Summer 2011

The "Owl Express", a shuttle efficiency study

Quarterly Report for Parking and Transportation Services at FAU

This document describes the tasks performed and the progress achieved so far for the efficiency study of the "Owl Express Shuttle" at Florida Atlantic University's main campus, Boca Raton. Some of the information in this quarterly report includes a proposed fixed schedule for the shuttle service, stop locations based on the demand, recommendation to increase ridership, etc. This information is provided for the Parking and Transportation Services at Florida Atlantic University (PTS FAU).

Dr. Evangelos Kaisar, Ph. D.
Benazir Portal, E.I.
Multimodal Intelligent Transportation Systems Laboratory
6/6/2011

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Brief description of activities implemented during quarter

During the spring semester of 2011, the Multimodal Intelligent Transportation Systems Laboratory from the CEGE Department has analyzed the current conditions which the shuttle system will be exposed during the following semesters: Summer and Fall 2011. The research team came up with new proposed routes for the shuttle routes as well as a fixed schedule in order to provide the students with a reliable time frame for the service. It was also possible to determine the most important shuttle stop locations based on the available information such as the demand data and class schedule.

Shuttle Routes

The current shuttle network system runs two different routes; the main purpose of this measure is to reduce the travel time and serve the higher demand on the northern end of campus. The need to serve two different routes arose when the construction for the 30,000 seats stadium started. Once the construction began, the students who parked in Lot 5 had difficulty moving from Lot 5 to their class locations or the center of campus since there were no designated walkways and the distance actually became longer. Therefore, the need of a shuttle connecting that highly transited area between Lot 5 and the Breezeway became crucial.

After several questionnaires to the students the research team realized that the division of these two routes was confusing to the students and the ridership was being affected since the students prefer to walk instead of riding the wrong bus. Thus, the research team recommends using a COLOR CODED system in order to differentiate between the two routes. Several schools use the color coded system to facilitate and simplify the information to the students. For this study we decided to use colors that will relate to FAU: Blue and Red. However, these colors have been used for other purposes such as parking lot division and parking permits, hence the idea of changing the colors in a future would be highly recommended.

Figure 1 illustrates the color-coded routes for the current shuttle system. The Blue line represents the route that serves the students from Lot 5 to the Business buildings and Breezeway. The Red line is the shuttle route that provides service to the main buildings on campus. Before the beginning of the stadium construction the Red line was the only route and included Lot 5. However, due to the high demand on the northern end of campus it was necessary to have a

shuttle providing transportation to the highly transited parking area of Lot 5 without having to wait for the shuttle to go through the entire network.

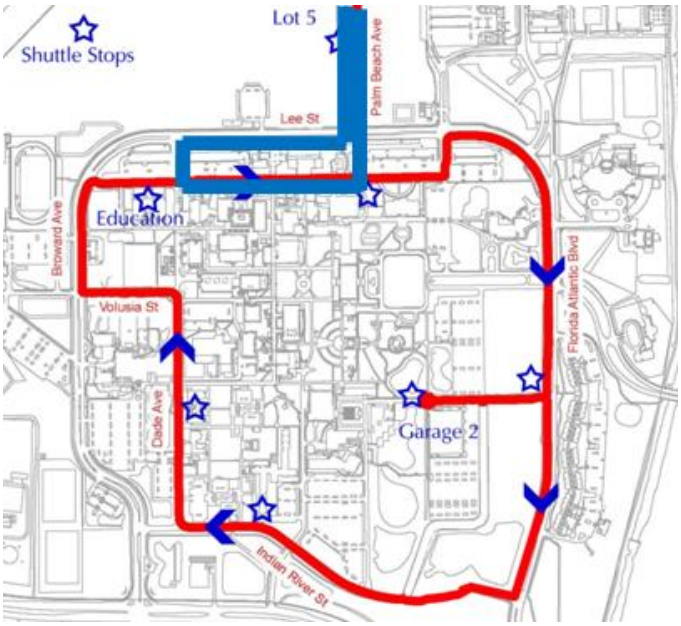

Figure 1 - Blue and red lines for shuttle routes

Microsimulation was used to analyze the current conditions of the road network. Some future conditions were also taken into consideration since it was necessary to provide a shuttle schedule for Summer 2011 which does not include traffic created by the new stadium and the Innovation Village. The simulation platform used was VISSIM version 5.10. This software allows microscopic traffic modeling of vehicular traffic, public transportation, bicyclists, and pedestrians. These capabilities aid to represent in a better manner our real life scenarios in order to have a closer approximation to reality. The platform is also capable of reproducing 2D and 3D modeling, provides signal timing coordination and green time optimization, helps with land use and traffic impact/management studies, etc.

The simulation model was modified based on the new collected data. New road network characteristics were implemented, such as a new traffic light, signal timings, and pedestrian counts. The new signal timing incorporated was for the intersection of Broward Blvd. and Volusia St. The road network was modified using both architectural drawings provided by the University Architect's (UA) office along with aerial photography of the campus. New road

network characteristics have to be implemented for future scheduling based on the latest version of the Master Plan recently provided by the UA's office.

Once all the shuttle characteristics were input to the microsimulation model, the research team was able to obtain an average of each route's travel time and route length. The following section illustrates the characteristics of the current existing network for both routes.

Red Line Characteristics

$$Current\ length = 2.6\ mi$$

$$Average\ travel\ time = 13\ min$$

Current "designated" stops

1. Office Depot Center/College of Business and Education
2. Parking Lot 4 near Biomedical Sciences
3. University Village Student Apartments
4. Parking Garage 2
5. Glades Park Towers
6. Student Support Services Building

Blue Line Characteristics

$$Current\ length = 1.6\ mi$$

$$Average\ travel\ time = 10\ min$$

Current stops

1. Office Depot Center/College of Business and Education
2. Northern end of Breezeway
3. Northern end in Lot 5
4. Southern end in Lot 5

(Due to the high ridership the dwell time is approx. 40 sec.)

Proposed Modification to current shuttle routes

Blue Line

There are no physical proposed modifications to the blue line route. As mentioned earlier there are currently four stops in the Blue Line, two of them are along Lot 5 and the other two coincide with two of the stops in the Red Line. Therefore, in order to avoid confusion between names/numbers of the stop locations the research team proposes to make the location number's match on both shuttle routes. Figure 2 illustrates the map of the Blue line with the proposed stop location numbering.

Figure 2 - Blue Line with Proposed Modifications

From the several questionnaires to the students the research team was able to identify one of the most concurrent recommendations for improvement provided by the students: shelters. The need for shelters at the stop locations has become obvious when it comes to analyze the efficiency of the infrastructure provided for the shuttle service. Once the research team noticed the continuous recommendations for shelters they decided to investigate what is the impact of the shelters at stop locations. Several authors state that the installation of shelters at the stop locations greatly impacts the ridership in any type of transportation system.

Red Line

Due to the high pedestrian movement volume and parking spaces available over the Oxley Center, an extension of the Red Line is proposed. Figure 3 illustrates the map of the Red line incorporating the new extension over the Oxley Center. In order to test the feasibility of the route extension we obtain the average travel time and route length from the microsimulation model by implementing this change into the network.

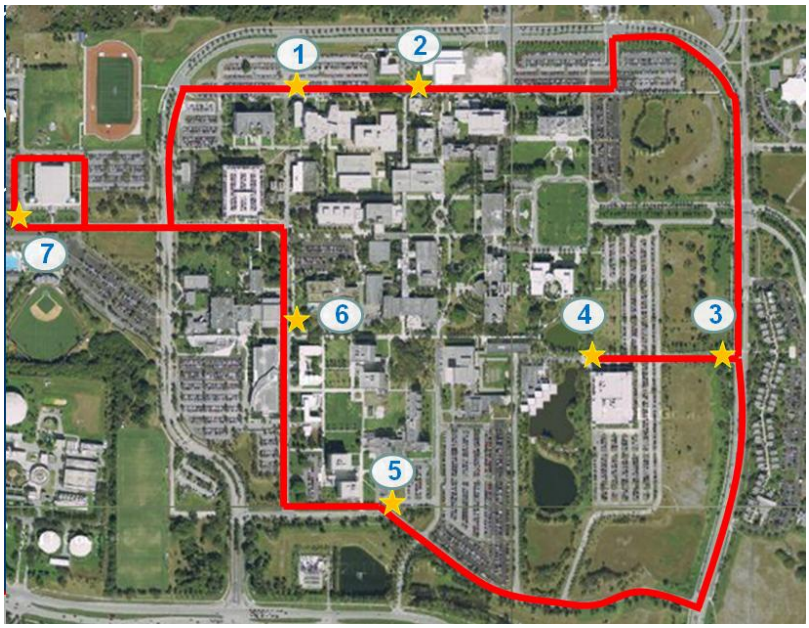

Figure 3 - Red Line with Proposed Modifications

$$Proposed\ length = 3.1\ mi$$

$$Average\ expected\ travel\ time = 17\ min$$

- Proposed stops
    1. Office Depot Center/Colleges of Business and Education (Same as Blue Line)
    2. Northern end of Breezeway (Same as Blue Line)
    3. University Village Student Apartments
    4. Parking Garage 2 (Fine Arts Complex)
    5. Glades Park Towers
    6. Student Support Services Building
    7. Oxley Center

From the results obtained in the microsimulation platform we know that by including the Oxley Center into the Red line the route would increase by 0.5 miles. As a consequence of the distance traveled being increased, the average travel time would increase by 4 min. yielding an average travel time of 17 min. total.

Fixed Schedule

Based on the reconnaissance of the optimal stop locations, the research team created the schedule for both shuttle routes. The main characteristics of the shuttle schedule were maintained in order to avoid confusions (Operation times, current layout, etc.). Calibration and validation of the simulation was first considered and verified. Calibration was determined by comparing reported vehicle counts in the simulation versus field recorded counts by Jacobs Engineering. Network validation was performed by comparing simulated travel times versus actual reported shuttle route travel times. The actual shuttle travel times were determined by using a GPS tracker system that was placed on the bus during 3 separate time periods during peak times during the semester. The GPS data allowed us to review the current shuttle path and travel time between the different segments of the route.

Table 2 is a sample of the fixed schedule produced for the Red line. It has to be taken into account that the stop locations 1 & 2 in the Red Line coincide with the Blue line numbering.

Currently, there is only one shuttle running for the Red line route. However, as you may notice from the sample schedule, the research team provided a schedule for a second shuttle in case another shuttle is designated for this route. The gap time recommended to have between the shuttles running the Red line is of 8-10 min. due to the relatively high travel time of the route.

Table 1 - Red Line Fixed Schedule for Regular and Peak Hours

Red Line		
Stop	**Shuttle #1**	**Shuttle #2**
1	7:30	`
2	7:31	7:41
3	7:33	7:43
4	7:35	7:45
5	7:38	7:48
6	7:40	7:50
7	7:43	7:53
1	7:46	7:56
2	7:47	7:57
3	7:49	7:59
4	7:51	8:01
5	7:54	8:04
6	7:56	8:06

For the Blue line schedule the research team has provided two schedules. Table 2 is the sample schedule for regular hours. What is noticeable from this is that the schedule is only provided for one shuttle. Table 3 represents the sample schedule for the Blue line during peak hours. The observed peak hours for the northern end of campus (mainly traffic in Lot 5) is during the following schedule: 11:00 AM and 4:00 PM.

The main reason for having two schedules is optimization. Since only one shuttle is required to serve the demand during the regular hours, we recommend designating the second shuttle to run the Red line. The demand in the Red line remains mostly constant throughout the day; therefore, it is not as crucial to serve a higher demand during peak hours as it is for the Blue line.

Table 2 - Blue Line Schedule for Regular Hours

Blue Line		
Stop	**Shuttle #1**	**Shuttle #2**
3	7:30	NA
4	7:31	NA
1	7:34	NA
2	7:36	NA
3	7:40	NA
4	7:41	NA
1	7:44	NA
2	7:46	NA
3	7:50	NA
4	7:51	NA
1	7:54	NA
2	7:56	NA
3	8:00	NA

Table 3 - Blue Line Schedule for Peak Hours

Blue Line		
Stop	**Shuttle #1**	**Shuttle #2**
3	11:30	11:35
4	11:31	11:36
1	11:34	11:39
2	11:36	11:41
3	11:40	11:45
4	11:41	11:46
1	11:44	11:49
2	11:46	11:51
3	11:50	11:55
4	11:51	11:56
1	11:54	11:59
2	11:56	12:01
3	12:00	12:05

In order to improve the efficiency of the shuttle service we highly recommend the implementation of shelters at the stop locations. From literature, research and surveys it is obvious that ridership is directly affected by the infrastructure provided by the facilities for the transit system. By providing shelters at the stops, the users (in this case the students) get a visual recognition of the stop locations. Shelters are very convenient since the students can protect themselves from weather conditions (rain heat, etc.), some of the students implied that most of the time they rather walk instead of waiting for the shuttle since it is either really hot or starting

to rain. Another recommendation that is highly recommended is to provide the students with clear maps with the stop locations throughout campus and the color coded routes. This information can be posted on the shelters once they are implemented. This will not only increase ridership in the shuttle service but it will also help the students plan their activities based on the information that they are provided with.

Recommendations Summary

- Provide color coded routes to differentiate the shuttle routes
- Stop locations 1 & 2 in the Red Line should coincide with the Blue line numbering
- During regular hours:
    - ❖ Two shuttles running the Red Line
    - ❖ One shuttle running the Blue Line
- During peak hours (11:00 AM & 4:00 PM):
    - ❖ One shuttle running the Red Line
    - ❖ Two shuttles running the Blue Line
- Shelter installation at stop locations
- Provide maps with the stop locations throughout campus and the color coded routes
    - ❖ The maps can be posted on the shelters

Future Work

Because college campuses tend to have a high pedestrian movement volume, pedestrian new crossing counts need to be conducted on crosswalks deemed as high flow areas. The objective of conducting the pedestrian counts is to better understand the flow of pedestrians within campus in order to anticipate possible shuttle ridership. Table 4 indicated the locations of where the pedestrian counts were conducted. The new pedestrian counts will be determined once the pedestrian flow starts from the new buildings and there are preferred walkways. The number of passengers directly affects the shuttle route travel time, thus the importance of the pedestrian counts.

Table 4 - Pedestrian Crossing Count Locations

Crosswalk	Intersection
1	Dade Av. (In front of Admissions Building.)
2	Dade Av. &Volusia St.
3	Lee St. (In front of LOT 10)
4	Lee St. (In front of LOT 11)
5	Lee St. (In front of LOT 5)
6	Lee St. & St. Lucie Av.
7	20th St. & Florida Atlantic Blvd.
8	Florida Atlantic Blvd. & Student Housing
9	Broward Av. & LOT 15
10	Broward Av. & LOT 16