# The Paladin Shuttles: Potential for increasing efficiency in transportation service by proposing a route schedule

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#### Abstract

The Paladin Shuttles are a dependable source of transportation that many students at Furman University rely on to get around on campus and to nearby grocery stores and restaurants. The shuttles operate through a call-request service system. There, however, are nights when the shuttles are overwhelmed by calls for rides from students all over campus to pick up its clients. This project aims to identify sites on and nearby campus frequented most by Furman students and construct an efficient bus stop route schedule that would help eliminate unneeded trips to answer request calls. The results should assist Furman University in organizing a transportation system on campus that could potentially be part of the school's plan to reduce its carbon footprint by decreasing gas consumption.

#### Introduction

The Paladin Shuttles at Furman University provide transportation for students to and from sites on and off Furman campus. Students can request for rides by phoning 313-7171. However, the convenience of requesting transportation service has sometimes created situations where the drivers have to provide back to back service for one area of campus as individual or groups of students of that area phone in to request for rides. This form of service is disorganized and often leads both the driver and rider to confusion regarding scheduled meeting time and location. A bus route schedule is a potential solution to eliminating the problem of inefficient bus service and excessive gas consumption. There is a rotation of two Paladin Shuttles that provide service to students at nights during the week and weekend. A survey of the places frequented most by the clients of these vans will be conducted to help in the planning of a route system for the Paladin Shuttles.

# Frequented Spots on Furman Campus During Week

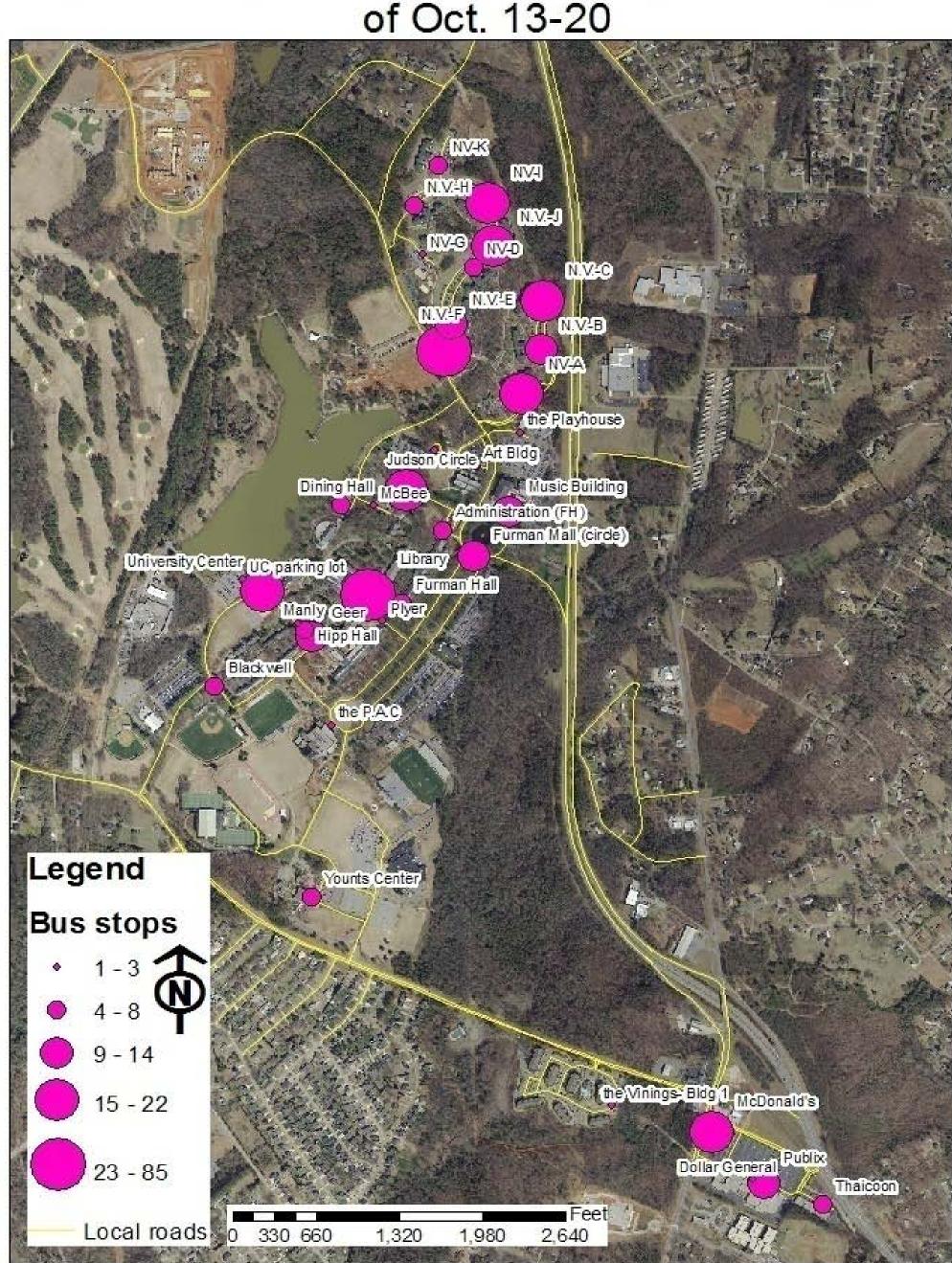
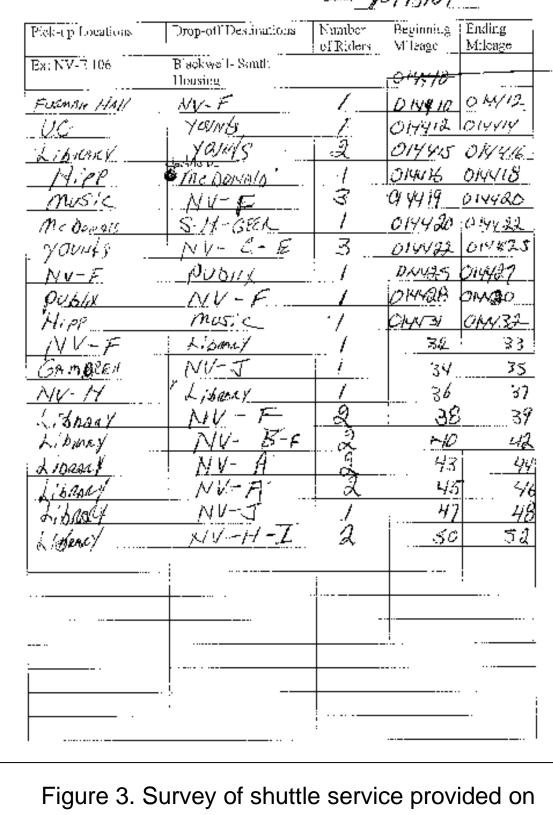


Figure 1. Map of most popular pick-up and drop-off points during the week of Oct. 13-20.



Route of Most Frequented Places

Figure 2. Map of most visited sites on and off Furman campus



### Methodology

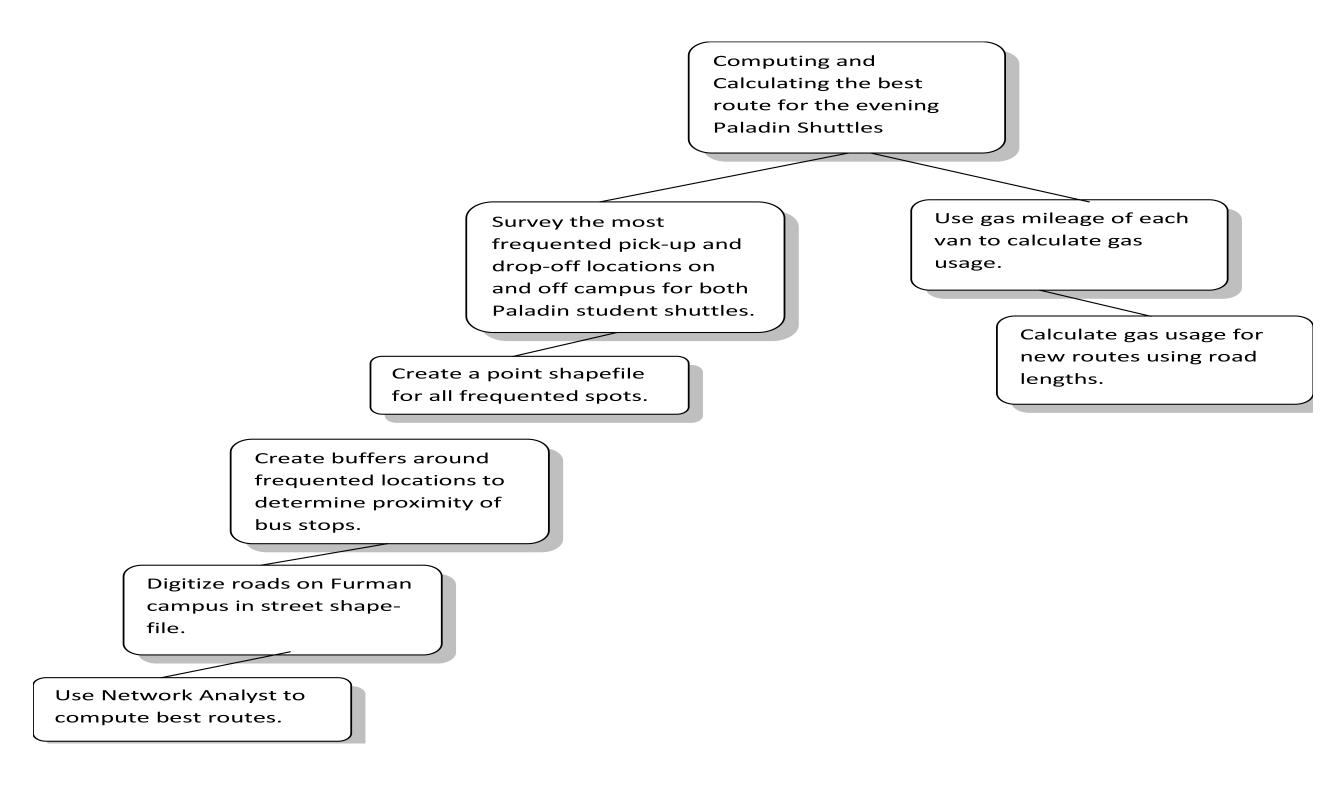


Table 1. Total mileage travelled each night was used to calculate gas consumption.

The Paladin Student Shuttles- Data for the Week of Oct. 13-20					
Date	Total Distance (mile)	Daily Gas Consumption (gallon)			
10/13	42	2.08			
10/14	37	1.83			
10/15	38	1.88			
10/16 (Ford)	26	1.86			
10/17 (Ford)	36	2.57			
10/18 (Ford)	39	2.79			
10/19	43	2.13			
10/20	35	1.73			

Figure 4. Graph of the amount of gas used every night by both shuttles within the week of Oct. 13-

**Calculated Annual Gas Consumption by Dodge** 

**Sprinter and Ford Club Wagon** 



Weeknight shuttle: 2006 Dodge Sprinter 2500 2.7L (20.2 mpg overall)<sup>4</sup>



Weekend shuttle: 1994 Ford Club Wagon 4.9L L (City 13 mpg)<sup>5</sup>

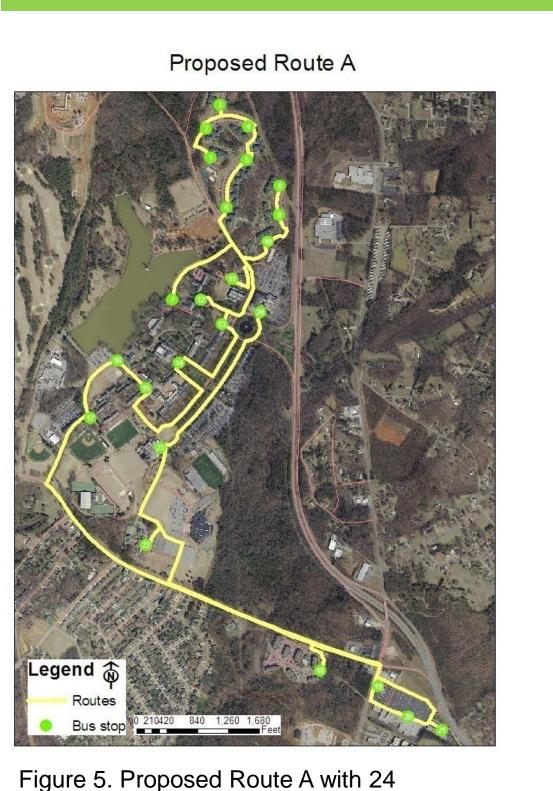
#### Acknowledgements

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# References

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- 3. Dr. Pierre Owusu, owner of the Paladin Shuttles
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#### **Results and Discussion**



Proposed Route C

Figure 7. Proposed Route C with 20 stops.

Figure 8 **Estimate of Daily Gas Consumption by Ford** 

Figure 9

Route A

Route B

Route C

**Estimate of Daily Gas Consumption by Dodge** 

Sprinter 2500



Figure 6. Proposed Route B with 24 stops.

Proposed Route D

#### Estimate of Gas Consumption by **Dodge Sprinter 2500** Estimate of Daily Gas Consumption Consumption per Route

Route	D	17	5.45	0.27	1.35
		Estimate	Gas Consump	tion by <b>Ford Cluk</b>	Wagon
		# of	Total	Gas	Estimate of Dai
		Stops	Distance	Consumption	Gas Consumpti
			(miles)	per Route	
Route	A	24	7.14	0.51	2.55
Route	B	24	7.67	0.55	2.74
Route	e C	20	6.93	0.49	2.47
Route	, D	17	5 45	0.39	1 95

Distance

(miles)

0.38

Table 2 (top) and 3 (bottom) provide the calculations for total distance Figure 8. Proposed Route D with 17 stops.

The map in Figure 1 show the frequency of locations on and off campus that were visited by students who used the Paladin Shuttle during week of October 13-20. Figure 2 presents the paths that the drivers used to transport students. The figure does not represent one continuous route that was travelled by the shuttles. Note that with the current call-request service system, the shuttles travel back to the their parking station near the Playhouse in between calls on non-busy nights. Therefore, Figure 1 only provides a general idea of the numerous paths the shuttles travelled when on service.

The proposal of the new routes is based on the potential of reducing mileage while maintaining efficiency. Based on the popularity of the recorded locations shown in Figure 1, Route A (Figure 5) schedule is proposed to meet most of these interest points. Some of the visited points are within a 4 minute walk from one another. Buffers are created around these spots to help determine their proximity to one another so that a systematic method of determining where to join the points can be established. Any point that has half or more of its buffer overlapped by another point's buffer is joined at a compromised spot in between the points. Figure 5 and 6 show proposed Routes A and B, respectively, with the same reduced number of 24 stops and different arrangements of bus stops and paths. Routes C and D (Figure 7 and 8 respectively) are calculated with different numbers of stops to further reduce the travel distance.

Creating a new route yields only the distance measured for the route. The amount of gas for the entire evening can be calculated by dividing the given measurement of each route by the gas mileage of each van and then finding the product of that answer and 5. For this project each route is limited to 5 roundtrips per night. In comparing the recorded gas consumption by both vans (Table1) and the calculated gas usage on proposed routes by individual vans (Table 2 and 3) we see that the majority of the recorded data is slightly larger than that of the new routes, which translates to some small reduction in the amount of gas that's used nightly.

# **Conclusion and Future Work**

Calculations of gas usage by the Paladin Shuttles on a particular night and those from proposed routes show: •A bus schedule does have the potential for reducing mileage and yielding a more efficient and reliable transportation system, but the reduction in gas consumption is minimum.

•Further research is needed to find if a minimum reduction is worth changing the system of shuttle service and whether this new practice will adversely affect students or create any sort of inconvenience for the passengers. •Further investigation can use speed limits and loading time at each bus stop to calculate the actual time for a shuttle to travel one full proposed route and then determine exactly how many rounds the shuttle can make in one night. The one way function can also help create a more realistic route schedule when considering the distance and time the shuttle can travel on a one way street on campus.