



MIAMI STOPS 2023 CALIBRATION REPORT

June 2023



**Miami-Dade Transportation
Planning Organization**





Miami-Dade STOPS 2023 Calibration

Report Prepared by:

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In association with



Report Prepared for:

Miami-Dade Transportation Planning Organization

June, 2025

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EXECUTIVE SUMMARY

This report describes the 2023 calibration of the Simplified Trips-on-Project Software (STOPS) model for forecasting transit ridership in Miami-Dade County and surrounding areas. This implementation of STOPS is designed to support ongoing planning, development, and funding applications for Miami-Dade County's Strategic Miami Area Rapid Transit (SMART) Program. Ridership forecasting for the SMART corridor projects commenced several years ago with STOPS models calibrated to match observed 2015 transit ridership. As part of the federal approval process for Bus Rapid Transit (BRT) service in the South Dade Transitway, STOPS was updated to represent observed 2017 transit ridership demand.

To continue planning in the remaining corridors, the Miami-Dade Transportation Planning Organization (TPO) began a large-scale transit ridership origin-destination survey in 2020 and planned to use this information to develop a new STOPS incremental (survey-based) forecasting model with a 2020 base year. The COVID-19 pandemic and subsequent disruption to transit ridership patterns has delayed both the survey and the model update projects. The survey was completed in Spring 2023, and the resulting incremental model is calibrated to represent observed 2023 transit ridership demand. The 2023 STOPS incremental model is based on STOPS version 2.55.

The resulting model closely matches existing ridership patterns. Both the calibration results and the model application to estimate future ridership are presented in the following tables.



CALIBRATION RESULTS

COMPARISON OF COUNTED RIDERSHIP BY ROUTE TYPE TO MODELED RIDERSHIP

ROUTE TYPE	2023 WEEKDAY RIDERSHIP COUNT	MODELED 2023 WEEKDAY RIDERSHIP
Metrobus (local)	161,446	164,391
Metrobus (express)	5,422	5,299
Metrorail	49,942	49,543
Metromover	23,470	22,279
MIAmover (airport)	4,381	4,423
Municipal Shuttles/Trolley	32,499	32,497
BCT Bus (local)	67,782	67,806
BCT Bus (express)	1,604	1,538
PalmTran Bus	24,875	24,870
Tri-Rail	13,007	13,412
Brightline*	5,151	536
Total	389,579	386,594

*Brightline counts were an approximate estimate with promotional fares.





1.0 INTRODUCTION

This report describes the 2023 calibration of the Simplified Trips-on-Project Software (STOPS) model for forecasting transit ridership in Miami-Dade County and surrounding areas. This implementation of STOPS is designed to support ongoing planning, development, and funding applications for Miami-Dade County's Strategic Miami Area Rapid Transit (SMART) Program, **Figure 1**. The SMART Program of projects includes new rapid transit service along six corridors:

- Beach Corridor
- East-West Corridor
- Kendall Corridor
- North Corridor
- Northeast Corridor
- South Dade Transitway
- Flagler Corridor as part of the bus express rapid transit (BERT) network

Ridership forecasting for these projects commenced several years ago with STOPS models calibrated to match observed 2015 transit ridership. As part of the federal approval process for Bus Rapid Transit (BRT) service in the South Dade Transitway, STOPS was updated to represent observed 2017 transit ridership demand, followed by a further update to represent 2019 demand.

In the time since the most recent 2023 update, the region has experienced significant shifts in travel patterns like those seen across the country during and after the COVID-19 pandemic; while the immediate impacts of the virus has faded, transit ridership changes persist. To continue planning in the corridors described above with these new patterns in mind, the Miami-Dade Transportation Planning Organization (TPO) began to conduct a large-scale transit ridership origin-destination survey in 2023 and planned to use this information to develop a new STOPS incremental (survey-based) forecasting model with a 2023 base year. The 2023 STOPS incremental model is based on STOPS version 2.55. The data, coding practices, calibration results, and test application results of that model are discussed in this document.





Strategic Miami Area Rapid Transit SMART Plan

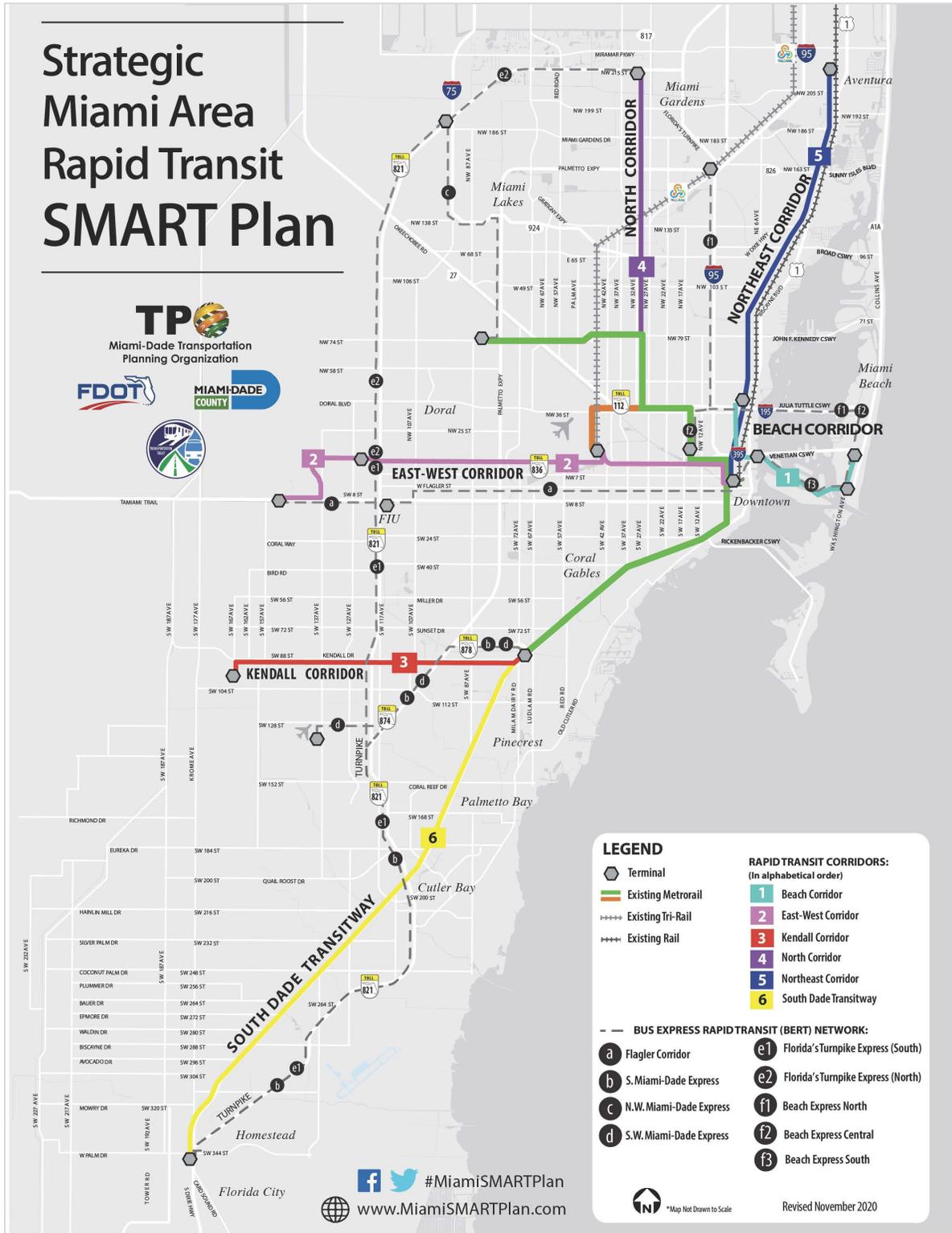


FIGURE 1: SMART PLAN MAP





2.0 NON-TRANSIT INPUT DATA

This chapter discusses the non-transit input data assembled for the STOPS model calibration. In most cases, these datasets will not require adjustment for the application of the STOPS model to forecast ridership for any project in Miami-Dade County.³

2.1 ZONE AND DISTRICT SYSTEM

The STOPS model Traffic Analysis Zone (TAZ) system is based on the TAZ system developed for the Southeast Regional Planning Model (SERPM) Version 9, the travel demand model used in Miami-Dade County and other portions of Southeast Florida. SERPM TAZs are used in lieu of the original American Community Survey (ACS) zone system file supplied by the Federal Transit Administration (FTA) to STOPS users. The use of local TAZs is often recommended by FTA and allows for an exact representation of the socioeconomic information in each SERPM TAZ to be used without allocation or aggregation to ACS zones. Local TAZs also avoid problems in coastal areas, where ACS TAZs often include large waterway areas that distort the true geography of urban travel.

The approach for using local TAZs in lieu of ACS TAZs required the following steps:

1. Obtain an ESRI Shape File delineating SERPM Version 9 TAZs and rename it to match the ACS zone filename for Florida (AC12_D00.shp).
2. Create ACS identifier fields in the accompanying .dbf file (State, County, and Tract or TAZ)
3. Overlay the original- and SERPM-based ACS files and post the State, County, and Tract/TAZ information from the original ACS zone file to the SERPM-based ACS zone file.

STOPS model aggregates groups of TAZs into Districts for the purposes of determining calibration parameters and reporting results. For this application, STOPS districts are based on the SMART planning corridors (in Miami-Dade County), barriers to circulation, and local Central Business Districts and are shown in **Figure 2** (districts in Miami-Dade County), **Figure 3** (districts in and around Broward County), and **Figure 4** (districts in and around Palm Beach County).



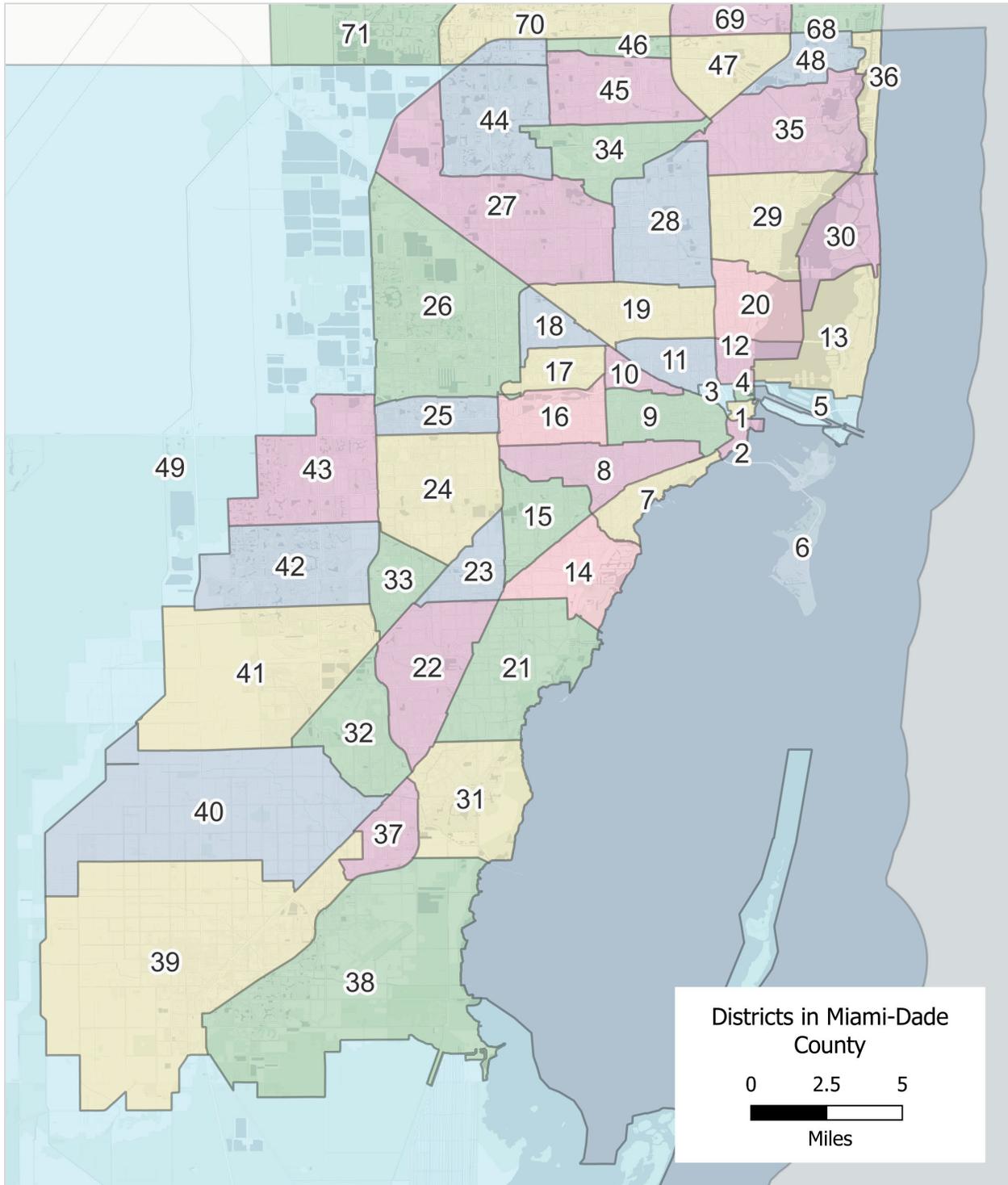


FIGURE 2: DISTRICT SYSTEM IN MIAMI-DADE COUNTY



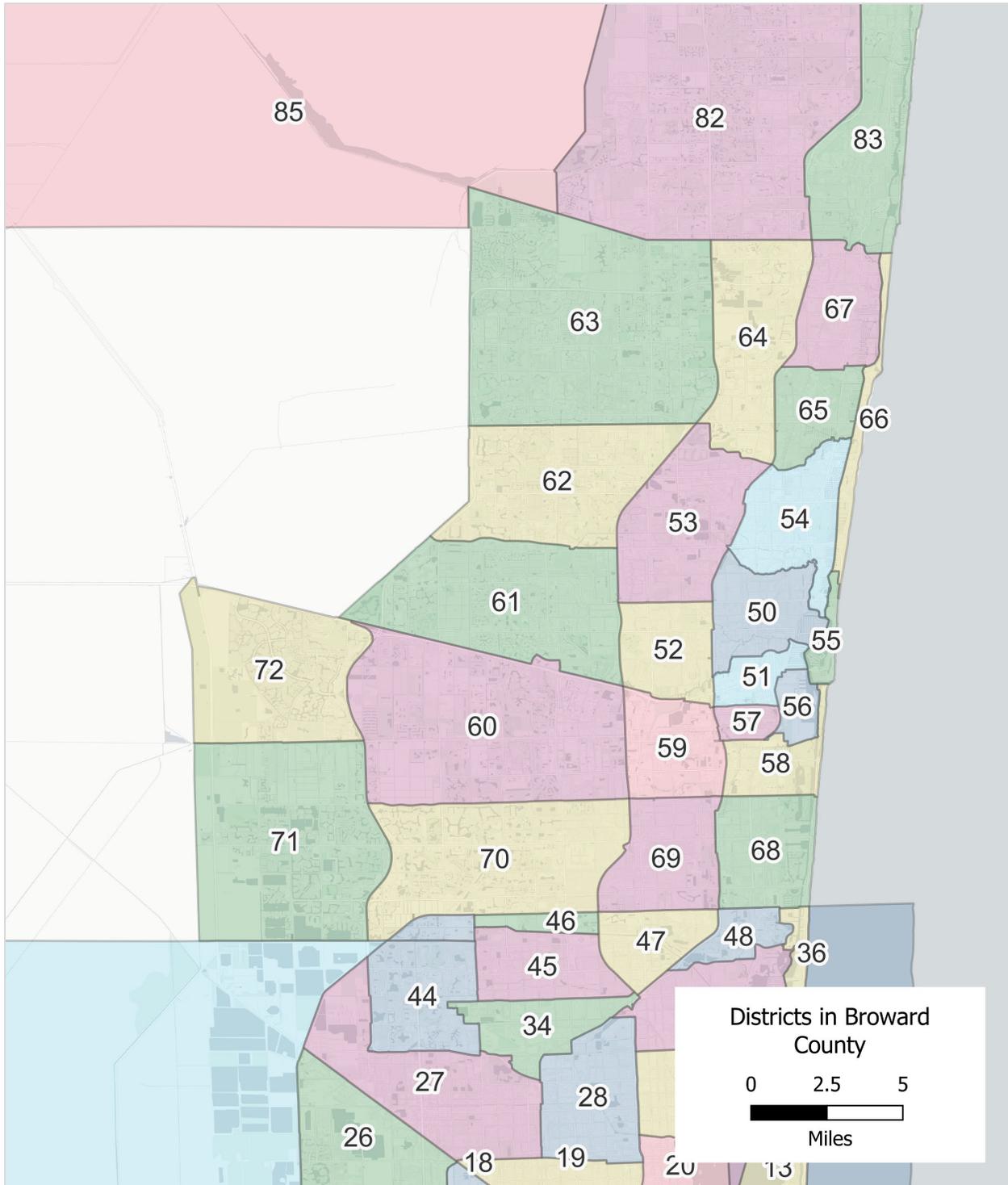


FIGURE 3: DISTRICT SYSTEM IN BROWARD COUNTY



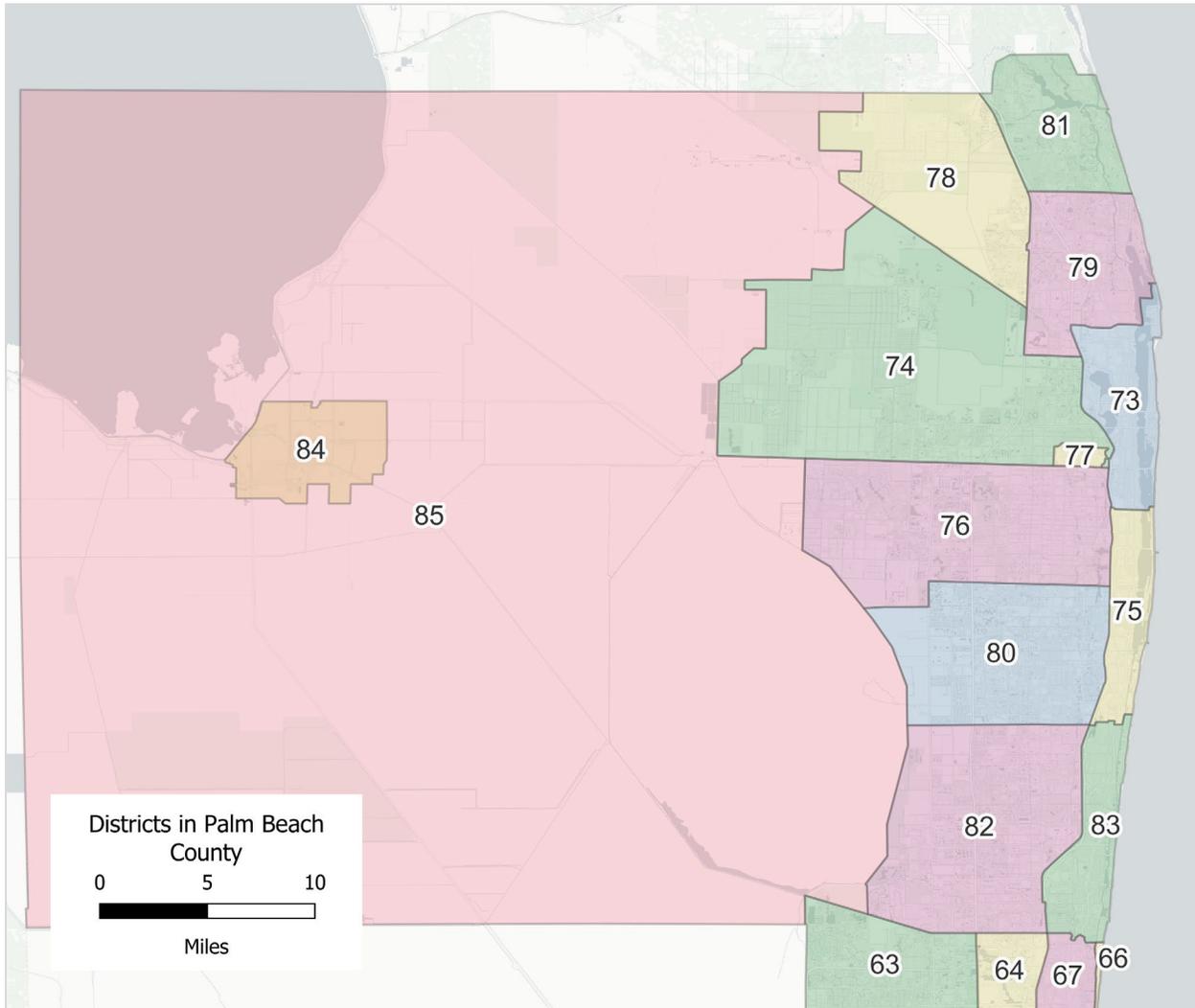


FIGURE 4: DISTRICT SYSTEM IN PALM BEACH COUNTY

2.2 SOCIO-ECONOMIC INPUTS

TAZ-level estimates of population and employment for 2023 and 2050 were obtained directly from SERPM 9, reflecting the MPO’s adopted forecasts for those years.

The resulting forecasts of population and employment are presented in **Tables 1, 2, 3, and 4**. Between 2023 and 2050, the population and employment in Miami-Dade County are both expected to grow by 16 percent.

Of note are the population forecasts for the Miami Central Business District (CBD, District 1) and nearby areas (Districts 3 and 4). Between 2023 and 2050, the population in these areas is expected to increase by nearly 50 percent. This could lead to substantial increases in future



Miami-Dade bus and rail ridership that are larger than implied by the county-wide growth forecasts, since these high growth areas also have higher-than-average transit shares.

Forecasts for the whole region, including Broward and Palm Beach Counties, are slightly higher than for Miami-Dade County alone; between 2023 and 2050, the regional population and employment are expected to grow by 20 percent.

TABLE 1: POPULATION BY FORECAST YEAR AND DISTRICT

DISTRICT	2023	2050	% CHANGE FROM 2023
1	11,491	18,012	57%
2	44,829	53,825	20%
3	9,877	14,331	45%
4	4,744	6,938	46%
5	16,225	19,900	23%
6	15,041	16,602	10%
7	26,495	34,227	29%
8	74,182	89,453	21%
9	118,989	149,033	25%
10	12,930	15,948	23%
11	47,160	66,393	41%
12	38,340	61,388	60%
13	42,500	48,167	13%
14	21,316	24,806	16%
15	36,396	48,335	33%
16	66,833	81,891	23%
17	19	61	221%
18	16,200	19,586	21%
19	85,753	101,193	18%
20	38,844	46,179	19%
21	39,518	44,819	13%
22	56,507	65,851	17%
23	24,987	30,889	24%
24	93,357	112,352	20%
25	81,418	103,429	27%





DISTRICT	2023	2050	% CHANGE FROM 2023
26	78,454	91,605	17%
27	213,870	255,909	20%
28	90,946	109,587	20%
29	74,672	90,871	22%
30	49,298	52,988	7%
31	52,873	62,521	18%
32	56,841	67,206	18%
33	40,040	51,072	28%
34	24,108	28,869	20%
35	115,099	138,495	20%
36	37,457	43,484	16%
37	35,934	44,982	25%
38	62,291	79,575	28%
39	121,443	163,543	35%
40	22,171	28,822	30%
41	89,701	105,370	17%
42	135,204	164,438	22%
43	122,128	140,407	15%
44	117,086	139,378	19%
45	75,118	89,582	19%
46	10,833	13,880	28%
47	64,307	80,433	25%
48	28,106	34,203	22%
49	2,787	9,145	228%
50	77,040	88,593	15%
51	17,323	19,838	15%
52	57,188	66,162	16%
53	108,617	125,042	15%
54	75,343	87,172	16%
55	6,423	7,369	15%
56	384	442	15%
57	0	0	
58	21,132	31,446	49%





DISTRICT	2023	2050	% CHANGE FROM 2023
59	33,602	38,941	16%
60	152,379	175,565	15%
61	163,263	188,566	15%
62	179,218	205,455	15%
63	278,805	321,732	15%
64	71,799	81,697	14%
65	42,750	49,214	15%
66	30,307	34,841	15%
67	68,991	79,782	16%
68	98,237	112,410	14%
69	87,195	100,591	15%
70	202,573	233,682	15%
71	103,343	119,358	15%
72	73,215	84,583	16%
73	95,747	124,390	30%
74	198,839	250,660	26%
75	97,430	112,823	16%
76	287,172	334,660	17%
77	19	19	0%
78	35,210	35,523	1%
79	112,269	131,181	17%
80	197,167	227,838	16%
81	77,845	86,330	11%
82	255,517	302,233	18%
83	100,412	124,940	24%
84	22,004	31,854	45%
85	11,353	23,491	107%



TABLE 2: POPULATION BY FORECAST YEAR AND COUNTY

DISTRICT	2023	2050	% CHANGE FROM 2023
Broward County	1,949,211	2,252,576	16%
Miami-Dade County	2,744,687	3,359,934	22%
Palm Beach County	1,490,998	1,785,956	20%
Total	6,184,896	7,398,466	20%

*Aggregated district controls may not exactly match TAZ controls.

TABLE 3: EMPLOYMENT BY FORECAST YEAR AND DISTRICT

DISTRICT	2023	2050	% CHANGE FROM 2023
1	44,380	54,861	24%
2	45,609	59,193	30%
3	10,841	12,427	15%
4	2,805	5,134	83%
5	26,342	36,075	37%
6	8,622	10,157	18%
7	22,384	28,335	27%
8	69,728	83,203	19%
9	40,999	50,822	24%
10	5,806	7,664	32%
11	48,573	72,272	49%
12	23,450	42,271	80%
13	52,540	74,071	41%
14	22,076	26,538	20%
15	39,867	47,159	18%
16	39,474	44,876	14%
17	35,183	36,295	3%
18	9,353	11,391	22%
19	32,584	41,243	27%
20	20,293	29,877	47%
21	21,137	24,419	16%
22	23,268	27,481	18%





DISTRICT	2023	2050	% CHANGE FROM 2023
23	23,475	41,640	77%
24	47,890	54,987	15%
25	18,033	24,119	34%
26	201,598	222,072	10%
27	81,411	98,895	21%
28	27,132	34,101	26%
29	29,951	36,350	21%
30	18,865	23,033	22%
31	11,885	13,842	16%
32	12,870	15,178	18%
33	21,177	25,127	19%
34	24,313	33,132	36%
35	43,861	52,784	20%
36	15,777	20,062	27%
37	7,966	10,224	28%
38	11,887	16,594	40%
39	30,736	40,122	31%
40	8,987	11,429	27%
41	40,429	46,502	15%
42	30,606	38,479	26%
43	33,802	41,270	22%
44	41,340	49,861	21%
45	18,096	23,747	31%
46	2,128	3,284	54%
47	22,823	27,482	20%
48	25,373	32,151	27%
49	7,647	9,264	21%
50	62,999	72,933	16%
51	28,929	33,619	16%
52	24,375	28,469	17%
53	90,412	105,151	16%
54	67,534	78,045	16%





DISTRICT	2023	2050	% CHANGE FROM 2023
55	7,027	7,604	8%
56	5,385	6,314	17%
57	6,856	7,686	12%
58	14,257	17,147	20%
59	44,680	49,918	12%
60	62,343	72,155	16%
61	94,538	109,475	16%
62	50,318	58,296	16%
63	105,927	121,849	15%
64	78,333	90,632	16%
65	21,835	25,325	16%
66	10,234	12,007	17%
67	31,233	36,101	16%
68	37,729	44,350	18%
69	39,349	45,495	16%
70	81,228	94,305	16%
71	25,196	29,104	16%
72	32,173	36,948	15%
73	106,133	125,506	18%
74	87,565	119,850	37%
75	30,931	32,838	6%
76	122,053	135,857	11%
77	3,689	7,312	98%
78	16,150	16,271	1%
79	90,741	105,489	16%
80	64,855	80,180	24%
81	50,437	61,461	22%
82	218,434	240,483	10%
83	94,550	118,991	26%
84	8,600	8,662	1%
85	10,370	24,916	140%



TABLE 4: EMPLOYMENT BY FORECAST YEAR AND COUNTY

DISTRICT	2023	2050	% CHANGE FROM 2023
Broward County	1,022,352	1,182,301	16%
Miami-Dade County	1,505,950	1,872,164	24%
Palm Beach County	904,518	1,077,825	19%
Total	3,432,820	4,132,290	20%

**Aggregated district controls may not exactly match TAZ controls.*

2.3 HIGHWAY TRAVEL TIME INPUTS

TAZ-to-TAZ highway travel distance and time estimates (skims) were developed using the SERPM Version 9 2019 and 2050 scenarios. Time and distance skims are based on AM Peak Drive-Along Toll paths. Travel times represent a combination of time and cost (i.e., Generalized Cost) using a value of time equal to \$12.00 per hour, the default value.

2.4 CENSUS INPUTS

Census inputs to the Miami STOPS implementation include the following:

- A census block boundary file (obtained from FTA) was used to define the density of census blocks throughout the modeling region. Block density is a measure of the complexity of the street system and is used in STOPS to assess the walkability of each TAZ.
- American Community Survey (Parts I, II, and III, obtained from FTA) was used to provide information on TAZ-level travel patterns in the 2012-2016 timeframe, the most recent available from FTA.



3.0 TRANSIT INPUTS

Static transit inputs are various descriptions of the transit system that are part of the development of the STOPS application for Miami-Dade County and, generally, do not vary from alternative to alternative. As such, these files will not be regularly adjusted except when changes are required to the STOPS implementation related to changing estimates of existing (count) ridership, required modifications to calibration parameters, or other system-level changes to the modeling framework.

The following static transit inputs are employed in the Miami-Dade STOPS Model:

- Transit route and stop counts representing April 2023
- Transit fare structure.

3.1 TRANSIT ROUTE AND STOP COUNTS

Route and station-level count data for April 2023 were obtained from each operator as shown in **Table 5**. Stop-level ridership data for the Miami-Dade Department of Transportation and Public Works operated Metrobus routes were derived from Automated Passenger Count (APC) equipment.

Stop-level counts were not available for some municipal shuttle/trolley routes, as well as Palm Tran buses, Broward County Transit (BCT) local and express buses, and the MIA Mover (which has only two stops). In cases where stop-level information was unavailable and routes extensively shared stops, ridership was allocated between groups of routes or mode/operator-based groups, to be disaggregated when running the STOPS simulation.

TABLE 5: 2023 RIDERSHIP BY AGENCY AND MODE

OPERATOR-SERVICE TYPE	REPORTED ROUTE RIDERSHIP	SOURCE
Metrorail	46,859*	Faregate counts*
Metromover	23,470	Automated passenger counter data
MIA Mover	4,381	Estimated from MIAmover ridership counts for the first week of April 2023
Tri-Rail	13,007	Monthly operations report for April 2023
Brightline	5,151	Estimated from quarterly short-distance ticket sales
Metrobus – Local	161,446	Estimated from average bus stop ridership by trip for April 2023
Metrobus – Express	5,422	Estimated from average bus stop ridership by trip for April 2023



OPERATOR-SERVICE TYPE	REPORTED ROUTE RIDERSHIP	SOURCE
Municipal Shuttle/Trolley	30,546	Estimated from Municipal Shuttle 2022-23 Quarterly Breakdown
BCT Bus - Local	67,782	Monthly ridership report for April 2023
BCT Bus - Express	1,604	Monthly ridership report for April 2023
Palm Tran Bus	24,875	Monthly ridership report for April 2023
Total	384,543	

* Faregate data is missing for Douglas Station Counts

3.2 FARE STRUCTURE FILE

The STOPS model fare structure file is intended to represent major aspects of a region's fare policy. In STOPS, fares should be coded to represent fares available to all travelers (i.e., not representing discounts for selected population groups) and be consistently applied to all services to show how fares might cause travelers to select one transit service over another. Fares are usually expressed as full one-way fares and are converted to time (in minutes) and discounted using a coded value-of-time. Since fare policies are often highly complex with many special cases that cannot be represented in STOPS, the focus is on representing the overall characteristics of the fare system that affect transit choice rather than all the myriad details.

The fare structure coded for the Miami STOPS implementation is as follows:

- Boarding Fare
 - Metrorail: \$2.25
 - Metromover: Free
 - MIA Mover: Free
 - Tri-Rail: \$2.50
 - Brightline short-distance trips not extending beyond West Palm Beach (fixed portion of fare): \$25.00
 - Metrobus Local Buses: \$2.25
 - Metrobus Express Buses: \$2.65
 - BCT Local Buses: \$2.00
 - BCT Express Buses: \$2.65
 - Palm Tran: \$2.00
 - Shuttles: Free





- Tri-Rail Zone Charge (in addition to boarding charge)
 - Internal to 1 fare zone: No additional charge
 - 2 fare zones: \$1.25
 - 3 fare zones: \$2.50
 - 4 fare zones: \$3.75
 - 5 fare zones: \$5.00
 - 6 fare zones: \$6.25
- Brightline Zone Charge (in addition to the boarding charge)
 - Internal to 1 fare zone: No additional charge
 - Between fare zones: \$10.00
- Transfers (coded as savings from the boarding fare of the “transfer-to” transit service)
 - Metrobus Local Bus or Metrorail to Metrobus Local Bus or Metrorail: \$2.25 savings (i.e., free transfer)
 - Metrobus Local Bus or Metrorail to Metrobus Express Bus: \$1.70 savings
 - Metrobus Local Bus to BCT Local Bus: \$1.50 savings
 - Metrobus Local Bus to BCT Express Bus: \$2.15 savings
 - Metrobus Local Bus, Express Bus, or Metrorail to Tri-Rail: \$2.00 savings
 - Metrobus Express Bus to Metrobus Local Bus or Metrorail: \$1.70 savings
 - Metrobus Express Bus to BCT Local or Express Bus: \$1.50 savings
 - BCT Local or Express Bus to Metrobus Local Bus: \$1.65 savings
 - BCT Local Bus to Metrobus Express Bus: \$1.70 savings
 - BCT Local Bus to BCT Express Bus: \$1.65 savings
 - BCT Local Bus to Palm Tran (or reverse): \$1.50 savings
 - BCT Local or Express Bus to Tri-Rail: \$2.00 savings
 - BCT Express Bus to Metrobus Express Bus: \$1.65 savings
 - Palm Tran to Tri-Rail: \$2.00 savings
 - Tri-Rail to Metrobus Local Bus: \$1.65 savings
 - Tri-Rail to Metrobus Express Bus: \$1.70 savings
 - Tri-Rail to Metrorail: \$1.05 savings





- Tri-Rail to BCT Local Bus or Palm Tran: \$1.50 savings
- Tri-Rail to BCT Express Bus: \$2.15 savings
- All other combinations offer no discount or are not possible (e.g., Tri-Rail to Metromover)
- Value-of-Time (VOT): \$12/hour (equivalent to 5 minutes of impedance for each dollar of fare) is the default value.





4.0 TRANSIT SERVICE CODING

This chapter presents a description of the input data used to represent transit services in the Miami-Dade region. This information was used to adapt information on existing transit services for use in STOPS and should also be followed when coding new transit service scenarios (i.e., coding upcoming transit projects).

4.1 GTFS SCHEDULE FILES

Schedules for the following transit services in General Transit Feed Specification (GTFS) format files were assembled for this project:

- Miami-Dade Department of Transportation and Public Works (DTPW) including select municipal shuttle routes valid for the modeling day selected for this STOPS application (3/22/2023).
- Tri-Rail (3/22/2023)
- Brightline (3/22/2023)
- Broward County Transit (3/22/2023)
- Palm Tran (3/22/2023)

Each GTFS file required modification to be ready for use in STOPS to represent existing conditions. If users wish to update the existing GTFS files with more current GTFS files or code future year alternatives, similar modifications and coding practices are required. Adjustments are described in the following sections.

Miami-Dade DTPW/Transit (MDT) GTFS

Given the differing levels of aggregation between the various ridership reports associated with each mode, as well as some other considerations like fare policy, the decision was made to split the consolidated DTPW/MDT GTFS file into six separate sets of GTFS files, split by mode:

- Metrobus Local Buses,
- Metrobus Express Buses,
- Metromover,
- MIA Mover,
- Metrorail,
- And those municipal shuttles for which GTFS feeds were available.

Any stop ID's that were shared by multiple modes were kept in both resulting sets of GTFS files and differentiated by the applicable suffix for the relevant mode.



Add PNR file

As in all STOPS applications, a park-and-ride file named “pnr.txt” must be added to all GTFS files where parking facilities are available. This file follows the standard STOPS file structure. The key coding elements are as follows:

1. Latitude and longitude are coded to represent the average locations of parked vehicles using the facility. In most cases, this translates to the approximate center of the facility. In large facilities with low usage, the center of the utilized area may be used.
2. End-of-line and next-to-end Metrorail stations with large PNR facilities (Palmetto, Okeechobee, Dadeland South, and Dadeland North) are coded as PNRTYPE=1. Intermediate stations and publicly owned bus park-and-ride lots are coded as PNRTYPE=2. Intermediate stations and bus PNR lots with facilities shared with other institutions are coded as PNRTYPE=3 and unofficial PNR lots for intermediate stations and bus stops are coded as PNRTYPE=4.
3. PNR lots are coded with a PNRCost (generalized cost, in minutes) reflecting their level of separation from transit boarding areas, as needing to venture above or below grade to reach transit incurs some level of time and effort penalty for users. The cost 0 was assigned to those locations where transit could be accessed easily from parking without moving up or down a floor, often bus stops, while each additional level up or down incurred a penalty of 1 (i.e., a cost of two was assigned if one needed to walk up two stories to reach Metrorail or walk up, across, and down to reach the other side of a train track at a Tri-Rail station).

BCT GTFS

The Broward County Transit GTFS file was split into local and express routes, similar to the DPTW/MDT GTFS, to accommodate differences in transfer costs between the two sets of routes. No additional changes were made to these GTFS feeds.

A PNR file (pnr.txt) was added to represent BCT PNR lots. Lots are coded with latitudes and longitudes representing the middle of the PNR facility. All lots are coded with PNRTYPE=2, and PNRCost varies somewhat with the distance between parking facilities and transit stops.

PalmTran GTFS

The PalmTran GTFS file is used without any modifications. A PNR file (pnr.txt) was added to represent PalmTran PNR lots. All lots but West Jupiter Recreation Center (type 2) are coded with PNRTYPE=3, and PNRCost varied somewhat with the distance between parking facilities and transit stops.

Tri-Rail GTFS

Since the Tri-Rail GTFS obtained included service along the new Downtown Miami Link corridor to Miami Central, this route, and Miami Central station were removed from the GTFS to reflect service as it existed in April 2023.





Tri-Rail park-and-ride facilities are coded in a supplemental GTFS file named “pnr.txt” following STOPS protocols. The end-of-line stations at Mangonia Park and Miami Airport are coded as PNRTYPE=1. All other park-and-ride facilities are coded as PNRTYPE=2. As with other modes, PNRCost varies with the number of floors required to traverse to reach the platform from the parking areas.

Brightline GTFS

Since the Brightline GTFS obtained included the newly launched service north of West Palm Beach to Orlando, trips were truncated to West Palm Beach to reflect service as it existed in April 2023.

Brightline park-and-ride facilities are coded in a supplemental GTFS file named “pnr.txt” following STOPS protocols. All park-and-ride facilities are coded as PNRTYPE=2. PNRCost was assigned a value of \$15 for all stations, the average of Brightline’s reserved (\$10) and walk-up (\$20) parking prices.

4.2 STATION FILE

The STOPS station file is used to represent all fixed guideway stations and all bus stops in the modeling region. Data coding for key fields in the modeling system are as follows:

- Latitude, longitude, and station (name) should be identical or near identical to the corresponding information in the GTFS files. Latitude and Longitude are only used for displaying stations/stops on maps which might be helpful in setting the stop group variable and accordingly should be close to the GTFS specification (i.e., within 50 feet). The station name is used in STOPS reporting and can be changed to clarify the displayed name.
- STAT_SEQ, or station sequence, group stops to make them easier to access in reporting generated by STOPS. In order of precedence, these are:
 - Brightline: 201
 - Tri-Rail: 202
 - Metrorail: 203
 - Metromover: 204
 - MIA Mover: 205
 - Metrobus Express Buses: 206
 - Metrobus Local Buses: 207
 - BCT Express Buses: 208
 - BCT Local Buses: 209
 - Palm Tran buses: 210





- Municipal shuttles: 211
- STAT_GRP (Station or Stop calibration group):
 - Metrorail GTFS included separate northbound and southbound stops, but ridership was only reported for the station as a whole; as such, northbound-southbound pairs have been grouped, occupying groups 1 through 23.
 - Similarly, Metromover GTFS included separate stops at one location for the various loops on the system; those GTFS stops representing the same station have been grouped, occupying groups 24 through 39.
 - Brightline stops are grouped in group 40.
 - The MIA Mover’s two stops are grouped into group 41.
 - BCT Local Bus stops are coded with group number 42.
 - BCT Express Bus stops are coded with group number 43.
 - Palm Tran bus stops are coded with group number 44.
 - Municipal shuttle stops are coded with group number 45.
 - Metrobus Local and Express Bus stops and Tri-Rail stations, for whom ridership was available at the stop level, were left ungrouped.
- NEWSTATION. This variable is set to one for project stations and is set to zero for non-project stations. Tri-Rail and Brightline were assigned a value of 1, and all other services’ stops were assigned a value of 0.
- DAILYBOARD (ridership). Daily boarding ridership is developed from reported ridership and automated passenger counter (APC) counts as discussed previously. This value will not be adjusted unless new count data is used to update the application. Note that for existing stops without stop-level ridership data (i.e., BCT, Palm Tran, and municipal shuttles), ridership is coded so that the total group ridership is correct without consideration of ridership at individual stations or stops. Since individual station or stop volumes are not relevant to the calibration, this simplification does not affect the model outcomes.
- STOPID_1 contains the GTFS stop_id for the station or bus stop. This data must include the suffixes specified in the parameter file for each GTFS file:
 - Metrorail: “&R”
 - Metromover: “&M”
 - Brightline: “&L”
 - Tri-Rail: “&T”





- MIA Mover: “&A”
 - Metrobus Local Buses: “&U”
 - Metrobus Express Buses: “&X”
 - BCT Local Buses: “&B”
 - BCT Express Buses: “&F”
 - Palm Tran buses: “&P”
 - Municipal shuttle buses: “&S”
- STOPID_2/3/4 are unused.
 - STOPSTYPE is coded in accordance with values prescribed in the latest edition of the STOPS User Guide, 1 and 2 being at-grade, 3 and 4 one level from grade, 5 and 6 two levels from grade, and 7 and 8 three levels or more from grade, with even numbers representing those with an associated park-and-ride lot. No stations are assigned the values 5 or 8.
 - Time Penalties for walking, kiss-and-ride, and park-and-ride of five and two minutes are assigned to Tri-Rail and Metromover stops respectively.
 - SAMEGTFX and DIFFGTFX were similarly coded as 0 for all stops, with the exception of Tri-Rail and Metromover stations, which were assigned a value of 5 and 2 respectively.
 - FAREZONE was left as 0 for all services besides Tri-Rail and Brightline, the only services employing zone-based fares included in the model. Brightline stops were assigned to either zone 1 or 2, while zones for Tri-Rail ran from 1 to 6.





5.0 CALIBRATION

The Miami-Dade County 2023 STOPS model is based on the incremental version of STOPS version 2.55. This version of STOPS used travel information from multiple transit Origin-Destination (OD) studies conducted in the region to develop a preliminary representation of transit travel within the region. Ridership counts are used to refine these estimates to represent travel in the base year of 2023.

The calibration process involves iteratively running STOPS and testing various model parameters so that the model generates ridership estimates that are as close as possible to the estimates of ridership counts before the count-based adjustment is applied. This strategy means that the count-based adjustment is just a “fine-tuning” adjustment rather than a step that could warp the meaning of the underlying model. This iterative approach is intended to represent local preferences regarding willingness to transfer, usage of park-and-ride lots, and the relative attractiveness of different transit sub-modes.

The 2023 model was calibrated without resorting to unusual adjustments to the default STOPS parameters. The fit of the model is discussed in Chapter 6.0, Validation.

This chapter presents all non-default STOPS parameters and the rationale for their adjustment.

5.1 LINKED TRANSIT TRIPS

OD surveys were used to estimate an input transit trip table for use by STOPS. Surveys were collected and analyzed for the following services:

- Miami-Dade DTPW
- BCT
- PalmTran

Some reweighting of the surveys was required to treat transfers between the systems as linked trips. Surveys with adequate OD data were not available for use for Tri-Rail or Brightline. Surveys were not used to estimate the Brightline intra-regional travel market. This market was captured to the extent that Brightline users utilize other transit services as part of their trip. Additionally, since the completion of Brightline’s extension to Orlando, the operator has moved to price out much of the local market in favor of long-distance travelers. As such, the model’s ability to replicate Brightline’s ridership was not considered a priority, as discussed in Chapter 6.0, Validation.

5.2 ESTIMATED TRI-RAIL TRIP TABLE

As previously stated, there was no survey available for developing the input transit trip table to account for Tri-Rail’s market, so an alternative solution was used. Tri-Rail conducts regular surveys, most recently in 2024 and 2018, however, these surveys did not collect detailed origin





and destination information from respondents. To estimate a synthetic version of the model was developed with Tri-Rail designated as the 'project' within STOPS.

5.3 TRANSFER (BOARDING) PENALTY

By default, STOPS assigns a penalty of 5 minutes each time a passenger boards a transit vehicle. In this application, this penalty is set to 1.5 (equivalent to 7 minutes) of this value so that in conjunction input transit trip table generates linked and unlinked trip estimates largely in line with the volumes observed in the surveys.

5.4 FIXED GUIDEWAY SETTING

In STOPS, the Fixed Guideway Settings are used to define the degree to which full fixed guideway routes (route_type not equal to 0 or 3) and partial fixed guideway routes (route_type=0) are treated in comparison to bus. These values are typically in the range from 0 to 1.0 with 1.0 equivalent to a rail line such as Metrorail or Metromover and 0 being equivalent to a bus-like fixed guideway. In this application, the full fixed guideway setting is set to the default of 1.0. The partial fixed guideway setting is currently coded as 0.3 (a value often accepted by FTA for BRT systems). The exact setting to use for partial fixed guideway facilities will vary from project to project and should be discussed with the FTA before a final decision is made on the most appropriate setting to use.

5.5 CALIBRATION SETTINGS (MAIN PARAMETER SCREEN)

Calibration settings are set as follows:

- Walk weight equals 1.0 (default).
- KNR Transit equals 0.5. Note that this was the value used in the previous model and has been confirmed with the survey data and model calibration process.
- PNR transit equals 1.0 (default).
- PNR bus equals 1.0 (default)
- Auto Time Factor equals 1.25. This value was derived for the 2023 version of the model based on a comparison of highway skim times and expected travel times for equivalent trips obtained from online mapping and routing websites.

5.6 PNR SETTINGS (PNR SETTINGS TAB)

PNR settings that are different from the defaults are:

- Maximum contribution of circuitry equals 1.0.
- Utilities for DenShr Breakpoints have been reduced by 30%.





5.7 ADDITIONAL SETTINGS (CALIBRATION SETTINGS TAB)

Non-default values include:

- The count factor limit indicates the maximum adjustment that will be made to zone-to-zone trip-making to match count targets. In Version 2.55, the default value is 1.5, but is set to the maximum value of 5.0 in the Miami application, as origin-destination data was not available for Tri-Rail and Brightline.





6.0 VALIDATION

This chapter presents comparisons of counts and modeled ridership for different transit services characterized by sub-mode (i.e., fixed guideway and bus services), route, and geographic area. In most cases, ridership is presented for model results before and after count-based adjustment to demonstrate that the model has a strong representation of different transit markets even before the count-based adjustment is used to more closely match ridership on specific services.

The validation process is layered so that the initial tests represent large-scale tests to determine the ability of the model to estimate ridership for each agency and each mode of travel followed by more detailed tests of ridership by fixed guideway station, bus garage, and ultimately SMART corridor routes and districts. Early parts of the validation process are used to confirm model-wide parameters such as transfer rates and preferences for using fixed guideway transit. The later parts of the validation process are used to adjust model details such as station penalties and park-and-ride time adjustments. This process is illustrated in **Figure 5**.

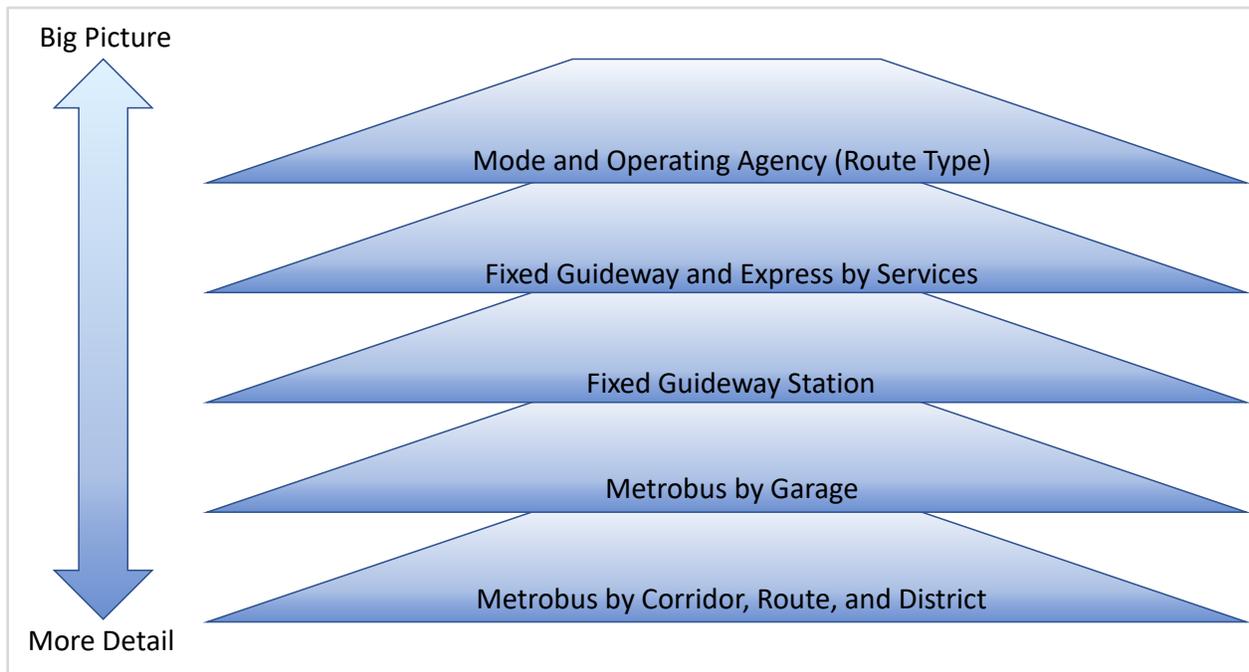


FIGURE 5 OVERVIEW OF THE VALIDATION PROCESS

6.1 OVERVIEW OF RIDERSHIP RESULTS

Table 6 presents a comparison of the Year 2023 weekday ridership counts to modeled ridership for different transit sub-modes and transit operating agencies. As this table shows, most services are well represented before the count-based adjustment is used to achieve the final ridership results. The largest discrepancy between counts and modeled ridership (before adjustment)



occurs for the grouped municipal shuttle system (13,900 riders representing a 42 percent overprediction). Given the fact that most if not all of the shuttles are free to ride.

Another significant difference (before count-based adjustment) concerns Tri-Rail. Initial ridership for this system is underestimated by 23 percent. This is not unsurprising, as the data used to develop the input transit trip tables for Tri-Rail was the output of a roughly calibrated synthetic application of STOPS. In this case, as in the others, the count-based adjustment process appears to work as intended to bolster ridership in places where the data miscounts ridership. All systems are properly represented in the final model.

TABLE 6: COMPARISON OF RIDERSHIP COUNTS BY ROUTE TYPE TO MODELED RIDERSHIP BEFORE AND AFTER COUNT ADJUSTMENT

ROUTE TYPE	2023 WEEKDAY RIDERSHIP COUNTS	MODELED 2023 WEEKDAY RIDERSHIP BEFORE COUNT-BASED ADJUSTMENT	MODELED 2023 WEEKDAY RIDERSHIP AFTER COUNT-BASED ADJUSTMENT
Metrobus (local)	161,446	157,563	164,391
Metrobus (express)	5,422	5,630	5,299
Metrorail	49,942	51,770	49,543
Metromover	23,470	21,933	22,279
MIAMover (airport)	4,381	2,486	4,423
Municipal Shuttles/ Trolley	32,499	46,394	32,497
BCT Bus (local)	67,782	63,242	67,806
BCT Bus (express)	1,604	713	1,538
PalmTran Bus	24,875	24,640	24,870
Tri-Rail	13,007	10,015	13,412
Brightline	5,151	153	536
Total	389,579	384,539	386,594

6.2 FIXED GUIDEWAY

Table 7 presents a comparison of Year 2023 weekday ridership counts to modeled ridership for selected fixed guideways that are most similar to the SMART Program Corridor projects. This table shows that services offering higher speeds and/or fixed guideway facilities are appropriately





modeled before and after count-based adjustment for rail or Automated Guideway Transit (AGT) systems (all other route types).

TABLE 7: COMPARISON OF FIXED GUIDEWAY RIDERSHIP COUNTS BY ROUTE TYPE TO MODELED RIDERSHIP BEFORE AND AFTER COUNT ADJUSTMENT

ROUTE TYPE	2023 WEEKDAY RIDERSHIP COUNTS	MODELED 2023 WEEKDAY RIDERSHIP BEFORE COUNT-BASED ADJUSTMENT	MODELED 2023 WEEKDAY RIDERSHIP AFTER COUNT-BASED ADJUSTMENT
Metrorail	49,942	51,770	49,543
Metromover	23,470	21,933	22,279
Tri-Rail	13,007	10,015	13,412
Total	86,419	83,718	85,234

6.3 METRORAIL BY STATION

Table 8 presents a comparison of the Year 2023 weekday ridership count to modeled ridership for groups of adjoining Metrorail stations. Before the count-based adjustment, Metrorail ridership was overestimated by 4 percent. Most of the markets north and west of Overtown are overestimated while the southern parts of the line perform quite well prior to the count-based adjustment. The overprediction on the north end of the line occurs despite some additional penalties in the model to compensate.

In any event, the count-based adjustment process successfully adjusts model results to match ridership counts for all station groups.



TABLE 8: COMPARISON OF METRORAIL RIDERSHIP COUNTS BY STATION GROUP TO MODELED RIDERSHIP BEFORE AND AFTER COUNT ADJUSTMENT

STATION GROUP	2023 WEEKDAY RIDERSHIP COUNTS	MODELED 2023 WEEKDAY RIDERSHIP BEFORE COUNT-BASED ADJUSTMENT	MODELED 2023 WEEKDAY RIDERSHIP AFTER COUNT-BASED ADJUSTMENT
Palmetto – Okeechobee	2,305	1,594	2,271
Hialeah – Northside	3,603	3,545	3,576
ML King – Brownville	1,526	2,226	1,544
MIA	1,272	1,764	1,277
Earlington – Civic Center	7,697	9,602	7,679
Culmer	1,116	1,929	1,118
Overtown – Government Center	8,897	7,622	8,854
Brickell – Vizcaya	6,072	5,971	6,044
Coconut Grove – Douglas Rd	4,580	4,995	4,598
University – South Miami	4,085	3,794	4,048
Dadeland North – Dadeland South	8,788	8,723	8,537
Total Metrorail	49,941	51,765	49,546

6.4 METROMOVER BY STATION

Table 9 presents a comparison of Year 2023 weekday ridership counts to modeled ridership for groups of adjoining Metromover stations. Modeled ridership matches ridership counts both after count-based adjustment for most station groups. The modeled ridership closely matches the observed counts with particularly accurate results on the southern and northern legs (Financial District and Adrienne Arsht-School Board). This outcome suggests that several aspects of the modeling system are working to represent the unique travel patterns in the central portion of Miami-Dade County.



TABLE 9: COMPARISON OF METROMOVER RIDERSHIP COUNTS BY STATION GROUP TO MODELED RIDERSHIP BEFORE AND AFTER COUNT ADJUSTMENT

STATION GROUP	2023 WEEKDAY RIDERSHIP COUNTS	MODELED 2023 WEEKDAY RIDERSHIP BEFORE COUNT-BASED ADJUSTMENT	MODELED 2023 WEEKDAY RIDERSHIP AFTER COUNT-BASED ADJUSTMENT
MM-Financial District	1,023	1,009	1,087
MM-Brickell	1,733	2,172	2,252
MM-Tenth St to Riverwalk	4,468	4,503	3,104
MM-Government Center	1,600	3,127	1,727
MM-Other CBD	11,048	6,442	10,288
MM-Freedom Tower to Museum Park	862	1,886	1,007
MM-Adrienne Arsht to School Board	2,736	2,794	2,815
Total Metromover	23,470	21,933	22,280

MM-Other CBD Stations include - Wilkie D. Ferguson, College North, College/Bayside, First Street, Bayfront Park, Knight Center, Third Street, Miami Avenue.

6.5 METROBUS BY SMART PROGRAM CORRIDOR AND ROUTE

Table 10 presents comparisons of the Year 2023 weekday ridership count to modeled ridership for Metrobus routes categorized by SMART Plan Corridor.

As this analysis shows, ridership before count-based adjustment varies from the counted volumes in a few places with one-pair of corridors (East-West and Flager) having modeled ridership before count-based adjustment that is lower than the counts by 22 percent and another corridor (Kendall Corridor) where modeled ridership before count-based adjustment is lower than the count by 13 percent. Modeled ridership for other corridors match counts much more closely (i.e., within 10 percent).

After count-based adjustment, however, bus ridership in all corridors is properly represented.



TABLE 10: COMPARISON OF BUS RIDERSHIP COUNTS BY ROUTE TO MODELED RIDERSHIP BEFORE AND AFTER COUNT ADJUSTMENT

CORRIDOR (ROUTES)	2023 WEEKDAY RIDERSHIP COUNTS	MODELED 2023 WEEKDAY RIDERSHIP BEFORE COUNT-BASED ADJUSTMENT	MODELED 2023 WEEKDAY RIDERSHIP AFTER COUNT-BASED ADJUSTMENT
Beach (Routes 103, 110, 113, 119, 120, 150)	19,424	20,273	19,278
East-West and Flager (Routes 77, 11, 51)	16,339	12,802	16,113
Kendall (Routes 88, 104, 204, 288)	4,456	3,855	4,389
North (Routes 17, 27, 32, 37, 277, 297)	18,685	18,387	18,585
Northeast (Routes 21, 33, 119, 120, 207, 208)	19,977	18,247	19,831
South Transitway (Routes 31, 34, 38, 52, 252, 287)	10,719	11,764	10,325
Total	89,600	85,329	88,521

6.6 PARK-AND-RIDE UTILIZATION

Tables 11 and 12 compare count and modeled park-and-ride utilization by service and facility for Metrorail, Metrobus, and Tri-Rail. The overall distribution of Metrorail park-and-ride utilization for the south and north sections of the line are well-represented by the model. Overall, Metrobus park-and-ride utilization is also well-represented.

TABLE 11: COMPARISON OF COUNTS AND MODELED PARK-AND-RIDE UTILIZATION BY SYSTEM

SYSTEM	2023 WEEKDAY PARKED CARS COUNT	2023 WEEKDAY PARKED CARS MODELED
Metrorail	2,968	2,933
Metrobus	1,155	1,234
Tri-Rail	1,191	1,218
Total	5,314	5,385





TABLE 12: COMPARISON OF COUNT AND MODELED METRORAIL PARK-AND-RIDE UTILIZATION

STATION GROUP	2023 WEEKDAY PARKED CARS COUNT	2023 WEEKDAY PARKED CARS MODELED
Palmetto – Okeechobee	287	297
Hialeah – Northside	112	100
ML King – Brownville	73	103
Earlington – Civic Center	178	244
Culmer	11	67
Brickell – Vizcaya	45	117
Coconut Grove – Douglas Rd	149	243
University – South Miami	384	231
Dadeland North – Dadeland South	1,729	1,531
Total Metrorail	2,968	2,933



7.0 SENSITIVITY TESTING

As a test of the model’s ability to represent a future “build” project, the Miami-Dade STOPS model was used to prepare ridership forecasts under two test scenarios. The first test scenario was the initial implementation of the Miami-Dade Better Bus Network (BBN) as it was run in January 2024 (The network undergoes biannual updates in response to changing usage patterns). The second test was a recent definition of the Northeast Corridor SMART Program project. The tests and their results are described in this chapter.

7.1 BETTER BUS NETWORK (BBN) FORECAST

For the Better Bus Network test, a set of GTFS feeds were prepared. Two sets were tested, both a full update of all systems to their January 2024 schedules and an updated version holding all networks unchanged except for Metrobus. The purpose of the incremental tests was to be able to isolate the model’s response to the BBN as well as an update to a January 2024 no-build which would be able to serve as the starting point for analysis in SMART Program Corridors.

Table 13 shows the results for the top five ridership Metrobus routes as well as the system total. As shown in Table 10, the model significantly underpredicts Metrobus ridership for the BBN by nearly 36,000 trips or 20%.

TABLE 13: COMPARISON OF RIDERSHIP COUNTS AND MODELED PARK-AND-RIDE UTILIZATION BY SYSTEM

ROUTE	2024 WEEKDAY RIDERSHIP COUNTS	2023 WEEKDAY MODELED RIDERSHIP
100 – Downtown-Aventura Mall	16,041	13,219
77 – Norwood – Downtown	11,487	8,242
11 – FIU – Downtown	10,972	8,095
9 – Aventura – Downtown	10,629	10,498
27 – Coco Grove – MIA Gardens	9,220	7,644
All other Metrobus Routes	131,784	106,550
Total	190,133	154,248

The results were similar in both BBN tests. To understand why the model responded this way an in-depth review of the BBN GTFS was undertaken. The GTFS review revealed that the updated Metrobus feeds from January 2024 have consistently longer travel times than the feed used to calibrate the model to 2023 counts. This increase in travel times drives the model to predict a





decrease in ridership while the opposite was true in reality. This may be due to a few reasons, the earlier 2023 GTFS feeds may reflect travel times achieved earlier in the post-pandemic return to office ramp-up. Whereas the 2024 feeds following the network update may be picking up recent changes in roadway congestion following changing trends in returning to office work. Alternatively, this may have been an opportune time to true up the schedule which many agencies do on a periodic basis.

Given that the other model inputs, auto skims, and trip tables are unchanged, it isn't surprising that the model predicts fewer riders when the reality is that the Metrobus routes have more riders. It is strongly recommended that the corridor teams coordinate with FTA on the project-specific guidance. A simple test holding the calibration settings constant but calibrating to updated route-level ridership data available for January 2024 showed that there is a strong path forward.

7.2 TEST APPLICATION TO NORTHEAST SMART PROGRAM CORRIDOR

As a test of the model's ability to represent a future "build" project, the Miami-Dade STOPS model was used to prepare ridership forecasts for a recent definition of the Northeast Corridor from Miami Central Station to Aventura¹. This project was run with 29-minute runtimes from Miami to Aventura and 30-minute headways in the peak and 60-minute headways in the off-peak. To support the project, Route 93 (Biscayne Max) is eliminated in the build scenario.

Table 14 presents the linked trip impacts of the project for 2023 and 2050. **Table 15** provides a more detailed depiction of the ridership impacts of the project showing ridership by route and ridership by station, respectively.

TABLE 14: WEEKDAY LINKED TRIP IMPACTS OF NORTHEAST CORRIDOR BUILD PROJECT FOR 2023 AND 2050 (TEST PROJECT DEFINITION)

STATISTIC	2023	2050 DEMOGRAPHICS WITH 2050 HIGHWAY TIMES	
No-Build Linked Trips	270,809	362,308	33.8%
Build Linked Trips	274,309	373,009	36.0%
Incremental Linked Trips	8,954	10,701	19.5%
Project Unlinked Trips	17,228	21,357	24.0%

Note: Percentages reflect the change from the 2023 Build Scenario

¹ Note that this project definition will change as this project proceeds through development. As such these ridership forecasts are only intended to demonstrate that the model calibration is behaving properly.





TABLE 15: NORTHEAST CORRIDOR BUILD WEEKDAY RIDERSHIP BY STATION FOR 2023 AND 2050 (TEST PROJECT DEFINITION)

STATION	2019 WITH BUILD NETWORK	2050 BUILD WITH 2050 HIGHWAY TIMES	
NE-Miami Central Station	4,156	4,947	19.0%
NE-26th St Wynwood	835	1,491	78.6%
NE-39th St Midtown	1,912	2,395	25.3%
NE-Little Haiti	1,471	2,006	36.4%
NE-125th Street	1,593	2,008	26.1%
NE-151st Street	1,488	1,803	21.2%
NE-Aventura	5,771	6,707	16.2%
Total	17,226	21,357	24.0%





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