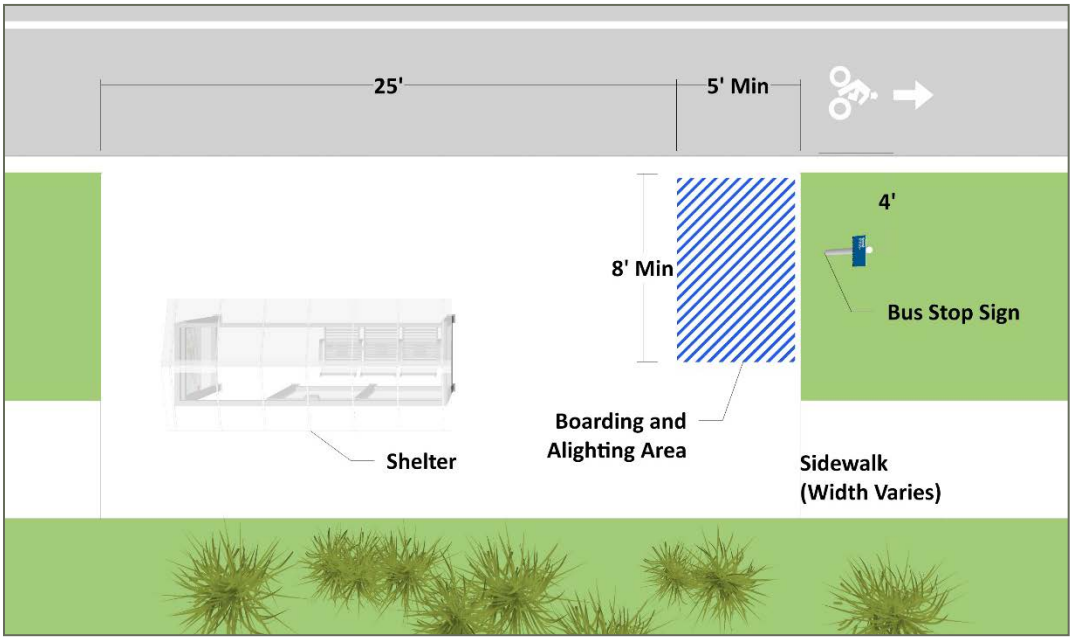
Boarding/Alighting Area Standards

Minimum width and length of paved boarding/alighting areas, as well as surface qualities, are regulated by ADAAG/FDOT. Many standards for sidewalk surfaces also apply to boarding/alighting areas, including the following:

- The clear area of the boarding/alighting area must be no less than 60" parallel and 96" perpendicular to the curb or street/roadway edge and connected to the accessible route.
- The cross slope of the boarding/alighting area (perpendicular to the curb) must be equal to or less than 2%.
- The running slope (parallel to the curb) of the boarding/alighting area must match the slope of roadway.
- The boarding/alighting area must provide a firm, stable, slip-resistant surface.

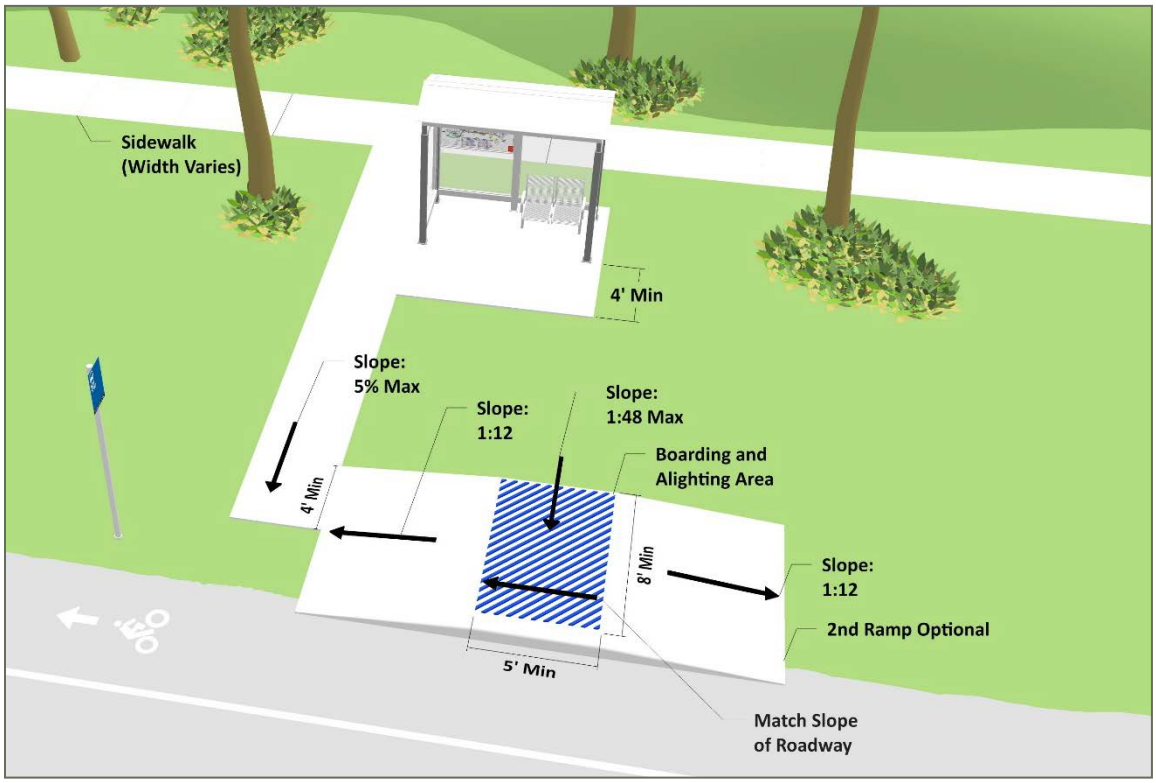
Figure 3-1 illustrates some of these standards in the context of an urban bus stop with a continuous curb, **Figure 3-2** illustrates these standards in the context of a suburban bus stop, and **Figure 3-3** illustrates standards in the context of a rural bus stop.

Figure 3-1: Layout of Boarding/Alighting Area and Standards (Urban Bus Stop)



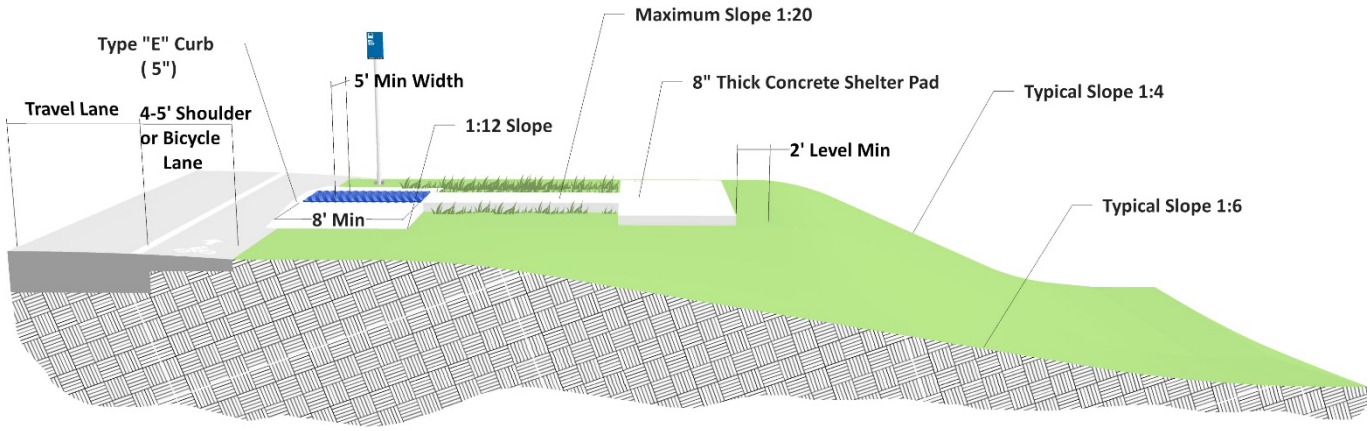
Source: FDOT *Accessing Transit Handbook*

Figure 3-2: Layout of Boarding/Alighting Area and Standards (Suburban Bus Stop)



Source: FDOT *Accessing Transit Handbook*

Figure 3-3: Layout of Boarding/Alighting Area and Standards (Rural Bus Stop)



Source: FDOT *Accessing Transit Handbook*

BUS STOP SHELTERS

Bus stop shelters provide a comfortable waiting area for passengers and help protect them from natural elements such as sun, rain, and heavy wind. However, if placed improperly at a bus stop, shelters can impede accessibility to the accessible path and/or boarding/alighting area.

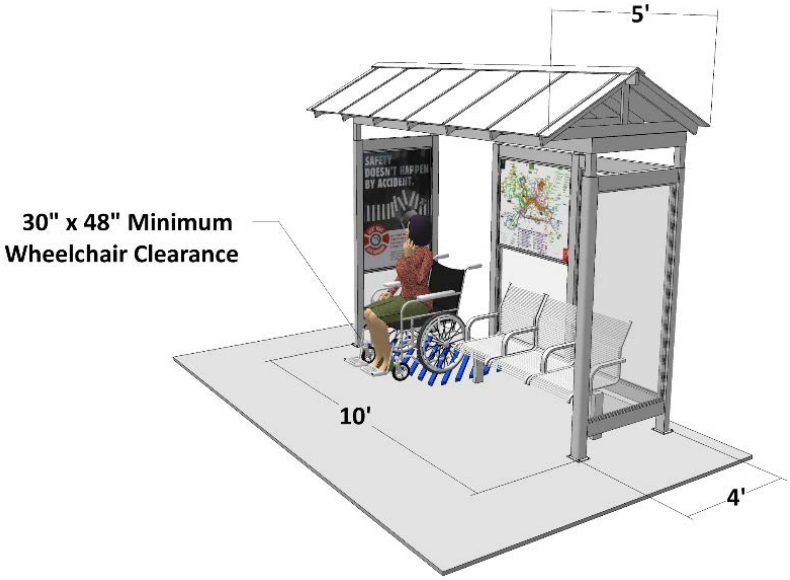
Bus Stop Shelter Accessibility Standards

The design and function of a bus stop shelter can vary considerably based on its function, ridership levels, agency design standards, and other factors. However, important considerations are in place related to how shelter placement and design can affect accessibility to and within the shelter itself, as well as the accessible path and boarding/alighting area. Accessibility standards for bus stop shelters include the following:

- A clear and level floor space of 30" wide by 48" deep within the shelter and 36" minimum approach to the clear area to be accessible for persons in wheelchairs.
- Placement that does not obstruct the boarding/alighting area or that blocks access to the accessible path. When a shelter is located on the street side of a sidewalk, a minimum 4' pedestrian pathway should be maintained on three sides of the shelter. In areas with high pedestrian volumes, a 6’ sidewalk on one side of the shelter is preferred.

Figure 3-4 illustrates the typical dimensions of a bus shelter, including required wheelchair clearance space.

Figure 3-4: Bus Shelter Typical Dimensions



Source: FDOT *Accessing Transit Handbook*

BUS STOP SIGNS

Bus stop signs are important because they identify the location of an active bus stop, but they also are critical for showing passengers the correct area for boarding the bus and serve as a guide to bus operators for positioning the bus for safe boarding/alighting. Bus stop signs must follow particular standards set by ADAAG/FDOT for placement and visibility.

Bus Stop Sign Standards

Bus stop signs providing route designations, bus numbers, destinations, and other access information must be designed for use by transit riders with vision impairments. The general ADAAG/FDOT standards for bus stop sign placement and visibility are as follows:

- The bottom of the sign should be at least 7' above ground level; however, it may be placed as low as 40" above ground level and should not be located closer than 2' from the curb face. Placement of the sign is critical so that both bus operators and passengers can identify and read the sign and the sign is not an obstruction to passing vehicles.
- Characters and the background of the sign should have a non-glare finish, making the sign clear and visible in bright sunlight or headlights.
- Minimum character height must be visible to the passenger and should comply with ADAAG/FDOT standards, as detailed in **Table 3-1**.
- Other signs sharing the mount location also should be properly mounted.
- Suggested for all bus stops, but required for bus stops that serve more than one route, the bus stop sign must also include the bus route number(s) that provide services to the stop.

Table 3-1: Bus Stop Sign Visual Character Height Standards

Height to Finished Floor or Ground from Baseline of Character	Horizontal Viewing Distance	Minimum Character Height
40" to less than or equal to 70"	Less than 72"	5/8"
	72" and greater	5/8" plus 1/8" per foot of viewing distance above 72"
Greater than 70" to less than or equal to 120"	Less than 180"	2"
	180" and greater	2", plus 1/8" per foot of viewing distance above 180"
Greater than 120"	Less than 21'	3"
	21' and greater	3", plus 1/8" per foot of viewing distance above 21'

Source: FDOT *Accessing Transit Handbook*

The SCAT bus stop sign shown in **Figure 3-5** meets these requirements. All bus stops that require updated or relocated signage as a result of this study must meet applicable ADA requirements. It should be noted that, through the ride check process, flag stops were observed along two routes (3 and 5). **It is recommended that SCAT discontinue this practice system-wide to avoid accessibility, safety, and operational/scheduling issues that can result from using flag stops.**

Figure 3-5: ADA-Compliant SCAT Bus Stop Sign, Schedule, and Route Number

ACCESSIBLE ROUTES AND SIDEWALKS

Accessible routes and sidewalks leading to and from the bus stop are critical for all passengers, particularly those with disabilities.

Accessible Route Standards

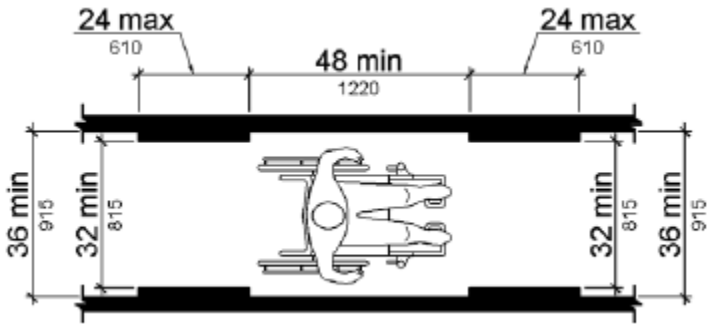
An accessible route must be sufficiently wide, continuous, and an unobstructed path enabling passengers to access the bus stop and surrounding activity centers. The following are the specific guidelines for accessible routes and sidewalks set by ADAAG/FDOT:

- Must be a 36" minimum wide continuous unobstructed path.
- Must have a 32" minimum width at doorways.
- Must have 60" x 60" passing spaces at 200' intervals.
- Running slope (parallel to direction of travel) must be equal to or less than 5% (>5% = ramp).
- Cross slope (perpendicular to direction of travel) must be equal to or less than 2%.
- Surface must be firm, stable, and slip-resistant (wet or dry).
- Changes in level between 1/4" and 1/2" must be beveled at 1:2 slope.
- Changes in level greater than 1/2" are not allowed or must be ramped.

- Gaps in gratings must be no greater than 1/2" wide and openings must be aligned perpendicular to travel.

Figure 3-6 illustrates the standards for providing a clear width of an accessible route.

Figure 3-6: Clear Width of an Accessible Route



Source: Department of Justice, *2010 ADA Standards for Accessible Design*, Chapter 4, Section 4.03

CURB RAMPS

Curb ramps provide a means of easily and safely accessing sidewalks from a crosswalk or other surface and should be provided wherever a curb is encountered along the path to transit services and facilities. These are particularly critical for passengers with disabilities who require wheelchairs.

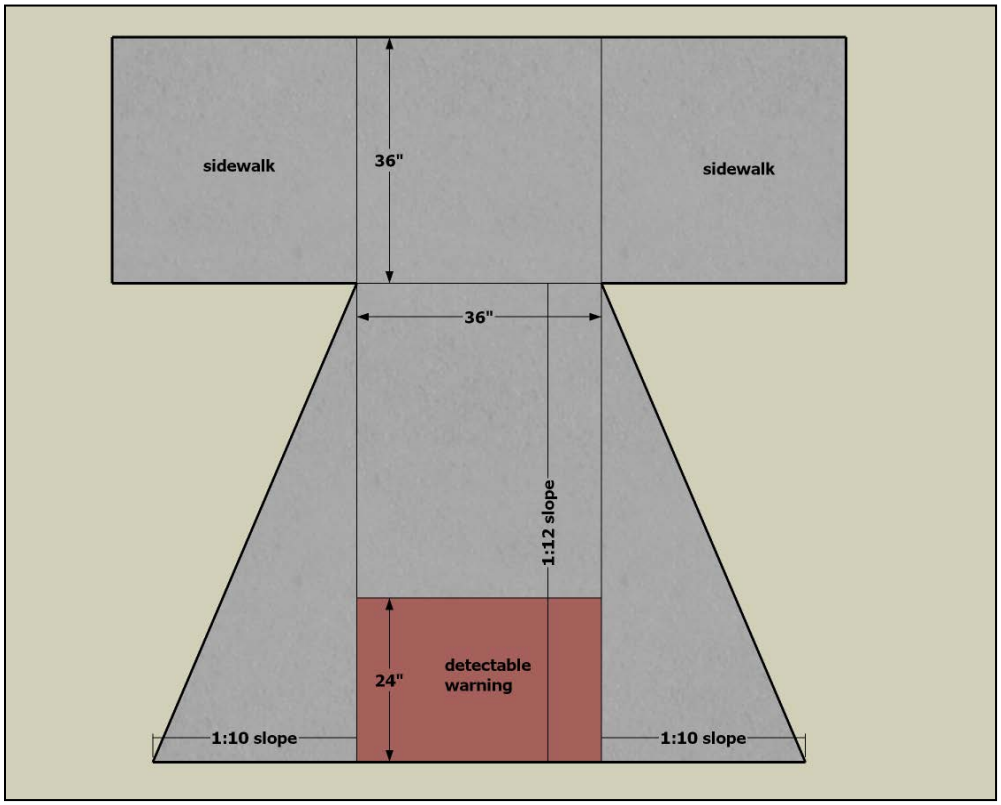
Curb Ramp Standards

ADA-compliant curb ramps must be provided at all crosswalks, marked and unmarked, and should not interfere with free access to the bus stop. Particular standards limit the minimum width and maximum slope of the curb ramp to ensure accessibility. The following are the standards for curb ramps required by ADAAG/Florida Administrative Code (FAC).

- Maximum ramp segment slope permitted is 1:12 (8.3%).
- Maximum cross slope permitted is 1:48 (2%).
- Detectable warnings are required at curb landings and along flush transitions at street crossings.
- Detectable warnings must extend the full width of the ramp and be 24" in depth.
- Curb ramps must have a 36" long landing at top of slope.
- Ramped portion must be at least 36" wide. The exception is curb ramps that are part of an egress, which must be not less than 44" wide.
- Curb ramps must have detectable warnings in truncated domes with pattern and characteristics defined by regulations, including contrasting color.

Figure 3-7 illustrates a number of these standards.

Figure 3-7: Curb Ramp Accessibility Standards Diagram



Source: Tindale Oliver, "Space Coast Area Transit Bus Stop ADA Assessment Report," 2015.

OBSTRUCTIONS

Infrastructure such as shelters, benches, trash cans, utility boxes, and leaning rails should be placed in a manner as to not interfere with the sidewalks or the boarding/alighting area. Not only can these obstructions prevent passengers from using the path, they also can present a potential safety concern.

The field data collection included an assessment of bus stop infrastructure such as benches, garbage cans, advertisement structures, etc., to determine if they present an obstruction. Based on the data collected, the difficulty level of removing an obstruction can be assessed and could range from moving a bench out of the path to redesigning the accessible path around fixed infrastructure such as a utility pole.

Figure 3-8 illustrates an example obstruction observed during the field data collection effort where an advertisement board is obstructing the required wheelchair clear area within the shelter. This obstruction also has the potential to create a blind spot for passengers waiting in the shelter that could decrease the safety of the area.

Figure 3-8: Example SCAT Bus Stop Obstruction

(This page intentionally left blank)

Section 4

IMPLEMENTATION PROCESS

IMPLEMENTATION PROCESS STEPS

The improvement needs identified from the field data collection process were reviewed and organized into categories based on which agency is responsible and the relative ease/cost in which they can be addressed. The development of the phased implementation plan considers several steps, including the following:

Step 1: Identify the entity responsible for the improvement (SCAT or other).

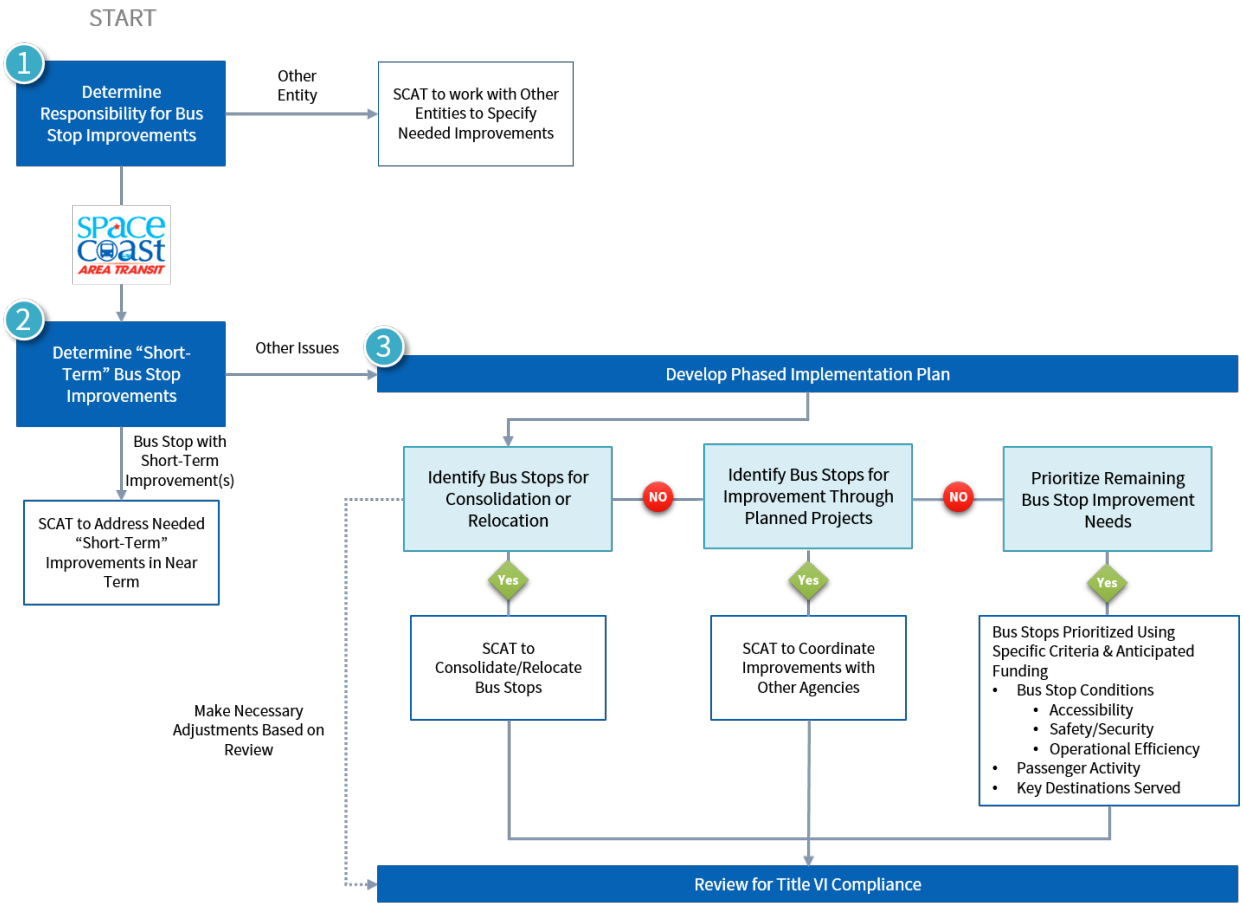
Step 2: Determine improvements that should be addressed immediately (short-term improvements).

Step 3: Categorize and prioritize improvements that are SCAT's responsibility through:

- Determining whether stops can be removed, consolidated, or relocated.
- Prioritizing the remaining bus stop improvements based on the following:
  - Severity of accessibility, safety/security, and operational efficiencies
  - Passenger activity levels
  - Key destinations served
  - Presence of critical hazards

Figure 4-1 illustrates the step-by-step process used to prioritize bus stop improvements to be included in the phased implementation plan. The steps are discussed in the remainder of this section.

Figure 4-1: Bus Stop Accessibility Implementation Plan Process



Step 1: Identify Responsible Entity

The first step in developing the phased implementation plan is to determine which improvements are the responsibility of SCAT versus other agencies. Although many of the identified potential bus stop improvements will need to be addressed by SCAT, a number of the recommended improvements may fall under the responsibility of FDOT, Brevard County, the cities, and/or other public agencies and private entities.

Based on the responsible entities identified for each type of improvement, as presented in **Table 4-1**, improvements identified as the responsibility of an entity other than SCAT can be removed from SCAT's implementation plan. These improvements may then be considered separately, as SCAT will need to coordinate with these entities to specify the needed improvements and determine the best course of action to complete them in an appropriate timeframe.

Table 4-1: Responsible Entity for Bus Stop Improvements

Description	Responsible Entity
Replace sign at stop	SCAT
Refurbish shelter	SCAT
Install lighting for shelter	SCAT
Install other lighting sources	Entity/jurisdiction in which bus stop located
New boarding/alighting area	SCAT
Resurface boarding/alighting area	SCAT
New connecting path	SCAT
New sidewalk	Entity/jurisdiction in which bus stop located
Resurface sidewalk	Entity/jurisdiction in which bus stop located
New curb ramp	Entity/jurisdiction in which bus stop located
Resurface curb ramp	Entity/jurisdiction in which bus stop located
Relocate bus stop	SCAT

As shown in **Table 4-1**, SCAT is not responsible for a number of infrastructure items that are primarily implemented and maintained by other jurisdictions; it is responsible for only the infrastructure pertaining to its bus stop directly, such as bus stop signs, shelters, and boarding/alighting areas. Sidewalks and curb ramps are maintained by other jurisdictional entities; however, SCAT is responsible for installation of a connecting path from the boarding/alighting area to the sidewalk if one is present. In some cases, where a sidewalk would be expected and the shoulder of the roadway cannot be used as the accessible path, SCAT is responsible for the installation of a sidewalk from the boarding/alighting area to the nearest intersection.

Step 2: Determine Short-Term Improvements

The second step in developing the phased implementation plan is to determine which improvements are short-term and can be completed with minimal effort and/or cost by SCAT. For purposes of this analysis, a short-term improvement consists of the following:

- Addition, replacement, or modification of a bus stop sign
- Other minor or partial improvements, such as an obstruction or accessibility issue caused by an official or third-party bench or trash can

The modification or removal of third-party amenities is not SCAT's responsibility; however, having non-compliant amenities/infrastructure associated with SCAT's bus stops could cause issues, and, as such, it is recommended that they be remediated. Also, as previously noted, bus stops that serve more than one route are required to have signs that display the bus routes that serve that particular stop. Although this attribute was not assessed for all bus stops, in locations where bus route identification signs are missing, they should be (re)mounted.

Step 3: Categorize and Prioritize Remaining Improvements

The remaining improvements that are SCAT's responsibility are grouped into three categories as part of the phased implementation plan.

Bus Stops Identified for Removal, Consolidation, or Relocation

It is possible that SCAT's system has some bus stops with identified issues that can be consolidated (i.e., grouping two or more stops into a single stop) or eliminated altogether. The decision to consolidate or eliminate stops can be based on factors such as existing passenger activity levels, spacing between bus stops, placement/location of bus stop, and/or severity of needed improvements. For this effort, the possibility of consolidating stops considered four specific criteria:

- *Distance* – A minimum bus stop spacing distance of 1/8 mile was considered for urban bus stops and 1/4 mile for suburban and rural bus stops. Stops that are spaced more closely were reviewed to determine if consolidation may be feasible without negatively impacting passenger walk access to SCAT service.
- *Ridership* – The number of passengers boarding/alighting at each stop was evaluated.
- *Nearby Trip Generators* – The number of nearby trip generators was used to determine if consolidation is recommended for each bus stop.
- *Bus Stop Conditions Priority Scoring* – The stage of the prioritization process that considered bus stop conditions (i.e., accessibility, safety/security, operational efficiency) was used to help determine the timing of the bus stops being proposed for consolidation (i.e., immediate, near-term, long-term).

While some bus stops may meet the criteria for stop consolidation, relocating the bus stop either away from another nearby stop or closer to an obvious trip generator was instead recommended.

It should be noted that this effort also included identifying bus stops that SCAT may want to consider relocating, based on safety/security or operational efficiency issues identified during the inventory process. Scenarios warranting possible relocation include the following:

- Bus stop located just over crest of a hill
- Bus stop located just after curve in a street
- Bus stop located near a railroad crossing or track
- Waiting passengers hidden from view of oncoming traffic
- Stopped bus straddles crosswalk or obstructs curb ramp
- Bus stop discharges passengers onto driveway apron
- Bus stop discharges passengers onto roadway
- Bus stops are spaced close together
- Bus stop located away from trip generators

Improvements Completed in Conjunction with Other Planned Projects

There may be bus stop improvements identified through this assessment process that can be completed in conjunction with various types of planned transportation projects, such as roadway widening and transportation enhancements being implemented by FDOT, Brevard County, and/or various municipalities. It should be noted that if a road is being altered, which would include

repaving, than all ADA issues associated with the bus stops, sidewalks, curb ramps, pedestrian signals, and pedestrian crossings adjoining the improved roadway must be rectified by the agency completing the roadway improvements *(FDOT Design Manual, January 1, 2018 – Chapter 114.1.1)*.

Prioritized List of Remaining Improvements

The remaining bus stop improvements that are SCAT's responsibility are prioritized into a multi-year phased implementation plan using a series of criteria to help guide SCAT in addressing the more significant improvements needed. This prioritization process is necessary in recognition of SCAT's limited financial and staff resources. The prioritization process helps to rate the conditions at each stop and assess the severity of the needs to determine which improvements should be implemented first based on a number of factors, including bus stop condition, passenger activity level, key destinations served, and presence of critical hazards.

Bus Stop Conditions

The initial assessment of the remaining bus stop improvement needs focused on issues with the bus stops related to three major characteristics: accessibility, safety/security, and operational efficiency. To conduct this analysis, three steps were followed to guide the prioritization of bus stops related to these three major characteristics. As part of the inventory process, information on multiple data elements was collected to support the evaluation of the accessibility, safety/security, and operational efficiency of each bus stop. This information was used to determine a score for each bus stop and to determine whether the overall condition assessment of each characteristic falls into one of three rating ranges: High, Medium, or Low. These ratings account for the fact that there are two factors that could drive the scores—the relative number of deficiencies present at the stop and the relative nature of those deficiencies (i.e., how critical they are compared to the deficiencies in other elements). Given these two factors, the meaning of each rating range is as follows:

- High – the stop has many critical deficiencies, a combination of critical and less-critical deficiencies, or all of its elements are deficient to some degree.
- Medium – the stop has very few critical deficiencies or a greater number of less-critical deficiencies.
- Low – the stop has no deficiencies or very few less-critical deficiencies.

Accessibility

This category addresses how accessible and available the bus stop is to passengers by determining how easy or difficult it is to navigate through assessment of obstructions within the accessible path or sidewalks, presence of infrastructure such as curb ramps or bus stop signs, and compliance of that infrastructure. An overall accessibility score was developed for each bus stop using the following elements related to accessibility:

- Bus stop location

- Presence of a controlled pedestrian crossing
- Presence of a curb and compliant curb ramp
- Ability to maneuver a wheelchair through the shelter
- Bench/amenity obstruction
- Presence and compliance of a sidewalk
- Presence and compliance of boarding/alighting area
- Presence and compliance of the bus stop sign

Each of these elements was reviewed for its level of accessibility and provided a positive score if it is accessible and a zero or negative score based upon its level of non-compliance. The scores were developed based upon an analysis of the data collected in the master inventory and translated into an accessibility rating scale from low to high based on the relative scores assigned.

Safety/Security

Similar to the accessibility score, an overall safety/security score was developed for each bus stop using seven elements related to safety/security. This category rates how safe or secure passengers are based on the location of the bus stop and whether the passengers/pedestrians would be visible to oncoming traffic or potential hazards at the bus stop such as steep swales or guide wires. The following elements were used to develop the safety/security score:

- Bus stop location
- Presence of a controlled pedestrian crossing
- Presence of detectible warnings on the curb ramp
- Presence of marked crosswalk(s)
- Landing area in a safe location
- Presence of lighting
- Presence of other potential safety or security hazards

Each of these elements was assessed for its level of safety/security and provided a positive score if no or relatively low safety/security issues are observed and a zero or negative score if more significant safety/security issues are determined. The scores were developed based on an analysis of the data collected in the master inventory and translated into a safety/security rating scale from low to high based on the relative scores assigned.

Operational Efficiency

This category rates each bus stop by its effectiveness to facilitate timely and efficient operation of the transit system. The following five elements were used to develop the score:

- Bus location when stopped (e.g., right-turn lane, curb lane, parking lane, etc.)
- Bus stop in relation to nearest intersection (e.g., near side, far side, mid-block, etc.)
- Presence of controlled pedestrian crossing
- Potential hazards

- Presence and compliance of a sign at the bus stop

Each of these elements was assessed and provided a positive score if no or relatively low operational issues are observed and a zero or negative score if more significant operational issues are determined. The scores were developed based upon an analysis of the data collected in the master inventory and translated into an operational rating scale from low to high based on the relative scores assigned.

Bus Stop Activity

Passenger activity was collected for the bus stops using a manual ride check process. Using ride check data, bus stop activity is considered an important criterion in establishing the relative "necessity" of each stop due to the level of passenger use—the higher the bus stop activity, the more important it is to address potential issues when also factoring in the severity of deficiencies.

Nearby Trip Generators

During the field inventory process, surveyors assessed and recorded information on various key trip generators (e.g., schools, offices, shopping centers, social service agencies, etc.) located near each bus stop. This information was taken into consideration when analyzing the stops, as some of these generators typically are more closely related to transit use. As with passenger activity levels, this criterion also is important for establishing the relative "necessity" of a particular stop. Bus stops that serve nearby major transit generators can be critical despite the level of ridership because the trips are life-sustaining—the more trip generators around the stop, the more important it is to address potential issues when also factoring in the severity of the deficiencies.

Prioritization of Weighting Factors

The prioritization criteria were weighted to ensure that the relative importance of each is considered in preparing the phased implementation plan. **Table 4-2** presents the prioritization weighting factors for each criterion, developed in cooperation with SCTPO and SCAT staff.

Table 4-2: Prioritization Weighting Factors

Criteria	Weighting Factor
Bus Stop Conditions	**50%**
Accessibility	*20%*
Safety/Security	*15%*
Operational Efficiency	*15%*
Passenger Activity	**30%**
Nearby Trip Generators	**20%**

Note: Bus stop conditions weighting factor is a sum of accessibility, safety/security, and operational efficiency factors.

Title VI Assessment

The phased implementation program was reviewed to determine compliance with Title VI of the Civil Rights Act of 1964. As a federally-funded transit system, SCAT must ensure that the services and programs are in compliance with Title VI requirements, as described below:

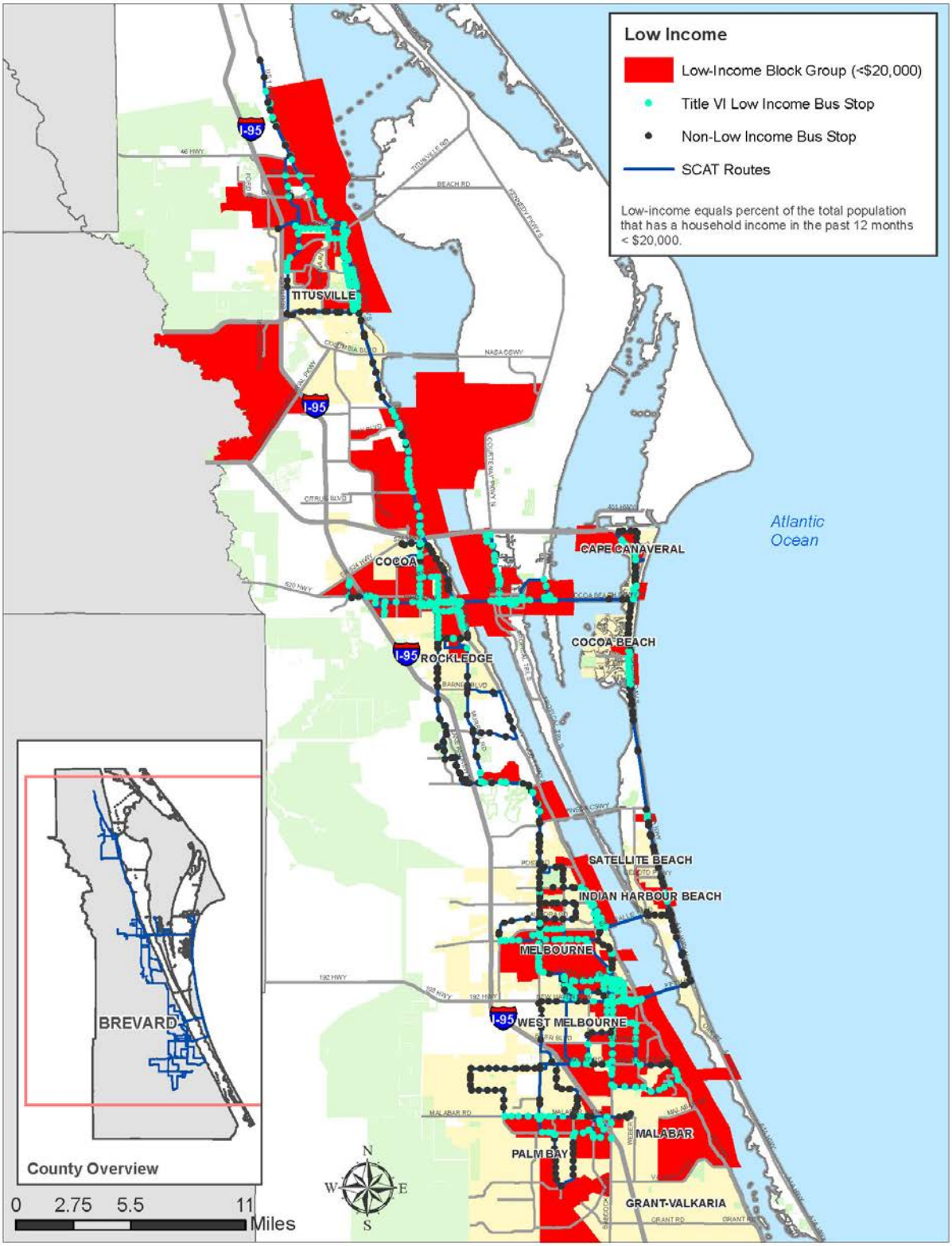
> No person in the United States shall, on the ground of race, color, or national origin, be excluded from participating in, or denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. The grantee must ensure that federally supported transit services and related benefits are distributed in an equitable manner. *(Source: FTA Triennial Review Workbook, FY 2008)*

To review Title VI compliance, a GIS-based analysis of SCAT's service area was completed to assess the comparative nature and distribution of the proposed bus stop improvements with regard to both minority and non-minority portions of the service area.

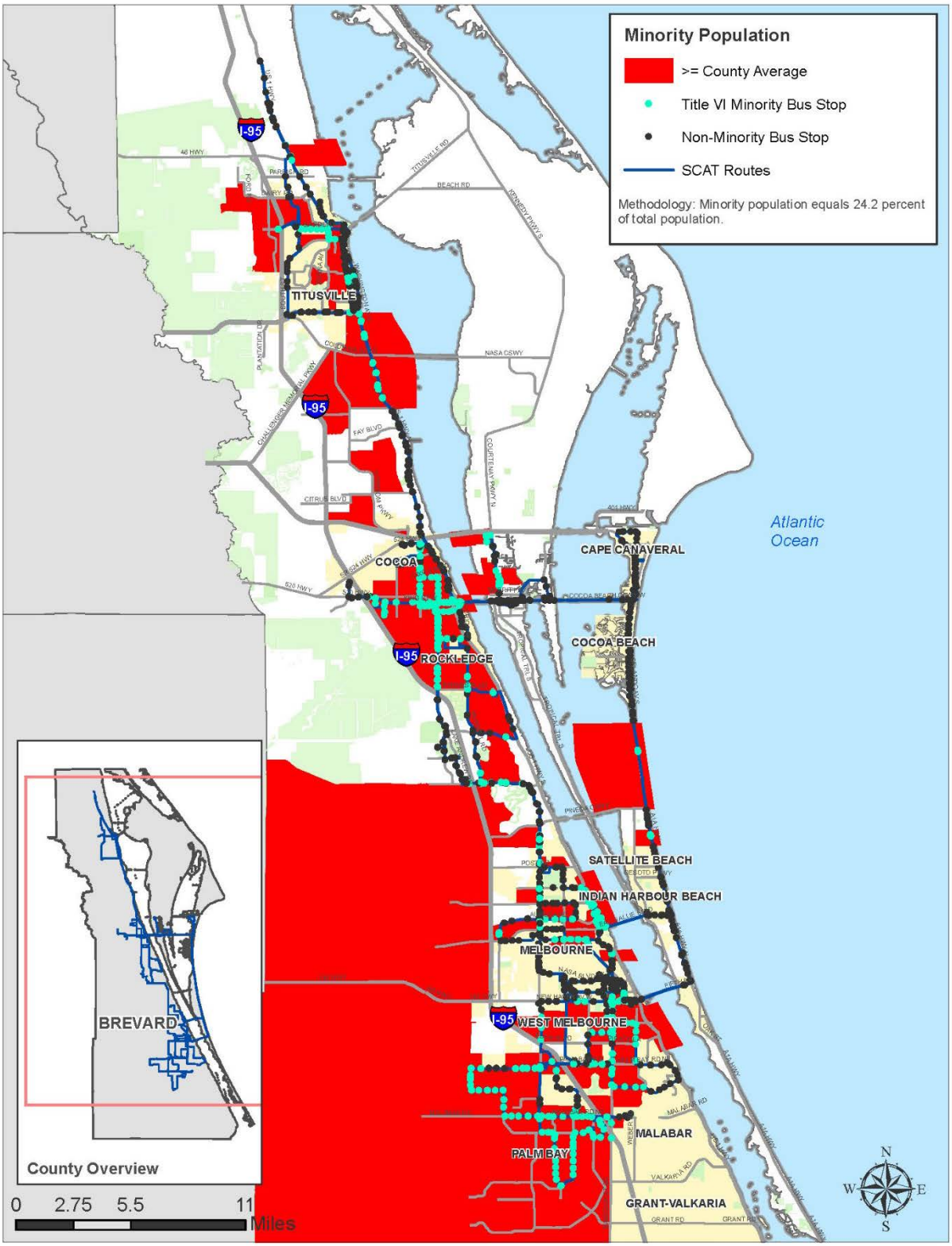
Estimates from the 2012–2016 American Community Survey (ACS) were used to identify and compare the proportion of the population that is minority (county-wide and by Census block group). The assessment was extended to include low-income communities as defined by the proportion of households with an income less than $20,000. Areas with incomes below the poverty level and/or the percent minority populations higher than the county average were selected as Title VI areas. **Map 4-1** and **Map 4-2** illustrate the resulting Title VI areas within Brevard County.

Based on this analysis, 54.9 percent of the bus stops are located in Title VI low-income areas and 36.4 percent are located in Title VI minority areas. Overall, 68 percent of the bus stops are located within a Title VI area (low-income and/or minority). The implementation plan calls for improvements to be made to 96.7 percent of bus stops; 69.2 percent of these bus stops are located in Title VI areas. Based on this review, it was concluded that the implementation program is in compliance with Title VI requirements.

Map 4-1: Brevard County Low-Income Title VI Areas



Map 4-2: Brevard County Minority Population Title VI Areas



Section 5

DATA ANALYSIS RESULTS

Following the data collection and quality control stages, attributes collected for each bus stop were compiled into individual summary forms, with definitions and summary forms, sorted by identification number; rank; cost, and municipality, provided under separate covers in Appendix B, C, and D. The individual data elements were then analyzed to determine the number of bus stops that had deficiencies, the proposed recommendations to mitigate the barriers to accessibility, and the associated costs to mitigate the accessibility issues. Shown below are the results of the analysis.

ANALYSIS RESULTS

Table 5-1 through 5-4 and **Map 5-1** summarize the results of the bus stop accessibility analysis performed for the SCTPO and SCAT.

Table 5-1: Boarding/Alighting Deficiencies

Deficiency	Number of Instances[1]
No boarding/alighting area present[2]	51
Non-compliant boarding/alighting area material	622
Slope > 2% (perpendicular to roadway)	405
Running slope > 5% (parallel to roadway)[3]	8
No raised curb[4]	417

(1) A bus stop may have more than one deficiency listed in this table.
(2) Presence of a boarding/alighting area refers to a clear area in which a person in a wheelchair could potentially access a wheelchair lift or ramp, regardless of standardized dimensions, minimal slope, elevation changes, or connections to the surrounding area. Per ADAAG, the material does not have to be concrete, but must be a firm and stable surface.
(3) If the sidewalk or boarding/alighting area has a running slope that does not match that of the roadway and it has a slope that is greater than 5%, it would be considered a ramp and would therefore be non-compliant.
(4) ADAAG does not require a raised curb to be present at a boarding/alighting area. However, the absence of a raised curb could cause the bus's wheelchair lift or ramp to have a non-complaint slope.

Table 5-2: Accessibility of Amenities

Deficiency	Number of Instances[1]
Bench inaccessible[2]	151
Bench is an obstruction[3]	51
Trash can inaccessible[2]	10
Trash can is an obstruction[3]	4
Bus schedule inaccessible[2]	256

(1) A bus stop may have more than one of the deficiencies listed in this table.
(2) An inaccessible amenity is one that is not adjacent or within reach/range of a level, firm, stable, and slip resistant surface.
(3) An amenity that is considered an obstruction is one that is blocking access to the boarding/alighting area or adjacent pedestrian infrastructure.

As the majority of the benches and trash cans are not secured to the ground, they have the potential to move over time due to bus patrons, maintenance staff, and out-of-control vehicles. As such, once positioned in an accessible location, SCAT will need to be vigilant to ensure that these amenities remain accessible.

Table 5-3: Signage

Deficiency	Number of Instances
No bus stop sign present	84
Bus stop sign present, but not properly mounted	17

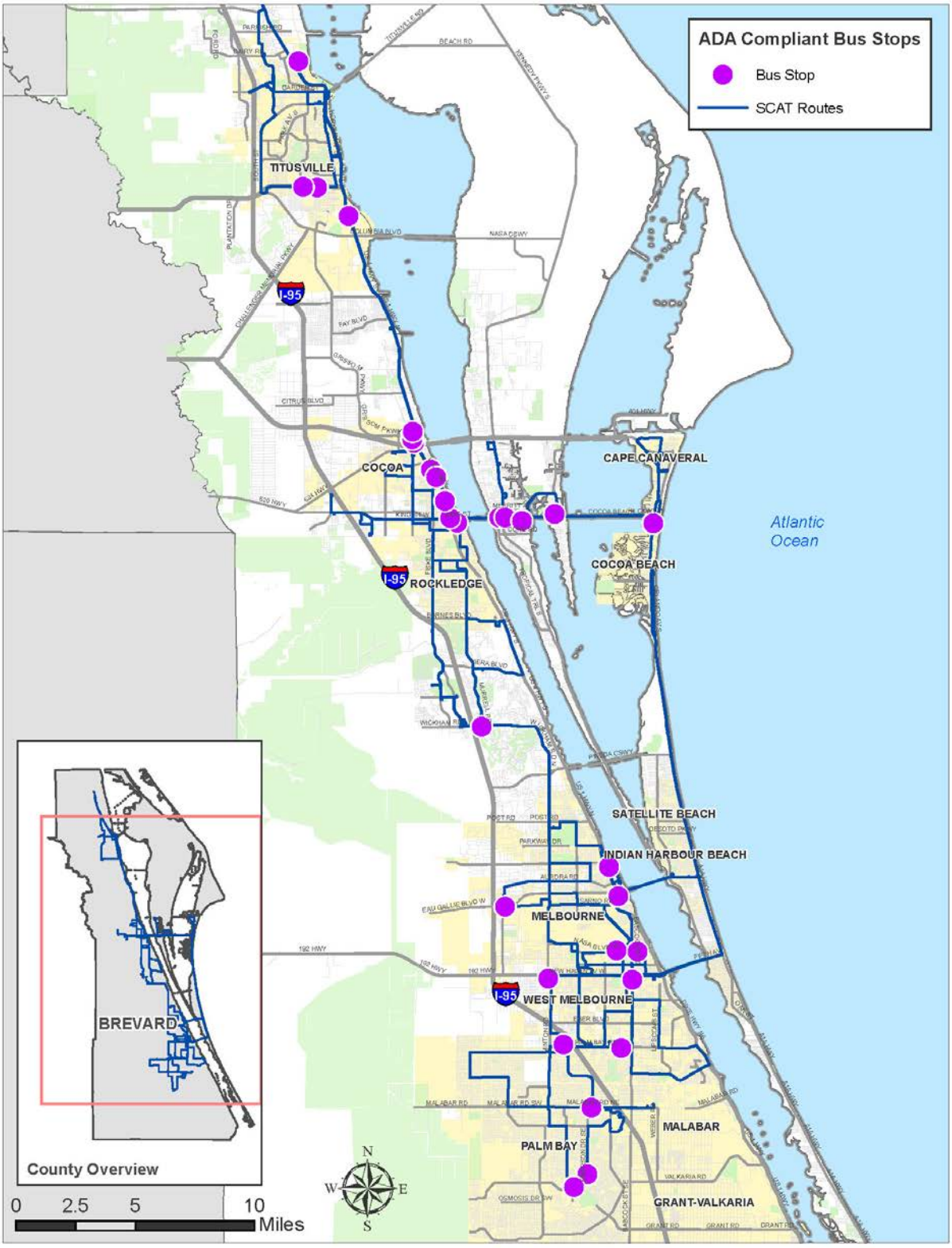
It should be noted that some locations with no signage were unable to be fully assessed, as the specific location of the bus stop was unknown. In those instances, the location was recorded as having "no bus stop sign present." However, it is possible that some of these locations are no longer being used as a bus stop, in which case there is no ADA violation since the bus stop does not exist.

Table 5-4: ADA Compliance

Description	Number of Instances
Fully ADA-compliant	32

As shown in **Table 5-4** and **Map 5-1**, a total of 32 bus stops and their adjacent accessible routes were found to be fully ADA-compliant. The boarding/alighting area, signage, and amenities were found to be fully-accessible at additional bus stops; however, in some cases, barriers to accessibility were found in the connecting pedestrian infrastructure, thereby classifying the entire stop as non-compliant. It is important to note, as described in Section 4, that the mitigation of these barriers to accessibility are not fully the responsibility of SCAT.

Map 5-1: ADA-Compliant Bus Stops



DEVELOPMENT OF IMPROVEMENT COSTS

To develop the Implementation and Financial Plan, unit costs for each type of improvement were developed. These unit costs are based on recent data from SCAT, other transit agencies, and standard industry costs when local data were not available. The cost estimates are intended to reflect the order-of-magnitude costs for SCAT's overall bus stop improvement needs.

It is important to note that the unit costs include across-the-board assumptions that will need to be reviewed prior to actual improvements being completed. For this reason, the improvement costs are referred to as "estimates of probable costs."

Table 5-5 reflects the unit costs for each type of improvement, the number of bus stops needing each improvement, and the resulting estimate of probable costs. Note that these costs are planning-level estimates; once the projects progress through design, the estimated construction costs will become more refined. To be conservative, the costs associated with mobilization, maintenance of traffic, signed and sealed plans, and clearing and grubbing are significant since they are assumed to occur as part of smaller phases of improvements over time. These costs could be reduced significantly if funding were secured to implement larger phases of improvements.

In addition, numerous bus stops were found to have potential safety/security or operational efficiency issues, such as stops located in front of a driveway or over the crest of a hill where the passengers are not in view of oncoming traffic. Relocation of the identified bus stops would provide many benefits, including correcting the potential safety hazards to passengers and/or increasing the overall operational efficiency of the bus stop. SCAT staff should carefully review the stop consolidation and relocation recommendations and these decisions also will have an impact on the estimate of probable cost.

Table 5-5: Estimate of Probable Cost Summary

Improvement	Cost	Number of Instances	Approx. Amount Recommended (sq/lf)	Approximate Cost
Relocate bus stop	$450 ea	132		$60,000
New boarding/alighting area	$1,200 ea @ 40 sf	487	19,500	$580,000
Partial boarding/alighting area	$30 per sf	806	13,300	$400,000
“Rural” boarding/alighting area	$15,000 ea	64		$ 960,000
New sidewalk/connecting path	$5 per sf (5’ wide sidewalk)	140	43,300	$650,000
Add/replace/move bus sign at stop	$250 ea	232		$60,000
Add detectable warnings	$250 ea	438		$110,000
Resurface boarding/alighting area	$1,000 ea	30		$30,000
Resurface curb ramp	$1,000 ea	21		$20,000
Raised curb	$500 ea @ 5’ long	420		$210,000
Remove cement	$1,000 ea	264		$260,000
Add curb ramp	$2,000 ea	126		$250,000
Crosswalk striping/infrastructure	$5,000 ea	11		$60,000
Relocate bench	$100 ea	178		$20,000
Other improvements				$110,000
Sub-total estimate				**$3,780,000**
Mobilization	20%			$760,000
Maintenance of traffic	10%			$380,000
Survey, design, & inspection	40%			$1,510,000
Clearing & grubbing	20%			$760,000
General conditions	10%			$380,000
CM fee	13%			$450,000
Total order-of-magnitude cost estimates				**$8,020,000**

DEVELOPMENT OF IMPLEMENTATION AND FINANCIAL PLAN

Following development of the Improvement Plan, an Implementation and Financial Plan was developed to identify when the improvements should occur based on the relative priority of the improvements and anticipated level of funding that would be available. The Implementation and Financial Plan includes all improvements that are SCAT's responsibility as well as those improvements that ultimately may be the responsibility of other entities.

Due to the nature of the short-term improvements, it is assumed that the majority of these improvements could be completed within the five-year plan, with proper funding, as provided in Appendix E.

It would be ideal if SCAT could take advantage of "piggy backing" needed bus stop improvements with planned roadway widening or resurfacing projects. This would allow SCAT to benefit either because the project directly addresses some or all needed stop improvements or the project allows SCAT to reduce its improvement costs due to concurrent construction activities. It is not known how much could potentially be saved by completing the bus stop improvements concurrent with planned transportation projects.

It should be stressed that the Implementation and Financial Plan will serve as a general guide for the planning of bus stop and facility improvements and that several factors will influence the timing for implementation of specific improvements and the overall cost of the program, including:

- Opportunities for partnering with other jurisdictions or organizations on implementing improvements.
- Specific site conditions at individual stops, including landscaping, utilities, and drainage, which could have a significant impact on the type of improvements required and the associated cost.
- Contracting opportunities, including awarding a unit-price contract for the implementation of improvements at multiple locations.
- Additional opportunities to relocate or consolidate individual bus stops.

On an annual basis, the list of needed improvements should be reviewed by SCAT staff against the funding available to develop a more specific work program. As noted previously, this will involve development of more detailed cost estimates based on a more comprehensive review of site conditions at individual bus stops. This review should take place on a timeline consistent with the SCTPO project prioritization process so changes can be reflected.

Funding Plan for Needed Improvements

Improvements to SCAT's bus stops and shelters are funded through the following agencies:

- Federal Transit Administration
- Federal Highway Administration
- Florida Department of Transportation
- Local jurisdictions

An estimated total of $150,000 is projected to be available annually to support bus stop improvements over the next five years. To prepare a funding plan, costs for all improvements were calculated and then compared to the amount of funding projected to be available over the next five years. This comparison is shown below:

Program Expenses – Total Program*	$8,020,000
Anticipated Annual Revenue:	$150,000

**Costs are planning-level estimates; once the projects progress through design, actual construction cost estimates will become more refined.*

The estimate of probable costs for the bus stop improvement program far exceeds the anticipated annual revenues, making it critically important to set priorities to achieve the best return on investment. Appendix E presents the recommended phased implementation plan for the first five years of study improvements.

Due to the limited funding currently available for bus stop improvements, the focus of improvements is largely on the short-term, lower-cost improvements. However, as the improvement program progresses, high-ranking but more costly bus stop improvements are included in future years.

This phased Implementation Plan is a guide only; the number of bus stops improved each year and the specific locations chosen for improvement may vary due to factors such as the actual cost of the improvement or potential right-of-way issues. As such, the improvements will need to be reviewed and a work program developed specifying the improvements that will be undertaken on an annual basis. It is envisioned that the effort could focus on implementation of improvements along specific corridors, which is anticipated to result in efficiencies in the improvement process.

The phased implementation plan, in coordination with the bus stop assessment database, identifies the type of improvements proposed to be undertaken for each of the first five years of the plan. The phased implementation plan and assessment database should be used in developing a specific action program for implementing the improvements on an annual basis.

(This page intentionally left blank)

Section 6

NEXT STEPS

The following is a summary of recommended next steps for SCAT to consider to ensure that the major goals of the Bus Stop and Facility Accessibility Study are achieved and maintained over time.

BUS STOP AND FACILITIES STANDARDS

- Refer to the *Accessing Transit Design Handbook* concerning the concepts of accessibility, safety/security, and operational efficiency to guide the design of new bus stops and facilities, as well as improvements to existing bus stops and facilities.

FUNDING FOR IMPROVEMENTS

- Seek additional funding for bus stop improvements.

ANALYSIS TO DETERMINE JURISDICTIONAL RESPONSIBILITY

- Conduct an analysis to determine the specific improvements that fall within the responsibility of each respective jurisdiction (Brevard County, cities, and FDOT).

ADVISE ENTITIES RESPONSIBLE FOR IMPROVEMENT NEEDS

- Based on the results of the analysis, formally advise each jurisdiction of the specific improvement needs that are within their responsibility.
- Review and update standards as necessary (as ADAAG/FAC requirements change, etc.).
- Continue to coordinate with FDOT and local jurisdictions on the development and implementation of strategies to implement accessibility improvements.

BUS STOP RELOCATION

- Conduct a comprehensive review of stops that can be relocated, using the spacing standards and ridership and bus stop inventory data.
- Continue to identify consolidation opportunities as part of roadway improvement reviews requested by other agencies, including FDOT, Brevard County, and various cities.
- Review the list of bus stops identified for relocation and determine if they should be relocated or improvements made to correct any accessibility, safety/security, or operational efficiency issues, if feasible.

SCAT TRAINING

- Review and discuss standards for bus stops and facilities on an ongoing basis to ensure that staff have an understanding of accessibility issues, requirements, and procedures.
- Review and discuss procedures and responsibilities for implementing new stops and updating the inventory on an ongoing basis.

DATABASE MAINTENANCE PROCEDURES

- Finalize procedures and staff responsibilities for keeping the inventory up-to-date and ensuring that all new bus stops implemented are in compliance with SCAT's adopted standards.
- In the future, use the updated inventory to enable customer service, service planning, and scheduling staff to access information on each stop, including photographs, list of available amenities, conditions at bus stop, and list of planned improvements.

IMPLEMENTATION SCHEDULE FOR SHORT-TERM IMPROVEMENTS

- Develop a schedule for maintenance staff to complete short-term improvements.

REVIEW IMPLEMENTATION AND FINANCIAL PLAN

- Provide to SCAT staff the specific phasing plan for use in updating the Implementation and Financial Plan on an annual basis, including developing a specific action program for implementing the improvements.
- Pursue mechanisms for increasing the efficiency with which improvements identified in the Implementation and Financial Plan are completed (i.e., pursuing unit price contracts, etc.).
- Conduct high-level coordination between the TPO, FDOT, and local jurisdictions to ensure that necessary improvements are addressed.

UPDATE INVENTORY DATABASE REGULARLY

- Update the inventory on a regular basis to reflect any revisions to routes and bus stops undertaken since completion of the initial inventory, including stops that are removed or relocated to address bus stop consolidation and/or relocation issues.

ANNUAL REVIEW OF PROGRESS

- Review the progress of addressing improvements identified in the Implementation and Financial Plan on an annual basis.
- Coordinate with local jurisdictions, FDOT, and stakeholder groups on strategies for implementing improvements.
- Update the following year's work program to reflect the new list of needed improvements.

REGULARLY REPORT PROGRESS OF IMPLEMENTATION

- Regularly report the progress of implementing improvements to SCAT's ADA Coordinator.
- Continue to coordinate with local jurisdictions, the development community, and stakeholder groups to advise them of the established standards and discuss strategies for implementing improvements.

REGULARLY UPDATE GIS ANALYSIS

- Provide updated GIS information and the results of GIS analyses conducted for SCAT bus stops to the SCTPO, local jurisdictions, and FDOT.

EXPLORE FUTURE APPLICATIONS FOR INVENTORY INFORMATION

- Explore future applications for making information from the inventory available to the public, including a list of amenities, conditions, and photographs for each bus stop, potentially tied to a system map and/or individual route maps and available via the Internet.
- Explore the feasibility of providing inventory information to the public via Google Transit.