Deriving Bus Travel Speed/Dwell Time Using Automatic Passenger Counter (APC) Data

Tallahassee, Florida

Prepared For:
Florida Department of Transportation Transit Office
605 Suwannee Street, MS 26
Tallahassee, Florida 32399

Final Report

April 2012

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1. INTRODUCTION

The Florida Department of Transportation (FDOT) and the Florida Model Task Force (MTF) have identified the need for better transit performance data. Travel time information is currently difficult to obtain and is often collected manually by riding buses with GPS and making direct observations. At the same time, most transit providers have, or are in the process of installing systems that use GPS devices to continually track vehicle locations. The two most common systems are Automatic Vehicle Locators (AVL) and Automatic Passenger Counters (APC). Data that these systems collect are stored and archived by most agencies, but few have fully explored the capabilities of these databases.

AVL systems are typically used to provide real time information to transit operators on system status and are also sometimes used to provide customers with bus arrival estimates. APC systems provide information on passenger loads and stop dwell time. Both systems can be used in offline analysis to get a much better understanding of system performance.

FDOT initiated this study to get a better understanding of the potential uses of archived APC and AVL data. We would like to thank the Orlando area transit service provider LYNX for generously providing data and staff time to make this study possible.

2. STUDY PURPOSE

The purpose of this study is to evaluate the feasibility of using archived Automatic Passenger Count (APC) data to calculate average bus travel speeds and dwell times. This information will prove useful in validating speeds and dwell times in several transit modeling applications and for use by transit agencies in assessing operational performance. The focus of this effort is the estimation of system-wide travel times and dwell times on LYNX, the public transit agency serving Greater Orlando, FL.

The methodology used in this study involved matching transit route alignments to the Orange, Seminole, and Osceola County roadway networks. An average speed was then calculated for all trips on each roadway segment used by transit. The average was calculated based on the complete dataset, AM peak only, PM peak only, and midday only.

This information can be used to streamline planning and implementation of system improvements to locations where they are needed most. The major benefits for using APC data have been identified as follows:

- APC data can provide large amounts of accurate data for transit system performance measures that may be used for a variety of bus performance measurement purposes (e.g., travel time, reliability, driver performance, etc.). This information can be used in Transit Development Plans (TDPs) and in the preparation of MPO long range transportation plans.

- The Transit Boarding and Estimation Simulation Tool (TBEST) developed by the FDOT Public Transit Office performs comprehensive transit analysis and ridership forecasting. Using the APC analysis methodology will help TBEST predict transit speed more accurately based on observed data at the segment level, route level, or system level.
- Results from the observed APC data can help calibrate the FSUTMS travel demand models. The relationship curves between bus and auto travel times (and speeds) in the mixed-flow conditions can be further calibrated and understood using APC data and auto speed observations data.
- Average values obscure differences between corridors and make it difficult to know where to focus transit funding resources. Using APC data will help transit agencies in Florida better understand operating conditions and identify specific congestion locations in need of bus speed enhancing improvements. All day, AM, midday, and PM peak transit speed conditions can be evaluated and compared using this technology. With accurate transit speed, the user benefits and costs can be better estimated for transit improvement projects, and effective before and after studies can be completed.

3. DESCRIPTION OF APC DATA STRUCTURE AND GIS SHAPEFILES

The original scope of the study required the use of Advance Vehicle Locating (AVL) system data to estimate bus travel times and dwell times. AVL systems are typically designed for real time bus operations monitoring. Bus locations are monitored through global positioning systems (GPS) and mapping software which provide the real time location of buses along a specified route. Unfortunately, AVL data had not been stored or archived by LYNX in a workable way for performing off-line analysis. LYNX is currently working to build its Computer-Aided Dispatch (CAD)/AVL system, and the CAD/AVL system is anticipated to be a potential resource for both management and planning of operations for off-line analysis.

Consequently, APC data are the primary resource for LYNX service reporting and planning purposes. The APC system uses a variety of technologies including various sensors such as infrared sensors at doors for counting passengers and GPS to capture location and time at each stop or time point. The collected APC data has a wealth of information such as passenger boarding and alighting counts, arrival time, dwelling time, and departure time for each stop.

An extract from the APC database spanning April 25, 2011 to August 13, 2011 was provided to the team by LYNX staff. Route geometry and bus stops were also provided in ArcGIS shapefile format.

APC DATA

APC data is collected at each bus stop. A record is generated every 30 seconds and upon each door open/door close event marking the GPS derived location and time of recording. Records are either

aggregated, totaling the number of door events that occur at layover stops, or reduced to the 30 second interval that was nearest to a stop that did not have a door open/close event (the bus did not stop). The time and location of arrival and departure are logged. If the bus does not stop, the arrival and departure times will be the same. If the bus does stop, the system notes the dwell time. A detector is positioned at each doorway on the bus. When passengers board or alight, they trigger the detector. The system then records the number of passengers that either boarded or alighted the bus at each stop. It also keeps a running count to estimate the passenger load at any given point along the route. Because the time that the bus arrives and leaves its stops and the route it takes are also recorded, the travel speed anywhere in the system can be estimated.

Available Fields in APC data

APC data archived by LYNX is a very rich, well organized, and complete set of information. LYNX provided the following four output tables.

- **Schedule Adherence:** Provides information needed to understand on-time performance for each trip between designated timing points.
- **Trip:** Provides summary information at the trip level information about passenger load, passenger miles, passenger hours, etc.
- **Segment:** Provides summary information at the segment level between designated timing points.
- **Stop:** Provides detailed information of activity at each stop such as arrival time, departure time, dwell time, boardings, alightings, etc. A detailed field description is provided in Appendix A.

For this study, the stop output table was used to extract the bus travel time and dwell time on roadway segments. A list of data fields in the stop output file is also included in Appendix A.

GEOMETRIC DATA

Format

Bus route and bus stop shapefiles were provided by LYNX. The bus route shapefile included both the route name and route number in the attribute table. Each record in the bus route shapefile represents a complete bus route. The provided bus route geometry in the shapefile did not include route directionality. The fields of the bus stop shapefile include bus stop ID, stop name, and the bus route IDs in the attribute table. Each record in the bus stop shapefile represents a bus stop. If the stop is not currently associated with a bus route, the route number is shown as 0 in the attribute table. If it does belong to a bus route, the number is 1 in the attribute table. Each bus stop only has one record regardless of the number of routes that use it.

4. POST PROCESSING METHODOLOGY

The following describes the two processing procedures utilized for the analysis:

- Directional information was added to route geometry and a separate set of line-work was created for the inbound or outbound trips.
- Proper route sequence was determined for bus stops to ensure that calculations were made in the correct order.

A new bus route shapefile was created. An attribute called 'bus key' was added to indicate whether a particular segment of the route belongs to the inbound or outbound portion of the route. Each bus route with either inbound or outbound trips was redrawn to be made up of directional polylines.

Similarly, a new bus stop shapefile was created with a reformatted attribute table to have the sequence of bus stops in the records belonging to each bus route and 'bus key' combination. Additional records were added to ensure that a unique table row exists for every bus stop and bus route combination.

5. CONNECTING TRANSIT ROUTES WITH THE ROADWAY SEGMENTS

QUALITY CHECK

The latest roadway shapefiles for Orange, Seminole, and Osceola Counties were downloaded from each county's GIS website and combined into one shapefile. The bus route, bus stop and roadway shapefiles were overlaid and quality checked for consistency. The bus route and bus stop shapefiles were found to match closely to the roadway shapefile and reflect the correct locations on the roadway networks.

GIS PROCESS

A GIS program was developed and written in ArcGIS to associate the bus route and bus stop shapefiles with the roadway shapefile.

The following steps were performed in the program to assign the APC data to the appropriate routes:

- Bus stop points were snapped to the directional bus route file, and the directional route distance between two successive bus stops was calculated.
- Directional information was assigned in the roadway shapefile, and a unique ID for each directional roadway segment was provided.
- The unique directional roadway segment ID was associated with the split bus route by the bus stop file.

6. APC DATA REDUCTION

The stop level APC file that was provided contained over 3,000,000 bus stop records. These stop observations are used to create a complementary link file. The first stop is paired with its predecessor in a single row in the new file to provide a link record rather than a single point. The "To" point from the record becomes the "From" point in the next record allowing the line to hold information about the trip from one point to another. This link file serves as the primary input to the GIS.

The link file contains attributes to identify the "from stop" and the "to stop," or the start and end of the link. The link file also contains information on the amount of dwell time at both stops, the arrival time at both stops, and the departure time at both stops. This allows travel time to be calculated in several ways depending on the purpose of the specific query.

While APC data in its raw form provides a distance traveled attribute for each stop record, there is significant uncertainty that prevents its use. If a bus does not stop at a bus stop, therefore having no door open/close events, the buses location is only recorded every 30 seconds. For a bus traveling at 30 mph, that gives a 1,320 foot potential range of location (660 feet on either side of the stop) without accounting for addition error in the GPS itself. The provided distance value was not used in this analysis.

7. SYSTEM TRAVEL TIME PERFORMANCE

BUS TIME POINTS TRAVEL TIME

Travel times between each stop for each route have been derived and saved in the generalized shapefile. These travel times can then be aggregated by segment or route level. LYNX uses specific stops as time points for tracking segment travel times. Once the stop ID for each time point is known, travel times or speeds between time points for each trip can be calculated and aggregated. Table 1 and Figure 1 show route segments between time points to time points with the slowest observed travel times in the network.

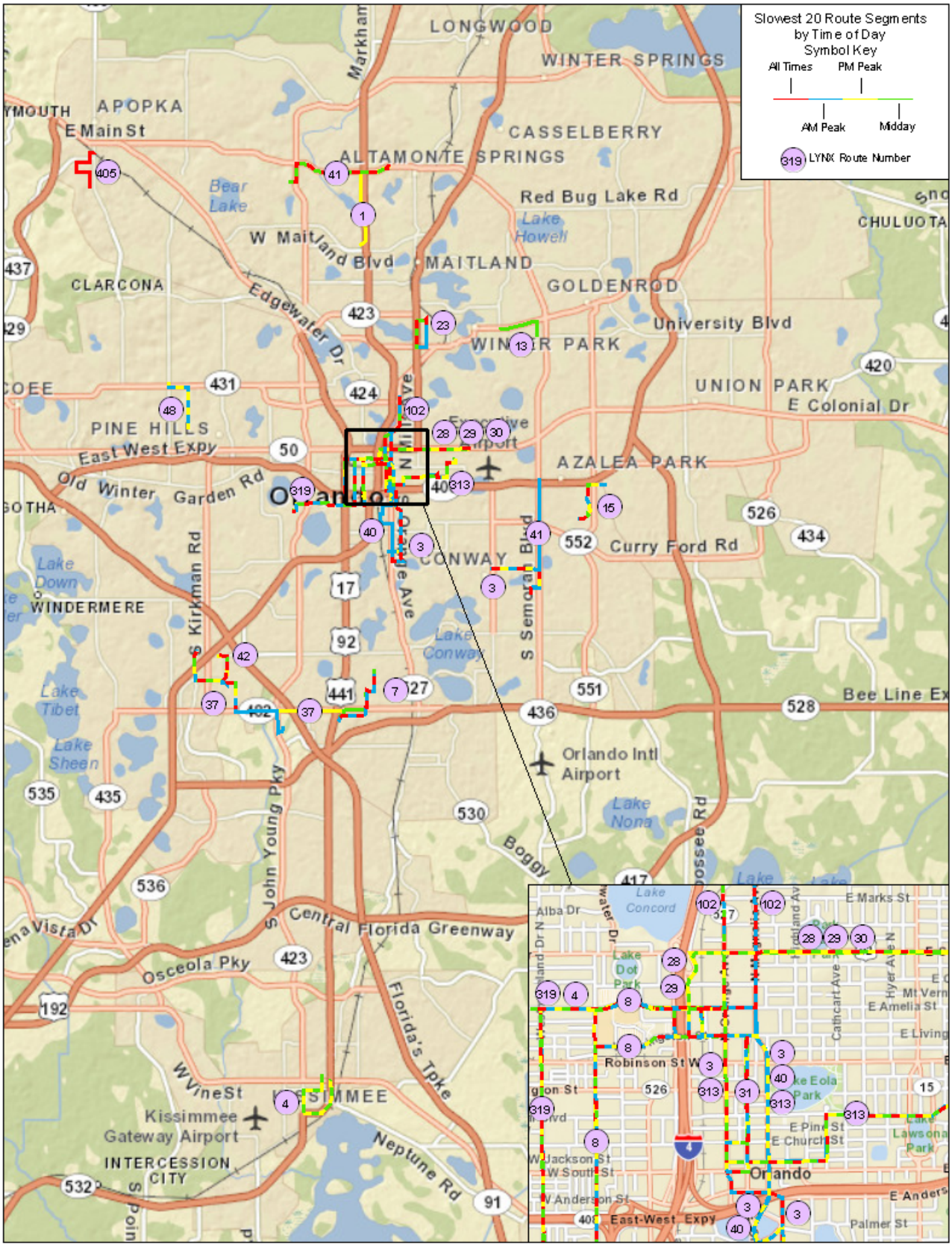
Table 1: 20 Slowest Route Segments between Time Points to Time Points in LYNX Network by Time of Day

Link	Start	End	All Times		AM		PM		Midday	
			Rank	Speed	Rank	Speed	Rank	Speed	Rank	Speed
31	400 Amelia St	South St	1	11.9	1	10.8	2	12.5	1	11.5
37	7900 Mandarin Dr	Universal Bus Loop	2	14.1	4	14.1	8	13.8	7	14.1
8/42	Oak Ridge Rd & International Dr	6200 International Dr	3	14.2	--	17.7	5	13.3	9	14.4
8	Parramore Ave & Peidmont St	455 N Garland Ave	4	14.2	2	13.0	3	13.0	4	13.7
8/42	International Dr & American Way	Oak Ridge Rd & International Dr	5	14.4	21	16.2	4	13.3	3	13.5
23	N Denning Dr & Swoope Ave	1200 Fairbanks Ave	6	16.0	--	17.7	24	15.4	8	14.3
15	8010 Lake Underhill Rd	Autumnvale Dr & Colton Dr	7	16.1	20	16.2	15	14.8	20	16.0
102	Orange Ave & Rollins St	455 N Garland Ave	8	16.1	18	15.5	28	15.8	12	15.7
28/29	3100 E Colonial Dr	455 N Garland Ave	9	16.2	25	16.8	6	13.6	2	13.3
319	Bethune Dr & Columbia St	455 N Garland Ave	10	16.4	16	15.5	--	16.2	14	15.8
405	Central Ave & Cleveland St	Central Ave & E 7th St	11	16.6	--	18.5	--	16.0	--	16.7
319	455 N Garland Ave	Bethune Dr & Columbia St	12	16.7	22	16.4	18	15.0	19	16.0
4	Orange Blossom Tr & Long St	455 N Garland Ave	13	16.7	15	15.5	11	14.2	13	15.8
3	455 N Garland Ave	Orange Ave & Illiana St	14	16.7	6	14.7	20	15.3	--	16.8
8	455 N Garland Ave	Parramore Ave & Peidmont St	15	16.7	26	16.8	16	14.8	23	16.3
41	1000 Bunnel Rd	SR 436 & Essex Dr	16	16.7	--	18.3	23	15.4	15	15.9
7	Florida Mall Ave & August Ln	Winegard Rd & Lancaster Rd	17	16.8	17	15.5	--	16.1	30	16.6
3	Dixie Belle Dr & Gatlin Ave	Lake Margaret Dr & Conway Rd	18	16.8	10	15.2	10	14.0	--	17.7
313	455 N Garland Ave	Primrose Dr & Colonial Dr	19	16.9	23	16.4	7	13.7	18	16.0
102	455 N Garland Ave	Orange Ave & Rollins St	20	17.1	19	16.0	22	15.3	25	16.4
48	Powers Dr & Bolling Dr	2600 Hiawassee Rd	21	17.1	9	14.9	12	14.3	--	18.5
7	6100 Winegard Rd	Florida Mall Ave & August Ln	22	17.3	--	25.3	--	17.0	16	15.9
313	Primrose Dr & Colonial Dr	455 N Garland Ave	26	17.4	14	15.4	--	16.9	27	16.5
4	Central Ave & Columbia St	Main St & Cypress St	29	17.8	24	16.7	13	14.5	10	14.5
3/7/11/18	Orange Ave & Illiana St	455 N Garland Ave	30	17.8	5	14.2	17	14.9	--	18.3
1	Lake Destiny Dr & Maitland Center Pky	SR 436 & Essex Dr	--	18.1	--	17.8	9	14.0	--	18.3
40	Michigan St & Taylor Ave	455 N Garland Ave	--	18.1	8	14.9	25	15.4	24	16.4
41	Dixie Belle Dr & Gatlin Ave	Semoran Blvd & Dogwood Dr	--	18.2	13	15.4	--	16.0	21	16.2
13	University Blvd & Driggs Dr	Lakemont Ave & Aloma Ave	--	18.3	--	18.2	26	15.6	17	16.0

Link	Start	End	All Times		AM		PM		Midday	
			Rank	Speed	Rank	Speed	Rank	Speed	Rank	Speed
28/29	455 N Garland Ave	3100 E Colonial Dr	--	18.6	--	21.0	19	15.2	6	14.1
34	400 Airport Blvd	4500 Seminole Centre Plz	--	18.7	12	15.3	1	10.4	5	13.8
34	4500 Seminole Centre Plz	400 Airport Blvd	--	18.7	3	13.2	--	17.5	--	17.0
30	E Colonial Dr & N Magnolia Ave	3100 E Colonial Dr	--	19.2	--	22.6	--	17.8	11	14.9
37	South Park Cir	Florida Mall Ave & August Ln	--	19.4	--	20.8	14	14.7	--	18.4
37	South Park Cir	7900 Mandarin Dr	--	19.5	7	14.7	--	19.3	--	20.6
23	1200 Fairbanks Ave	Bethune Dr & Columbia St	--	21.1	11	15.2	--	19.8	--	21.5

* Speed values are in miles / hour

Figure 1 20 Slowest Route Segments in LYNX Network by Time of Day



ROADWAY SEGMENTS TRAVEL TIME

After travel speeds by route segments between time points to time points are identified, roadway segments can be investigated to identify bottlenecks with the slowest bus speeds. The 20 roadway segments with the slowest aggregated bus speeds were calculated for daily, PM, AM, and midday time periods. Running speeds are calculated using stop departure time to the next stop arrival time. Dwelling time is not considered in this portion of the analysis. The results are presented in Table 2. The segment locations are shown in Figure 2. Maps of system speeds are provided in Appendix B.

Table 2: 20 Slowest Corridor Segments in LYNX Network by Time of Day

Roadway	Start	End	All Times		AM		PM		Midday		Notes
			Rank	Speed	Rank	Speed	Rank	Speed	Rank	Speed	
Livingston Street	LYNX Central Station	Hughey Avenue	1	5.69	1	4.86	1	4.15	1	5.06	Left turn onto Hughey Avenue
Magnolia Avenue	St George Square	Robinson Street	2	5.87	4	5.89	4	5.51	4	6.14	CBD
Amelia Street	Railroad	Hughey Avenue	3	6.68	3	5.82	3	5.26	2	5.81	Signal at Hughey Avenue
Magnolia Avenue	Central Boulevard	Jackson Street	4	6.18	2	4.99	--	8.69	6	6.91	CBD
Columbia Street	Goldwyn Avenue	Bethune Drive	5	7.16	18	8.25	6	5.95	3	6.07	Shared through/left turn lane at Mable Butler Avenue
John Young Parkway	Lynx Lane	Silver Star Road	6	7.44	11	7.64	15	7.24	11	7.65	Left turn at Silver Star Road
Amelia Street	Hughey Avenue	Railroad	7	7.80	5	6.76	5	5.74	10	7.57	Signal at Garland Avenue
Cinderlane Parkway	Rosewood Way	Orange Blossom Trail	8	7.86	14	8.00	7	6.19	13	7.71	Left turn onto Orange Blossom Train
Conway Road	Yorkshire Lane	Curry Ford Road	9	8.21	15	8.01	2	4.80	--	9.75	Left turn onto Curry Ford Road
Sun Life Path	Florida Mall Avenue	Orange Blossom Trail	10	8.25	13	7.88	10	6.53	15	7.88	Left turn onto Orange Blossom Train
Garland Avenue	Amelia Street	Colonial Drive	11	8.46	7	7.24	12	6.75	7	7.30	CBD
Millenia Boulevard	Conservatory Lane	Conroy Road	12	8.61	--	9.27	13	6.78	17	8.15	Left turn onto Conroy Road
Major Boulevard	Kirkman Road	Caravan Court	13	8.76	--	10.42	20	7.38	--	9.06	
Parramore Avenue	Robinson Street	Livingston Street	14	8.84	--	9.68	29	8.48	20	8.48	Signal at Livingston Street / At grade rail crossing
Colonial Drive	Coletta Drive	Semoran Boulevard	15	8.86	6	7.07	--	8.74	--	9.51	Signal at Semoran Boulevard
Livingston Street	Primrose Drive	Bumby Avenue	16	8.87	--	9.55	--	9.00	12	7.65	Left turn on Bumby Avenue
Fanfare Avenue	Olivia Street	Gilman Circle	17	8.88	16	8.08	--	9.35	18	8.19	Residential street / Speed humps
Livingston Street	Hughey Avenue	Garland Avenue	18	8.93	19	8.27	11	6.68	21	8.50	Signal at Garland Avenue
Livingston Street	Magnolia Avenue	Orange Avenue	19	9.02	24	8.54	--	8.79	23	8.52	CBD
Ferguson Drive	Cherry Lane	Colonial Drive	20	9.06	9	7.55	19	7.77	--	9.68	Left turn on Colonial Drive
Bumby Avenue	Lake Como Circle	South Street	22	9.09	17	8.12	8	6.23	--	9.48	Left turn on South Street

Roadway	Start	End	All Times		AM		PM		Midday		Notes
			Rank	Speed	Rank	Speed	Rank	Speed	Rank	Speed	
Colonial Drive	Garland Avenue	Hughey Avenue	23	9.26	8	7.35	22	8.18	14	7.73	I-4 interchange
Conroy Road	Lawing Lane	Kirkman Road	24	9.34	10	7.58	--	9.84	5	6.79	Left and right turn on Kirkman Road
Municipal Drive	Vanguard Street	International Drive	25	9.35	--	10.81	--	8.95	19	8.25	Left and right turn on International Drive
Powers Drive	Shadow Wood Court	Silver Star Road	27	9.61	20	8.29	18	7.68	--	9.84	Left turn on Silver Star Road
Main Street	Cherry Street	Vine Street	--	10.29	--	10.81	--	10.51	8	7.36	Signal at Vine Street
University Boulevard	Semoran Boulevard	Driggs Drive	--	10.69	--	9.89	--	11.65	9	7.46	Signal at Driggs Drive
Mercy Drive	Elray Road	Colonial Drive	--	11.87	--	13.39	9	6.48	24	8.75	Signal at Colonial Drive
Colonial Drive	Oberry Hoover Road	Alafaya Trail	--	12.21	12	7.72	--	11.85	--	9.30	Left turn on Alafaya Trail
Colonial Drive	Magnolia Avenue	Orange Avenue	--	12.31	--	10.81	--	9.66	16	8.10	Signal at Orange Avenue
Jackson Street	Orange Avenue	Rosalind Avenue	--	12.95	--	16.37	17	7.56	--	10.72	CBD
Pearl Lake Causeway	Pisgah Avenue	Semoran Boulevard	--	15.67	--	12.94	14	7.05	--	23.36	Left turn on Semoran Boulevard
Orange Avenue	Crystal Lake Street	Michigan Street	--	15.99	--	15.34	16	7.29	--	13.42	Right turn on Michigan Street

* Speed values are in miles / hour

Figure 2 20 Slowest Segments in LYNX Network by Time of Day

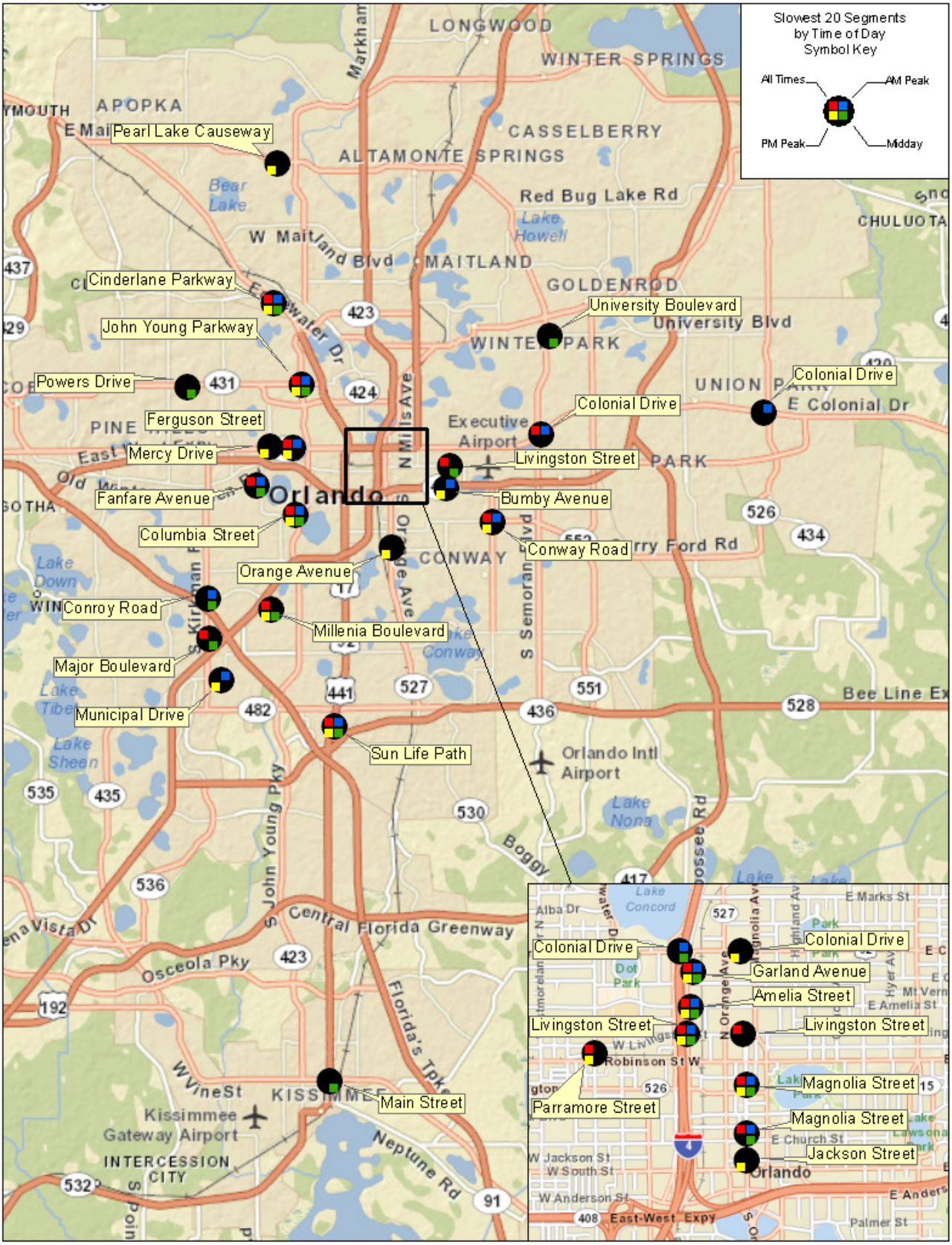


Table 3 shows the speed profile for each of the analysis time periods for the LYNX network as a whole. This type of analysis could serve as a performance metric for the system when compared year to year.

Table 3 Bus Speed Characteristics by Time of Day

Percentage of Network Operating Within Speed Range	All Times	AM Peak	PM Peak	Midday
< 10 mph	0.8	1.6	1.8	1.4
10 mph to < 20 mph	25.4	29.2	32.4	28.6
20 mph to < 30 mph	47.1	45.7	43.6	44.8
30 mph to < 40 mph	22.5	19.4	18.2	21.2
≥ 40 mph	4.1	4.5	4.0	4.1

The mean segment travel speed for all times was 24.8 mph. It was observed that the slower segments are concentrated in Orlando's Central Business District. Other segments that that are below average speeds are overwhelmingly associated with downstream signals that could be candidates for bus priority.

DWELLING TIME

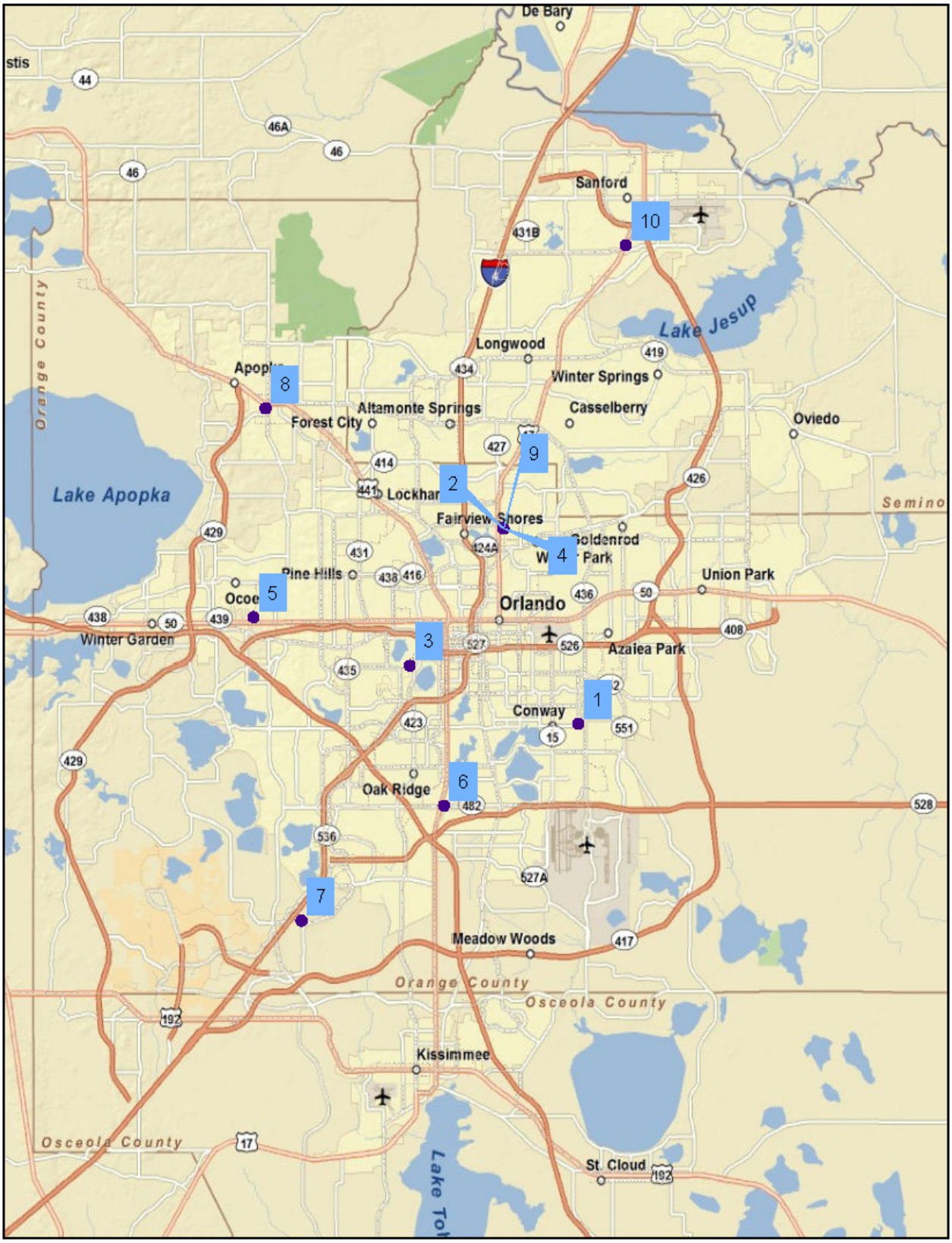
Dwell times are calculated directly by the APC system and are stored in the LYNX database every time the bus stops. When a stop is bypassed, the dwelling time is reported as zero. Dwelling times can be aggregated at the stop level to derive an average dwell for each location by time of day. The aggregate can be made to include only occasions where the bus actually stopped, or can include bypasses in the aggregation. When coupled with boarding and alighting numbers that are also stored, it is possible to calculate dwelling time per passenger loading and unloading.

Average dwelling times at stops for different time periods have been derived and saved in the generalized shapefile for each route and can be visualized on maps. Table 4 and Figure 3 show the locations and values of 10 highest dwelling times ranked by all day dwelling time. Different routes may use the same stop. In the Table 4, the same stop location could be shown more than once because it may belong to different Route ID.

Table 4 10 Highest Dwelling Times Ranked by All Day

Map ID	STOP NAME	Route ID	Dwelling Time All Day (Seconds)	Dwelling Time AM (Seconds)	Dwelling Time PM (Seconds)	Dwelling Time Midday (Seconds)
1	4600 DIXIE BELLE DR & GATLIN AVE	3	422	380	275	484
2	900 WEBSTER AVE & N DENNING DR	9	321	464	239	394
3	1100 BETHUNE DR & COLUMBIA ST	21	182	185	181	164
4	900 WEBSTER AVE & N DENNING DR	23	204	31	258	63
5	WEST OAKS LOOP RD CIR	30	162	64	44	91
6	1600 SAND LAKE RD & SKYVIEW DR	42	192	219	330	226
7	8000 VINELAND AVE & INTERNATIONAL DR	42	335	398	99	513
8	CENTRAL AVE	44	251	170	165	296
9	700 N DENNING DR & WEBSTER AVE	102	166	178	138	115
10	4500 SEMINOLE CENTRE PLZ	103	219	332	419	301

Figure 3 Locations of 10 Highest Dwelling Times Ranked by All Day



8. RECOMMENDATIONS

POTENTIAL OF APC DATA USES

APC data is normally used to track passenger loads and bus stop activity; however, this study demonstrates the ability to derive bus travel times and dwell times from APC data for use in many different applications. The results of the study illustrate transit performance by roadway segment to identify locations for possible operational improvements necessary to enhance the efficiency of the transit system. Additionally, the study has evidenced the ability to extract and synthesize existing transit data for use in transit modeling and other applications. APC data can be used to:

- Help predict transit speed more accurately based on observed data at the segment level, route level, or system level;
- Understand the relationship curves between bus and auto travel times (and speeds) in the mixed-flow conditions to travel demand model calibration;
- Identify specific congestion locations in need of bus speed enhancing improvements during different time periods;
- Demonstrate dwell time per passenger boarding/alighting;
- Monitor schedule adherence (slow and fast buses);
- Find slack in existing schedules that could allow for more service at the same cost;
- Track operator performance;
- Evaluate the effectiveness of new improvements or the impacts of system changes; and
- Calculate the reliability as the bus performance measure during long periods of time.

Each of these measures can help to identify areas that may be addressed to save money, improve on-time performance, enhance service, or to improve transit ridership forecasting techniques.

These data could be used even more effectively if combined with the General Transit Feed Specification (GTFS) that is used to support transit trip planning in Google. Currently, only a few transit agencies in Florida maintain a version of their routes, stops, and schedules in GTFS. Any tool that is developed to relate APC data to GTFS system information will be transferrable between any agencies that have GTFS formatted scheduling data. The format of the APC archive will likely vary, but the information contained within them will be similar. The APC archives can be converted into a universal format for future use.

Appendix A: STOP Output Table File Data Fields

Stop Output Table File Data Fields

List	Fields
1	Stop ID
2	Arrive Time
3	On Board
4	Off Board
5	Load
6	Date
7	Route
9	Block
10	Latitude
11	Longitude
12	Driving Mile
13	Trip ID
14	DRCLS (DOOR CYCLES)
15	DELTA ERROR
16	DAY OF WEEK
17	DIRECTION
18	DELTA MILES
19	DELTA MINUTES
20	DELTA PASSENGER MILES
21	DELTA PASSENGER HOURS
22	BUS NUMBER
24	DATA BATCH
25	SCHED TIME
26	SCHED RUN TIME
27	Actual RUN TIME
30	SCHEDULE DEVIATION
31	DWELL TIME

Appendix B: Travel Speed Performance Maps