

Appendix G Scenario Development

Memorandum

Date: December 18, 2024

To: Matthew Masa and Andrew Uhlir (Palm Beach TPA), Stewart Robertson (Kimley Horn)

Cc:

From: Ashutosh Kumar (Insight Transportation Consulting Inc.)

Subject: Scenario modeling using SERPM9 for Palm Beach Vision 2050 LRTP DRAFT

This memorandum documents the travel demand modeling results for two scenarios evaluated by the Palm Beach Vision 2050 update team. The two scenarios modeled quantify the impacts of (1) automated and connected vehicles (AV/CV), and (2) changes in commuting patterns observed after the pandemic. Insight Transportation Consulting Inc. (Insight) used the Southeast Florida Regional Planning Model (SERPM version 9) model provided by the SERPM model development team in May 2024 for modeling both scenarios.

Scenario 1: AV/CV Scenario

The purpose of this scenario is to quantify the impacts of the expected increase in roadway capacities¹ due to the anticipated (some level of) adoption of AV/CV by 2050 on travel demand. Although researchers agree that AV/CV adoption will lead to roadway capacity increase, the expected magnitude of the roadway capacity increase varies significantly among them².

Few MPOs have tried³ to model the impacts of AVs on travel demand. In these modeling efforts, the roadway capacity increase due to AV adoption was assumed to be in the range of 0% to 100% capacity increase. Within South Florida, the Regional Transportation Planning (RTP) team assumed that in the high-tech scenarios, the expressway capacities would increase by 100% and the arterial capacities would increase by 40%.

Modeled Scenario and Assumptions:

To account for a high degree of uncertainty regarding the effects of the technology, the Palm Beach LRTP team modeled two AV/CV scenarios using the following assumptions on the roadway capacities, which are within the ranges suggested in a Pooled Fund Study led by Oregon DOT in 2022⁴:

¹ <https://rosap.ntl.bts.gov/view/dot/61597>

²

https://abdulpinjari.weebly.com/uploads/9/6/7/8/9678119/abdul_pinjari_autonomous_vehicles_whitepaper_rec_ent.pdf

³ Page 8 of <https://ctr.utexas.edu/wp-content/uploads/143.pdf>

⁴ https://www.oregon.gov/odot/Planning/Documents/CAVinHCMPhase1_2_finalreport.pdf

1. **AV/CV Alternative 1 (Alt 1):** 50% increase in capacity on expressways and 33% increase in capacity on all other roadways.
2. **AV/CV Alternative 2 (Alt 2):** 25% increase in capacity on expressways and 15% increase in capacity on all other roadways.

The assumed capacity increases in the above scenarios provide two very different assumptions for scenario planning considering the high degree of uncertainty regarding the effects of future technology adoption.

Model Results:

The SERPM9 model was updated to reflect the capacities assumed for Alt 1 and Alt 2. Specifically, the *SpdCap_Lookup.DAT* file that assigns the per hour per lane capacities for different roadway classifications was modified to reflect the increased capacities. The results of the runs were compared to the SERPM9 2050 Existing Plus Committed (E+C) model run.

Table 1 shows the results from the AV/CV Alternative 1 model run, along with E+C and 2019 scenarios. The estimated congested speed in 2050 improves significantly under the Alt 1 AV/CV scenario compared to the 2050 E+C. The congestion level in this scenario is similar to the 2019 congestion levels (the average travel speed on the roadways in Palm Beach is 38 miles per hour). The vehicle hours of travel (VHT) go down by 12%, while the vehicle miles traveled (VMT) remain the same.

Compared to the E+C scenario, the average household in Palm Beach County will spend 51 fewer hours in traffic per year. Using a \$28.58 per hour value of time (FHWA⁵), this equates to approximately \$1,400 (2024 dollars) savings per household per year.

Figures 1 and 2 in the Appendix show volume over capacity (V/C) for all roadways modeled in SERPM. As can be observed, under the AV/CV Alt 1 scenario, there is a significant improvement (compared to E+C) in roadway conditions with most roadways operating below V/C of 1.

⁵ <https://ops.fhwa.dot.gov/wz/resources/publications/fhwahop12005/sec2.htm> . The document estimates travel time value of \$19.85 per vehicle-hour (2010 dollars) for local personal travel. Using an inflation factor of 1.44 (<https://www.in2013dollars.com/us/inflation/2010?amount=1>), it equates to \$28.58 per vehicle hour (2024 dollars).

Table 1: AV/CV Alternative 1 Modeling Results

	Existing (for Reference)		2050 E+C		2050 E+C with AV/CV (Alt 1)		Change (E+C with AV/CV Alt 1 vs. E+C without AV/CV)	
	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region
Vehicle Miles Traveled (1)	32,500,000	123,900,000	42,200,000	157,300,000	42,200,000	156,000,000	0%	-1%
Vehicle Hours Traveled (1)	860,000	3,580,000	1,260,000	6,930,000	1,110,000	4,440,000	-12%	-36%
Congested Speed (VMT/VHT) (2)	38	35	33	23	38	35	14%	55%
Time in Congestion Saving per Household per Year of E+C							51	215
Cost Savings per Household per Year of E+C							\$ 1,459	\$ 6,145

Notes:

- (1) Based on SERPM9 2019, SERPM 2050 E+C Runs and SERPM 2050 E+C with AV/CV Alternative 1 Assumptions
- (2) Based on the ratio of VMT and VHT estimates

Table 2 shows the results from the AV/CV Alternative 2 model run. Overall, the results are similar to Alt 1 results. The estimated congested speed in 2050 improves under the Alt 2 AV/CV scenario as well when compared to the 2050 E+C scenario. The congestion level in this scenario is similar to the 2019 congestion level. The vehicle hours of travel (VHT) go down by 10% and the vehicle miles traveled (VMT) remain the same.

Compared to the E+C scenario, the average household in Palm Beach County will spend 41 fewer hours in traffic per year. Using a \$28.58 per hour value of time, this equates to approximately \$1,200 (2024 dollars) savings per household per year.

Figure 3 in the Appendix shows volume over capacity (V/C) for the roadways modeled in SERPM. As can be observed, under the AV/CV Alt 2 scenario, there is a significant improvement (compared to E+C) in roadway conditions with most roadways operating below V/C of 1.

Table 2: AV/CV Alternative 2 Modeling Results

	Existing (for Reference)		2050 E+C		2050 E+C with AV/CV (Alt 2)		% Change (E+C with AV/CV Alt 2 vs. E+C without AV/CV)	
	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region
Vehicle Miles Traveled (1)	32,500,000	123,900,000	42,200,000	157,300,000	42,100,000	156,100,000	0%	-1%
Vehicle Hours Traveled (1)	860,000	3,580,000	1,260,000	6,930,000	1,140,000	4,710,000	-10%	-32%
Congested Speed (VMT/VHT) (2)	38	35	33	23	37	33	11%	46%
Time in Congestion Saving per Household per Year of E+C							41	192
Cost Savings per Household per Year of E+C							\$ 1,166	\$ 5,490

Notes:

- (1) Based on SERPM9 2019, SERPM 2050 E+C Runs and SERPM 2050 E+C with AV/CV Alternative 2 Assumptions
- (2) Based on the ratio of VMT and VHT estimates

The table below compares the three 2050 scenarios. Alt 1 and Alt 2 show similar impacts. The roadways under Alt 2 show slightly more congestion on the roadways – slightly higher VHT and lower congested speed.

Table 3: Comparison of Modeling Results for E+C and the two AV/CV Scenarios

	2050 E+C		2050 E+C with AV/CV (Alt 1)		2050 E+C with AV/CV (Alt 2)		% Change (AV/CV Alt 2 vs. AV/CV Alt 1)	
	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region
Vehicle Miles Traveled (1)	42,200,000	157,300,000	42,200,000	156,000,000	42,100,000	156,100,000	0%	0%
Vehicle Hours Traveled (1)	1,260,000	6,930,000	1,110,000	4,440,000	1,140,000	4,710,000	3%	6%
Congested Speed (VMT/VHT) (2)	33	23	38	35	37	33	-3%	-6%
Time in Congestion Saving per Household per Year of E+C							-20%	-11%
Cost Savings per Household per Year of E+C							-20%	-11%

Notes:

(1) Based on SERPM9 2050 E+C, AV/CV Alternative 1 and AV/CV Alternative 2 Assumptions

(2) Based on the ratio of VMT and VHT estimates

Scenario 2: Commute Scenario

In regard to work-from-home and telecommuting, SERPM9 assumes the following in 2019 and 2050 E+C models. There are separate submodels within SERPM9 framework that estimate work-from-home and work telecommute frequencies.

Table 4: SERPM 2019 and 2050 assumptions

	2019	2050 E+C	Universe
Work from Home	7.0%	7.2%	All workers
Telecommute 1 day per week	4.4%	4.5%	All workers
Telecommute 2-3 days per week	1.9%	1.8%	All workers
Telecommute 4 days per week	0.2%	0.2%	All workers
Regular commute	86.5%	86.2%	All workers

Recently, the TOMNET University Transportation Center led by Arizona State University and the National Center for Understanding Future Travel Behavior and Demand led by The University of Texas at Austin have released a new joint Data/Policy Brief summarizing trends in travel, time use, and transportation consumer expenditures in the United States⁶. With the release of 2023 data, the Brief highlights trends based on the American Community Survey (ACS), American Time Use Survey (ATUS), and Consumer Expenditure Survey, complemented by other transportation statistics. The data illustrate changes in travel, mode choice, time use, and transportation expenditure patterns over the past decades, with key implications for transportation modeling and planning in a “new normal”. The analyses of the ACS suggest that

⁶ <https://tbd.ctr.utexas.edu/research-product/emerging-travel-behavior-insights-from-2023-national-surveys/>

work from home continues to decline since the high of 17.9% of all workers in 2021 during the height of the pandemic. In 2023, the work-from-home percentage stood at 13.8% compared to 5.7% in 2019. Recent trends from employers indicate that work from home is expected to continue to decline, although it will most likely remain higher than pre-COVID level. It should be noted that due to its wording, the ACS question, which relies on respondents discerning their “usual” commute mode, has become less meaningful in an era of hybrid work patterns and increasingly variable work schedules.

Table 5: United States Commuting Profile: 2019-2023, American Community Survey, One-Year Estimates 2019-2023

Share of Workers by Means of Transportation

Mode	2019	2020 Experimental	2021	2022	2023
Drive Alone	75.9%	69.0%	67.8%	68.7%	69.2%
Carpool	8.9%	7.9%	7.8%	8.6%	9.0%
Transit	5.0%	3.2%	2.5%	3.1%	3.5%
Other Means	4.5%	4.1%	4.1%	4.4%	4.4%
Work-at-Home	5.7%	15.8%	17.9%	15.2%	13.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Charles Purvis, CTPP News Forum

ATUS does a better job of capturing hybrid workers and occasional telework participants than the ACS. It provides the share of respondents (18- to 65-year-old full-time workers) who worked exclusively at home on the survey day. The ATUS indicates that the work from home and telecommuting continues to decline from the high of 27% in 2021 during the height of the pandemic. In 2023, the work-from-home percentage stood at 21.6% compared to 7.8% in 2019.

Researchers at the Georgia Institute of Technology⁷ estimated that the expected post-COVID teleworking frequency is 2.6 to 3.3 times that of pre-COVID levels. Within South Florida, the RTP team did not change the work-from-home assumptions but increased the telecommute frequency from 6.5% to ~14% for resiliency scenarios and to ~21% for high-tech scenarios.

Modeled Scenario and Assumptions:

The Palm Beach LRTP team modeled the commute scenario based on expectations that both the work-from-home and the telecommuting will continue to be at a higher level than pre-COVID. Overall, the assumption is that 31% of the workers will have some kind of work-from-home or telecommuting arrangement (compared to 14% before the pandemic) in 2050. A comparison of the assumptions is documented below.

⁷ “Teleworking behavior pre-, during, and expected post-COVID: Identification and empirical description of trajectory types”, October 2023. Accessed October 10, 2024 <https://www.sciencedirect.com/science/article/pii/S2214367X23000790#:~:text=Mohammadi%20et%20al.,do%20so%20in%20the%20future.>

Table 6: Work from Home and Telecommuting Assumptions in the Commute Scenario Modeling

	2050 E+C	2050 E+C with Commute Scenario	Universe
Work from Home	7.2%	11%	All workers
Telecommute 1 day per week	4.5%	12%	All workers
Telecommute 2-3 days per week	1.8%	5%	All workers
Telecommute 4 days per week	0.2%	3%	All workers
Regular commute	86.1%	69.1%	All workers

Model Results:

The SERPM9 model was updated to reflect the commute scenario assumptions. Specifically, the constants in the work_from_home.csv and telecommute_frequency.csv files were updated. In the work_from_home.csv file, the util_calib_ft and util_calib_pt used for SERPM calibration were changed from -0.8267 and -1.5713 to -0.4 and -0.9 to increase the work-from-home commute. In the telecommute_frequency.csv file, the calibration utils, 1_day_week, 2_3_days_week, and 4_days_week were changed from -4, -4.25, and -6 to -2.75, -3, and -3.5 respectively.

The majority of the trips in the region are non-work related. Work trips constitute only 14% of overall trips in the region. As such, the higher telecommuting assumption results in a small (1.7%) reduction in daily trips from Palm Beach County.

Table 7 shows the results from the Commute Scenario model run, along with the 2050 E+C and 2019 scenarios. The overall estimated congested speed in 2050 will improve by 4% under the Commute Scenario compared to the E+C. The vehicle hours of travel (VHT) go down by 5%, and the vehicle miles traveled (VMT) go down by 2%.

Compared to the E+C scenario, the average household in Palm Beach County will spend 22 fewer hours in traffic per year. Using a \$28.58 per hour value of time (FHWA), this equates to approximately \$600 (2024 dollars) savings per household per year.

Figure 4 in the Appendix shows volume over capacity (V/C) for the roadways modeled in SERPM. As can be observed, under the Commute Scenario assumptions, there is some improvement (compared to E+C) in roadway conditions when compared to the E+C scenario (Figure 1).

Table 7: Commute Scenario Modeling Results

	Existing (for Reference)		2050 E+C		2050 E+C with Commute Scenario		% Change (E+C with Commute Scenario vs. E+C without AV/CV)	
	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region	Palm Beach	Tri-County Region
Vehicle Miles Traveled (1)	32,500,000	123,900,000	42,200,000	157,300,000	41,400,000	154,600,000	-2%	-2%
Vehicle Hours Traveled (1)	860,000	3,580,000	1,260,000	6,930,000	1,200,000	6,140,000	-5%	-11%
Congested Speed (VMT/VHT) (2)	38	35	33	23	35	25	4%	11%
Time in Congestion Saving per Household per Year of E+C							22	68
Cost Savings per Household per Year of E+C							\$ 631	\$ 1,952

Summary

As part of the scenario planning process, the Palm Beach LRTP team quantified the impacts of two AV/CV scenarios and one commute scenario using SERPM9.

The results from the AV/CV scenarios indicate that with the adoption of AV/CV and expected increase in roadway capacities, the congestion level on roadways within Palm Beach County in 2050 will be similar to the 2019 congestion levels even with the continued population and employment growth in the county.

Commute scenario (modeled independently without any AV/CV adoption assumption) suggest that even with the higher (compared to pre-COVID levels) expected work from home and telecommuting trend, the reduction in overall vehicle trips within the county will be small and hence the improvement in roadway congestion levels will be limited. This is because commute travel represents only 14% of all travel that occurs in the South Florida region.

Appendix: Volume over Capacity Plots for Different Scenarios

2050 E+C Scenario: Volume over Capacity (VC) Plot

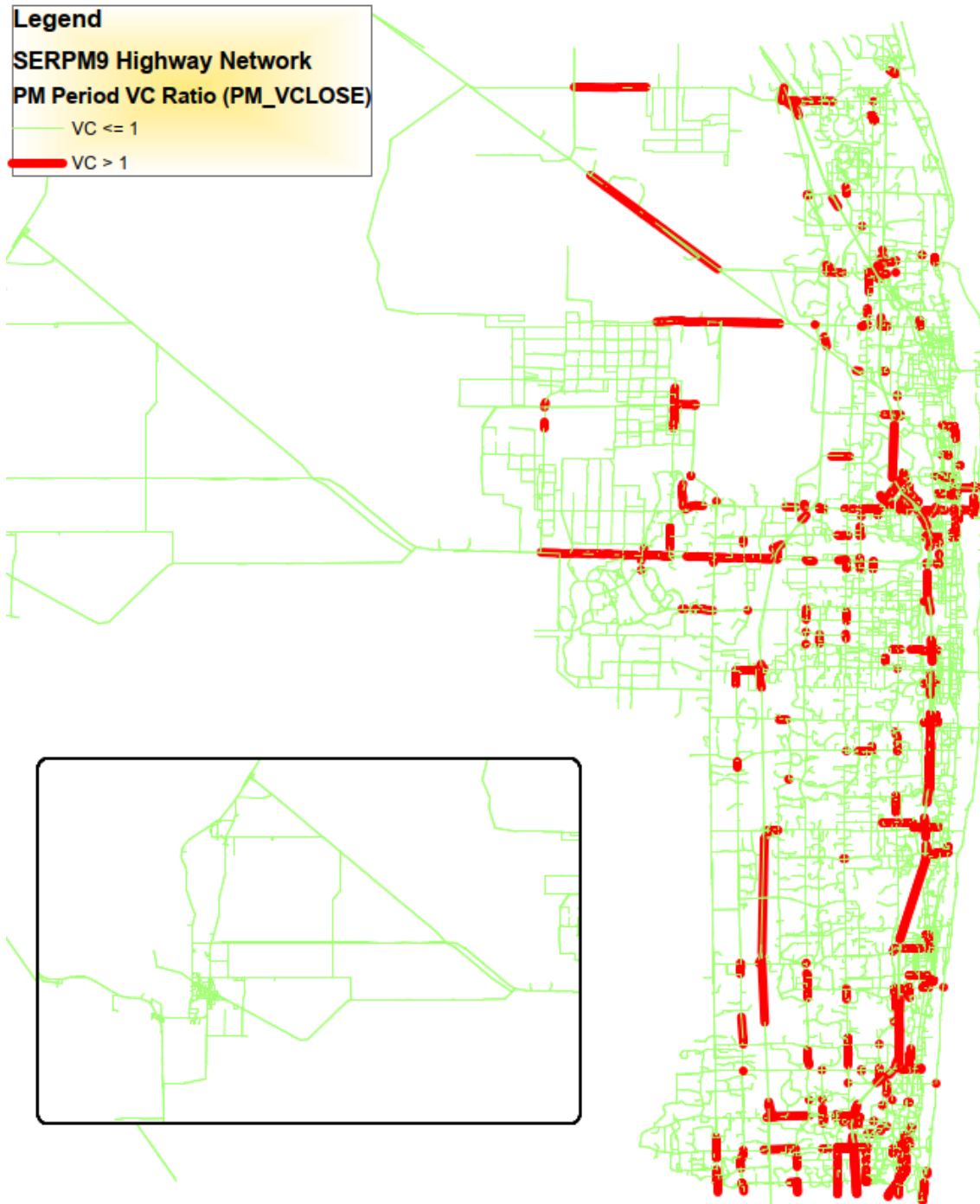


Figure 1: 2050 E+C – Volume over Capacity Plots (PM Period, LOSE Capacities Coded in SERPM9)

AV/CV Alternative 1: Volume over Capacity (VC) Plot

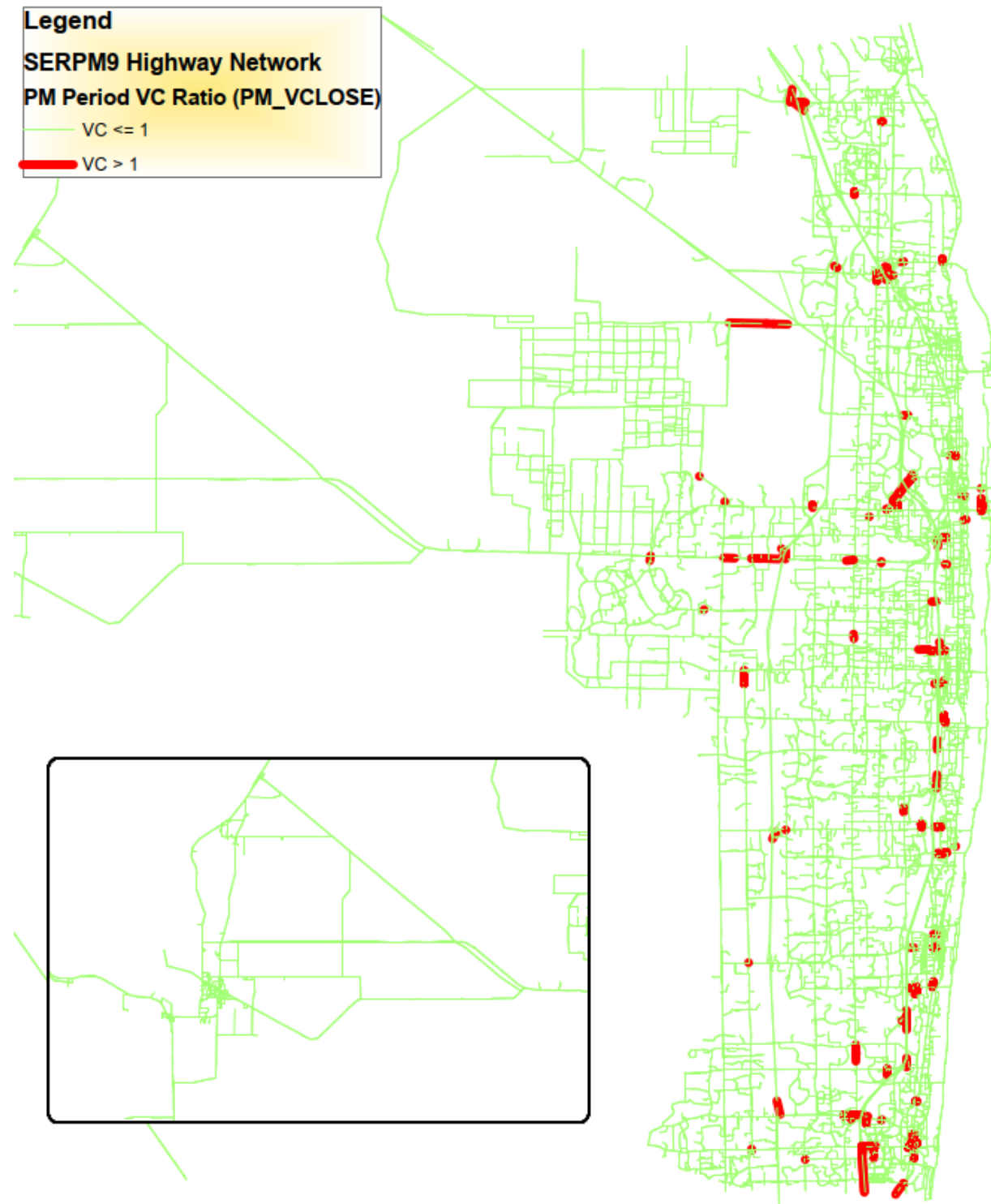


Figure 2: 2050 E+C with Alt 1 AV/CV Assumptions – Volume over Capacity Plots (PM Period, LOSE Capacities Coded in SERPM9)

AV/CV Alternative 2: Volume over Capacity (VC) Plot

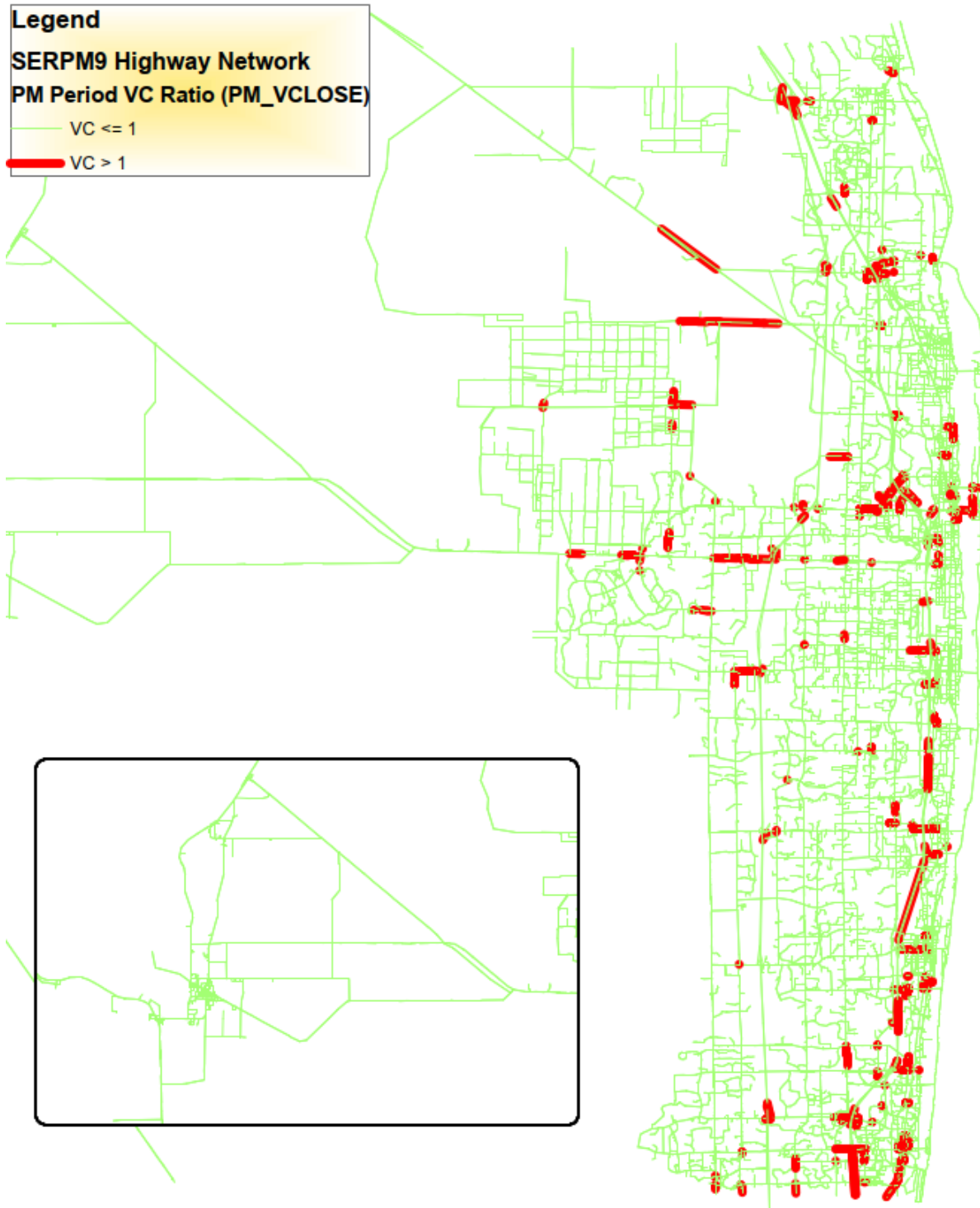


Figure 3: 2050 E+C with Alt 2 AV/CV Assumptions – Volume over Capacity Plots (PM Period, LOSE Capacities Coded in SERPM9)

Commute Scenario: Volume over Capacity (VC) Plot

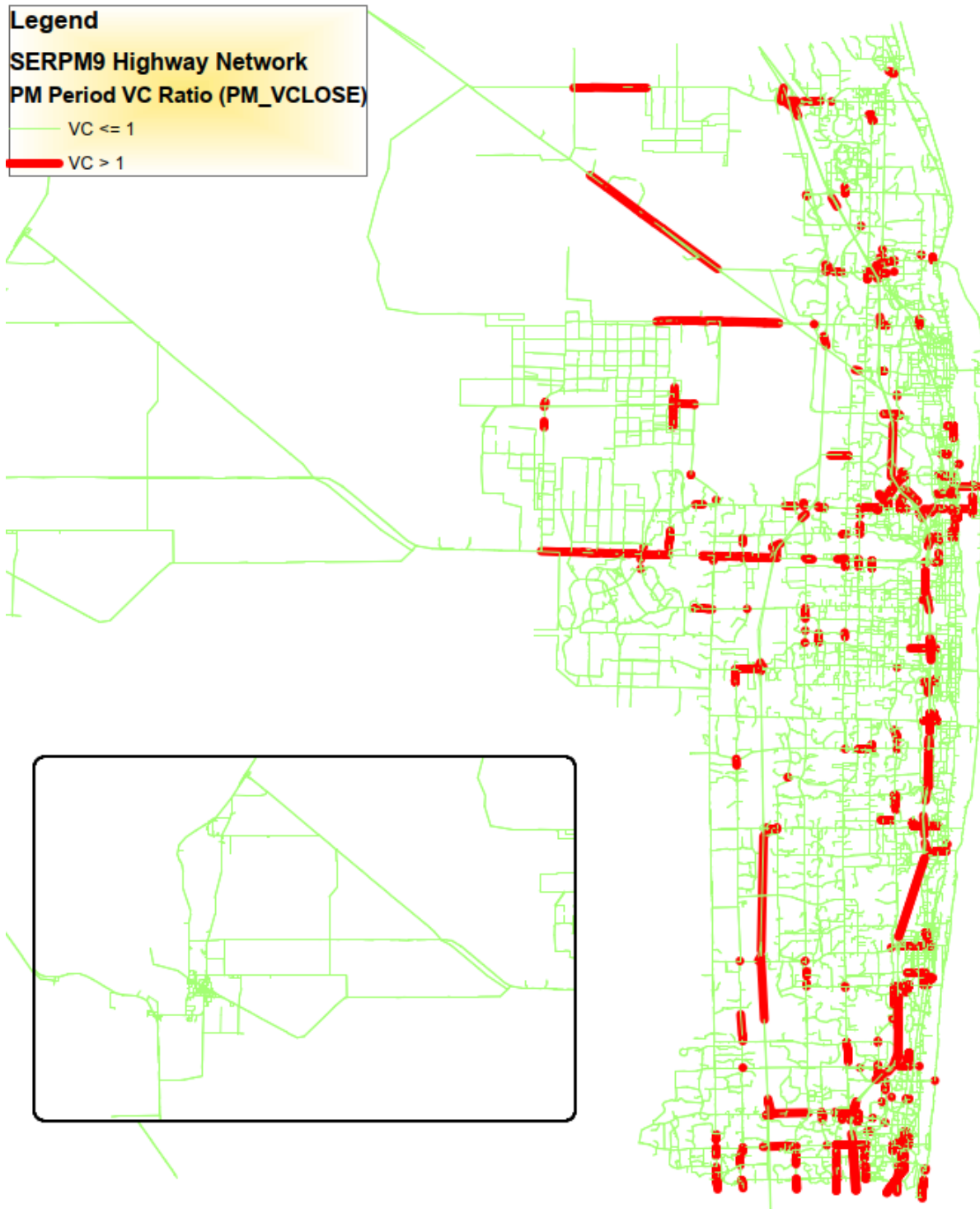


Figure 4: 2050 E+C with Commute Scenario Assumptions – Volume over Capacity Plots (PM Period, LOSE Capacities Coded in SERPM9)

Memorandum

Date: December 18, 2024

To: Palm Beach Transportation Planning Agency

Cc: Stewart Robertson, Kimley Horn

From: Insight Transportation Consulting Inc.

Subject: Transit Demand Forecasts for Desires Plan of Vision 2050 LRTP (DRAFT)

Insight Transportation Consulting Inc. (Insight), as part of the Kimley Horn team, implemented Simplified Trips on Project Software (STOPS) for Palm Beach County (PBC) and developed ridership forecasts for several transit scenarios, including a “Desires” scenario containing transit projects ranging from local bus improvements, bus rapid transit, light rail transit, and commuter rail. The analysis is conducted to support the development of Palm Beach Transportation Planning Agency’s (TPA) Vision 2050 Long Range Transportation Plan (LRTP). This memorandum describes the STOPS model settings and calibration, as well as the 2050 ridership forecasts for enhanced transit corridors across Palm Beach County.

The analysis and results presented here provide an estimate of ridership potential and should be used only for planning purposes and for project prioritization. The estimates should not be used for detailed corridor-level or project-level planning since detailed service plans, service operating patterns, and station locations are yet to be determined for several premium transit corridors. For this forecasting effort, assumptions are made on service plans which are documented in this memorandum.

A. Palm Beach STOPS Inputs and Parameters

1. STOPS Set up and Model Years

STOPS version 2.52 is implemented with a synthetic approach that utilizes the Census Transportation Planning Products (CTPP) Journey-to-Work flows and route-level ridership counts to estimate average weekday transit trips within Palm Beach County as well as Broward and Miami-Dade counties. The model is calibrated to the 2023 conditions and the horizon year is set to 2050. The latest 2020 and 2050 population and employment data at the Traffic Analysis Zone (TAZ) level for Palm Beach County was obtained from the TPA and from Southeast Florida Regional Planning Model (SERPM) version 9.0 for Broward and Miami Dade counties.

2. Transit Network

STOPS uses the General Transit Feed Specification (GTFS) format to define the transit network. The “Existing” network in Palm Beach STOPS model includes the September 2023 GTFS data for Palm Tran, South Florida Regional Transportation Authority (SFRTA) / Tri-Rail including shuttles, and Broward County Transit (BCT) systems. For Miami Dade County, the 2019 GTFS data for Miami-Dade Transit (MDT) and Miami municipal buses are used since more recent ridership data isn’t readily available to the team.

The “No-Build” network includes the Brightline inter-city service in addition to the fixed route transit services in the “Existing” network. The “Build” network includes 2050 Desires transit projects in the county. The Palm Tran 2050 Desires plan includes premium services offered under the 561 Plan¹, new express buses, new local bus routes, and PBIA to ITC connector. The commuter rail services in the Desires plan include two additional stations on Tri-Rail, Tri-Rail VA hospital extension, and Tri-Rail Coastal Link service along the FEC tracks.

The model also includes park-and-ride lots to simulate park-and-ride access trips. Appendix A provides the list of all park-and-rides in Palm Beach County included in the model.

3. District System for Modeling

STOPS uses districts to define logical groupings of TAZs around transportation corridors. STOPS uses districts to expand CTPP Journey to Work trips based on the population and employment forecasts from regional travel demand model (SERPM 9) and to summarize ridership results. Forty (40) districts are created in the region, with smaller districts defined in Palm Beach County for a more detailed calibration and eight (8) districts each in Broward and Miami-Dade counties. Figure 1 shows the districts defined in the Palm Beach STOPS model.

¹ <https://palmbeachtpa.org/561plan/>

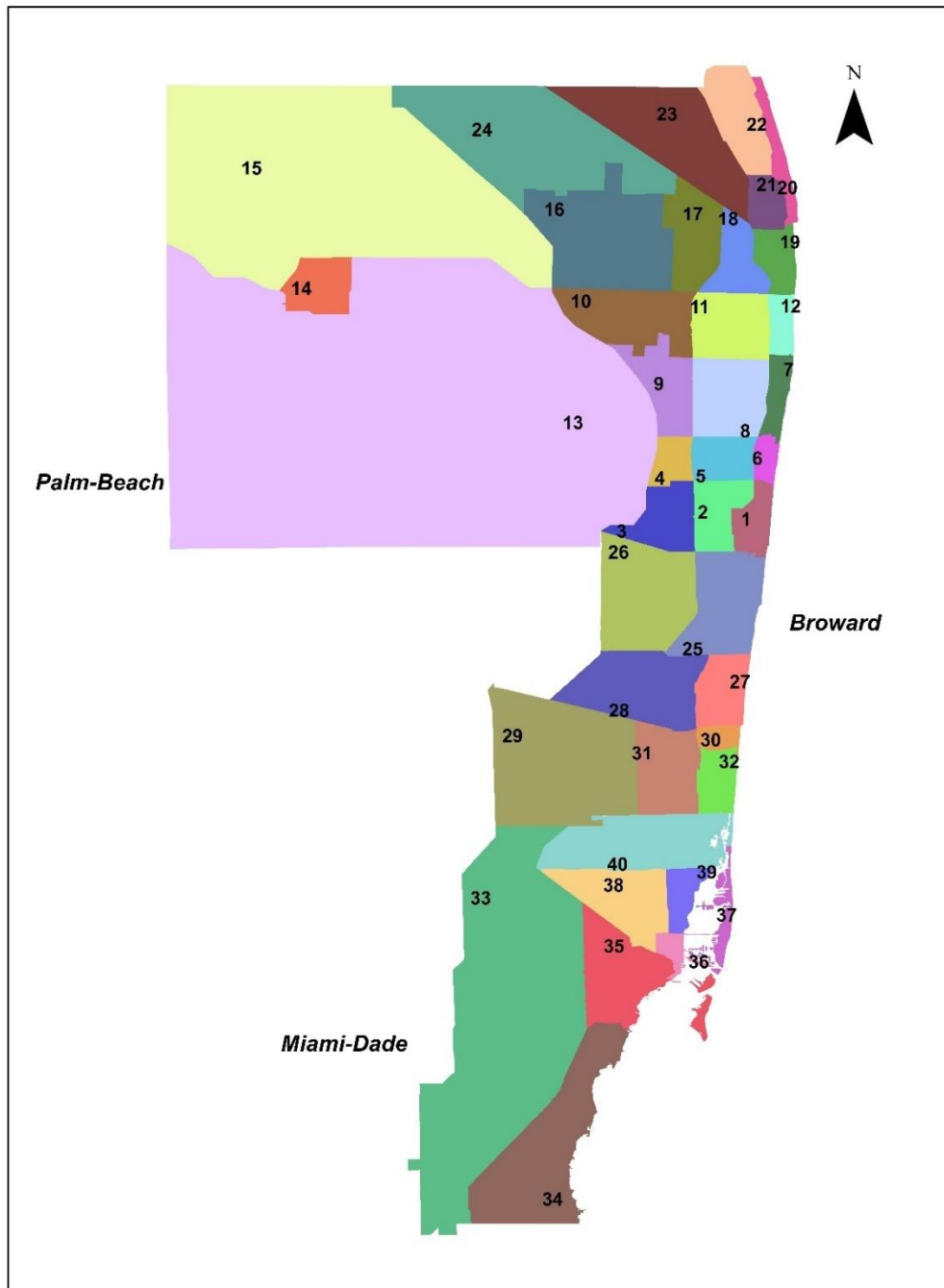


Figure 1 District Definition in the Palm Beach STOPS Model

4. MPO Auto Skims and Population and Employment Data

STOPS uses TAZ-to-TAZ current year (2023) and future year (2050) peak period automobile travel times and distances from the regional travel demand model. These skims are obtained

from the 2019 base year and 2050 projection year SERPM 9.0 model runs. This assumes that changes in the demographics and highway network between 2019 and 2023 did not have a significant impact on automobile congestion levels in the County. Note that the 2050 automobile skims represent a SERPM9 2050 Existing plus Committed run, resulting in higher roadway congestion than the congestion expected under a cost-feasible scenario. At the time of this STOPS implementation, a SERPM9 2050 cost-feasible run is not available to the team.

The latest 2020 and 2050 population and employment data at the Traffic Analysis Zone (TAZ) level for Palm Beach County is obtained from the TPA and from Southeast Florida Regional Planning Model (SERPM) version 9.0 for Broward and Miami Dade counties. The 2020 data is used as a proxy for the 2023 model. Table 1 shows population and employment by district as shown in Figure 1. Compared to 2020, the 2050 population and employment levels are expected to grow by 23% and 22%, respectively in Palm Beach County.

Table 1 Summary of district-level population and employment for Palm Beach County

District	Population			Employment		
	2020	2050	% Change	2020	2050	% Change
1-PB1	67,998	86,989	27.9	70,771	91,523	29.3
2-PB2	73,333	91,307	24.5	144,722	152,481	5.4
3-PB3	93,077	108,725	16.8	31,249	37,602	20.3
4-PB4	8,570	12,888	50.4	3,602	6,665	85.0
5-PB5	80,111	94,305	17.7	33,811	41,084	21.5
6-PB6	35,556	44,717	25.8	23,357	29,822	27.7
7-PB7	59,560	72,850	22.3	20,843	22,837	9.6
8-PB8	169,093	196,236	16.1	56,367	65,723	16.6
9-PB9	31,816	39,307	23.5	8,826	16,713	89.4
10-PB10	83,234	98,330	18.1	32,221	42,552	32.1
11-PB11	198,193	236,011	19.1	86,303	91,096	5.6
12-PB12	51,459	57,929	12.6	15,666	16,160	3.2
13-PB13	1,562	2,269	45.3	1,133	1,133	0.0
14-PB14	23,454	34,636	47.7	8,457	8,559	1.2
15-PB15	8,821	14,218	61.2	2,751	4,310	56.7
16-PB16	84,514	116,470	37.8	27,150	38,433	41.6
17-PB17	28,357	33,037	16.5	16,969	23,388	37.8
18-PB18	89,611	114,950	28.3	49,976	67,229	34.5
19-PB19	68,152	95,968	40.8	85,443	105,366	23.3
20-PB20	28,396	33,078	16.5	18,192	23,649	30.0
21-PB21	57,510	64,815	12.7	42,683	48,669	14.0
22-PB22	88,575	102,019	15.2	62,347	79,945	28.2
23-PB23	60,604	66,977	10.5	41,076	51,697	25.9
24-PB24	622	10,656	1613.2	1,308	12,284	839.1
County Total	1,492,178	1,828,687	22.6	885,223	1,078,920	21.9

The 2010 population and employment data are obtained from a previous STOPS implementation in the region that used SERPM 7 model. This 2010 data is used as a proxy for the 2008 CTPP-year data (required by STOPS).

5. Group Calibration Approach

The group calibration approach (GCA) is a key element of the STOPS internal calibration process. The group calibration approach in STOPS is set to “00 - None Selected” for initial runs to understand how STOPS can calibrate itself to local conditions using just CTPP estimates and regional unlinked trips data. As calibration was finalized, GCA “11 - OD Matrix Adj. (Route)” was also utilized to calibrate the STOPS modeled ridership against the observed route-level ridership. Since stop-level counts are not available for Palm Tran and other systems in the region, GCA 11 is used to calibrate the ridership estimates to the route level observed ridership.

The Desires plan forecasts are based on GCA 00 as it is deemed reasonable by the team based on STOPS estimation of transit travel. However, a sensitivity run is also performed using GCA 11 and is documented in this report.

6. Other Penalties

In addition to defining boarding, transfer, and zonal fare the model accounts for other contributors to impedance (e.g., fare or perceptions of the service) through penalties. An additional two-minute penalty is added to the transfers that occur between the Palm Tran routes. To reflect impedances in transferring between different transit systems, a two-minute penalty is added to Tri-Rail stations.

7. STOPS Parameters

The Full and Partial Fixed Guideway Settings (FGS) in STOPS v2.50 ensure that fixed guideway systems attract higher levels of ridership than predicted solely based on the service attributes. The Full and Partial FGS are set to 1 and 0.5. The partial FGS is applied to GTFS route type “0” in STOPS including 561 Plan BRT corridor routes and PBIA to ITC streetcar connector. The full FGS is applied to GTFS route types “1” and “2” in the model which includes Brightline, Tri-Rail, Tri-Rail Coastal Link, Metrorail, Metromover, and Miami People Mover services. Sensitivity runs are also performed using different FGS settings and the results are documented in the Sensitivity Analysis section.

The walk weight factor representing the perceived amount of difficulty in walking to/from a transit stop is set to a default value of 1.0. Additionally, the ‘KNR Transit’, ‘PNR Transit’, are ‘PNR Bus’ settings are set to 0.5, 1.0, and 1.5 (default value being 1.0) to match the existing share of ridership by access mode. The transfer penalty in the model is set to 7.5 minutes (STOPS default being 5 minutes).

B. Palm Beach STOPS Planning Model Calibration

1. Observed Data for Calibration

The synthetic STOPS approach requires CTPP flows and observed ridership counts to estimate average weekday transit travel patterns. The observed ridership (i.e., Average Weekday Unlinked Trips) for Palm Tran is obtained from the Quarter 1 2024 American Public Transportation Association (APTA) ridership report. The unlinked trips on Palm Tran are approximately 28,100 on an average weekday. Similarly, the Quarter 4 2023 APTA report suggests approximately 13,300 boardings on the Tri-Rail. For other transit systems in the three-county region, a total of 361,495 unlinked trips is used as the target based on various ridership data sources. Combined, the regionwide average weekday unlinked trip target is set at 402,895 in STOPS. Table 2 shows the observed average weekday boardings and totals used in the model.

Table 2 Observed Average Weekday Regionwide Ridership

Agencies	Observed Ridership	Source
Palm Tran	28,100	Quarter 1 2024 APTA ridership
Tri-Rail	13,300	Quarter 4 2023 APTA ridership
Other South Florida Transit Systems (Tri-Rail Shuttles, Miami Dade Transit, Broward County Transit and Miami Municipal Buses)	361,495	Various sources (BCT: December 2023 BCT ridership report, Miami Dade: Quarter 2, 2019 to be consistent with the GTFS network used for Miami Dade)
Regional Total	402,895	

For all systems, the route level targets are also developed by scaling the 2019 route level ridership available from a previous implementation of STOPS for Broward County to the observed ridership counts shown in the above table.

2. Calibration Results

Without calibration, STOPS estimates 410,997 transit boardings in 2023, which is slightly higher than the observed ridership of 402,895 trips. This results in a regional calibration factor of 0.98 to match the unlinked trip observed ridership. After adjustment at the regional level, STOPS is able to match the regional target of 402,895 as shown in Table 3. At a system level, the boardings on Palm Tran routes are higher by approximately 20%, and on Tri-Rail, it is low by 20%. STOPS estimates an overall transfer rate of 43% (ratio of unlinked and linked transit trip estimates of 410,997 and 287,484 respectively).

Table 3 Observed vs. Estimated Ridership by Agency – No Group Calibration

Agencies	Observed	2023 Estimated (Model)
<i>Palm Tran</i>	28,100	33,969
Tri-Rail	13,300	10,744
Other South Florida Transit Systems	361,495	358,181
<i>Regional Total</i>	402,895	402,895

Table 4 shows a detailed comparison of linked transit trips by purpose, auto ownership, and access mode. The results are consistent with the team's expectations based on the understanding of the ridership in South Florida. Results suggest that more than 50% of linked trips are home-based work trips. Approximately half of all transit trips in the region are made by households (HH) that do not own a car. Additionally, 85% of the trips are walk access trips. Approximately 9% of the trips are park-and-ride access, predominantly to Metrorail and Tri-Rail systems.

Table 4 Regional Linked Transit Trips Estimated by STOPS, Classified by Trip Purpose, Car Ownership, and Access Mode

Classification Type	Levels	Linked Transit Trip	% of Total Trips by Type
Trip purpose	Home-based Work	148,316	53%
	Home-based Other	100,260	36%
	Non-home based	33,238	12%
Car ownership	Zero-Car HH	136,907	49%
	1-Car HH	77,707	28%
	2+-Car HH	67,201	24%
Access mode	Walk Access	240,312	85%
	Drop off Access	17,361	6%
	Park and Ride Access	24,141	9%

When Group Calibration Approach 11 is used, STOPS is able to match observed ridership more accurately at system and route levels to the given ridership targets. Table 5 shows the observed and estimated ridership comparison with Group Calibration Approach 11.

Table 5 Observed vs. Estimated Ridership by Agency – Group Calibration Approach 11

Agencies	Observed	2023 Estimated (Model)
<i>Palm Tran</i>	28,100	27,912
Tri-Rail	13,300	11,327
Other South Florida Transit Systems	361,495	363,595
<i>Regional Total</i>	402,895	402,835

C. Ridership Forecasts for Desires Plan

3.1. Projects included in Desires Plan

The 2050 Desires Plan transit projects coded in STOPS for modeling ridership are listed in Appendix 2. The plan includes premium services offered in the 561 Plan corridors, new express buses, new local bus routes, improvements to the existing local bus service frequencies, and Palm Beach International Airport (PBIA) to Palm Beach Intermodal Transfer Center (ITC) connector. The commuter rail service expansion in the Desires Plan includes two additional stations on Tri-Rail within the current service alignment, Tri-Rail VA Hospital extension, and Tri-Rail Coastal Link (TRCL) service along the Florida East Coast Railway (FEC) tracks.

For modeling purposes, the following service plan assumptions are made:

- All premium transit services under the 561 Plan are modeled as fixed guideway BRT.
- All premium transit services under the 561 Plan are assumed to operate at a 15-minute frequency throughout the day.
- The underlying local bus in the corridors in which the premium transit service operates is assumed to run at a 60-minute service frequency throughout the day.
- The travel speeds on the premium service in the 561 corridors are assumed to range between 18 and 20 mph. This represents an increase of approximately 20% to 30% compared to the current travel speeds of the corridor local buses.
- Express buses are assumed to provide direct service from a park-and-ride to a destination in the peak direction and during the peak periods only. Please note that these model runs do not include the express buses from WestLake.
- Tri-Rail Coastal Link and Tri-Rail service are assumed to operate at a headway of 30 minutes during the peak periods and 60 minutes during the off-peak periods.
- The station spacing on the 561 Plan premium transit services is approximately half a mile.

3.2 Ridership Forecasts

Table 6 shows the 2050 forecasts under No Build and Build conditions. No Build scenario represents a 2050 scenario with existing transit service, 2050 land use, and auto congestion levels from a 2050 E+C SERPM9 run. The Build scenario represents a transit network that includes the Desires Plan projects for Palm Beach County. The 2050 No Build forecasts suggest an approximately 37% increase in boardings on Palm Tran routes. If all the projects in the Desired Plan are implemented, the forecasts suggest an approximately 80% increase in the Palm Tran systemwide boardings. The boardings on the commuter rail stations served by Tri-Rail and TRCL in Palm Beach County are expected to increase by 146% compared to the existing commuter rail ridership levels in the County.

Overall, the boardings in Palm Beach County increases by 86% in the 2050 Desires Plan scenario compared to the existing ridership levels.

Table 6 Ridership Forecasts by Agency (STOPS Group Calibration Approach 0)

Agencies	2023 Estimated (Model)	2050 No Build	2050 Desires Plan
<i>Palm Tran</i>	33,969	44,747	61,151
<i>Tri-Rail & TRCL (Stations in Palm Beach County)</i>	3,709	6,082	9,125
<i>Tri-Rail & TRCL (Stations in Other Counties)</i>	7,035	13,074	33,223
<i>Other South Florida Transit Systems</i>	358,181	499,534	493,000
<i>Regional Total</i>	402,895	563,434	596,756
<i>Percent Change compared to Existing (Palm Tran + PBC Commuter Rail)</i>		+35%	+86%
<i>Percent Change compared to Existing (Regionwide)</i>		+40%	+48%

Table 7 summarizes the ridership for Palm Tran and Tri-Rail/TRCL. Compared to the No Build, the ridership on the Palm Tran local bus service is estimated to decrease by approximately 38% under the 2050 Desires Plan scenario. This decrease on the local buses is due to the substantial ridership moving to the premium services offered by the 561 Plan. The nine premium corridors in the 561 Plan are expected to serve more than 30,000 boardings on an average weekday.

Similarly, the ridership on the commuter rail system (Tri-Rail and TRCL services combined) is expected to increase by 146%. Due to some competition between the commuter rail services on the two tracks, ridership on the existing Tri-Rail stations decreases as better service is offered along FEC tracks for several existing Tri-Rail riders. Overall, the model is sensitive to the auto congestion levels assumed in the model, especially in Miami-Dade County. Since the model run presented in Table 6 assumes auto congestion levels if only existing plus committed roadway projects are implemented in 2050, the automobile mode is likely under-represented in the model. The Sensitivity scenario #2 presented in the Sensitivity Analysis section of this report quantifies the impacts of assumed auto congestion level on the commuter rail ridership.

Table 7 Ridership Summary by Service/Mode Offered within Palm Beach County

Service	Mode	2023 Model Estimate	2050 No Build	2050 Desires Plan
Palm Tran	Local Bus	33,969	44,747	27,330
Palm Tran	Planned New Local Bus	-	-	3,308
Palm Tran	561 Plan Premium Transit	-	-	30,292
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	3,709	6,082	9,125
Other Services	Trolley, Streetcar, Express Bus	-	-	475
<i>County Total</i>		37,678	50,829	70,530

D. Sensitivity Analysis

The team also performed a sensitivity analysis to understand the impacts of various assumptions in modeling the Desires Plan.

Scenario 1: Underlying local bus routes in the 561 Plan corridors operate at 30-minute headways

This scenario estimates ridership assuming the underlying local bus routes along the 561 Plan corridors operate at 30-minute headways as opposed to 60-minute headways assumed in the Desires Plan run presented in the previous section. In this scenario, the headways are updated for eight (8) local bus routes (Palm Tran Routes 1, 2, 3, 46, 62, 73, 81, and 91). Results illustrated in Table 8 suggest 2,095 additional trips in this scenario compared to the 2050 Desires Plan run.

Table 8 Ridership by Agency under Scenario 1

Agencies	2050 No Build	2050 Desires Plan	2050 Scenario 1
<i>Palm Tran</i>	44,747	61,151	63,142
<i>Tri-Rail & TRCL (Stations in PBC)</i>	6,082	9,125	9,178
Tri-Rail & TRCL (Stations outside PBC)	13,074	33,223	33,261
Other South Florida Transit Systems	499,534	493,000	493,269
<i>Regional Total</i>	563,434	596,756	598,851

As expected, increasing the local bus service frequency resulted in an increase of 3,573 boardings on the local bus routes and a 1,580 decrease in boardings on the premium routes in the 561 Plan corridors operating as an overlay service (refer to Table 9).

Table 9 Ridership by Service/Mode offered within Palm Beach County under Scenario 1

Service	Mode	2050 No Build	2050 Desires Plan	2050 Scenario 1
Palm Tran	Local Bus	44,747	27,330	30,996
Palm Tran	Planned New Local Bus	-	3,308	3,215
Palm Tran	561 Plan Premium Transit	-	30,292	28,712
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	6,082	9,125	9,178
Other Services	Trolley, Streetcar, Express Bus	-	475	462
<i>County Total</i>		50,829	70,530	72,563

Scenario 2: Using existing automobile congestion levels for the 2050 scenario

In this scenario, the ridership for 2050 is estimated assuming existing automobile congestion levels in 2050. This is done by using the auto skims from the 2019 SERPM model instead of using the skims from the 2050 SERPM model run. Due to reduced auto congestion levels, automobile travel options improve for riders and hence they switch from transit to automobile. Hence, there is an estimated reduction of approximately 50,000 boardings in this scenario. Compared to the 2050 Desires Plan run, the model estimates 1% lower ridership on Palm Tran routes and 27% lower ridership on the Tri-Rail/TRCL stations within Palm Beach County (refer to Table 10).

Table 10 Ridership by Agency under Scenario 2

Agencies	2050 No Build	2050 Desires Plan	2050 Scenario 2
<i>Palm Tran</i>	44,747	61,151	60,541
<i>Tri-Rail & TRCL (Stations in PBC)</i>	6,082	9,125	6,645
Tri-Rail & TRCL (Stations outside PBC)	13,074	33,223	23,070
Other South Florida Transit Systems	499,534	493,000	452,818
<i>Regional Total</i>	563,434	596,756	543,076

The ridership on the 561 Plan corridor premium transit routes decreases by 12% compared to the 2050 Desires Plan run (refer to Table 11), while the ridership on the Palm Tran local bus routes increases by 13%.

Table 11 Ridership by Service/Mode offered within Palm Beach County under Scenario 2

Service	Mode	2050 No Build	2050 Desires Plan	2050 Scenario 2
Palm Tran	Local Bus	44,747	27,330	30,601
Palm Tran	Planned New Local Bus	-	3,308	3,162
Palm Tran	561 Plan Premium Transit	-	30,292	26,571
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	6,082	9,125	6,645
Other Services	Trolley, Streetcar, Express Bus	-	475	423
<i>County Total</i>		50,829	70,530	67,402

Scenario 3: Assuming Rapid Bus service along all 561 Plan corridors instead of BRT running in dedicated guideways

In this scenario, the partial FGS applied to route type “0” in the model for the 561 Plan corridor routes is set to 0.1 instead of 0.5 used for the Desires Plan run. A small FGS value suggests that the fixed-guideway mode is not perceived as significantly different from traditional bus service, except in terms of headway and faster travel time. An FGS of 0.1 is generally used for rapid transit

bus service that offers faster, more frequent, and limited stop service. They have limited fixed guideway facility elements. Compared to the 2050 Desires Plan run, the scenario estimates 14% lower ridership on Palm Tran routes and 6% higher ridership on the Tri-Rail/TRCL stations within Palm Beach County (refer to Table 12).

Table 12 Ridership by Agency under Scenario 3

Agencies	2050 No Build	2050 Desires Plan	2050 Scenario 3
<i>Palm Tran</i>	44,747	61,151	53,128
<i>Tri-Rail & TRCL (Stations in PBC)</i>	6,093	9,125	9,668
Tri-Rail & TRCL (Stations outside PBC)	13,105	33,223	33,235
Other South Florida Transit Systems	499,534	493,000	492,593
<i>Regional Total</i>	563,434	596,756	588,627

The ridership on the 561 Plan corridor premium transit routes decreases by 37% compared to the 2050 Desires Plan run (refer to Table 13), while the ridership on the Palm Tran local bus routes increases by 11%.

Table 13 Ridership by Service/Mode offered within Palm Beach County under Scenario 3

Service	Mode	2050 No Build	2050 Desires Plan	2050 Scenario 3
Palm Tran	Local Bus	44,747	27,330	30,314
Palm Tran	Planned New Local Bus	-	3,308	3,554
Palm Tran	561 Plan Premium Transit	-	30,292	19,042
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	6,093	9,125	9,668
Other Services	Trolley, Streetcar, Express Bus	-	475	312
<i>County Total</i>		50,829	70,530	62,890

Scenario 4: Assuming Light Rail Transit (LRT) along Okeechobee Boulevard

In this scenario, an LRT service is assumed along Okeechobee Boulevard and is coded as route type 1 in STOPS. In this scenario, the ridership on the Okeechobee Boulevard premium service increases by approximately 1,600 boardings. Compared to the 2050 Desires Plan run, the scenario estimates 13% higher ridership on Palm Tran routes and almost no change in ridership on the Tri-Rail/TRCL stations within Palm Beach County (refer to Table 14).

Table 14 Ridership by Agency under Scenario 4

Agencies	2050 No Build	2050 Desires Plan	2050 Scenario 4
<i>Palm Tran</i>	44,747	61,151	62,666
<i>Tri-Rail & TRCL (Stations in PBC)</i>	6,082	9,125	9,256
Tri-Rail & TRCL (Stations outside PBC)	13,074	33,223	33,255
Other South Florida Transit Systems	499,534	493,000	493,809
<i>Regional Total</i>	563,434	596,756	598,986

The ridership on the 561 Plan corridor premium transit routes increases by 5% compared to the 2050 Desires Plan run (refer to Table 15), most of which is in the Okeechobee Boulevard corridor.

Table 15 Ridership by Service/Mode offered within Palm Beach County under Scenario 4

Service	Mode	2050 No Build	2050 Desires Plan	2050 Scenario 4
Palm Tran	Local Bus	44,747	27,330	27,269
Palm Tran	Planned New Local Bus	-	3,308	3,301
Palm Tran	561 Plan Premium Transit	-	30,292	31,897
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	6,082	9,125	9,256
Other Services	Trolley, Streetcar, Express Bus	-	475	990
<i>County Total</i>		50,829	70,530	72,713

Scenario 5: Using Group Calibration Approach 11 in STOPS Setting

In this scenario, a group calibration approach 11 is used to forecast ridership. Compared to the 2050 Desires Plan run, the scenario estimates 17% lower ridership on Palm Tran routes and almost no change in ridership on the Tri-Rail/TRCL stations within Palm Beach County (refer to Table 16).

Table 16 Ridership by Agency under Scenario 5

Agencies	2050 No Build	2050 Desires Plan	2050 Scenario 5
<i>Palm Tran</i>	44,747	61,151	50,765
Tri-Rail & TRCL (Stations in PBC)	6,082	9,125	9,283
Tri-Rail & TRCL (Stations outside PBC)	13,074	33,223	35,370
Other South Florida Transit Systems	499,534	493,000	506,954
<i>Regional Total</i>	563,434	596,756	602,372

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The ridership on the 561 Plan corridor premium transit routes decreases by 17% compared to the 2050 Desires Plan run (refer to Table 17).

Table 17 Ridership by Service/Mode offered within Palm Beach County under Scenario 5

Service	Mode	2050 No Build	2050 Desires Plan	2050 Scenario 5
Palm Tran	Local Bus	44,747	27,330	22,712
Palm Tran	Planned New Local Bus	-	3,308	2,778
Palm Tran	561 Plan Premium Transit	-	30,292	25,078
Tri-Rail & TRCL (Stations in PBC)	Commuter Rail	6,082	9,125	9,283
Other Services	Trolley, Streetcar, Express Bus	-	475	414
County Total		50,829	70,530	60,265

E. Summary

Overall, the Palm Beach STOPS model is well-calibrated and can reasonably estimate the size of various travel markets on both bus and rail services. The calibration results and the test applications suggest that the model is adequate for developing planning level ridership estimates for transit projects in Palm Beach County. However, the model should not be used for making detailed project- or corridor-level decisions since it has not been calibrated at the corridor level.

Table 18 shows the system-level boardings under various scenarios. Ridership on Palm Tran routes is expected to increase from approximately 28,000 on an average weekday in 2023 to between 51,000 and 63,000 under the Desires Plan in 2050. The results suggest that 561 Plan routes contribute to most of the additional ridership on Palm Tran. Similarly, on the commuter rail system, the ridership will increase from 13,000 in 2023 to between 30,000 and 45,000 in 2050.

Sensitivity analysis helped provide a range of ridership that can be expected in various corridors on the premium transit service. Table 19 shows the corridor-level ridership expectations and includes boardings on both the premium service and the underlying local bus service. The results suggest that the services along US-1, Congress Avenue, Military Trail, and Okeechobee Boulevard are the most productive corridors (besides the commuter rail services).

Table 18 Summary of Expected 2050 Ridership of Desires Plan under Various Scenarios

Service	2023 Observed	2023 Model Estimate (for comparison)	2050 No Build	2050 Desires Plan	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3	2050 Scenario 4	2050 Scenario 5
Palm Tran	28,100	33,969	44,747	61,151	63,142	60,541	53,128	62,666	50,765
Tri-Rail & TRCL (Stations in PBC)	13,300	3,709	6,082	9,125	9,178	6,645	9,668	9,256	9,283
Tri-Rail & TRCL (Stations outside PBC)		7,035	13,074	33,223	33,261	23,070	33,235	33,255	35,370
Other South Florida Transit Systems	361,495	358,181	499,534	493,000	493,269	452,818	492,593	490,524	506,954
Total	402,895	402,895	563,434	596,756	598,851	543,076	588,627	598,986	602,372

Notes: Scenarios are

2023 Observed: Observed boardings (late 2023) for various agencies

2023 Model Estimate: STOPS model estimate for base year 2023

2050 No Build: A 2050 scenario with existing transit service, 2050 land use, and auto congestion levels from a 2050 E+C SERPM9 run

2050 Desires Plan: Palm Beach 2050 LRTP update transit desires plan

2050 Scenario 1: Desires Plan + Underlying local bus routes in the 561 Plan corridors operate at 30-minute headways

2050 Scenario 2: Desires Plan + Using existing automobile congestion levels for the 2050 scenario

2050 Scenario 3: Desires Plan + Assuming Rapid Bus service along all 561 Plan corridors instead of BRT running in dedicated guideways

2050 Scenario 4: Desires Plan + Assuming Light Rail Transit (LRT) along Okeechobee Boulevard

2050 Scenario 5: Desires Plan + Using Group Calibration Approach 11 in STOPS Setting

Table 19 Summary of Expected 2050 Ridership in Key Corridors under Various Scenarios

Corridor	2023 Observed	2023 Model Estimate	2050 No Build	2050 Desires Plan	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3	2050 Scenario 4	2050 Scenario 5
Atlantic Avenue	286 (Route 81)	574	809	1,625	2,109	2,013	1,063	1,625	1,381
Boynton Beach Boulevard	512 (Route 73)	407	610	1,061	1,136	1,027	828	1,059	891
Congress Avenue	2,814 (Route 2)	4,789	7,428	8,693	9,196	8,663	7,022	8,509	7,311
Forest Hill	688 (Route 46)	687	720	1,057	1,117	1,079	598	1,058	833
Glades Road	551 (Route 91)	519	737	1,331	1,519	1,416	1,092	1,331	1,386
Lake Worth	1,906 (Route 62)	1,997	2,270	2,390	2,451	2,363	1,470	2,388	1,955
Military Trail	3,501 (Route 3)	2,861	3,146	6,323	6,544	6,047	4,513	6,360	5,297
Okeechobee Boulevard	1,564 (Route 43)	2,030	3,173	4,836	4,845	4,611	3,808	6,780	3,815
US-1	6,494 (Route 1)	6,305	7,772	9,971	10,439	10,139	7,509	9,716	8,169
Tri-Rail Coastal Link Commuter Rail	--	--	--	26,840	26,858	19,184	27,067	26,907	28,008
Tri-Rail Commuter Rail	13,300	10,744	19,172	15,511	15,582	10,533	15,839	15,604	16,645

Notes: Scenarios are

2023 Observed: Observed boardings (late 2023) for various agencies

2023 Model Estimate: STOPS model estimate for base year 2023

2050 No Build: A 2050 scenario with existing transit service, 2050 land use, and auto congestion levels from a 2050 E+C SERPM9 run

2050 Desires Plan: Palm Beach 2050 LRTP update transit desires plan

2050 Scenario 1: Desires Plan + Underlying local bus routes in the 561 Plan corridors operate at 30-minute headways

2050 Scenario 2: Desires Plan + Using existing automobile congestion levels for the 2050 scenario

2050 Scenario 3: Desires Plan + Assuming Rapid Bus service along all 561 Plan corridors instead of BRT running in dedicated guideways

2050 Scenario 4: Desires Plan + Assuming Light Rail Transit (LRT) along Okeechobee Boulevard

2050 Scenario 5: Desires Plan + Using Group Calibration Approach 11 in STOPS Setting

F. List of Appendices

Appendix 1 List of Park and Ride Locations in Palm Beach County coded the Model

PNR Name	Tracks	Latitude	Longitude	PNR Type in STOPS	Agency
Mangonia Park	CSX	26.75786	-80.0769	1	SFRTA/Tri-Rail
West Palm Beach	CSX	26.7135	-80.0621	2	SFRTA/Tri-Rail
Lake Worth	CSX	26.61607	-80.0696	2	SFRTA/Tri-Rail
Boynton Beach	CSX	26.55338	-80.0712	3	SFRTA/Tri-Rail
Delray Beach	CSX	26.4542	-80.0915	3	SFRTA/Tri-Rail
Boca Raton	CSX	26.3925	-80.0993	3	SFRTA/Tri-Rail
Boca Raton	FEC	26.35389	-80.0875	3	TRCL
Delray Beach	FEC	26.46146	-80.0703	3	TRCL
Boynton Beach	FEC	26.52822	-80.0597	3	TRCL
Lake Worth	FEC	26.61527	-80.0596	2	TRCL
PBI Airport	FEC	26.67748	-80.0711	2	TRCL
West Palm Beach	FEC	26.71204	-80.0557	4	TRCL
West Palm Beach 45th St	FEC	26.75398	-80.0602	2	TRCL
Palm Beach Gardens	FEC	26.84405	-80.0956	2	TRCL
Jupiter	FEC	26.92604	-80.0942	1	TRCL
Palm Beach Airport	CSX	26.68476	-80.071	3	SFRTA/Tri-Rail
Boca Raton Glades Road	CSX	26.36705	-80.1208	3	SFRTA/Tri-Rail
W. Jupiter Recreation Ctr		26.93504	-80.133	4	Palm Tran
Gardens Mall		26.84796	-80.0823	3	Palm Tran
WPB Fire Rescue Station		26.70956	-80.1694	4	Palm Tran
Shops at Southern Palms		26.6815	-80.1836	4	Palm Tran
Lake Worth Rd/Turnpike		26.61829	-80.1725	4	Palm Tran
Wellington Green		26.64428	-80.2099	4	Palm Tran
Palms West Hospital		26.6818	-80.2514	4	Palm Tran
West Tech		26.70374	-80.6835	4	Palm Tran
Palm Beach Outlets		26.72537	-80.0845	4	Palm Tran

Appendix 2 Palm Tran and Tri-Rail 2050 Desires Projects and Map

Name	Mode (GTFS Route Type)	Terminal Station Locations	Headway (minutes)	Approx. Length (miles)
Atlantic Ave	Trolley Bus / Streetcar (0)	SE 1 st St & Federal Hwy to Atlantic Ave & Military Trail	15	4.8
Boynton Beach	BAT to BRT-Lite (0)	Bethesda Hospital West to Boynton Beach Blvd & US1	15	6.8
Congress	BRT-Lite (0)	WPB ITC to Boca Raton Tri-Rail	15	23.8
Forest Hill	BAT to BRT-Lite (0)	Forest Hill Blvd & Dixie Hwy to Wellington Mall	15	10.2
Glades Rd	Trolley Bus / Streetcar (0)	Glades Rd & US1 to Glades Rd & NW 15th Ave	15	3.3
Lake Worth	BRT to LRT (0)	Lake Ave & Dixie Hwy to Wellington Mall	15	12.5
Military Trail	BAT to BRT-Lite (0)	The Gardens Mall to Military Trail & Yamato Rd	15	34
Okeechobee	LRT (0)	WPB ITC to Wellington Mall	15	15.4
US-1	BRT-Lite (0)	The Gardens Mall to US1 & Camino Real	15	40.9
100X	Express Bus (3)	The Gardens Mall to WPB ITC	60	12.5
105X	Express Bus (3)	The Gardens Mall to Boca Raton Tri-Rail	60	34
PBIA-ITC	Streetcar (0)	PBIA to WPB ITC	15	7.5
TRCL	Commuter Rail (2)	Miami Central Station to Jupiter	30/60 (peak/off-peak)	80
Tri-Rail	Commuter Rail (2)	Miami Airport Station to VA Medical Center	30/60 (peak/off-peak)	80

