GPC IV-08

Modeling Support for Near-Term Public Transportation Improvements on Major Urban Travel Corridors

November 30, 2010

Gannett Fleming
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1 Introduction

The Miami-Dade Metropolitan Planning Organization (MPO), in conjunction with all transportation agencies in the metropolitan area, has worked to develop a two-to-five year plan for major public transportation improvements. The plan is looking at ways to develop new premium public transportation services in high volume urban travel corridors. Gannett Fleming, Inc. was retained by the MPO to provide travel forecasting services to support the development of the Near-Term Public Transportation Plan for Miami-Dade County (Plan).

The Plan is an effort to program transit improvements within the priority transit corridors defined in the County's People's Transportation Plan (PTP). The purpose of this Plan is to improve transit facilities and to develop transit ridership within the PTP corridors so that rail transit service can be implemented when it is deemed feasible. In essence, the Plan focuses on the evolution of transit services within the PTP corridors during the two-to-five year time frame.

The transit service alternatives were evaluated using the Southeast Florida Regional Planning Model, Version 6.5 (SERPM 6.5). The travel forecasting models are useful tools to assess suitability and expected performance of transit service improvements. A well calibrated model can generate the information necessary to identify relative benefits and constraints of different transit service improvements and thereby, provide critical information to decision makers. The travel forecasting efforts undertaken for this study assisted the development of the Plan in the following ways: (1) identified performance of proposed transit service improvements; and, (2) identified impact of proposed service improvements on existing transit routes and system-wide transit services.

The report addresses the areas presented below:

- Background information of the study
- Brief description of the SERPM 6.5 model
- Efforts to review and update the model
- Description of improvements evaluated
- Preliminary cost estimates
- Summary of findings
- User benefit analysis

1.1 Study Background

During the development of the 2035 Cost-Feasible Long Range Transportation Plan, it became apparent that expected transportation funding levels could only provide modest improvements to the existing transportation system in the County. It also became evident that new methods to manage existing infrastructure are required to support the development of lower capital public transportation improvements. To identify near-term public transportation needs and improvements, a Near-Term Public Transportation Committee (Committee) comprised of staff from the following agencies was constituted:

1. Miami-Dade Metropolitan Planning Organization (MPO)
2. Miami-Dade Transit (MDT)
3. Florida Department of Transportation (FDOT)
4. Miami-Dade Expressway Authority (MDX)
5. South Florida Regional Transportation Authority (SFRTA) or Tri-Rail
6. Miami-Dade County

The Committee developed a planning framework for the Near-Term Plan by evaluating potential transit infrastructure and service improvements along the PTP corridors. Meetings were held in the first half of the year 2010 and four transit alternatives were identified for further evaluation using travel forecasting model. These near-term transit alternatives were tested using the SERPM 6.5. The results were used to recommend cost-feasible improvements that can provide incremental mobility benefits along the PTP corridors. These corridors and transit alternatives are discussed in greater detail in the subsequent sections.

1.1.1 Planning Horizon

The focus of the Near-Term Public Transportation Improvements Plan is on implementable transit solutions that can meet current and near-term mobility needs of the county residents. Therefore, the Committee selected the year 2015 as the future year for the purpose of travel forecasting.

2 Travel Demand Modeling

The travel demand forecasting tool used for this task is SERPM 6.5, which is validated to year 2005 conditions. SERPM 6.5 is a traditional four-step model that is comprised of Palm Beach, Broward and Miami-Dade Counties. Furthermore, SERPM 6.5 is a time of day, multimodal travel demand model that accounts for the fluctuations in travel behavior, traffic congestion, and traffic and transit operations throughout the day. The effort is focused on transit improvements and therefore, SERPM 6.5's multimodal capabilities were found to be useful. In addition to automobiles and trucks, SERPM 6.5 provides the capacity to estimate trips for the following transit modes:

- Local Bus
- Express Bus
- Limited Stop Bus
- Metromover
- Metrorail
- Tri-Rail

2.1 Key Characteristics of SERPM 6.5

2.1.1 Transit Components

The SERPM 6.5 model has four (4) main transit components; transit access, transit path, mode choice, and transit assignment. Transit access builds the connectors to transit stops and stations. Specifically, this step provides the ability to build walk-access connectors, drive-access connectors, and transfer connectors. The transit path step finds the best path of travel and calculates the costs for the path. The mode choice component determines the total number of trips made by each mode listed above. Finally, the transit assignment process assigns the transit trips calculated by the mode choice module to the transit network.

2.1.2 Transit Speed

One of the primary inputs required for transit modeling is transit speed. SERPM 6.5 allows the coding of transit speed through two methods, exclusive right-of-way (ROW) and shared ROW. Using exclusive ROW allows the user to "hard code" the transit speed on a link-by-link basis. Typically, these speeds are based on published schedules of a given transit agency. For shared ROW, transit speeds are estimated as a function of the congested highway speeds. Transit modeling using the shared ROW depends upon several different auto-transit speed relationship curves. In general, auto-transit speed relationship curves are available by area type/facility type combinations for both the peak and off-peak periods.

2.1.3 Park-N-Ride Lots in SERPM 6.5

An important aspect of transit modeling is the provision of park-n-ride (P&R) lots because they allow for automobile access. Park-n-ride lots are manually coded into the transit network. In SERPM 6.5, the variable ACTIVEFLAG on the node layer allows the model to perceive P&R access at the station level. If this flag is turned off, then no auto access is permitted. The coding of P&R lots consists of the following inputs:

- Service miles (maximum roadway distance allowed)
- Number of parking spaces (for informational purposes only)
- Peak and off-peak period parking costs
- Peak and off-peak terminal times (time required to access the transit vehicle, once the vehicle leaves the network)

2.2 Preparation of 2015 SERPM 6.5 Model

2.2.1 2013 Existing Plus Committed (E+C) Transportation Network

The most recent version of the SERPM 6.5 model was downloaded from the FDOT's modeling web portal (http://www.fsutmsonline.net/index.php?/model_pages/comments/2005_2035_serpm_65_cost_feasible_created_on_02_01_2010/) following appropriate protocols. The SERPM 6.5 model includes input files for base year (2005), E+C year (2013), and LRTP horizon year (2035). The 2013 E+C network was prepared as part of the 2035 LRTP update. It provides the most reliable source for determining transportation projects that are likely to exist in Year 2015. Therefore, the 2013 E+C transportation network was used as the starting point to assess the likely 2015 conditions.

The transit networks for 2005 base year and 2013 E+C were compared. Overall, the E+C network assumed an 11 percent decrease in route miles for services in Miami-Dade County. A detailed breakdown by different modes is provided in Table 1.

Table 1: SERPM 6.5 Transit Network Comparison

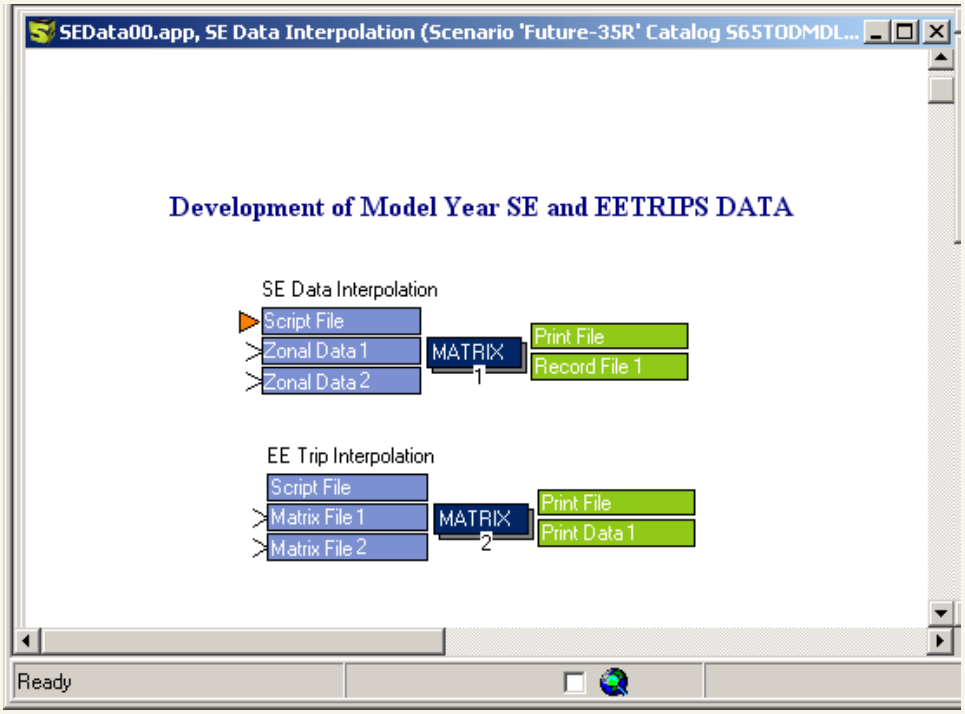
Transit Technology / Mode	System	2005 Network (in miles)	2015 E+C Network (in miles)	Change (in %)
Metrobus System				-12%
Local Bus	Metrobus	2,953	2,430	-18%
Express Bus	Metrobus	200	457	129%
Limited-Stop Bus	Metrobus	418	255	-39%
Metrobus Total		**3,571**	**3,142**	**-12%**
Heavy Rail	**Metrorail**	**45**	**77**	**71%**
Automated Guideway Transit	**Metromover**	**12**	**12**	**0%**
Total		**3,628**	**3,231**	**-11%**

Note: Values represent directional miles as coded in the model.

2.2.2 2015 Socio-Economic Data

The 2015 socio-economic data was developed by linear interpolation using the 2005 and 2035 datasets. These two datasets were prepared as part of the MPO's LRTP efforts. In order to provide the complete input data for a 2015 model run, an external-to-external trip file (EETRIPS) was created by linear interpolation using the 2005 and 2035 EETRIPS files. A Cube Application was developed to accomplish this task (Figure 1).

Figure 1: Cube Application to Develop 2015 Socio-Economic and EETRIPS Data



2.2.3 2015 E+C Transportation Network

The 2015 transportation network was developed by incorporating relevant changes in both existing facilities and planned projects into the 2013 E+C network. The resulting network is the 2015 E+C network and serves as the baseline for comparing different transit improvement alternatives.

Several changes have been made to the MDT's transit network since the E+C network was developed. A number of changes were made to the Metrobus system in December 2009 and June 2010. Several new routes have been introduced and service characteristics of existing routes have been modified. The E+C network was compared against the existing service and based on the Near-Term Committee's input, changes were made to the 2013 E+C transit network to more accurately reflect the transit infrastructure and services in the year 2015 (Table 2). A Total of 12 park-and-ride lots were also included in the E+C highway network (Table 3).

Table 2: Revisions to the E+C Transit Network

Service	From[1]	To[1]	Change
Metrorail			
Metrorail	System-wide		Peak-period headway from 7.5 mins to 6.5 mins
Metromover			
Route 133	MIA	MIC	Replaced with Metromover
Metrobus			
Routes 7, 37, 42, 110, 238	-	-	Stop at the Miami Intermodal Center (MIC) instead of at Miami International Airport (MIA) terminal
Route 2 Weekend Service			Deleted as the SERPM 6.5 is a weekday model
Busway Extension	Dadeland South	SW 344 St	Extended Busway from SW 264 St to SW 344 St
Route 21	Miami Art Museum	City of Opa-Locka	Alignment correction
Route 24	SW 137 Ct/Coral Way	Gov't Center Metrorail Station	Changed headway from 20 to 40 minutes to reflect two route alignments
Routes 34-Busway Flyer	City Hall in Florida City	Dadeland South Metrorail Station	Modified alignment from local streets to the Busway
Route 38 Busway Max	Wal-Mart in Florida City	Dadeland South Metrorail Station	Modified alignment from local streets to the Busway
Route 40 Weekend Service	Downtown Bus Terminal	Aventura Blvd	Deleted as the SERPM 6.5 is a weekday model
Routes 41	Dolphin Mall	NE 36 St/4 Ave	Deleted as merged with Route 36
Route 71	Dolphin Mall	Miami Dade College Kendall Campus	Off-peak headway changed from 40 to 65 minutes
Route 87	Dadeland North Metrorail Station	Palmetto Metrorail Station	Off-peak headway changed from 40 to 45 minutes
Route 120 Beach Max			Alignment correction
Route 137 West Dade Connection	Dolphin Mall	South Dade Gov't Center	Off-peak headway changed from 30 to 45 minutes
Route 150 Airport Flyer	Miami International Airport	19 St/Meridian Ave in Miami Beach	Included this new service
Route 175: Northwest Dade Express	Palmetto Metrorail Station	C. B. Smith Park-and-Ride at Pine Boulevard in Broward County	
Route 183 – 183 St Local	NW 87 Ave	NE 151 St	Alignment correction Changed Mode – Limited Stop to Local Bus
Route 224: Coral Way Max			Deleted as service has been discontinued
Route 236: Airport Owl			Deleted as service has been discontinued
Route 238 East-West Connection	Dolphin Mall	Earlington Heights Metrorail Station	Off-peak headway changed from 30 to 45 minutes
Route 240: Bird Road Max			Deleted as service has been discontinued
Route 252			Changed Mode – Local to Express Bus

Service	From[1]	To[1]	Change
Route 267			Deleted as service has been discontinued
Route 282			Deleted as service has been discontinued
I-95 Express services	All services		Corrected Field "Headway 2" in the SERPM to reflect the current evening service
Kendall Cruiser			Changed from Limited-stop to express service
Route 500: Midnight Owl	Dadeland South Metrorail Station	Gov't Center Metrorail Station	Alignment correction

Note:
1: Description from MDT website, accessed on July 20, 2010.

Table 3: Revisions to the E+C Highway Network

New Park-and-Ride Lot Locations
1. Kendall Dr / SW 150 Av
2. Kendall Village Center (Kendall Dr / SW 124 Av)
3. Kendall Town Center (Kendall Dr / SW 162 Av)
4. Miami Gardens Dr / NW 73 Av
5. Busway / SW 344 St
6. Dolphin Station (NW 12 St / NW 107 Av)
7. Douglas Rd Metrorail Station (under guideway)
8. NE Passenger Activity Center
9. 7th Av Transit Village (NW 7 Av / NW 62 St)
10. SW 127 Av / Kendall Dr
11. NW 27 Av / NW 215 St
12. SW 8 St / SW 147 Av

2.2.4 Performance of the SERPM 6.5

The model calibration relies on observed data of systems and services. The last Metrobus survey was conducted in 2004 and since then a considerable number of changes have been made to the Metrobus network. Therefore, before conducting analysis for the future year, it was necessary to assess the reasonableness of the model's performance. As shown in Table 4, the model performed reasonably well at the system level. The model forecast indicates a four (4) percent increase in the Metrobus ridership over the April

2010 ridership. The forecast indicates that the local bus service ridership will decrease by two (2) percent. This is largely due to the projected 18 percent decrease in local bus service (Table 1). However, express and limited-stop services will see an increase substantial enough to offset these losses.

The model's performance at route level, however, shows greater variation. For the purpose of this study, the Committee decided to focus on relative performance of transit alternatives based on the E+C and improvements scenario comparison.

Table 4: Ridership – 2015 Projected vs. 2010 Actual

	2015 Projected	2010 Actual	Projected vs. Actual
Metrobus	235,940	228,200	3%
- Metrobus - Local Service	202,554	206,248	-2%
Metrorail	76,366	66,700	14%
Metromover	23,540	27,400	-14%
Total MDT Ridership (excluding STS)	**335,846**	**322,300**	**4%**

3 Transit Alternatives

3.1 Scenario Development

The Committee developed three scenarios to evaluate proposed transit improvements as shown in Table 5.

Table 5: Transit Improvement Scenarios

Scenario #	Scenario Description	Improvements Included	Purpose
2015 E+C Scenario	Revised 2013 existing and committed (E+C) network	None	This scenario will act as a baseline to evaluate impact of proposed improvements.
Improvement Scenario 1	2015 with existing and committed transportation improvements + transit improvements identified by the Committee	- Enhancements to existing limited-stop routes - New transit routes	This scenario was primarily designed to screen alternatives identified by the Committee. The focus was to identify ridership potential of transit improvements.
Improvement Scenario 2	2015 with existing and committed transportation improvements + modified transit improvements based on the results of Scenario 1	- Transit services included in the Scenario 1 were modified to achieve optimal performance.	To maximize potential of service improvements based on results of Scenario 1.

The Committee developed transit service alternatives for Improvement Scenarios 1 and 2 and focused on services along the following three corridors. These three corridors have been part of the County's PTP and therefore, prioritized for implementing near-term transit improvements.

1. **Flagler Corridor:** It consists of Flagler Street and provides connection to numerous major destinations located along the entire length of the corridor. Some of the major destinations along this corridor include Florida International University, the Mall of the Americas, and the Miami CBD. Major trip origination areas include residential communities in the Westchester area.
2. **North Corridor:** It consists of NW 27th Avenue and is a priority PTP corridor for the County. Major destinations along this corridor include the Sun Life Stadium at Miami-Dade-Broward county line, Miami-Dade College North Campus, and the Miami International Airport. Major trip origination areas are several transit-dependent communities along NW 27th Avenue and in the southern Broward County.
3. **East-West Corridor:** The East-West Corridor is the area bounded on the north by NW 12th St, on the south by SW 8th St on the west by 137th Ave and on the east by downtown Miami. For this study, the focus was on SR-836 alignment to provide an express connection.

3.2 Transit Service Alternatives

Transit service alternatives were tested as part of a two-step process. The first step was development of Improvement Scenario 1 that included two service improvements and two new routes (Table 6). Based on the results of Scenario 1, Improvement Scenario 2 was developed that included two service improvements (Figures 2 and 3) and a new route (Figure 4). Ridership forecasts for both improvement scenarios were compared against the E+C ridership forecasts.

1. **E+C Scenario:** The E+C scenario closely resembles the current services which indicate that no service improvements are committed along the Flagler and North Corridors between now and the Year 2015. In the E+C Scenario, the Route 51 service along the Flagler Corridor will have 15 and 30 minute headways during peak and off-peak periods, respectively. Similarly, Route 97 service along the North Corridor will operate at 18 and 30 minute headways during peak and off-peak periods, respectively.

2. **Improvement Scenario 1:** Improvement scenario 1 was used for screening transit service alternatives. As listed in Table 6, peak and off-peak period headways were improved for Routes 51 and 97. Route 97 was extended to the MIC to provide one-seat rides to the Airport.

   Additionally, two new express services were tested. Both services were designed to operate during peak periods with 15 minute headway. The East-West Express service originated from the planned park-and-ride lot at SW 8th Street and SW 147th Avenue. The goal was to test the feasibility of providing one-seat rides to commuter trips originating in the western suburban area of the County and going to the Miami CBD.

   The MIC Express, on the other hand, was tested to identify the feasibility of a service connecting Doral and the MIC. This service originated from the planned park-and-ride lot at NW 12th Street and NW 107th Avenue.

3. **Improvement Scenario 2:** The results of Improvement Scenario 1 were presented to the Committee. Based on ridership forecasts and trip origin-destination analysis, the Committee decided to modify the East-West Express service alternative (Figure 4). The East-West Express service in this scenario terminated at the MIC and the service was improved to provide 10 minute headway during peak periods. The MIC Express service was eliminated from further consideration. Premium services along Flagler Corridor and North Corridor remained unchanged (Figures 2 and 3).

Table 6: Transit Service Alternatives

	Route 51 - Flagler Premium Service	Route 97 – North Corridor Premium Service	East-West Express	MIC Express
E+C Scenario Specifications				
Primary Alignment	Flagler Street	NW 27 Avenue	This is a new route designed as part of the Near-Term Plan. It is not included in the E+C scenario.	This is a new route designed as part of the Near-Term Plan. It is not included in the E+C scenario.
From	SW 137 Ave./Coral Way	MLK Metrorail Station		
To	Miami Art Museum	NW 37 Ave/211 St		
Peak Period Headway (mins)	15	18		
Off-peak Period Headway (mins)	30	30		
Route Length (directional miles)	18.7	10.9		
Number of Stops (directional)	31	14		
Improvement Scenario 1 Specifications				
Primary Alignment	Flagler Street	NW 27 Avenue	SR-836	SR-836
Improvement Type	Enhancements to Existing Service	Enhancements to Existing Service	New Route	New Route
From	P&R Lot at SW 8 St/ 147 Ave	P&R Lot at NW 215 St and 27 Ave	P&R Lot at SW 8 St/ 147 Ave	P&R Lot at NW 12 St/107 Ave
To	Miami Gov't Center	MIC	Miami Gov't Center	MIC
Peak Period Headway (mins)	12	15	15	15
Off-peak Period Headway (mins)	30	30	No service	No service
Route Length (directional miles)	15.5	13.5	19	8.3
Number of Stations (directional)	19	9	5	2
Improvement Scenario 2 Specifications				
Primary Alignment	Flagler Street	NW 27 Avenue	SR-836	Based on the results of Scenario 1, this service was eliminated for further consideration in Scenario 2.
Improvement Type	Enhancements to Existing Service	Enhancements to Existing Service	New Route	
From	P&R Lot at SW 8 St/ 147 Ave	P&R Lot at NW 215 St and 27 Ave	P&R Lot at SW 8 St/ 147 Ave	
To	Miami Gov't Center	MIC	MIC	
Peak Period Headway (mins)	12	15	10	
Off-peak Period Headway (mins)	30	30	No service	
Route Length (directional miles)	15.5	13.5	12.9	
Number of Stations (directional)	19	9	7	

Figure 2: Flagler Premium Service (Enhanced Route 51 Service)

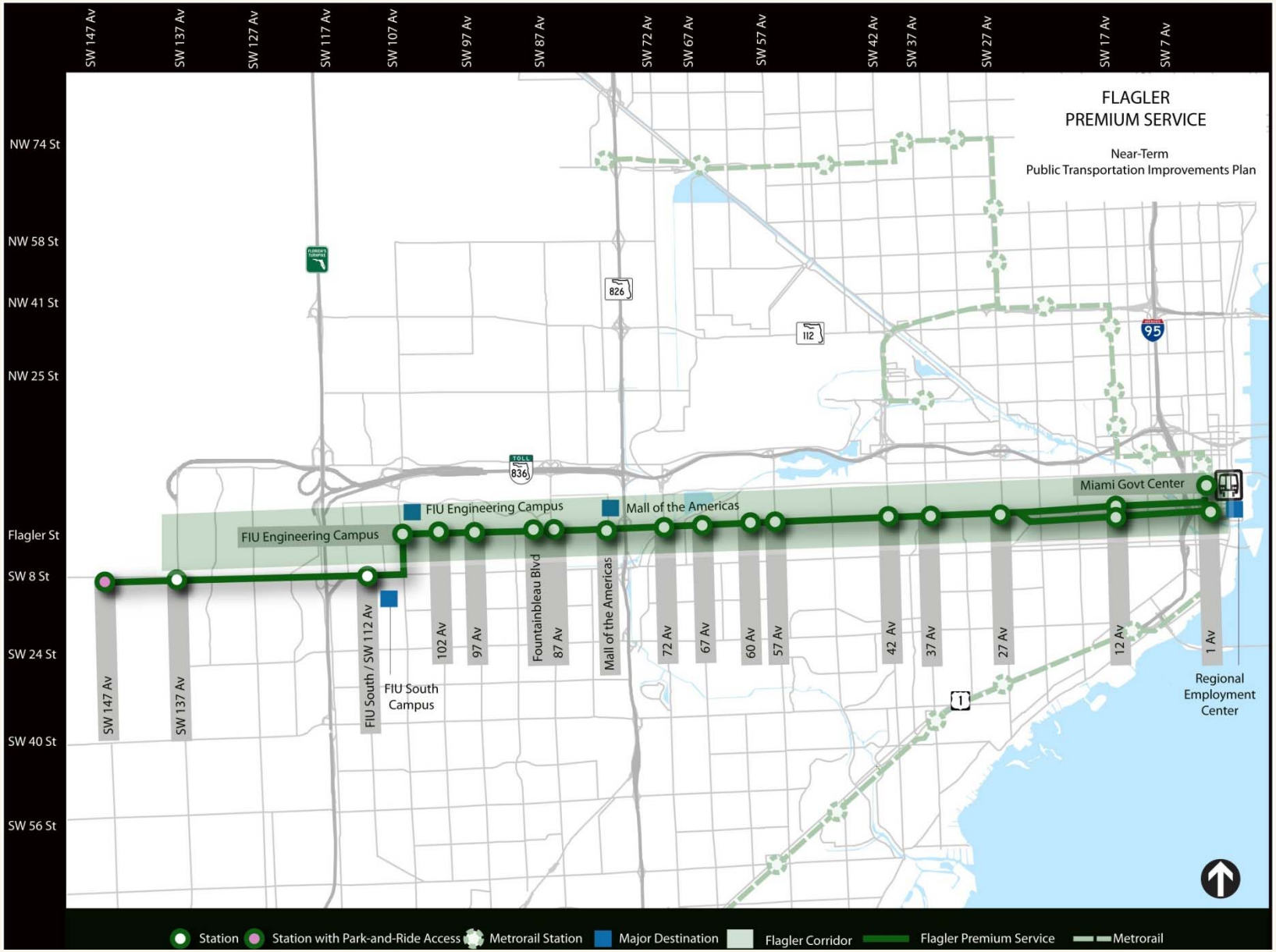


Figure 3: North Corridor Premium Service (Enhanced Route 97 Service)

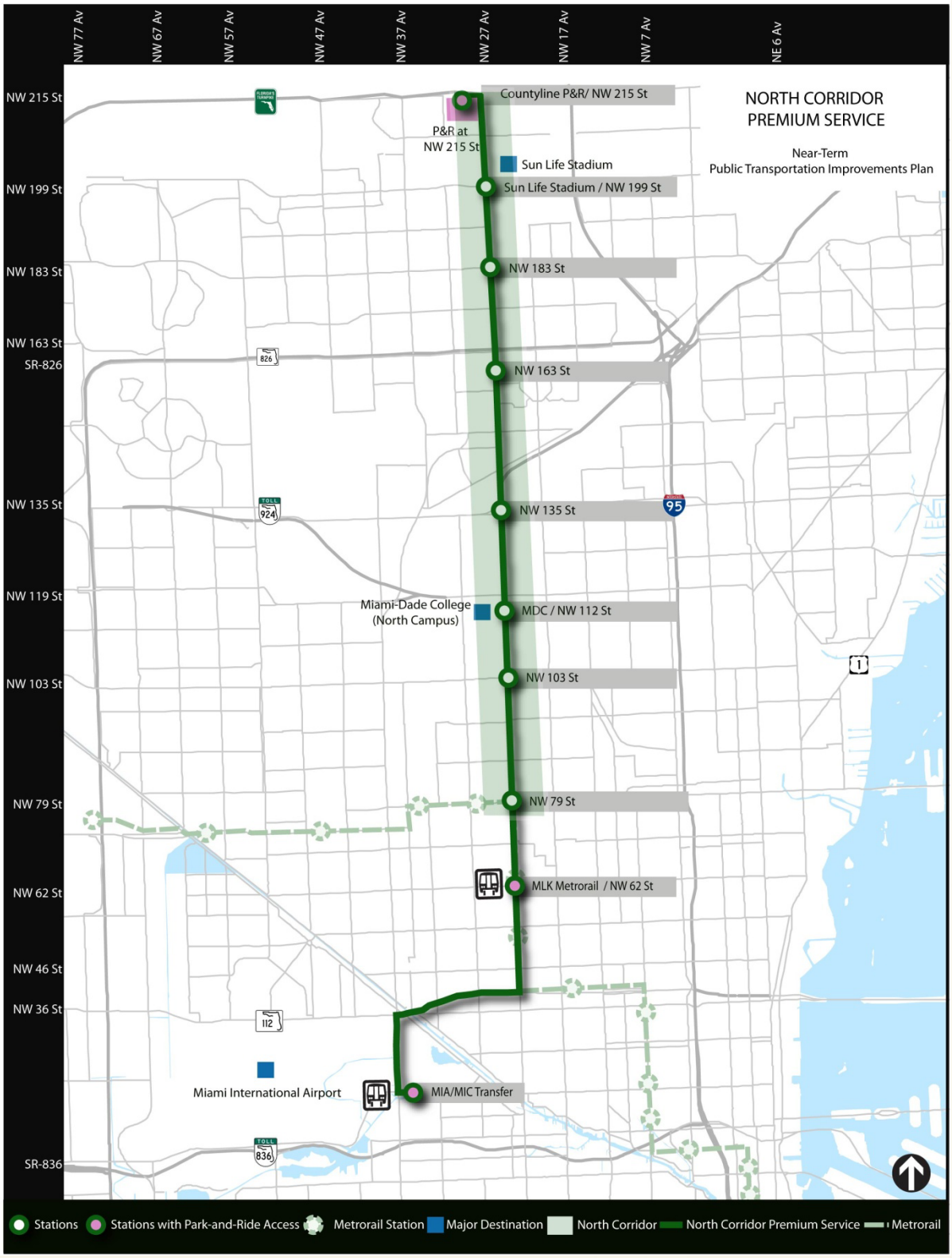
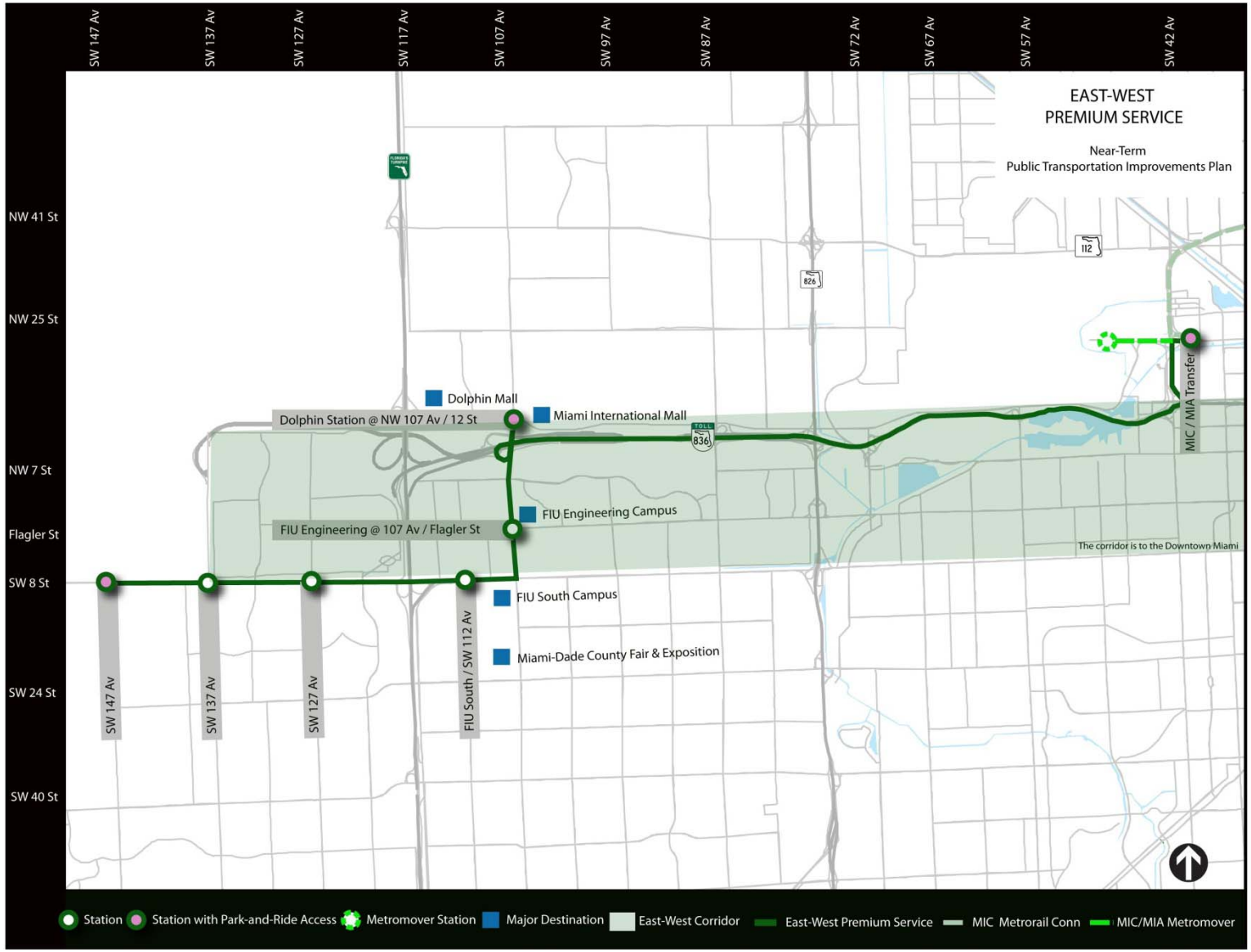


Figure 4: East-West Express Premium Service (New Service)



4 Ridership Forecasts

Each of the aforementioned transit service alternatives were tested using the SERPM 6.5 travel demand forecasting model. A review of the model results indicates that the planned service improvement will increase daily ridership by nearly 140 percent or 3,145 daily riders (Table 7). A brief description of results for each scenario is provided below:

1. **E+C Scenario:** The E+C scenario included Routes 51 and 97. These two routes were projected to have a daily combined ridership of 2,245. Route 51 service along the Flagler Corridor was projected to carry 1,830 daily riders while the North Corridor service was projected to have 415 daily riders.
2. **Improvement Scenario 1:** The Improvement Scenario 1 ridership forecast indicated an 81 percent increase over the E+C scenario. Most gains resulted from a significant ridership increase for Route 97. The East-West Express and MIC Express were forecasted to carry 494 and 167 daily riders, respectively.
3. **Improvement Scenario 2:** The Improvement Scenario 2 ridership forecast indicated a 140 percent increase over the E+C scenario. The modified East-West Express service was projected to carry nearly 1,850 daily riders. It should be noted that this service was designed to operate during peak periods only.

Table 7: Travel Forecasting Results for Transit Service Alternatives

Route	Ridership by Scenario			Change in Ridership over E+C (in %)	
	E+C	Imp. Scenario 1	Imp. Scenario 2	Scenario 1 v. E+C	Scenario 2 v. E+C
Route 51 - Flagler Corridor	1,830	1,793	1,922	-2%	5%
Route 97 – North Corridor	415	1,613	1,616	289%	289%
East-West Express	N/A	494	1,852	N/A	N/A
MIC Express	N/A	167	N/A	N/A	N/A
Total	**2,245**	**4,067**	**5,390**	**81%**	**140%**

An analysis of ridership forecast results also indicated that the Scenario 2 will increase overall transit ridership by the greatest amount (Table 8). In general, the tested transit improvements did not show a significant

ridership impact on Metrorail or Metromover services. The specific modal exception was the Local Bus service that was projected to witness a decrease in ridership in Improvement Scenario 2 over the E+C Scenario. These decreases were not unexpected as local bus services competed for ridership with the designed premium transit service alternatives. However, overall, Scenario 2 system ridership was projected to see an increase of nearly 2,220 daily riders. The ridership estimates for the transit system as a whole are summarized in Table 8.

Table 8: Travel Forecasting Results for MDT System (Excluding STS)

Mode	Ridership by Scenario			Change in Ridership over E+C (in %)	
	E+C	Scenario 1	Scenario 2	Scenario 1 v. E+C	Scenario 2 v. E+C
Metrobus	235,940	238,928	237,889	1%	1%
- Metrobus - Local Service	202,554	203,745	201,426	1%	-1%
Metrorail	76,366	76,255	76,490	0%	0%
Metromover	23,540	22,715	23,660	-4%	1%
Total MDT Ridership (excluding STS)	**335,846**	**337,898**	**338,039**	**1%**	**1%**

4.1 Adjusted Forecast

Due to the difference in the actual ridership numbers and the projected ridership numbers for the year 2010, adjustments to the Scenario 2 forecasts were made (Table 9). With adjustments, these three services are forecasted to carry a total of 7,780 daily riders in 2015.

Table 9: Adjusted Travel Forecasting Results for Transit Service Alternatives

Route	Ridership by Scenario			Net Change	Adjusted 2015 Forecast
	Actual (2010)	E+C (2015)	Imp. Scenario 2 (2015)	Gain (Imp Scenario – E+C)	
Route 51 - Flagler Corridor	3,411	1,830	1,922	92	3,503
Route 97 – North Corridor	1,225	415	1,616	1,200	2,425
East-West Express	-	N/A	1,852	N/A	1,852
Total	**4,636**	**2,245**	**5,390**	**1,292**	**7,780**

5 Preliminary Cost Estimates

Preliminary planning-level cost estimates were prepared for the E+C Scenario and Improvement Scenario 2. The purpose of the E+C Scenario estimates was to provide a basis for comparing incremental benefits of service improvements. It is advised that these planning-year cost estimates should only be used to compare the order of magnitude of required capital investment for different improvements.

5.1 Capital Costs

The capital cost estimates consisted of two elements: (1) Vehicles; and (2) Transit Facilities such as transit stations and park-and-ride lots. Estimated itemized unit costs for both elements are listed in Table 10. The capital cost estimates were prepared using MDT's recent procurement costs and data from other transit agencies. The capital cost estimates do not include cost for signal improvements and utilities relocation.

The cost of developing a station for premium transit services was estimated to be $150,000. The cost included all basic amenities such as shelter, additional bench, bike racks, and street-level lighting. The cost also included an information kiosk that will contain monitors for real-time bus arrival and system and route maps.

As directed by the Committee, all additional vehicles for these three routes were assumed to be articulated hybrid buses. MDT recently procured such vehicles at an approximate cost of $950,000 per vehicle. It was assumed that the County will have necessary centralized hardware and software in place by 2015 to implement real-time bus arrival system along these routes.

Three P&R lots will be developed to support planned service improvements. The capital cost of P&R lot development was provided by the County based on information provided by MDT. The cost of developing a P&R at SW 8 Street and SW 147 Ave was estimated to be $10,535,000. The cost of developing a P&R at NW 215 Street and NW 27 Avenue to support the North Corridor service was estimated to be $10,100,000. The lot at NW 12 Street and NW 107 Avenue will be developed by private developers.

Table 10: Itemized Capital Cost per Unit

Item	Per Unit Cost
- Bus Station	$150,000
- Articulated Bus	$950,000
- 40' Hybrid Bus	$680,500
- ROW for Stations	$140,000
- Parking Space	$7,200

Note: Estimates provided by the County.

The unit costs listed in Table 10 were used to develop capital cost for each service route (Table 11). Overall, approximately $51.2 million dollars will be needed to support the planned premium services. A significant portion of that amount will be spent on development of P&R lots.

Service improvements along the Flagler Corridor will require an initial outlay of approximately $14.3 million. The north corridor will require 11 additional buses and a total $25.2 million in capital costs. Approximately $11.6 million will be needed to procure buses and build stations to start a new East-West Express service along SR-836.

5.2 Annual Operations and Maintenance Costs

To identify incremental benefits of improving transit services along the three identified corridors, O&M cost per rider was developed. The purpose was to provide a common base for route by route comparison and help prioritize. As listed in Table 12, the East-West Express service has the lowest cost per rider. The improved headways on Route 51 will increase cost per rider to $3.70, still lower than the majority of the limited service costs. The planned improvements will result in an overall 71 percent increase in cost per rider for these three services.

Table 11: Capital Costs by Transit Service Alternative

System-Wide	Number Needed due to Service Improvements	Amount
Stations	50	$5,840,000
Vehicles	15	$24,700,000
P&R Lots	3	
Total		**$51,175,000**
Route 51 - Flagler Max		
Stations	0	0
Additional Vehicles	4	$3,800,000
P&R at SW 147 Ave and SW 8 St	1	$10,535,000
Sub-Total		**$14,335,000**
Route 97 - 27 Max		
Stations	16	$4,640,000
Vehicles	11	$10,450,000
P&R at NW 215 St and NW 27 Avenue	1	$10,100,000
Sub-Total		**$25,190,000**
East-West Express		
Stations	8	$1,200,000
Vehicles	11	$10,450,000
P&R at NW 12 St and NW 107 Avenue	1	Developer provided
Sub-Total		**$11,650,000**

Table 12: O&M Cost per Rider

	Estimated Annual O&M Cost (2009 dollars)		Change in Estimated O&M Cost - Imp. Scenario 2 v. E+C	
	Current	**With Improvements**	**In Dollars**	**In %**
Route 51 - Corridor	2.52	3.70	1.18	46%
Route 97 – North Corridor	4.25	4.26	0.01	0%
East-West Express Corridor	0.0	3.62	3.62	N/A
Total	**2.98**	**3.86**	**0.88**	**30%**

6 User Benefits Analysis

6.1 Background

User benefits refers to gains achieved by travelers in the form of travel time savings, lower out-of-pocket costs, or increased safety as the result of transportation improvements. User benefits can be measured in many different ways. The measure adopted by the Federal Transit Administration (FTA) is the Transportation System User Benefits (TSUB). TSUB represents the change in mobility for individual travelers that are induced by a project, measured in hours of travel time and summed for all travelers. TSUB estimates are required by the FTA for projects being considered for Section 5309 New Starts discretionary funding provided through the FTA.

To implement the TSUB measure, the FTA has developed a software package called SUMMIT to extract data needed to calculate user benefits from travel forecasting models. The calculation uses the "utiles" from the denominator of the logit equation of the model choice model and divides them by in-vehicle travel time coefficient to convert to equivalent minutes of travel time savings. One common use of SUMMIT is to compare the benefits experienced by all travelers from a major transit investment to a low-cost service improvement option. Thematic mapping of results can be used to evaluate how the transit investment might benefit different segments of the community. Another important use of SUMMIT is to perform quality control and identify illogical results in forecasts and potential problems in the model.

The user benefits analysis was conducted to supplement the work tasks specified in the original Scope of Work and is supported by the Contingency Fund. It serves two purposes. One is to compute travel time savings for all transit riders resulting from the near-term public transportation improvement projects and evaluate the impacts of these projects from a system-wide perspective. The other is to ensure the quality of the modeling work and identify areas of potential improvements for the SERPM 6.5 model as they relate to transit studies.

For the purpose of this study, only one improvement scenario is evaluated. The scenario is Improvement Scenario 2 as described in Table 5 on Page 10. This will be the "Build" Alternative. The baseline alternative will be the 2015 E+C Scenario also described in Table 5.

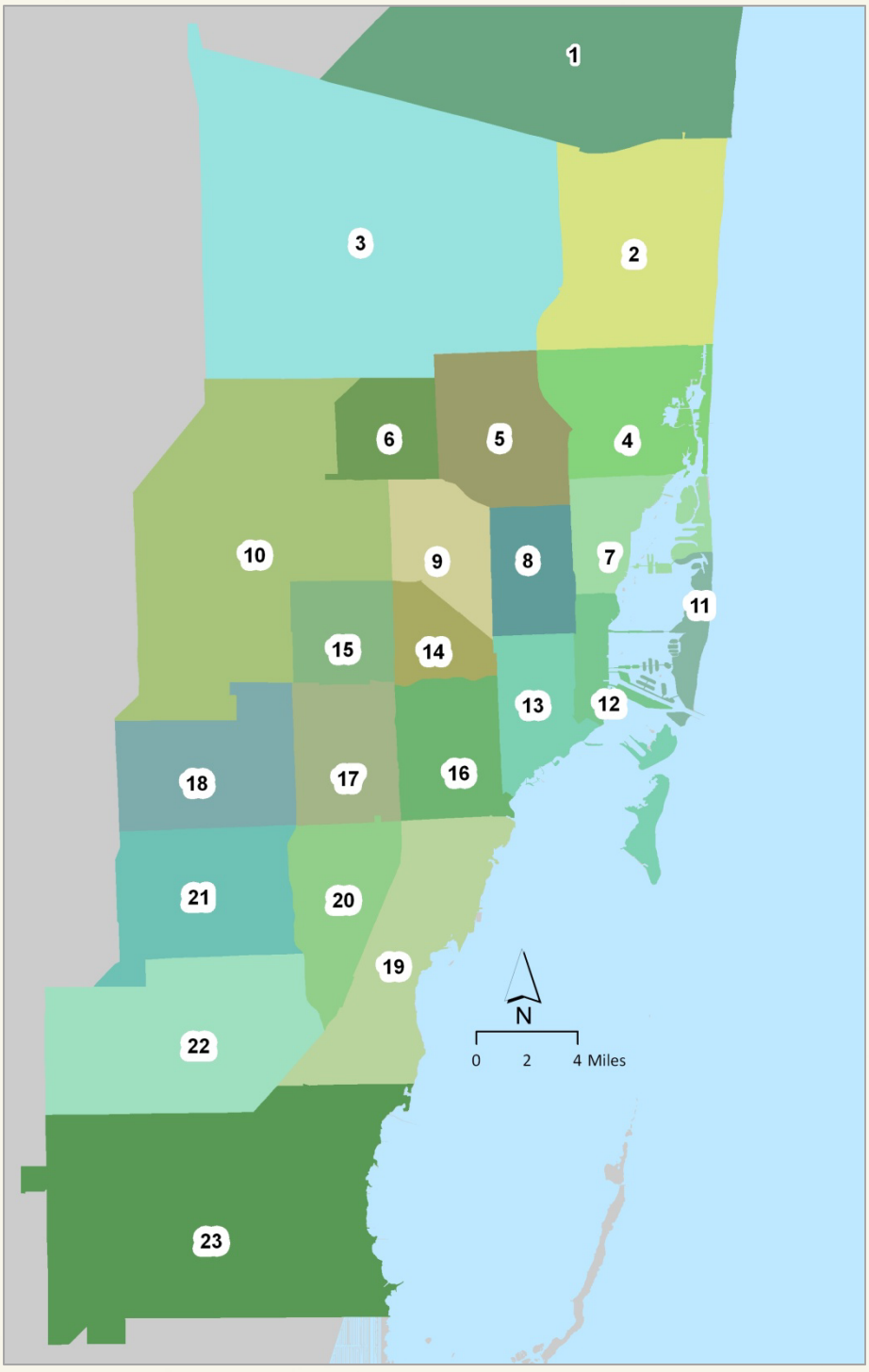
6.2 SUMMIT Districts

The SUMMIT program calculates the benefits of the build scenario versus the baseline at the traffic analysis zone (TAZ) level. It then aggregates this information into user-defined districts for the study area and allows for comparison between the build and baseline alternatives. The SERPM model contains 4,284 traffic analysis zones, and these TAZs are aggregated into 26 districts. The TAZs in Palm Beach County and northern Broward County are combined into one district. The TAZs in southern Broward County are grouped into two districts. Miami-Dade County has the largest number of TAZs and these TAZs are aggregated into 20 districts. The dummy zones and external stations of the three counties make up the remaining three districts. Table 13 shows the sequence number and description of the districts. Figure 5 shows the district boundaries.

Table 13: SUMMIT District Number and Description

No.	District Abbreviation	District Description	No.	District Abbreviation	District Description
1	BRD PB NTH	Palm Beach County/North Broward	14	MD MIA EST	Miami Dade Miami East
2	BO STH EST	Southeast Broward	15	MD MIA WST	Miami Dade Miami West
3	BO STH WST	Southwest Broward	16	MD MIA STH	Miami Dade Miami South
4	MD NTH EST	Miami-Dade North East	17	MDC GBL	Miami Dade Coral Gable
5	MD NTH CTR	Miami-Dade North Central	18	MDC WES	Miami Dade West Miami
6	MD NTH WST	Miami-Dade North West	19	MD PBK PNS	Miami Dade Pembroke Pines
7	MD CTR EST	Miami-Dade Central East	20	MD CTL BAY	Miami Dade Cutler Bay
8	MD CTR CTR	Miami-Dade Central Central	21	MD KDL STH	Miami Dade Kendall South
9	MD CTR WST	Miami-Dade Central West	22	MD RED LND	Miami-Dade Redland
10	MDC WST	Miami-Dade County West	23	MDC STH	Miami-Dade County South
11	MDC MB	Miami-Dade County Miami Beach	24	PB Wst Dmy	Palm Beach External and Dummy
12	MD MIA CTY	Miami-Dade County Miami City	25	BO S WstDm	Broward External Dummy
13	MDC BKL	Miami-Dade County Brickell	26	MD S ExDmy	Miami-Dade External and Dummy

Figure 5: SUMMIT District Boundaries



6.3 SUMMIT Runs

The user benefits calculations encompass all travel components for all travel modes. The utility function of the mode choice model includes in-vehicle travel time, out-of-vehicle travel time, transfer penalties, and transit fares, each of which is multiplied by a model coefficient. The denominator of the logit model is the sum of the utilities across all modes. However, based on the FTA's evaluation of SUMMIT results for a number of different areas, and partially because of the convergence issues associated with the highway equilibrium assignment process, the FTA has decided to not include the user benefits resulting from indirect improvements in highway travel times. Therefore, the total TSUB represents only the travel time savings for transit modes. In practical terms, this means that when generating input files from the model choice model for the SUMMIT program, not only do the trip tables need to be kept constant between the build and the baseline alternatives, the highway networks and highway travel times also need to be consistent between the two alternatives.

The SUMMIT program requires "user benefits (UB)" files generated by the mode choice model as input. A control file is used to determine the types of calculations that will be performed for a particular model run, and a zone-to-district equivalency table is used to aggregate the user benefits to the district level. A special Cube Voyager application was developed to import the highway travel times from the baseline network to the build network and then recalculate the transit skims. The SERPM 6.5 mode choice program (NLOGITK) was executed using the same highway skims but different transit skims for the two alternatives. The SUMMIT program was run to calculate the user benefits for Home-Based Work (HBW), Home-Based Other (HBO), and None-Home Based (NHB) trips for both the peak and off-peak periods. A special "roll-up" procedure was used to calculate the user benefits for all trip purposes for all day.

6.4 SUMMIT Results

The SUMMIT program reports trips and user benefits by access market classes to help identify major differences in transit services or network coding errors. It references the following three (3) access market categories:

- Can Walk (CW) – represents trips or user benefits for which walk access is possible
- Must Drive (MD) – represents trips or user benefits for which only drive access is available
- No Transit (NT) – represents trips or user benefits for which no transit option is available

Based on the access markets in the base and build alternatives, the SUMMIT produces trip summaries and user benefits for the following market combinations:

- Can Walk – Can Walk (CW-CW) – users can walk to access transit in both base and build alternatives
- Can Walk – Must Drive (CW-MD) – users can walk to access transit in base alternative but must drive to access transit in build alternative
- Can Walk – No Transit (CW-NT) – users can walk to access transit but have no transit access in build alternative
- Must Drive – Can Walk (MD-CW) – users must drive to access transit in base alternative but can walk to transit in build alternative
- Must Drive – Must Drive (MD-MD) – users must drive to access transit in both base and build alternatives
- Must Drive – No Transit (MD-NT) – users must drive to access transit in base alternative but have no transit access in build alternative
- No Transit – Can Walk (NT-CW) – users have no transit access in base alternative but can walk to access transit in build alternative
- No Transit – Must Drive (NT-MD) – users have no transit access in base alternative and but must drive to access transit in build alternative
- No Transit – No Transit (NT-NT) – users have no transit access in either base or build alternatives

The user benefits results by trip purpose and by time period are presented in Table 14. The proposed transit improvements would produce a total of 15,710 minutes or 262 hours of travel time savings per day for all transit users with respect to the baseline scenario. Home-Based Work (HBW) trips during the peak period would benefit the most from the transit improvements.

Table 14: User Benefits by Trip Purpose and by Period

Trip Purpose	User Benefits in Minutes			User Benefits in Hours		
	Peak	Off Peak	Daily	Peak	Off Peak	Daily
HBW	17,848	(1,687)	16,161	297	(28)	269
HBO	3,745	(2,665)	1,080	62	(44)	18
NHB	(547)	(984)	(1,531)	(9)	(16)	(26)
Total	21,046	(5,336)	**15,710**	351	(89)	**262**

Note: numbers of in parenthesis represent negative user benefits.

As SUMMIT generates a large number of reports, only selected reports are provided. Figure 6 is a snippet of the User Benefits Calculations Summary Report for the Peak Period HBW trips. Figure 7 presents the district-to-district user benefits report for Peak Period HBW trips. Figure 8 shows the district-to-district user benefits report for all trips combined.

User benefits maps are also plotted to graphically display the travel time savings at each TAZ. Figure 9 shows the user benefits for Peak Period HBW trips produced at each zone; Figure 10 shows the user benefits for Peak Period HBW trips attracted to each zone. The shading of the individual zones in both Figure 5 and Figure 6 follows the specifications recommended by the FTA. Three shades of green represent the positive user benefits with the darkest green representing the largest benefits. The breakpoints are set such that the dark green represents top 40 percent of the positive benefits, the medium green represents the next 30 percent of the positive benefits, and the light green represents the next 10 percent of the user benefits. Similarly, three shades of red are used to represent the negative user benefits with the dark red representing the largest negative benefits. The breakpoints for the red shades are symmetric with the breakpoints for the positive benefits. They do not necessarily correspond to the percentage breakdowns set for the positive benefits. For example, if the breakpoint between the light-green and medium-green shades for positive benefits is 55 minutes (Figure 5), then the breakpoint between the light-red and medium-red shades is set to be -55 minutes. Zones with small positive (less than 20 percent) or negative benefits are not shaded. Most TAZs will experience small to modest positive user benefits with the introduction of the new or improved routes. However, there are a number of zones showing significant negative user benefits. This is also true at the district level as shown in Figures 7 and 8.

Figure 6: User Benefits Calculations Summary Report for Peak Period HBW Trips (Snippet)

```
            Summary of User Benefit Calculations

 Table   Contents   Conditions      Markets          Total
 -----   --------   ----------   ------------   ---------------
    1    trips      all          BASE  CW-CW     2135712 trips
    2    trips      all          BASE  CW-MD           0 trips
    3    trips      all          BASE  CW-NT           2 trips
    4    trips      all          BASE  MD-CW           0 trips
    5    trips      all          BASE  MD-MD      143096 trips
    6    trips      all          BASE  MD-NT          26 trips
    7    trips      all          BASE  NT-CW         293 trips
    8    trips      all          BASE  NT-MD         482 trips
    9    trips      all          BASE  NT-NT      380133 trips
   10    trips      all          BASE  TOTAL     2659743 trips
… … … … … … … … …
   21    trips      trn          BASE  CW-CW       88681 trips
   22    trips      trn          BASE  CW-MD           0 trips
   23    trips      trn          BASE  CW-NT           0 trips
   24    trips      trn          BASE  MD-CW           0 trips
   25    trips      trn          BASE  MD-MD        2391 trips
   26    trips      trn          BASE  MD-NT           0 trips
   27    trips      trn          BASE  NT-CW           0 trips
   28    trips      trn          BASE  NT-MD           0 trips
   29    trips      trn          BASE  NT-NT           0 trips
   30    trips      trn          BASE  TOTAL       91071 trips

   31    trips      trn          ALT   CW-CW       88996 trips
   32    trips      trn          ALT   CW-MD           0 trips
   33    trips      trn          ALT   CW-NT           0 trips
   34    trips      trn          ALT   MD-CW           0 trips
   35    trips      trn          ALT   MD-MD        2412 trips
   36    trips      trn          ALT   MD-NT           0 trips
   37    trips      trn          ALT   NT-CW           2 trips
   38    trips      trn          ALT   NT-MD           4 trips
   39    trips      trn          ALT   NT-NT           0 trips
   40    trips      trn          ALT   TOTAL       91413 trips

   41    userbens   total              CW-CW       16432 minutes
   42    userbens   total              CW-MD           0 minutes
   43    userbens   total              CW-NT          -1 minutes
   44    userbens   total              MD-CW           0 minutes
   45    userbens   total              MD-MD        1140 minutes
   46    userbens   total              MD-NT          -1 minutes
   47    userbens   total              NT-CW          80 minutes
   48    userbens   total              NT-MD         199 minutes
   49    userbens   total              NT-NT           0 minutes
   50    userbens   total              TOTAL       17848 minutes
… … … … … … … … …
   61    userbens   transit            CW-CW       16432 minutes
   62    userbens   transit            CW-MD           0 minutes
   63    userbens   transit            CW-NT          -1 minutes
   64    userbens   transit            MD-CW           0 minutes
   65    userbens   transit            MD-MD        1140 minutes
   66    userbens   transit            MD-NT          -1 minutes
   67    userbens   transit            NT-CW          80 minutes
   68    userbens   transit            NT-MD         199 minutes
   69    userbens   transit            NT-NT           0 minutes
   70    userbens   transit            TOTAL       17848 minutes
… … … … … … … … …

         person trips total      BASE recrds     2659743 trips
         person trips total      ALT  recrds     2659743 trips
         person trips motorized  BASE recrds     2659743 trips
         person trips motorized  ALT  recrds     2659743 trips
         transit trips CW        BASE recrds       88680 trips
         transit trips CW        ALT  recrds       88997 trips
         transit trips MD        BASE recrds        2391 trips
         transit trips MD        ALT  recrds        2416 trips
         transit trips total     BASE recrds       91071 trips
         transit trips total     ALT  recrds       91413 trips

         total expenditure       BASE          122904340 minutes
         total expenditure       ALT           122886492 minutes
         user benefits (d expnd) BASE - ALT        17848 minutes
```

Figure 7: District-to-District User Benefits Report for Peak Period HBW Trips

Table 17
User Benefits (hours) for the Build Alternative
Total
HBW Trips – Peak Period

Production District	Attraction District 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
1 BRD PB NTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
2 BO STH EST	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
3 BO STH WST	0	0	0	0	0	0	0	1	1	0	0	3	3	-3	2	0	0	0	0	0	0	0	0	0	0	0	8
4 MD NTH EST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
5 MD NTH CTR	0	0	1	0	0	0	0	-1	1	0	0	2	2	-1	1	0	0	0	0	0	0	0	0	0	0	0	5
6 MD NTH WST	0	0	0	0	0	0	0	0	2	0	1	2	5	-2	2	0	0	0	0	0	0	0	0	0	0	0	12
7 MD CTR EST	0	0	0	0	0	0	0	0	0	0	0	0	-1	-9	0	-1	0	0	0	0	0	0	0	0	0	0	-11
8 MD CTR CTR	0	0	0	0	0	0	0	-1	0	0	0	0	-1	-10	2	-1	0	0	0	0	0	0	0	0	0	0	-10
9 MD CTR WST	0	0	-1	0	1	0	0	0	0	0	0	0	1	8	1	4	1	0	0	0	0	0	0	0	0	0	15
10 MDC WST	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
11 MDC MB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 MD MIA CTY	0	0	0	0	0	0	0	0	0	0	0	1	0	-2	2	0	1	0	0	0	0	0	0	0	0	0	1
13 MDC BKL	0	0	1	0	0	0	0	-1	0	0	0	0	0	-3	2	1	1	0	0	0	0	0	0	0	0	0	0
14 MD MIA EST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
15 MD MIA WST	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	-2	0	0	0	0	0	0	0	0	0	0	-4
16 MD MIA STH	0	0	0	0	-1	0	-2	-4	0	0	0	-1	-1	0	0	1	1	-1	0	0	0	0	0	0	0	0	-9
17 MDC GBL	1	2	2	2	2	0	1	6	7	2	3	66	37	15	-1	3	-1	-15	1	0	0	0	0	0	0	0	133
18 MDC WES	1	2	1	2	1	0	0	3	5	2	2	40	21	-2	-4	-7	-8	-4	0	0	0	0	0	0	0	0	57
19 MD PBK PNS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	8	0	0	0	0	0	0	0	0	0	19
20 MD CTL BAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	2	5	0	0	0	0	0	0	0	0	0	14
21 MD KDL STH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2	0	0	0	0	0	0	0	0	0	8
22 MD RED LND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	6	0	0	0	0	0	0	0	0	0	15
23 MDC STH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	2	16	0	0	0	0	0	0	0	0	0	37
24 PB Wst Dmy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 BO S WstDm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 MD S ExDmy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3	6	4	0	17	7	66	57	33	1	0	0	0	0													297
	5	4	2	3	5	113	-11	4	-20	0	0	0	0	0													

Source: SERPM 65 Mode Choice Application (HBW-PK)

Figure 8: District-to-District User Benefits Report for All Trip Purposes

Report S-5
User Benefits (hours) for the Build Alternative
Total
All Transit-Access Markets
All Trip Purposes

Production District	Attraction District 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
1 BRD PB NTH	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
2 BO STH EST	0	0	0	0	0	0	0	0	0	0	0	1	1	-1	1	0	1	0	0	0	0	0	0	0	0	0	4
3 BO STH WST	0	0	0	0	2	1	1	2	1	1	1	10	7	-9	2	-2	1	0	0	0	0	0	0	0	0	0	19
4 MD NTH EST	0	0	0	0	1	0	0	1	0	0	0	0	0	-3	1	0	1	0	0	0	0	0	0	0	0	0	2
5 MD NTH CTR	0	0	4	0	1	0	0	0	1	0	1	1	3	-15	1	0	1	0	0	0	0	0	0	0	0	0	-2
6 MD NTH WST	0	0	1	0	-1	0	0	2	3	1	2	3	8	-3	3	0	1	0	0	0	0	0	0	0	0	0	20
7 MD CTR EST	0	0	0	0	0	0	0	1	0	0	0	0	-2	-15	0	-1	0	0	0	0	0	0	0	0	0	0	-16
8 MD CTR CTR	0	0	1	0	-1	0	0	2	0	0	2	1	-5	-72	2	-5	1	0	0	0	0	0	0	0	0	0	-74
9 MD CTR WST	0	0	-3	-1	0	0	0	8	0	0	8	0	5	8	2	19	4	0	0	0	0	0	0	0	0	0	51
10 MDC WST	0	0	-1	0	0	0	0	2	0	0	0	1	1	0	2	1	2	1	0	0	0	0	0	0	0	0	9
11 MDC MB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 MD MIA CTY	0	0	1	0	1	0	0	-1	0	0	0	1	-1	-3	3	0	2	0	0	0	0	0	0	0	0	0	3
13 MDC BKL	0	1	1	0	0	0	0	-3	0	0	0	0	-2	-10	3	-1	3	-1	0	0	0	0	0	0	0	0	-10
14 MD MIA EST	0	0	-5	-2	-5	-5	-10	-16	-1	0	-1	-1	-3	0	0	0	2	1	0	0	-1	0	0	0	0	0	-46
15 MD MIA WST	0	0	-1	0	0	0	0	-1	0	0	0	2	1	-3	0	-2	-1	0	0	0	0	0	0	0	0	0	-4
16 MD MIA STH	0	0	-1	-1	-3	-1	-4	-16	-1	0	0	-1	-1	0	0	2	3	-4	0	0	0	0	0	0	0	0	-29
17 MDC GBL	2	3	2	3	4	0	1	6	12	4	5	78	65	25	-4	8	-8	-49	1	0	0	0	0	0	0	0	158
18 MDC WES	2	3	3	3	2	0	1	6	9	3	3	51	37	-3	-28	-28	-21	8	1	1	0	0	0	0	0	0	52
19 MD PBK PNS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2	12	0	0	0	0	0	0	0	0	0	26
20 MD CTL BAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	11	1	0	0	0	0	0	0	0	0	24
21 MD KDL STH	0	0	1	0	0	0	0	0	0	0	0	0	0	0	7	1	7	-1	0	0	0	0	0	0	0	0	15
22 MD RED LND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	8	0	0	0	0	0	0	0	0	0	17
23 MDC STH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	2	18	0	0	0	0	0	0	0	0	0	39
24 PB Wst Dmy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 BO S WstDm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 MD S ExDmy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	5	2	-12	25	22	117	43	49	3	-1	0	0	0	262
	7	2	-2	-7	10	146	-103	-3	-45	0	0	0	0		

Source: SERPM Mode Choice Model

Figure 9: User Benefits for Home-Based Work Travel at the Production End

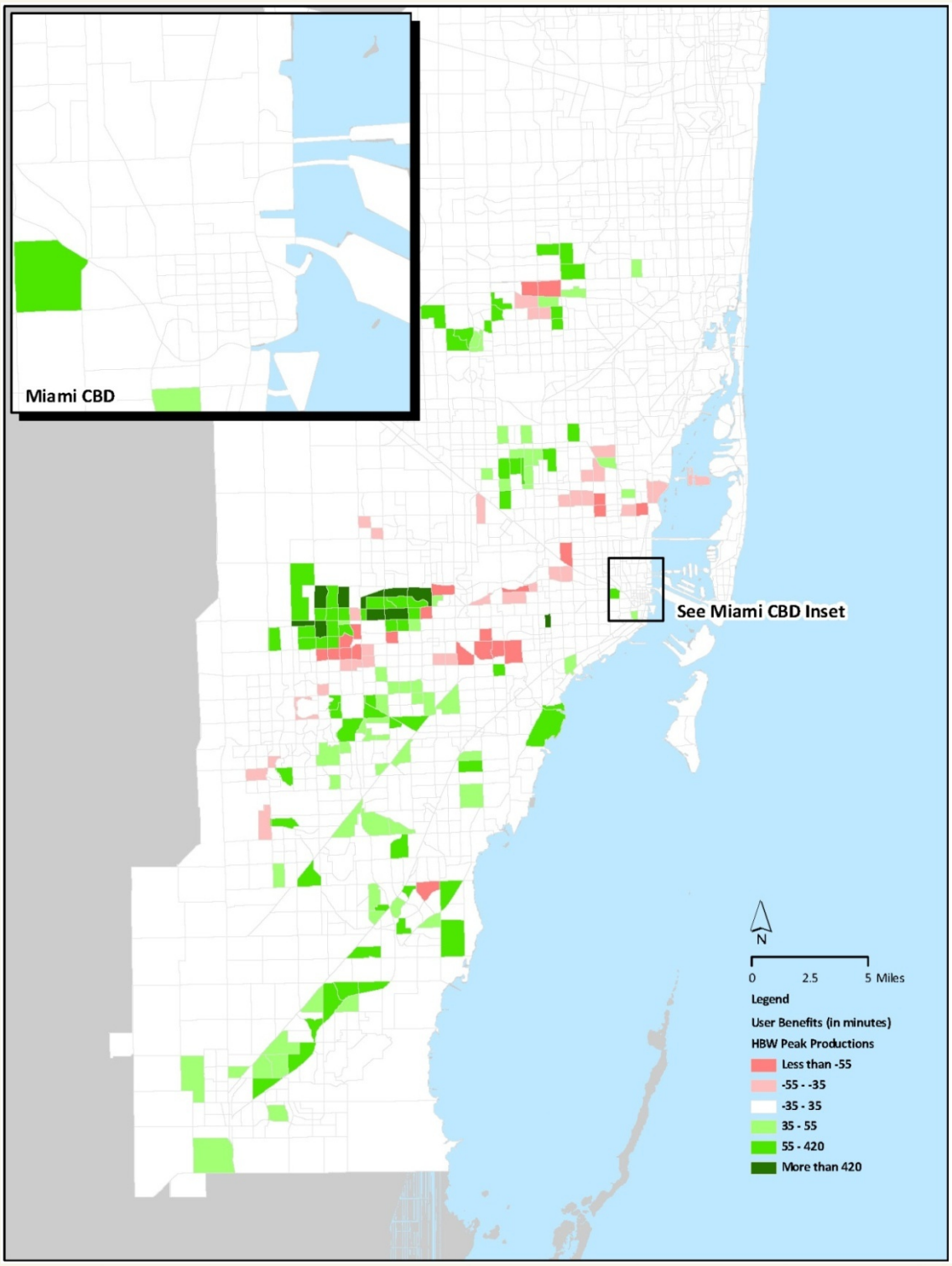
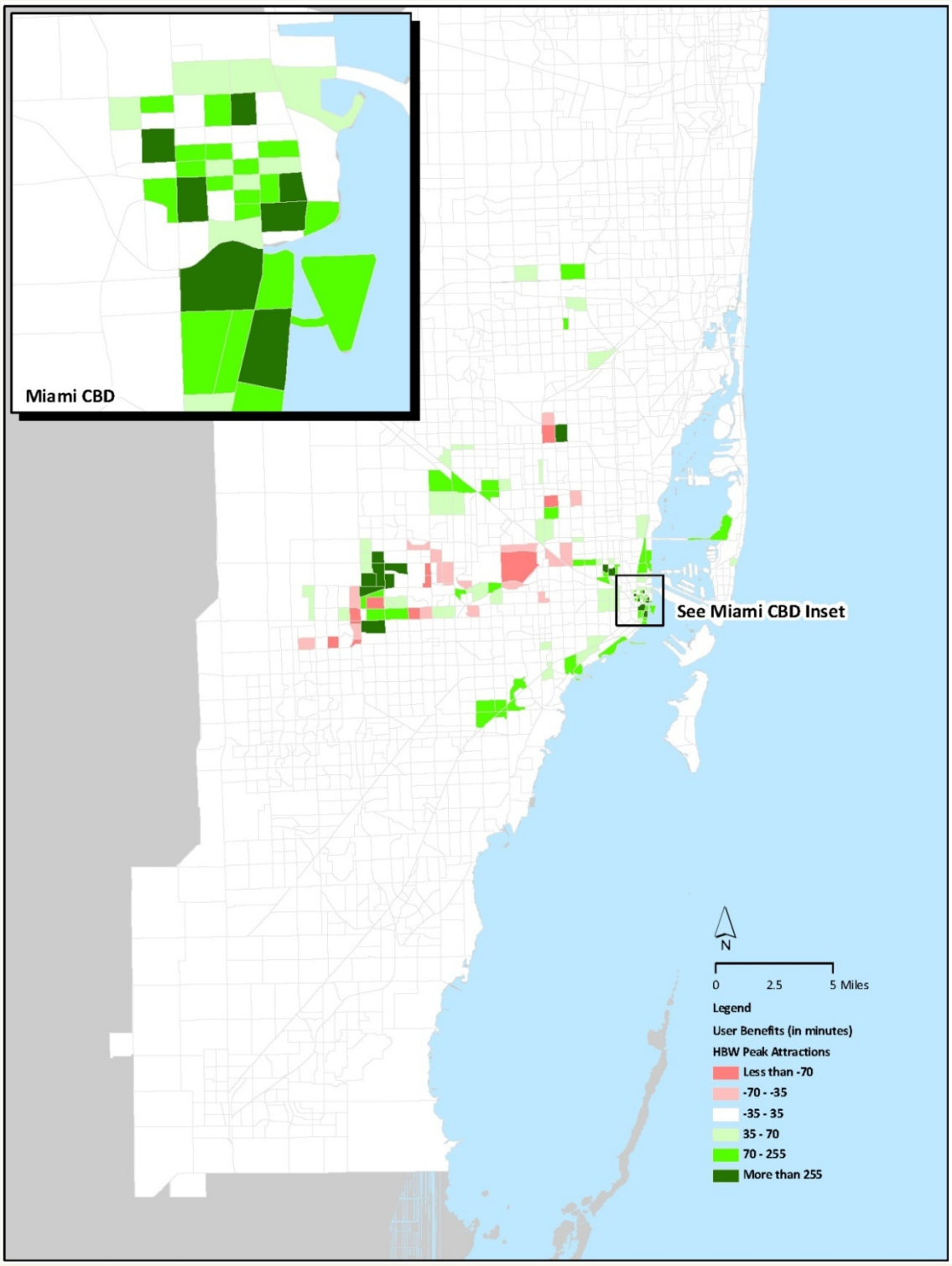


Figure 10: User Benefits for Home-Based Work Travel at the Attraction End

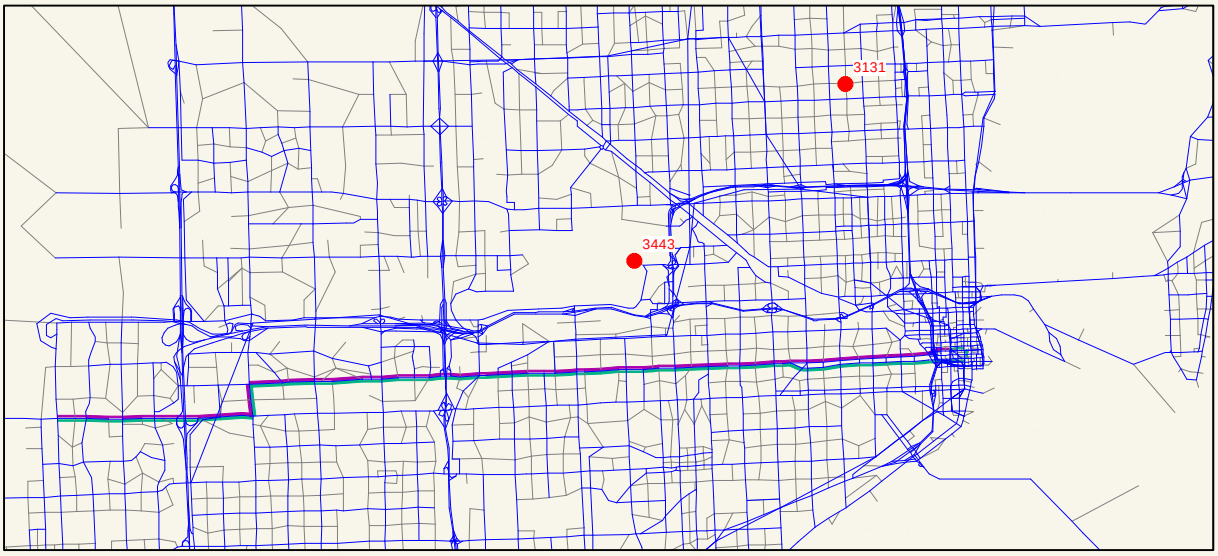


6.5 Possible Cause of Negative User Benefits

It seems to be counter intuitive to have negative user benefits when the only changes in the build alternative are improvements in transit services. In order to determine the possible cause of negative user benefits, a thorough quality check of the network coding was conducted first. The quality check focused on the route alignment, stop location, headway, speed, and mode. Walk connectors and auto connectors generated by the model were also reviewed for reasonableness. No coding errors or inconsistencies were found.

The next step involves the in-depth analysis of the transit model itself and performs SUMMIT style calculations using the User Benefits Calculator and Analysis System developed by the Citilabs. Figure 6 indicated that the Miami International Airport (TAZ 3443) had the largest negative user benefits. Further analysis identified that the zone pair 3443 and 3131 had high value of user benefits. The investigation was focused on this zone pair. Figure 11 shows the relative location of the two zones.

Figure 11: Location of TAZ 3131 and TAZ 3443



The SERPM 6.5 mode choice model considers the following eight transit modes:

- Walk to Bus
- Walk to BRT/LRT
- Walk to Metrorail
- Walk to Tri-Rail
- Auto to Bus
- Auto to BRT/LRT
- Auto to Metrorail
- Auto to Tri-Rail

Additionally, the model also considers the following three auto modes:

- Drive Alone
- Share Ride with 2 People
- Share Ride with 3 or more People

For each Origin-Destination (OD) pair, the model will find one single best path for each mode and determine the values for each associated cost components including walk time, auto time, etc. If a path does not exist between a particular OD pair, all the attributes will be set to zero.

A path tracing was performed for the peak period trips between TAZ 3131 and TAZ 3443 for Metrorail mode and the results are presented in Figure 12. The top portion of Figure 8 represents the path found for the base scenario. It involves using regular Metrorail and the Airport Shuttle to get to the Airport. TRNBUILD allows the user to factor the actual travel times on various segments of a trip to perceived travel times based on user-specified weighting factors. The perceived travel time represents the travel time as experienced by the traveler rather than the actual clock time. The perceived travel time is 97.86 minutes. The bottom portion of Figure 8 shows the path for the build alternative. Instead of using Metrorail, the path-builder found Route 97 on the 27th Ave because the perceived travel time is only 85.51 minutes. However, since this is the path for Metrorail, and Metrorail is not part of the path, this path will be discarded in mode choice calculations.

Figure 12: Path Tracing Between TAZ 3131 and TAZ 3443

(a) Base Scenario

```
TRACE: 3131-  Wait   Time Actual Percvd  Dist Total Lines (wt)  I-J= 3131-3443
M  1  24048     --   5.52   5.52  12.42    23    23
   5  24031   5.00   5.45  15.97  32.46   127   150 M5L65MO(.167) M5L66MO(.333)
                                                   M5L67MO(.333) M5L68MO(.167)
   3  30005     --   0.75  16.72  34.15     3   153
   7  30007   3.25   3.86  23.83  47.57   171   324 M7L1MD   (Metrorail)
   7  30522   3.25   8.81  35.89  65.94   263   587 M7L13MD-
   3  24271     --   0.72  36.61  67.56     3   590
   9  27774   1.35  10.34  48.30  89.76    72   662 M5L99MD- (Airport Shuttle)
   1   3443     --   3.60  51.90  97.86    15   677
```

(b) Build Scenario

```
    TRACE: 3131-  Wait   Time Actual Percvd  Dist Total Lines (wt)  I-J= 3131-3443
M  1  24048     --   5.52   5.52  12.42    23    23
   5  24031   5.00   5.51  16.03  32.53   127   150 M5L65MO(.167) M5L66MO(.333)
                                                   M5L67MO(.333) M5L68MO(.167)
  13  24271   5.00  11.40  32.43  59.71   405   555 M13L88MI (Route 97 on 27th Ave)
   9  27774   1.35  10.34  44.12  77.41    72   627 M5L99MD- (Airport Shuttle)
   1   3443     --   3.60  47.72  85.51    15   642
```

The negative user benefits indicate that the cost of travel is higher in build alternative than base alternative. The higher cost of travel is caused by lower value of utility which is in turn caused by lack of available paths (or modes). This problem would not exist with a multipath path builder such as Cube Voyager's Public Transport (PT) module. However, with single path path-builder in TRNBUILD, it could happen. Having recognized this problem, the run time factors used for Metrorail path building were adjusted and as a result, the Airport no longer showed the negative benefits. In fact, is showed almost the largest positive user benefits as one would expect. Unfortunately, the change caused other zones to show negative user benefits.

7 Summary

The purpose of this study was to support the MPO's and MDT's efforts to develop a Near-Term Public Transportation Improvements Plan. The Near-Term Plan Committee developed four transit service alternatives that were tested using the SERPM 6.5. Three service alternatives were selected for further consideration. The ridership forecasts indicate that service improvements will result in additional 1,292 daily riders for the three identified services and a system-wide increase of nearly 2,200 daily riders. The service improvements will require an initial outlay of approximately $51.2 million in capital costs.

The user benefits analysis using FTA's SUMMIT program evaluated the performance of the proposed transit improvements from a system-wide perspective. The SUMMIT results indicate that the transit users would save an equivalent of 262 hours of travel time when the proposed services are implemented. Home-Based Work travel during peak hours would enjoy the most benefits.

The possible cause of negative user benefits was investigated. It was found that the TRNBUILD path builder may not always find the best path, and being a single path path-builer, it would certainly not find all reasonable paths. Using a multipath path-builder such as PT may help mitigate the problem. It should be noted that the negative user benefits are a symptom of many modeling issues ranging from network coding to model specifications. Efforts to improve the model need to be made in the broader context of behavior modeling and close coordination with the FTA is needed.