Oakland Park Boulevard
Transit Corridor Study

June 2013

Oakland Park Boulevard Alternatives Analysis

Short Term Improvements Technical Memorandum

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

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Table of Contents

List of Figures

List of Tables

1.0 Introduction

The Oakland Park Boulevard Transit Study is examining several strategies for improving transit service on Oakland Park Boulevard, also known as State Road 816 (SR 816), one of the more heavily traveled corridors in Broward County, Florida, and host to the second most productive bus route (Route 72) in the Broward County Transit (BCT) system. The study is being led by the Florida Department of Transportation (FDOT), in partnership with the Broward MPO, BCT, and the South Florida Regional Transportation Authority (SFTRA).

Oakland Park Boulevard moves nearly 9,000 bus passengers/day (or 7.2% of the BCT system's total daily ridership[1]) and has been proposed for a Premium High-Capacity Transit service in the adopted 2035 Long Range Transportation Plan (LRTP). FDOT initiated this study to identify transit improvements along the corridor that achieve the desired high-quality, high-capacity premium transit service envisioned in the LRTP, as well as to meet the route's near- and long-term ridership demand. This study is expected to result in a Recommended Build Alternative (RBA) in November 2013.

Subject of this Report

The build alternatives being considered in the corridor include Enhance Bus Service alternative, Business Access and Transit (BAT) lane with bus or streetcar, and Exclusive lane with bus or streetcar. Recommendation of a RBA would allow this project to advance into the next phase of project development and environmental review. Although the advancement of projects from feasibility through project development, design and construction has been shortened through MAP 21, project planning and development may still require significant time (over 5 years) to complete before the start of operations. While the design and engineering of a RBA requires significant time and financial resources (yet to be identified), many aspects of the overall RBA can be implemented with shorter development time and fewer financial resources. It became evident during the development of the Build Alternatives that there were several smaller improvements which could address existing accessibility, mobility and travel time challenges within the corridor. These improvements could be advanced on a separate path pursuing short-term funding opportunities through the FDOT Work Program. These improvements would require minimal or no right-of-way, minimal operating resources, and capital investment requirements that could be funded within projected or reasonably obtainable short-term financial resources.

Given these assumptions, several physical and operational improvements have been identified that can be implemented in a shorter time (i.e., next two to five years) to address some of the transportation and transit mobility and accessibility issues included in all the build alternatives. These improvements include 1) revised schedule to improve on-time performance; 2) bus stop consolidation; 3) transit signal priority; 4) queue jump lanes; 5) bus islands; 6) traffic signal progression; 7) enhancing existing bus stops (i.e. shelters, benches); and 8) bicycle/pedestrian improvements to provide better accessibility to stops. This technical memorandum describes the assumptions and methodology used for identifying some of the short term improvements, initial results and next steps for determining the most effective short term transit solutions in the corridor. It should be noted that traffic signal progression is not discussed in this report.

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[1] *Oakland Park Boulevard Alternatives Analysis: Purpose and Need Statement,* prepared for the Florida Department of Transportation District Four, January 2013, page 25.

1.1 Study Area

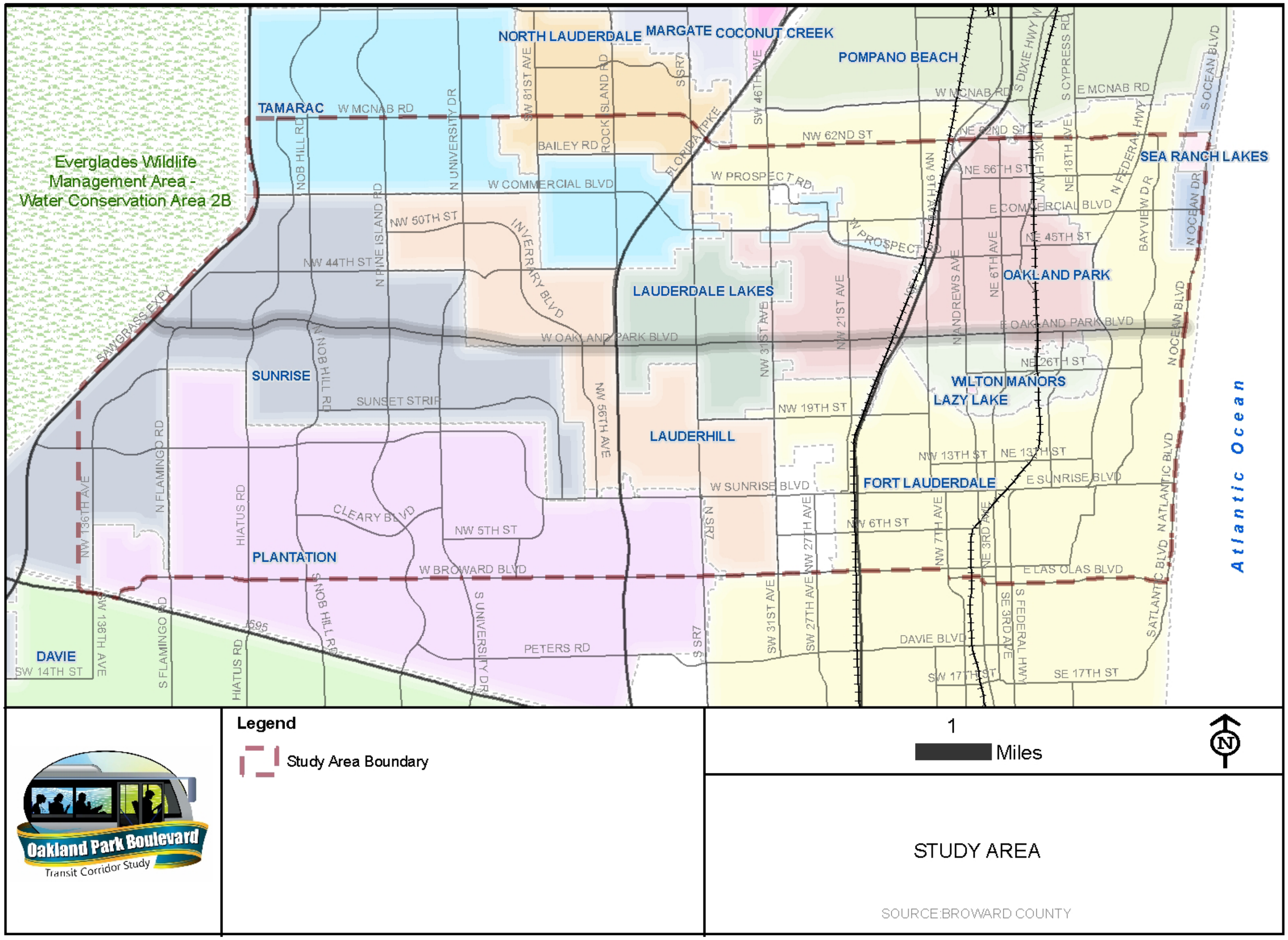
Oakland Park Boulevard is a six-lane, east–west arterial road serving central Broward County. It stretches 13.6 miles from its western terminus at an intersection with the Sawgrass Expressway (SR 869) in the City of Sunrise near the Sawgrass Mills Mall and BB&T Center (formerly called Bank Atlantic Center), and an eastern terminus at an intersection with Ocean Boulevard (SR A1A) in the City of Fort Lauderdale. As shown in Figure 1, the study area boundaries incorporate a travel shed that extends north to Cypress Creek Road and south to Broward Boulevard. The study area includes parallel roadways providing similar local and regional mobility (Commercial Boulevard to the north and Sunrise Boulevard to the south of Oakland Park Boulevard), and traverses portions of the Cities of Sunrise, Lauderhill, Lauderdale Lakes, Oakland Park, Wilton Manors, Fort Lauderdale; and the municipalities of Tamarac, North Lauderdale, Sea Ranch Lakes, Lauderdale-by-the-Sea, Lazy Lake, Plantation, and unincorporated areas of Broward County.

The Oakland Park Boulevard corridor is served by BCT Route 72, BCT paratransit services known as Transportation Options–TOPS, and city-run “Community Buses.”

Route 72 route provides weekday service between the Sawgrass Mills Mall area and SR A1A from 5:00 am to 12:35 am, including 15-minute service between 6:00 am and 6:00 pm. Weekend service is provided between 5:00 am and 12:30 am, with 20-minute and 30-minute service throughout the service periods on both Saturdays and Sundays. Route 72 uses both standard and articulated buses, and bus stops are placed approximately every 1,100 feet.

As shown in Figure 2, multiple BCT bus routes intersect and provide transfer opportunities along Route 72 at several intersections. Some of the highest performing routes in the BCT system that intersect with Route 72 include Route 18 (US 441/SR 7); Route 1 (south on US 1); and Route 2 (University Drive). Community Bus services are provided across and along Oakland Park Boulevard through the Cities of Fort Lauderdale, Lauderdale Lakes, Lauderhill, Sunrise, Lauderdale-by-the-Sea, and Tamarac.

Figure 1: Study Area



1.2 Purpose and Need

With such a high concentration of people and jobs and lack of an east-west expressway north of I-595 in Broward County, Oakland Park Boulevard is heavily used for east-west travel by travelers of all modes. The Oakland Park Boulevard intersections with SR 7 and University Drive are the two most congested intersections in Broward County, and its limited right-of-way restricts the number of opportunities available to expand roadway capacity. Oakland Park Boulevard accommodates small commercial parcels many of which provide multiple driveways, as well as a large number of pedestrians who cross streets to transfer to other bus lines, shopping, work places, etc. All of these activities contribute to delays along Route 72. Broward County Transit has implemented a variety of operational and capacity improvements to accommodate the high demand (including 15-minute headways and articulated buses), but given the above conditions, Route 72 continues to have difficulty in reliably meeting its schedule and providing an adequate number of seats and standing room for passengers.

Any improvements considered for the Oakland Park Corridor must meet the project's purpose to enhance the quality of transit service in the corridor in order by:

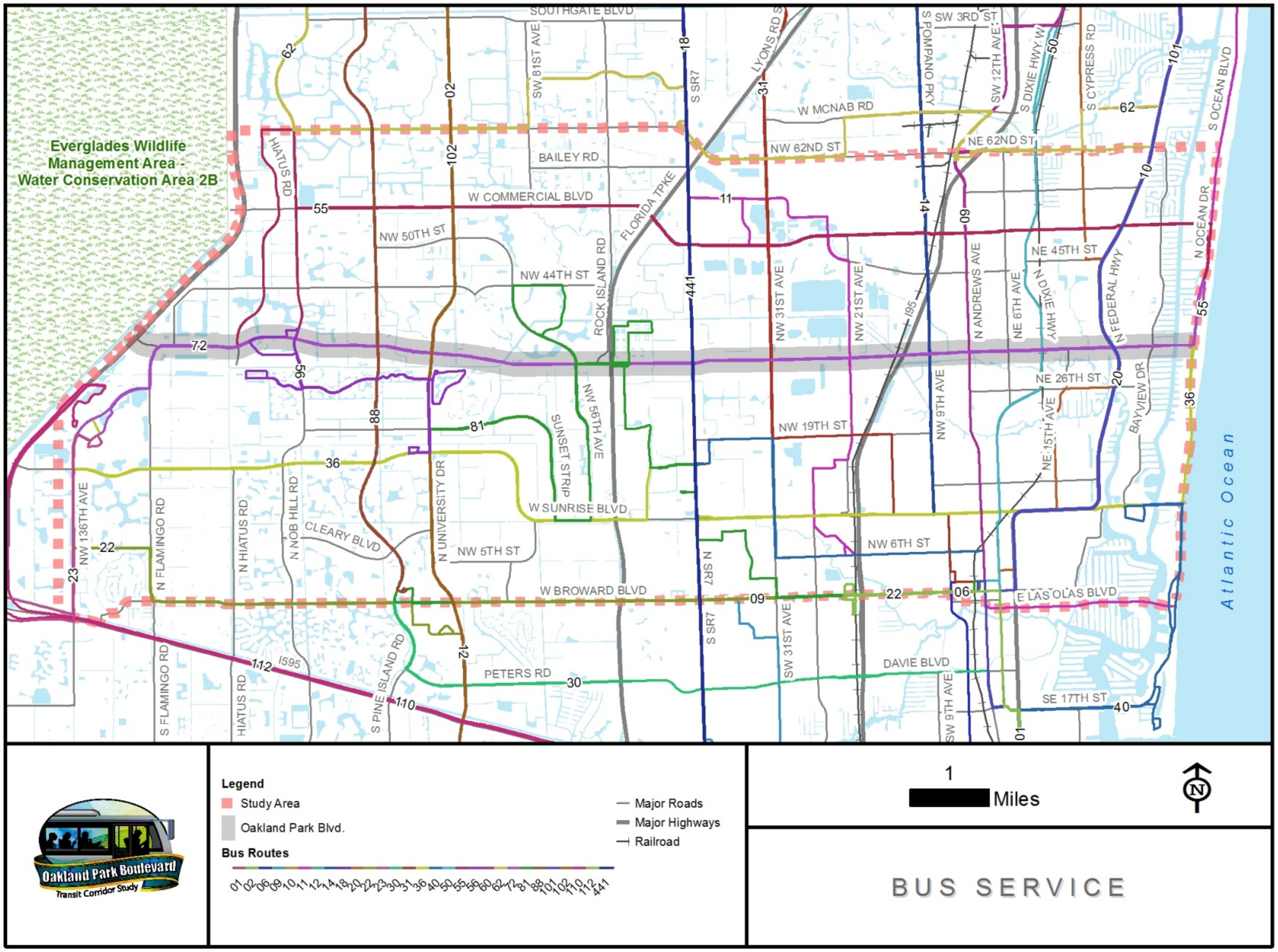
- Improving travel reliability, convenience, and accessibility;
- Increasing land use and development opportunities; and
- Supporting regional economic activity.

1.3 Need for the Project

Transit system/service improvements identified in the Oakland Park Boulevard Transit Study must supplement highway capacity, improve east/west connectivity, and improve the quality of transit services especially for those who are dependent on transit. This project must also accommodate robust future growth in population and employment consistent with regional land use objectives, improve mobility for shorter trips, and provide direct access to existing and planned development along the entire corridor. Based on the transportation and mobility issues in the study area, a premium transit investment in the corridor must address the following needs:

- Transit Service Quality
- Potential for Passenger Crowding
- Mobility and Accessibility
- Population and Employment Growth
- Traffic Congestion and Auto Orientation
- Economic Development and Land Use

Figure 2: Existing Transit Service



2.0 Route 72 Bus Schedule

2.1 Existing Route 72 Bus Schedule

The existing Route 72 – Oakland Park Boulevard operates seven days a week providing high frequency local stop bus service. Table 1-1 identifies Route 72 service characteristics (service levels and span of service hours) for weekdays, Saturdays and Sundays.

Table 1-1: Route 72 Service Characteristics (Effective: May 27, 2012)

Service Day	Service Periods / Span of Service	Service Frequencies
Weekday	5:00 a.m. – 6:00 a.m. 6:00 a.m. – 6:00 p.m. 6:00 p.m. – 7:00 p.m. 7:00 p.m. – 9:30 p.m. 9:30 p.m. – 11:45 p.m.	20 minutes 15 minutes 20 minutes 30 minutes 45 minutes
Saturday	5:50 a.m. – 9:05 a.m. 9:05 a.m. – 6:05 p.m. 6:05 p.m. – 9:30 p.m. 9:30 p.m. – 11:45 p.m.	30 minutes 20 minutes 30 minutes 45 minutes
Sunday	8:10 a.m. – 7:25 p.m. 7:25 p.m. – 8:55 p.m.	30 minutes ~40 minutes

2.2 Existing Route Schedule Analysis

BCT Schedule Development / Peer Experience

BCT much like most other transit authorities across the country develop transit schedules using a methodology designed to meet community needs (demand) within available resources. Route schedules begin as an identified route alignment. Schedule time points are established along the route alignment at key crossing route transfer locations or major activity centers and are generally evenly spaced along the route alignment. Schedule run times are generally developed between time points by time of day based on roadway travel speeds, traffic congestion and anticipated rider boarding and alighting demands. Service frequency is generally established based on anticipated demand, agency policy or funding available. Route 72 operating along Oakland Park Boulevard is an established route with known ridership demand and travel time experience from which to judge future run time adjustments. BCT makes route, service level (e.g., service frequency) and running time adjustment changes three to four times per year. The analysis of and the need for adjustments are determined for each of these service change implementation dates based on data collected and analyzed, significance of the modification required, and funding available for implementation. Once the need for service adjustments are determined and operating and capital costs are estimated, BCT prioritizes and implements these changes based on need and funding availability.

On-time performance related schedule adjustments account for a significant portion of service changes in established U.S. transit systems within growing communities such as BCT. Running time adjustments often require additional resources to correct or maintain existing service levels (i.e., service frequencies). On-time performance deficiencies occur most often during peak travel periods when traffic congestion and ridership volumes are at their peak. An additional bus or buses are generally required to add time into a bus schedule if buses running late. If buses are running ahead of schedule, time is removed from the schedule along the segment prior to the early running time point to ensure buses do not run ahead of the posted schedule times. This time is often moved to another portion of the schedule that needs additional time or added to the end-of-line layover time. BCT is experiencing both early arrivals as well as late arrivals at time points along the route 72, suggesting the need for reallocation of existing running time and possibly additional end-to-end running time, bus requirements and operating costs.

Transit agencies have the following options to correct poor schedule adherence:

- Adjust running times between time points if time is misallocated and no additional running time is required end-to-end (i.e., no additional operating or capital costs),
- Add running time where needed to ensure on-time performance, which may result in longer end-to-end run times which may require additional buses to maintain existing service frequency levels (i.e., higher operating and capital costs),
- Broaden the headways or service frequencies, i.e., increase the time between bus trips (e.g., from 15 minute frequencies to 17 minute frequencies) to continue the route within available funding resources (i.e., degradation of service levels with no additional operating and capital costs).

The last option of often the option of last resort because it may result in ridership over loads on heavy ridership routes and presents the loss of timed transfer connections in transit systems which operate all routes on clock faced2 service frequencies.

Existing Schedule Analysis

The existing weekday bus schedule is experiencing significant challenges regarding on-time performance and the following analysis results in a revised Route 72 bus schedule designed to improve on-time performance resulting in improved service reliability. Service reliability and consistency is a high priority of BCT and the following analysis provides the first step to improvement within the Oakland Park Boulevard corridor.

It is important to first identify the factors influencing service on-time performance reliability and understand the impacts each of these factors have on schedule adherence. Listed below are a number of factors influencing bus travel times and thus service reliability.

- Continuously evolving traffic volumes by roadway segment and time of day
- Multiple traffic signals/Intersection Level of Service (LOS) – excessive queuing at intersections and turn-lanes
- I-95 access queuing
- Train crossings
- Bus stop locations/transfer connections
- Bus bays versus curb side stops
- Number of bus stops served per trip

[2] Clock Faced Service Frequencies are service frequencies operated at 5, 10, 15, 20, 30 and 60 minute intervals between buses (frequencies divisible into 60 minutes). These systems are designed around time transfer connections or to ensure easier understanding of service levels by the transit passengers.

- Varying passenger boarding's and alighting's by bus stop, route segment and time of day
- Passenger loading time (volume, fare media, age and mobility)
- Range of bus operator driving skills
- Unpredictable wheelchair and bike boardings/alightings
- Transit vehicle performance (e.g., standard coach versus articulated coach)

The existing Route 72 schedule is contained in Appendix A. This schedule denotes existing scheduled times by trip and time point. A base travel time is identified which is assigned to traditional non-peak travel periods and transition periods between early morning and morning peak hours, as well as between the afternoon peak travel hours and the evening service hours. As noted in this schedule, travel times are increased during morning and afternoon peak travel hours (highlighted in green and generally one minute per time point to time point segment) and reduced (same manner, highlighted in pink) from the base during early morning and evening hours when traffic volumes are lowest.

The existing schedule depicted reflects block assignments (i.e., a number assigned to a bus that operates throughout the day, example 7201 is the first bus assigned block number) resulting in 11 blocks and/or in service peak buses. Actual blocking performed by BCT may vary slightly. Finally, pull-outs and pull-ins from the maintenance garage are noted in the early morning and late evening hours. Run cuts or shift assignments are not determined as they may vary from one service period (generally three to four months in duration) to another. Appendix A also contains a depiction of the existing travel times (in minutes) between time points and average travel speeds for each route segment. Revenue hours are summarized by block at the end of Appendix A and used for comparison to the revised schedule presented later in this technical memorandum.

Ride Check Survey Results

In April 2012 the study team performed a full weekday ride check survey documenting passenger boardings and alightings by stop for all scheduled bus trips. Additionally, this survey recorded time stamps at scheduled time point locations, allowing the study team to analyze actual travel times between time points and schedule adherence or on-time performance. A detailed assessment of ridership and service performance was documented in a previous technical memorandum titled "Existing Service Assessment." Tables 1-2 and 1-3 show ridership and service performance by route segment and by time period for both eastbound and westbound service.

On-Time Performance

As listed above, several factors influence bus route travel times along any given roadway corridor. Time stamp records recorded as part of the ride check survey confirm bus location and travel times between time point locations along Route 72. These time stamp records where compared against scheduled times to determine schedule adherence. Since bus travel times can vary schedule adherence or on-time performance is generally measured as a range of time. BCT currently considers on-time performance as buses running up to one minute early (or ahead of schedule time) to five minutes late (after scheduled time). This is generally the standard in the transit industry. Based on the ride check survey, 51% of Route 72 buses where on schedule or on-time at scheduled time points along both directions of the route. Eastbound trips where slightly more on-time than westbound trips, reflecting 54% considered on-time.

Approximately 35% of buses arrived early (two minutes or more), while 15% arrived late (six minutes or more). Since this data collection effort BCT has made adjustments to the Route 72 schedule run times (May 2012) without the benefit of and prior to the completion of this running time analysis. The results of this running time analysis have been provided to BCT as one source of data from which to include in future analysis within the corridor. As noted above, BCT conducts continuous monitoring and data collection on all of the routes it operates and implements schedule adjustments periodically throughout the year to improve the accuracy of bus travel times and schedules. BCT overall system on-time performance (Source: 2010 BCT COA) is approximately 57%t on-time, 23% early and 20% late. Table 1-4 illustrates on-time performance by time range variances.

Table 1-2: Route 72 Weekday Ridership by Route Segment by Time Period

Time Period / Route Segment	Route Direction	Sawgrass Mills Mall to Hiatus Road	Hiatus Road to University Drive	University Drive to S.R. 7	S.R. 7 to Powerline Road	Powerline Road to U.S. 1	U.S. 1 to A1A	Totals
Early Morning (before 6:00 a.m.)	Eastbound	0	8	87	45	13	0	153
	Westbound	7	9	51	25	19	0	111
A.M. Peak (6:00 a.m. to 8:59 a.m.)	Eastbound	31	85	435	316	82	8	957
	Westbound	34	64	247	185	200	34	764
Midday (9:00 a.m. to 2:59 p.m.)	Eastbound	121	145	613	500	168	61	1,608
	Westbound	23	173	486	583	452	155	1,872
P.M. Peak (3:00 p.m. to 5:59 p.m.)	Eastbound	199	103	337	234	66	20	959
	Westbound	13	80	308	322	240	121	1,084
Early Evening (6:00 p.m. to 8:59 p.m.)	Eastbound	177	77	190	89	21	16	570
	Westbound	5	32	127	100	121	51	436
Late Night (after 9:00 p.m.)	Eastbound	151	16	65	37	8	0	277
	Westbound	4	10	37	46	46	18	161
Total	**Eastbound**	**679**	**434**	**1,727**	**1,221**	**358**	**105**	**4,524**
	Westbound	**86**	**368**	**1,256**	**1,261**	**1,078**	**379**	**4,428**
	Total	**765**	**802**	**2,983**	**2,482**	**1,436**	**484**	**8,952**

Source: April 2012 BCT ridecheck data collection

Table 1-3: Route 72 Weekday Riders/Revenue Mile by Route Segment by Time Period

Time Period / Route Segment	Route Direction	Sawgrass Mills Mall to Hiatus Road	Hiatus Road to University Drive	University Drive to S.R. 7	S.R. 7 to Powerline Road	Powerline Road to U.S. 1	U.S. 1 to A1A	Totals
Early Morning (before 6:00 a.m.)	Eastbound	No Trips	1.6	6.6	3.8	1.4	0.0	3.3
	Westbound	0.8	1.2	5.2	2.7	2.6	No Trips	2.6
A.M. Peak (6:00 a.m. to 8:59 a.m.)	Eastbound	0.8	2.8	11.0	8.8	3.0	0.4	4.9
	Westbound	0.9	2.1	6.2	5.0	6.9	1.5	3.9
Midday (9:00 a.m. to 2:59 p.m.)	Eastbound	1.6	2.4	7.7	6.9	3.0	1.3	4.1
	Westbound	0.3	2.9	6.1	7.8	7.8	3.4	4.8
P.M. Peak (3:00 p.m. to 5:59 p.m.)	Eastbound	5.2	3.4	8.5	6.5	2.4	0.9	4.9
	Westbound	0.3	2.7	7.8	8.7	8.3	5.3	5.5
Early Evening (6:00 p.m. to 8:59 p.m.)	Eastbound	7.9	4.4	8.2	4.2	1.3	1.2	5.0
	Westbound	0.2	1.6	4.8	4.0	6.3	3.4	3.3
Late Night (after 9:00 p.m.)	Eastbound	9.4	1.3	3.9	2.5	0.7	0.0	3.6
	Westbound	0.4	1.0	2.8	3.7	4.8	2.4	2.6
Total	**Eastbound**	**3.5**	**2.8**	**8.2**	**6.4**	**2.4**	**0.9**	**4.5**
	Westbound	**0.4**	**2.3**	**6.0**	**6.5**	**7.1**	**3.3**	**4.3**

Source: April 2012 BCT ridecheck data collection

Table 1-4: Ride Check On-Time Performance

Route Direction	Time Points Checked	Greater than 10 minutes early	6 to 9 minutes early	2 to 5 minutes early	"On-Time" 1 minute early to 5 minutes late	6 to 9 minutes late	10 to 14 minutes late	Greater than 15 minutes late
Eastbound	308	2	23	71	165	22	15	11
		1%	7%	23%	54%	7%	5%	4%
Westbound	367	5	27	108	180	23	11	13
		1%	7%	29%	49%	6%	3%	4%
Total Route	675	7	50	179	345	45	25	24
		1%	7%	27%	51%	7%	4%	4%

Source: April 2012 Ridecheck

Segment travel time variances – Actual versus scheduled

Appendix B contains Schedule Tables depicting an analysis of incremental time variance from scheduled time for each time point to time point segment. Numbers reflected in these tables indicate the difference between actual travel time and scheduled travel time for the Route 72 bus schedule. Negative numbers reflect travel times in minutes that are faster than what is documented in the existing Route 72 bus schedule, generally resulting in buses traveling ahead of schedule and consistent with on-time performance results noted above (i.e., 35% running ahead of scheduled time). Positive numbers reflect additional actual travel time beyond what is documented in the Route 72 bus schedule. Positive numbers reflect buses running behind schedule or requiring more time than is allocated in the bus schedule. Note, some data (highlighted in yellow) is suspect because it reflects travel times significantly different than scheduled and may be physically impossible to achieve. These data are considered invalid and not used to draft a new Route 72 bus schedule.

Aggregate GPS Travel Time Data

In addition to documented travel times on the ride check data collection forms, GPS-based data was collected and analyzed to correctly position transit vehicle locations and times along the Oakland Park Boulevard corridor. Appendix B contains a set of summary tables (one for each direction) which identify travel times and average speeds by route segment. This data was used to supplement the manually collected data as inputs into the development of the new Route 72 schedule document in the following section.

2.3 Revised Route 72 Bus Schedule

Utilizing the data collected from the ride check survey, discussions with BCT bus operators while riding Route 72 buses, and upon professional judgment, a new Route 72 bus schedule was developed. The new schedule is designed to reduce the occurrence of buses operating ahead of schedule as well as minimizing late buses. It is the opinion of the study team that the initial bus schedule revisions will not fully correct existing on-time performance issues. Why? Below is a list of several reasons why initial time adjustments to the existing bus schedule generally will not correct buses from running off schedule.

- BCT Bus operators (each having some level of variance in driving styles and skills) are each trying to make adjustments in an attempt to operate the service on time. Some may be slowing down to make sure they don't run ahead of schedule while others may be speeding up to make schedule times at time points. This may be different by driver, time of day, and traffic conditions. Nonetheless, adjustments are being made on the existing schedule and will occur again with an initial revised schedule.
- BCT conducts a bus operator bid or shift selection process on a routine basis (every three to four months). This activity results in bus operators potentially selecting different work shifts (and routes) to operate the bus, thus a rotation of bus operators between bus routes. The net impact is potentially different bus operators, again with some variance in driving styles and skills, on Route 72 every three to four months. With different bus operators, there will be adjustments and some degree of difference in schedule adherence.
- Lastly, passenger volumes may shift from one trip to another with a revised schedule based on arrival times at points along the corridor influencing transfer connections times with crossing routes and passenger trip selection.

Because adjustments are currently occurring both by bus operators and the riding passengers the initial schedule rewrite may correct a significant portion of the on-time performance however additional adjustments to refine the schedule even further to achieve desirable on-time performance results may be required in the future. Making extreme travel time adjustments to a schedule may result in continued on-time performance issues as buses may shift from operating ahead of schedule to operating behind schedule (i.e., the pendulum effect). Therefore, the study team envisions the following three phases of rewrites of the Route 72 schedule to fully implement schedule adherence improvements and short-term corridor improvements.

- Phase 1 – eliminate early departures – remove time where it is currently occurring, monitoring, and supervision (schedule attached in Appendix C)
- Phase 2 – minor adjustments to continue to improve on-time performance (further BCT monitoring and schedule adjustments)
- Phase 3 – Implementation of Short-Term Improvements (TSP, Queue Jumpers, Signal Progression, Strategic Bus Bays, Bus Stop Consolidation, Passenger Amenities, ITS/Real-Time Information) to reduce overall passenger travel times

3.0 Bus Stop Consolidation Analysis

3.1 Existing Bus Stop Locations and Ridership Volumes

Broward County Transit (BCT) currently operates the Route 72 along the entire length of Oakland Park Boulevard. Accessibility to this service is extremely important and is measured by sidewalk connections, connectivity to surrounding land uses and appropriately placed, safe and convenient bus stop locations. Bus stop placement and spacing is critical to accessibility. Bus stops spaced infrequently results in lengthy walk distances while stops placed too frequently can result in very slow travel times. Each of these placement conditions can result in negative impacts on bus route ridership.

Route 72, operating along Oakland Boulevard, averages around 9,000 daily weekday boardings. For every boarding there is an alighting resulting in a total daily weekday boarding and alighting "activity" of around 18,000. While many bus stops experience multiple boardings and alightings per stop, it is easy to see the potential for a significant number of buses stopping along this corridor. While bus stop locations are sometimes justified by the number of rider boardings per day, the best measure is boarding and alighting “activity” because boardings may be low while alightings may be high resulting in a well utilized bus stop location.

Currently the Route 72 has 79 eastbound bus stop locations and 75 westbound stop locations (end-of-line bus stops common to both service directions). An on-board ridership count by directional bus trip in May 2012 identified 4,524 eastbound boardings and 4,428 westbound boardings. Currently BCT operates 64 eastbound daily bus trips and 63 westbound daily bus trips. Ridership volumes per trip vary over the day with higher ridership volumes occurring during peak and midday time periods. Highest bus stop ridership activity eastbound is 692 and westbound is 596, both occurring a far-side bus stops at SR 7. The lowest bus stop activity in the corridor is three at Flamingo Road and NW 136th Avenue. Surprisingly, the average number of bus stops served by time period (excluding early morning and late evening time periods) remains consistent across the day (see Table 2 below). However, the range of number of stops served can vary significantly from trip to trip, which as noted in Section 1.1 above, can have a significant impact on schedule reliability.

Table 2: Bus Stopping Activity by Time Period

Time Period	Eastbound		Westbound	
	Average number of Bus Stops Served / Trip	Number Range of Bus Stops Served / Trip	Average number of Bus Stops Served / Trip	Number Range of Bus Stops Served / Trip
Early Morning	16	12 – 20	19	15 – 22
A.M. Peak	26	14 – 38	26	20 – 33
Midday	25	14 – 34	26	18 – 37
P.M. Peak	24	8 – 33	26	19 – 37
Early Evening	25	18 – 29	21	11 – 29
Late Evening	14	7 – 18	15	10 – 21
Total	24	7 – 38	24	10 – 37

While frequent bus stops result in shorter walking distances from origins and to destinations they can also result in slower travel times. Therefore, there must be a balance between walk distances to transit stops and bus route travel speeds that attract use of the service. Currently bus stops along Route 72 are spaced .21 miles apart on average, indicating some are even closer together. Some have argued that the bus stops along Oakland Park Boulevard are too close together and overall bus travel speeds are negatively impacted as a result. It is for this reason an analysis was performed to determine if bus stops along this corridor could be consolidated to speed travel times while continuing to provide convenient, safe rider access.

3.2 Bus Stop Screening Analysis Methodology

To determine if bus stop consolidation is a viable alternative for the Oakland Park Boulevard corridor, the study team developed a two-tier screening approach. Screen 1 identifies those existing bus stops which have existing physical capital improvements. In general, bus stops with physical capital improvements are locations in which there is high ridership activity, present excellent pedestrian accessibility or allow for sufficient right-of-way to accommodate the improvement. Bus stop locations meeting the Screen 1 criteria are eliminated from consideration for bus stop consolidation and are not advanced for Screen 2 consideration.

Screen 1 Criteria:

- Does the stop have an existing shelter?
- Does the stop have an existing bus pullout bay?
- Does the stop have an existing concrete pad for future shelter?
- What is the stops daily ridership activity? Does it exceed BCT criteria for shelter placement?

Bus stop locations remaining after Screen 1 criteria is applied are subjected to a second screening that focuses on relational based criteria. Relational based criteria considers the bus stop location in relation to adjacent stop locations, justification for future amenity enhancements and well as rider accessibility to corridor bus stops for bidirectional trips (e.g., trip to/from work). Screen 2 criteria are listed below.

Screen 2 Criteria:

- Proximity to adjacent stop locations – If a series of stops are within .20 miles or less apart from each another and all stops are candidates for elimination or consolidation, then selected stops exhibiting the lowest ridership would be selected as candidates for elimination but only if the remaining stop locations provide good access from surrounding land use and do not create excessive walk distances.
- Amenities analysis – If a stop location is determined to be a candidate for future amenities enhancements then it would not be considered a candidate for elimination/consolidation.
- Other influencing factors
    - opposing bus stop activity – If a stop considered for elimination has an opposing bus stop on the other side of the street that exhibits high ridership or has capital improvements (e.g., bus shelter, bus bay, etc.) then it would not be a candidate for elimination.
    - surrounding land use – if the surrounding land use supports or is evolving towards supporting higher ridership volumes then the stop is not considered a candidate for elimination.
    - pedestrian accessibility – if the stop does not currently have pedestrian accessibility (e.g., sidewalks) and other criteria are not met (e.g., ridership volume), then the stop is a candidate for elimination

3.3 Conclusions

As noted above, some have argued that the bus stops along Oakland Park Boulevard are too close together and overall bus travel speeds are negatively impacted as a result. Based on this sentiment, the consultant team applied the screen 1 and 2 criteria to determine if there were locations along the Route 72 – Oakland Park Boulevard corridor in which bus stops could be eliminated to create travel time savings. Eliminating bus stops reduce travel speeds in two ways 1) time associated with the bus decelerating to the stop location and acceleration from the stop location versus normal speeds along the same roadway segment; and 2) dwell time at the stop associated with passenger boardings and alightings. Dwell time savings are typically not achieved as bus riders walk to adjacent bus stops which would incur increased dwell time delays, thus a net zero sum of dwell time delay. Therefore, travel time savings would only be achieved by eliminating the additional time associated with bus deceleration and acceleration at a bus stop.

Screen 1 criteria focuses on identifying bus stops that do not already have capital investments in passenger amenities (e.g., bus shelter, pull-out bus bay, concrete pad for future shelter) as well as on daily ridership activity. If a bus stop location has or is scheduled for passenger amenity improvements or qualify for a bus shelter placement (i.e., BCT shelter placement standards), then these stops were removed from consideration for elimination or consolidation with adjacent stops. Given the high ridership volumes along the Route 72 and the fact that this route is the most productive route in the BCT system, very few bus stops remained candidates after Screen 1 evaluation.

The eligible bus stops remaining after Screen 1 where reviewed based on Screen 2 criteria to determine overall impacts on the existing riders of the service. Although some locations qualified based on lower ridership volumes they failed to pass other Screen 2 criteria such as:

- proximity to adjacent stops resulted in excessive walk distances, and/or
- opposing bus stop activity did not qualify for elimination due to high ridership, and/or
- lack of surrounding land use accessibility reduced access to the bus service to select locations, again resulting in excessive walk distances if eliminated

Overall, the recommendation is not to remove or consolidate the existing Route 72 bus stops with the exception of one stop located at the Sports Park in Lauderhill (stop ID #2076). There are currently four stops serving the Sports Park within close proximity to each other. Three of these stops have existing capital improvements, while the four stops do not. Elimination of the fourth stop does not impact access to the Sports Park nor impact opposing street side stops. Given high ridership activity along the corridor, high route performance, short trip distances exhibited by the transit users along the corridor (i.e., based on on-board survey results) and minimal benefits achieved through stop consolidation along this corridor, no additional stops are recommended for removal/consolidation.

4.0 Transit Signal Priority (TSP)

4.1 TSP Defined

Transit Signal Priority (TSP) can be defined as signal prioritization provided to a transit vehicle at a given intersection through which additional, expedited or extended green time is provided to allow the transit vehicle to travel through the intersection within a short amount of time.

There are two types of TSP systems, unconditional and conditional. Unconditional TSP provides the bus with priority every time the bus approaches the intersection. Under Conditional TSP priority is only provided to the bus if it is behind schedule by some predetermined amount of time or if the headway between buses is longer than desired.[3]

Transit Signal Priority (TSP) can result from four means of travel time advantage for the through bus movement.

- Extension of the green interval for the through movement
- Provision of an early green phase by shortening the green interval of another movement
- Provision of the bus through movement phase before the phase of another movement

[3] TCRP Report 117, Design, Operation, and Safety of At-Grade Crossings of Exclusive Busways, 2007

- Insertion of a special phase to assist the bus in entering the travel stream ahead of the platoon of traffic.

4.2 Analysis of TSP along Oakland Park Boulevard

All signalized intersections along Oakland Park Boulevard where identified and analyzed for potential application of TSP. An initial qualitative assessment was performed to identify those intersections with 1) the probability of TSP application – given existing intersection LOS and green time as percent of cycle time, and 2) the Value or Benefit of applying TSP at the intersection – given existing LOS, would the TSP reduce intersection delay.

Appendix D contains the results of the qualitative assessment illustrating probability of TSP application and value/benefit of applying TSP at a given intersection. Based on the traffic analysis results from VISSIM and SYNCHRO, nineteen intersections were identified and recommended for TSP improvements and six required intersection modifications to improve traffic flow. The location of these improvements are specific modifications are reference in Section 11 of this report.

4.3 Next Steps

The Department will further analyze the feasibility of the recommended intersection improvements including TSP in the *Design* phase scheduled to begin in the summer of 2014.

5.0 Queue Jumper Lanes

5.1 Queue jumper Lane Defined

Queue jump or bypass lanes are methods by which buses can bypass traffic queues at intersections. The bus would enter a right-turn lane or a separate lane developed for buses only between the through and right-turn lane and then stop on the near-side of the intersection. A separate, short bus signal phase would be provided to allow the bus an early green to move into the through lane ahead of traffic.[4] Typically, green time from the parallel general traffic movement is reduced to accommodate the special green phase, which typically is only three to four seconds. Generally, bypass lanes do not have a special green phase but utilize the bypass lane to continue through the intersection and enter a far-side bus stop bay.

5.2 Analysis of Queue Jumpers along Oakland Park Boulevard

The Oakland Park Boulevard corridor was analyzed in the eastbound and westbound directions to determine potential application of queue jumper lanes. Criteria used to determine this potential include the list below.

- Intersections with existing right-turn lanes
- Intersections with sufficient right-of-way to accommodate a right-turn/queue jumper lane
- Intersections with significant existing and projected queuing traffic at intersections
- Intersections where near-side bus stops are currently located far from the intersection due to lengthy right-turn lanes and transit riders are crossing mid-block from this stop location creating a pedestrian safety concern

[4] TCRP Report 118, Bus Rapid Transit Practitioner's Guide, 2007

- Intersections where future Mobility Hubs may be located on the adjacent intersection quadrant enforcing the need for a near-side bus stop to reduce walk distances to the Mobility Hub
- Intersections where high transfer rates exist and where crossing route far-side stop locations are within close proximity of the intersection allowing minimal walk distances between transferring buses

Utilizing these criteria the following intersections where identified as locations with the potential to apply queue jumper lanes.

- Hiatus Road
- Pine Island Road
- University Drive
- Inverrary Boulevard/NW 56th Avenue
- State Road 7
- NW 31st Avenue
- NW 21st Avenue (eastbound only)
- US 1/Federal Highway (westbound only)

Based on the traffic analysis findings with regard to intersection LOS, turning movements, and queue lengths, the three locations recommended for queue jumper lane improvements included Hiatus Road, NW 31st Avenue, and NW 21st Avenue.

5.3 Next Steps

The Department will further evaluate the feasibility of the queue jumper lane improvements in the *Design* phase scheduled to begin in the summer of 2014.

6.0 Bus Islands

6.1 Bus Islands Defined

Bus islands or boarding islands are defined transit stops located between travel lanes, generally between a through lane (and in some cases bike lane) and a right-turn lane, and are designed to allow the bus to serve a near-side bus stop and remain in the through traffic lane to cross the intersection. Bus islands are utilized in locations were queue jumpers and TSP are not possible due to restricted green time for the bus route through movement. Bus islands require a larger intersection footprint as existing right-turn lanes are required to shift outward to accommodate the bus island requiring the use of additional right-of-way. Pedestrian safety issues must be addressed when considering the use of bus islands. Bus islands are currently utilized in Washington D.C. and San Francisco.

6.2 Analysis of Bus Islands along Oakland Park Boulevard

The Oakland Park Boulevard corridor was analyzed in the eastbound and westbound directions to determine potential use of the bus island concept. Criteria used to determine the need for a bus island at a given intersection include the list below.

- Intersections with near-side bus stops

- Intersections where TSP is unlikely to be possible given cross street volumes and existing and future intersection LOS
- Intersections where queue jumpers within the right turn lane is unlikely to be possible given cross street volumes and existing and future intersection LOS
- Intersections where near-side bus stops are currently located far from the intersection due to lengthy right turn lanes and transit riders are crossing mid-block from this stop location creating a pedestrian safety concern
- Intersections where future Mobility Hubs may be located on the adjacent intersection quadrant enforcing the need for a near-side bus stop to reduce walk distances to the Mobility Hub
- Intersections where high transfer rates exist and where crossing route far-side stop locations are within close proximity of the intersection allowing minimal walk distances between transferring buses

Figure 3 illustrates the bus island concept.

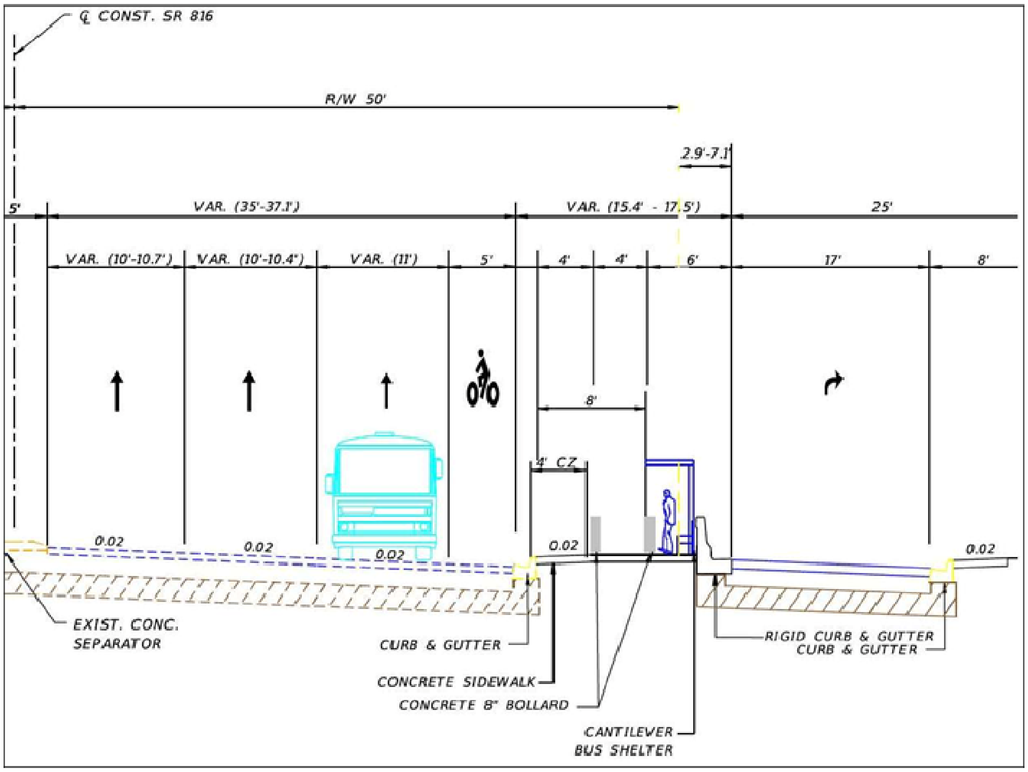
Figure 3: Bus Island Illustration, Isometric View

Utilizing these criteria the following five intersections where identified as locations with the potential for using the bus island design.

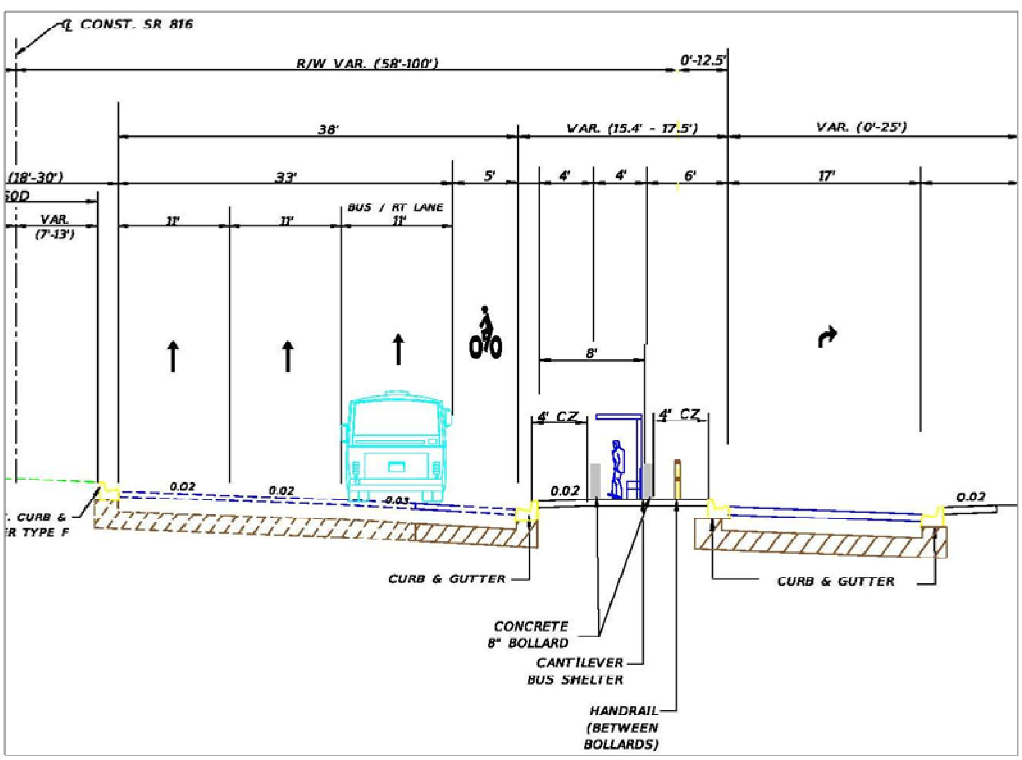
- Nob Hill Road – westbound, northeast intersection quadrant
- Pine Island Boulevard – westbound, northeast intersection quadrant
- University Drive – westbound, northeast intersection quadrant, and eastbound southwest intersection quadrant
- Inverrary Boulevard – westbound, northeast intersection quadrant, and eastbound southwest intersection quadrant
- State Road 7 – westbound, northeast intersection quadrant, and eastbound southwest intersection quadrant. Note bus island can also be placed along the crossing BCT Route 18 for the southbound service, northwest intersection quadrant and the northbound service at the southeast intersection quadrant

Appendix E includes plans for each of these locations on aerial maps. Figure 4 shows typical sections for bus islands with handrail and barrier wall options.

Figure 4: Bus Island, Typical Sections



Bus Island with Barrier Wall, Typical Section



Bus Island with Handrail, Typical Section

6.3 Next Steps

The project team met with FDOT design, traffic operations, and concept development team to explain the proof of concept for Bus Island. Based on the Department's review with regard to safety, ADA compliance, and operations, the design concept was modified and incorporated into the build alternatives. The concept and design will be revisited during the *Design* phase scheduled to begin in the summer of 2014.

7.0 **Bus Stop Amenities Analysis**

A spatial dataset/inventory of existing bus stop amenities (August, 2012[5]) was obtained from BCT. This GIS data was then spatially analyzed using Environmental Systems Research Institute, Inc. (ESRI) ArcGIS© Desktop version 10. A GIS spatial analysis is the process of examining locations and attributes to create extracts of data for evaluation. For more information on the process or methodology employed for the bus stop amenities analysis, refer to Appendix F.

BCT uses a different approach to identify shelter needs at bus stops than the methodology used in the bus stop amenity analysis documented in Appendix F. The transit agency uses a threshold of 25 boardings per day for a stop to qualify for a shelter. Currently, BCT uses three different shelter designs on Oakland Park Boulevard: 4'-0" shelter roof (minimum sidewalk dimension: 7'-0"); 5'-0" shelter roof (minimum sidewalk dimension: 8'-0"); and 8'-0" shelter roof (minimum sidewalk dimension: 10'-0"). The shelter designs are generally selected based on the available right of way. The locations identified and recommended for bus stop upgrade per Section 11 are based on BCT's ridership threshold and driven by right of way availability.

The intent of the bus stop amenities analysis is to prioritize shelter placement along Oakland Park Boulevard with an understanding that all the stops on Route 72 qualify for shelters per BCT thresholds. Figure 5 displays the ridership activity for each existing bus stop serving Route 72.

There are 151 existing bus stops (79 eastbound and 72 westbound bus stops) that serve BCT Route 72. The screening criteria were based upon the presence or absence of the following bus stop amenities:

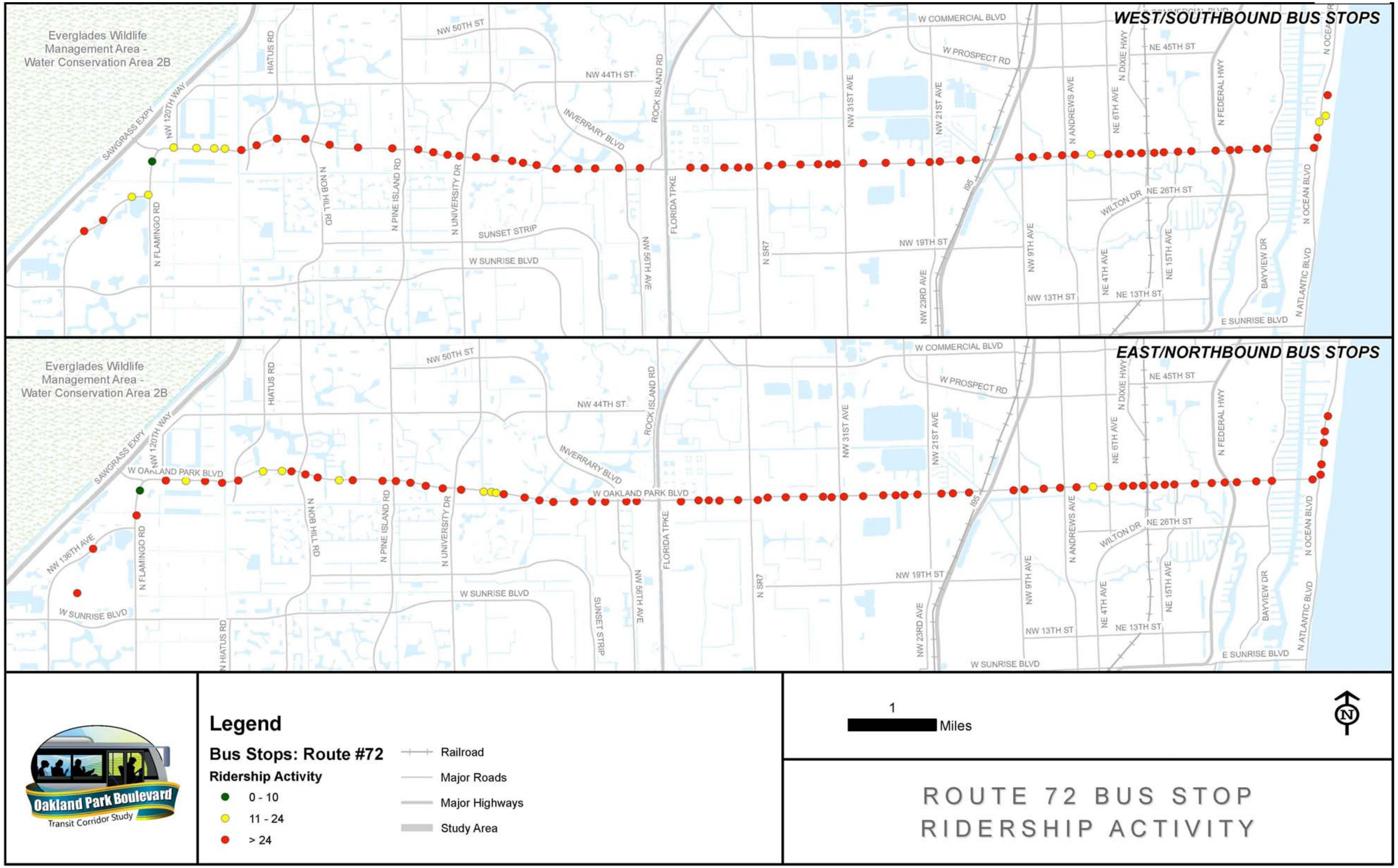
- Shelter
- Bench
- Bus ID Sticker
- ADA Sticker
- Trash Can
- Solar Light
- Bus Bay
- Ridership Activity

All the bus stop amenities listed above were mapped and can be found in Appendix F. These bus stops were then categorized by primary direction, mapped, and ranked by level of priority for future improvements based upon the methodology employed (see Appendix F).

[5] BCT did provide an updated bus stop amenities inventory for a select number of bus tops servicing Route 72 in May, 2013. However, there was no significant difference between the former and latter datasets, thus the results of the analysis remained nearly unchanged.

In summary, those existing bus stops that have lesser composite scores correspond to bus stops with lesser amenities and greater ridership and vice versa. In other words, those existing bus stops that have lesser composite scores may be a higher priority for future improvements, as these bus stops have less amenities and/or higher ridership activity.

Figure 5: Route 72 Bus Stop Ridership Activity (May 2012)



8.0 Bicycle and Pedestrian Improvements

To enhance the overall mobility and accessibility in the corridor the missing sidewalk links and bike lane gaps were identified within one quarter mile of the Oakland Park Boulevard corridor based on visual analysis using *Desktop Planning* tools such as GIS and Google Earth. This analysis of potential sidewalk and bike lane improvement projects was shared with local jurisdictions along the corridor to validate the missing links and refine the project list as well as reconcile it with the Broward MPO's 2040 LRTP Needs Assessment projects. Based on the input received from local jurisdictions the project sidewalk and bike lane project list and maps were updated. The sidewalk and bicycle improvement projects are mapped in Appendix G.

The bike lane and sidewalk projects have been segregated in three (3) tiers. Tier I includes improvements included in the Broward MPO's 2040 LRTP Needs Assessment, while Tier II comprises improvements on state/county/city's facilities, and Tier III incorporates improvements within communities or homeowner's association. It should be noted that Tier I improvements have corresponding construction costs that were provided by local jurisdictions (Appendix G).

9.0 Signal Warranty Study

Currently, there are 45 signalized intersections on Oakland Park Boulevard (13.1 miles long), which translates into a signal density of approximately 1,537 feet/signalized intersection. A preliminary evaluation was conducted to identify possible intersections for signal warranty study with the idea that removing unwarranted signal could possibly improve traffic flow on Oakland Park Boulevard.

Level of service (LOS) analysis was performed along Oakland Park Boulevard from Sawgrass Expressway to SR A1A using VISSIM. The intersections that were not operating at acceptable LOS (LOS D) along the corridor were identified. For 2018 traffic operations, a preliminary SYNCHRO LOS was performed for these failing intersections to determine whether any improvements could be implemented. Based on review of the right-of-way (ROW) information, 2011 traffic counts, roadway functional classifications, and local knowledge the 12 intersections along the study corridor were recommended for further study.

- NW 48th Avenue
- NW 47th Terrace
- North of NW 46th Avenue
- South of NW 46th Avenue
- NW 43rd Avenue
- NW 33rd Street
- NW 84th Avenue
- NW 64th Avenue
- NW 46th Avenue
- NW 33rd Avenue
- NW 18th Avenue
- NE 20th Avenue

Based on the input received from local jurisdictions and the Technical Advisory Committee (TAC), this list of intersections was refined. The updated list of intersections is included in Appendix H.

10.0 Traffic Signal Progression

East-west travel in Broward County is heavily reliant on its east and west arterials, including Oakland Park Boulevard which carries a daily traffic volume between 35,000 and 62,000 vehicles. While Oakland Park Boulevard's posted speed limits are 30 to 35 mph (east of NW 21st Avenue) and 45 mph west of NW 21st Avenue, the high traffic volume and closely spaced traffic signals result in slower average peak hour speeds of 19 to 26 miles per hour depending on the direction and time of the day; resulting in a corresponding delay between 12 and 24 minutes per trip[6]. Significant delay occurs at signalized intersections even during off-peak hours.

The Broward County Traffic Engineering Division (BCTED) is responsible for operating the traffic signal communications system which provides for signal progression by enabling communications between a central signal computer and each signalized intersection. Currently, all of the traffic signals on Oakland Park Boulevard from Flamingo Road to SR A1A are coordinated under the County's Green Light Program, while the using an Advanced Traffic Management System (ATMS) for the signals east of I-95 and the Urban Traffic Control System (UTCS) (which operates under on older analog communications protocol) for signals west of I-95.. Since the summer of 2012, BCTED has implemented a new signal progression pattern between University Drive and US 1 to improve signal coordination and reduce delay.

For the purposes of providing for transit signal priority (TSP) functionality, the ATMS platform is required.

To further enhance the traffic flow and increase traffic signal efficiency, as well as incorporate TSP capabilities, traffic signal progression was used as a short term strategy. The intent was to optimize traffic signal timing using VISSIM and SYNCHRO to minimize delay and ensure uninterrupted traffic flow to the extent possible. The intersection LOS analysis was performed based on the Broward County traffic signal plans for the existing traffic conditions. For traffic signal progression along the corridor, the offsets for each zone (from one intersection to another) obtained from the BCTED were utilized. The analysis culminated in identifying eight segments along Oakland Park Boulevard for implementing traffic signal progression. Appendix H identifies these segments and associated intersection modifications.

11.0 Next Steps

The analyses and conceptual engineering discussed in this technical memorandum and which led to the recommended short term improvements to address some of the transportation issues and problems in the corridor are summarized below. Appendix H provides a list of short term improvements and identifies their geographic location as well.

- **On Time Performance**
  - Revised bus schedule
  - Bus signal priority (17 locations)
  - Queue jump lanes (3 locations)

[6] *Oakland Park Boulevard Alternatives Analysis: Traffic Data Collection Report,* prepared for the Florida Department of Transportation District Four, May 2012.

- **Safety and Convenience**
  - Bus islands (Eight (8) bus islands at four (4) different locations)
  - Bus stop upgrades (25 locations)

- **Bike/Ped Connectivity and Complete Streets**
  - 44 miles of bike lanes
  - Complete missing sidewalk links

- **Traffic Congestion**
  - Traffic signal progression
  - Intersection improvements (19 locations)

The FDOT District Four will initiate the design of the short term improvements in the summer of 2014. The concept and design of bus islands and the location of bus stops recommended from upgrades will be revisited. This design phase may include an engineering feasibility study to determine the extent or existence of right of way impacts and will also address potential safety and traffic operations issues resulting from implementation of any of the short term improvements.