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Assessment of a Campus Transit Program(Auburn University Tiger Transit Case Study)

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Certificate

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A Synthesis Project

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Advisory Committee:

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Index

Abstract

This synthesis project describes a comprehensive framework to evaluate a campus transit program of universities and colleges. As a purpose and nature of college transit system differs from a normal public bus transportation system, four different parameters (1) Efficiency, (2) Effectiveness, (3) Supportive infrastructure, and (4) Financial aspect are selected to assess it. To assess these parameters, a mixed method research dataset consist of qualitative, quantitative, geographical information system, photographic analyses is used. Based on this assessment, it also describes strategies to optimize transit service in terms of efficiency, effectiveness, to increase ridership, and to provide environmental friendly transit system with the best possible short-term and long term strategies.

Executive Summary

Tiger Transit, the total outsourced campus transit service was initiated in response to a problem of shrinking parking supply in year 1997 for Auburn University. A mandatory student transit fees is the source of revenue.

Tiger Transit— Alabama's the most successful system—now, faces the following issues.

- Ridership is steady regardless of expansion of bus routes from 2 internal routes to 5 and 4 external routes to 11.
- The operating cost is increased due to fuel price hike and low ridership in relation to no. of routes.
- It covers only 70% population.
- Growing dissatisfaction with the service due to lack of time management.
- Improper infrastructure such as bus stops. There are total 149 bus stops and only 24 bus stops have bus shelters.
- Its outsourced contract expires in year 2010.

These issues make the university to conduct the investigation into Tiger Transit's capabilities to serve student population. Assessment of Tiger Transit is a comprehensive investigation for the following objectives.

1. Evaluate Tiger Transit in terms of efficiency and effectiveness.
2. Evaluate its supportive infrastructure and financial aspects.
3. Discuss various alternatives that may be implemented to improve the system
4. Recommend the optimum short term and long term strategies to improve the transit system.

The assessment of each objective listed above is discussed below.

(1) Efficiency and Effectiveness assessment:

An efficiency parameter is generally considered to be on the maximum utilization of input resources to produce maximum output. Effectiveness parameter reflects a system's ability to provide an adequate level of service. The detailed assessment in this section is presented as follows.

1.1 Efficiency Assessments

To conduct efficiency assessment, the hypothesis, *"If Tiger Transit stopped operations during fall semester 2004, how many additional vehicles would students drive to and from campus?"* is used to

- Determine the number of student riders of Tiger Transit during fall 2004.
- Estimate the passenger vehicle miles shifted from personal vehicles to the transit service.

These two answers provide a direct comparison of public transit vs. personal vehicles. This comparison measures efficiency and the following results have been found.

Comparison between Tiger Transit and Personal Vehicles, Fall 2004

	Tiger Transit	**Personal Vehicles**
Input resources		
1.Fuel Economy	$ 129,000	$ 75,630
2.Pollutant cost	$ 69,573	$ 45,151
3.Parking Permit Cost	-	$ 39,375
4.New Parking provision cost	-	$ 673,080
5.Associate driving cost	-	$ 139,340
6.Transit operating expenses*	$ 1,106,901	-
Total cost	*$ 1,176,474*	*$ 972,576*
Output		
Miles Driven	409,000	922,778
Vehicle Round Trips*	350	3,500

The above comparison proves that Tiger Transit to be more expensive mode of transportation choice. But in terms of vehicular safety, it significantly reduced vehicular volume on the city roads which results into less vehicular accidents.

1.2. Effectiveness assessment:

The efficiency assessment is conducted based on the Geographical Information System data which was built for this study. For the analysis, the city divided into four quadrant and the following results were observed. (Ref. Attach map)

Student Coverage by Tiger Transit Fall 2005

Quadrant	**% of located Students** (no. of students)	**% of Student covered by Tiger Transit** (no. of students)
North-East	15.03% (3457)	9.85% (2256)
North-West	8.05% (1852)	4.01% (992)
South-East	25.92% (5962)	17.72% (4076)
South-West	49.95% (11,489)	42.21% (9708)

Other the student coverage, the following issues are observed.

- Some of the student housing areas are not served by the transit system.
- Bus stops are either improperly located or are too closely located to each other.
- The easily walkable distance (0.25 mi) between the nearest bus stop and student residences may be too long in some cases, so the students prefer not to walk.
- Some of the bus routes run inside neighborhoods while others do not, even though large student populations are known to live there.
- The routes overlap on some routes.
- The two longest routes were found to have the lowest riderships.

2. Supportive Infrastructure and Financial aspect study.

Supportive infrastructure is the specialized programs (transit oriented policies, existing and future development plans, university time schedule, media etc), facilities and management resources (transit friendly streets, bus stops, bike lanes etc) which enables transit system to operate both efficiently and effectively.

In this section of study, the following issues have been emerged in the supportive infrastructure study.

1. A bus stop is a critical transit element and Tiger Transit's bus stops need significant improvement (84% bus stops needs improvement). This could be a large scale capital improvement program.

2. To identify responsibility for the development of bus stops is a critical task. Improving the collaboration between various agencies such as the university, city and private developers, will require a major effort.
3. The class schedule plays an important role in transit planning. There is a need to raise transit concerns regarding the class schedule, as it will help to guide a possible transit expansion.
4. The transit system is only specifically addressed and implemented in the university plans; city and region wide plans failed to address it aggressively. This may cause some delay in developing the capital improvement program needed to create transit friendly streets. It may require strong representation by Auburn University in local government forums to present the university's transit concerns effectively.

Financial aspect's two major component (1) expense and (2) revenue are studied. The expense subset is consisted of operating, administrative and capital expense. A mandatory student transit fee is the secured revenue. During this study, the following issues have been found.

1. The fuel price hike resulted in increased operating costs.
2. The difference between the expenses and revenue was very small ($ 90,000 as surplus) which created an issue due to the need to increase the mandatory transit fee or decrease the level of service.
3. The total driver requirement was 90 but the system was run on 56, which affected the level of service. The shortage of drivers was a major concern for the transit operating company.
4. The Oliver-Airport Line and Sunflower-Wire Road Express were the most expensive routes and the Charcoal-Museum, Gold-Wire Road, Sky-South Auburn , Navy-East Campus (Internal route) were relatively expensive routes, primarily due to low ridership. The issue of low ridership raised concerns over the current transit system's route design.
5. The transit service had to pay a fixed operating cost to the outsourced company regardless of the requirements of the buses, which resulted in the university having no control over the transit system.

The discussion up to this point proves that the level of service provided by Tiger Transit is less effective and efficient than it ought to be.

Potential Solution:

Several issues and themes emerged from the assessment that could help to make the transit system more effective, efficient and convenient compared to its current level of service. Both Short term and long term strategies are required in order to deal with the issues and concerns raised during the assessment. The short terms strategies can be formulated in-house and implemented immediately with in-house management, whereas long term strategies are more comprehensive in nature and require the involvement of the university, local, regional, state and federal governments. Some of the short-term and long-term strategies are as mentioned below:

Short-term Strategies:
(i) Redesign the bus routes to increase ridership and student coverage along with its yearly assessment. The redesigned bus routes should have the access to retail locations.
(ii) To encourage private developers to build bus shelters for apartment complexes. Bus shelter design should match the existing road and surrounding buildings' typology.
(iii) To install an Automotive Vehicle Location (AVL) system, which is a web based system that provides real time locations of buses over the internet. This will help students to plan their travel time.

Long-term Strategies:
(i) Tiger Transit should be considered while planning the classroom time schedule.
(ii) To start a weekend transit service for other major cities of Alabama to utilize the bus fleet in spare time.
(iii) To acquire the federal government appropriation for bus fleet and facilities.
(iv) To explore alternate fuel technology.
(v) To develop a supportive infrastructure plan in conjunction with the city.

The recommended strategies will help to improve the transit system significantly.

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Introduction:

The invasion of personal vehicles driven by young and relatively inexperienced drivers on university campuses nationwide makes it imperative to explore innovative solutions to contemporary mobility issues. University authorities traditionally control land use, transit and parking services on campuses so innovative transportation planning that addresses mobility issues and identifies solutions can be implemented easily. Auburn University—a prominent land-grant and comprehensive research institute in Alabama—is no exception to this need to grapple with transportation planning issues. The university launched its transit system 'Tiger Transit' in 1997 to assist students commuting to the university in response to a problem of shrinking parking supply. Tiger Transit is funded by a mandatory transit fees—$49/semester (Year 2004-05). Tiger Transit was introduced in order to address the following objectives:

1. To provide access to the university for as many as students as possible with lower mobility cost and safety.
2. To reduce traffic congestion on university streets and city streets surrounding the university.
3. To make the core campus pedestrian friendly by removing vehicles from an area that is heavily used by pedestrians.
4. To reduce the demand for parking and on campus housing.
5. To help the university to recruit and retain students.

The transit service has proved itself beneficial by not only protecting the campus from the influx of automobiles, but also by decreasing the demand for parking and on campus housing. There are only 10,000 parking spaces for the almost 30,000 people

coming to campus each day, including students, staff and faculty members. This university population represents 2/3 of the population of the City of Auburn's total population 42, 000, as per the 2000 census, and their vehicle occupancy ratio is more than 90%. There are only 6,500 parking spaces shared between 23,000 students, creating an acute shortage and the parking situation for faculty and staff is not much better. Parking spaces are also being replaced by new research building construction; for example, the Building Science department's new building is being constructed on what used to be the Goodwin Parking lot. The university has removed much of its substandard housing but this has not been replaced, relying instead on private developers to provide student housing. At present, only 16% of the students live on campus. Students generally prefer to live in newly developed neighborhoods based on the "city of villages" concepts and trailer parks away from campus due to the lower rent and better facilities compared to those that surround the university. These new developments have created a high demand for parking and transit for students commuting between campus and their apartments.

In recent years transit ridership has been steady regardless of the expansion of bus routes. As students live further away from the university, headways— timings between the frequencies of two buses—have increased and the transit service has becomes less effective, leading to a growing dissatisfaction with the present transit system. The transit service has been expanded from 2 internal routes to 5 internal routes and from 4 external routes to 11 external routes in the last three years. Even though the system has expanded considerably, the daily ridership has only increased from 11,587 to 13,244, which is not a significant growth in comparison to the system expansion. The transit system covers only 70% of the student population; students who live on the north-east and south-east

side of the city are not covered by Tiger Transit routes. Tiger Transit is currently a totally out sourced system, with approximately a $ 3 million budget. The system operates for the almost 88,000 hours/year and costs $33/hour at $ 1.63/gallon of diesel (costs for fall 2004).

At its current rate of growth, the demand is projected to grow from the current 35 buses to 50 buses. If the university owned the system, it would cost $ 31/hour, but any system expansion would require major financial investment. As the university is a public entity, it is eligible to receive federal and state funds under the Safe, Accountable, Flexible, and Efficient Transportation Equity Act-A Legacy of Users (SAFETEA-LU) and other alternate fuel technology acts. This eligibility makes it possible to explore different options. Increasing operating costs due to fuel price hikes, lower efficiency and effectiveness, system expansion requirements, and the contract ending in the near future are important issues for the university. Before any decision can be made, however, a careful investigation of the current system will provide valuable information to guide the process.

This synthesis project is an in depth study of the issues involved with the provision of a transit system for Auburn University. This project work began in January 2005 when the author served as a graduate research assistant to Dr. Christine Curtis, Principal Investigator for a grant from the Federal Transit Administration awarded to study parking and transit planning issues on campus. The source of information for most of the analysis herein is taken from the research supported by this grant.

Study Methodology:

The investigation for the transit study was guided by the research question: "What is the optimum methodology to evaluate a university transit system?" This question is asked to shape the goal and objectives, and the respnse takes the form of a case study with Tiger Transit as the case. The goal was formulated as follows:

Goal: '*To conduct an assessment of Auburn University's Transit System 'Tiger Transit'*. In order to accomplish this goal, the following objectives were studied.

Objectives:

1. Evaluate Tiger Transit in terms of efficiency and effectiveness.
2. Evaluate its supportive infrastructure and financial aspects.
3. Discuss various alternatives that may be implemented to improve the system
4. Recommend the optimum short term and long term strategies to improve the transit system.

A mixed method approach was taken that only consisted not only of qualitative and quantitative data, but also the extensive use of a geographical information system and photographic analysis. The efficiency study of the first objective, the results of a previously conducted survey, was used to generate quantitative data for various aspects of the efficiency assessment. The Geographical Information System was used for the effectiveness study, which examined spatial aspects of the Transit system. The Geographical Information system database was built using various data sources, including students' addresses, city streets, land parcels, bus routes and stops, etc. The second objective's dataset consisted of quantitative data (actual data obtained from relevant authorized sources), qualitative data (newspaper articles, election manifestos and

the Internet), photographic data, and windshield survey and site observations. The third and fourth objectives were achieved after a consideration of the conclusions reached the first two objectives.

Data Collection Time Line:

Date	Types of Data	Data description	Ref. Page No.
January-05 to May 05	Qualitative and Quantitative data For Transit vs. Personal Vehicle comparison	This data is generated thru the series of mathematical calculation to compare transit vs. personal vehicle.	6, 7, 77,78
	Fuel economy data	This data obtained from www.fueleconomy.gov which shows the vehicle mileage.	9,79, 80
May 05 to August 05	Parking cost	This data represents the cost of parking which was obtained from Facility Division of Auburn university in different formats.	83, 84, 85
March 05 to May 06	Transportation Operating Cost Model	This model developed over a year period through various discussions with transit authority.	51, 127
June 05 to November 05	Geographical Information System data (GIS)	This data was built by obtained from different sources such as the City of Auburn and Auburn University/	21-30, 62, 91-120
	Vehicular Accident Data	The row accident data obtained in excel spread sheet format from the City of Auburn's IT Dept and analyzed in Microsoft Access.	16
September 05 to October 05	Student Addresses	This data was necessary to built GIS data base which was obtained from Institutional Research Office and parking service system. These offices keep records of students' local addresses.	21,22

December 05 to July 06	Emission data	This data obtained from various EPA supported websites and Victoria Transportation Institute via internet access and correspondent through email.	10,11,81,82
January 05 to December-06	News paper articles	These articles were collected from various newspapers and other public media sources during the period of two years.	121-126
January 05 to December-06	Bus routes	The windshield survey had been conducted many times during the period of two years.	21-30, 62, 91-120
August 06 to November 06	Bus Stops	The site observation and photographs collected had been collected during the period of four months.	91-120

Literature Review:

The nature of this study is an assessment of a particular form of transportation utilizing various aspects and different datasets. To achieve this, the literature review will focus on the following topics:

1. Campus transportation scenarios and characteristics.

2. Types of public transportation, particularly the use of buses as a mode of transportation

3. Environmental aspects and concerns related transportation

4. Geographical Information Systems and their usefulness in transportation analysis

5. Financial and statistical aspects of transit systems.

6. Legal aspects affecting organizations involved in transit management

Information on the above subjects was obtained through an extensive review of a wide range of resources including books, articles, newspaper, actual data collection, personal communications, and the World Wide Web network. The relevant literature review will be discussed at the beginning and in the text of each chapter.

Chapter 1

Introduction:

Public transportation funds available through the US Department of Transportation substantially increased after the passage of the *Urban Mass Transportation Act of 1964*. The funds provided the by the grants awarded by this program could be used to cover up to two thirds of the capital investment for the construction, reconstruction or acquisition of transportation facilities, equipment, and for the coordination and planning of mass transit with highway and other multi modes of transportation. This has resulted in the provision of better transit facilities that are able to retain and increase ridership, which had declined with the growth in private automobiles. With federal, state and local government assistance, there is now growing interest among governments and transit operators in developing better ways to evaluate transit systems. Numerous studies—Fielding and Glauthier, 1976; Deen, 1977; Tomazinis, 1975; and Yunich, 1976—tested ways to evaluate transit services before a set of common parameters were adopted by the First National Conference for Transit Performance held at Norfolk, Virginia in September 1977 (Talley & Anderson, 1980). The common parameters were initially selected to be efficiency and effectiveness, and "Impact" was later added. Since then, evaluators have used these parameters in different senses, such as allocative efficiency, technological efficiency, environmental impact, and social impact (Fielding & others, 1984).

An efficiency parameter is generally considered to be based on the maximum utilization of input resources such as labor, fuel, and vehicles, to produce maximum output, while an effectiveness parameter reflects a system's ability to provide an adequate level of service, convenient locations, and characteristics service that meet the objectives

and needs of potential riders. Impact measures the effect of the service on all kinds of developments. As defined in Phillips (2004), efficiency and effectiveness are *"doing things right"* and *"doing the right things,"* respectively. The above stated references all discuss evaluations based on the statistics provided either by a transit agency or by the national transit database in order to analyze a transit service by comparing it with its peers.

As described in the introduction, the Auburn University transit service's goals and objectives are different to those of other public transportation system. University transportation has unique characteristics such as a targeted user group, fixed revenue, specific travel behavior, riders' living patterns and travel choices. Auburn University's transit service "Tiger Transit" provides commuting service to university from the students' apartments. Consequently the perspective adopted for the evaluation criteria will differ from those used by municipal public transit services, not only in terms of the statistical analysis but also by utilizing a different methodology. For this study, two different approaches were taken: a quantitative data analysis based on a hypothesized question to examine efficiency (section 1.1), and the use of a Geographical Information System to examine effectiveness based on the physical environment (section 1.2). These two approaches were taken to evaluate the transit service in terms of both its effectiveness and its efficiency. Tiger Transit's impact lies in the reduction of parking demands and the social change if produces. It provides opportunities to ride a bus and thus weaken personal vehicle driving habits and increases socialization while either riding or waiting for the bus in a safe environment. The assessment of Tiger Transit is the quantifiable part of this research, while the socialization opportunity is not quantifiable. It

also provides a commuting service between university and student housing and city commercial development that is neither transit oriented nor guided. Thus, here the impact element cannot be studied separately, as would be done for public transportation.

1.1 Efficiency assessment based on quantitative data

During the fall of 2004, the first efficiency study for this project was conducted under the guidance of Dr. Christine Curtis. The guiding hypothesis of the efficiency study was *"If Tiger Transit stopped operations during fall semester 2004, how many additional vehicles would students drive to and from campus?"* The question was asked to

- Determine the number of student riders of Tiger Transit during fall 2004.
- Estimate the passenger vehicle miles shifted from personal vehicles to the transit service. (Curtis, 2006).

These two answers provide a direct comparison of public transit vs. personal vehicles. This comparison measures efficiency through five core factors of transit evaluation namely: (1) fuel economy; (2) environmental impact; (3) reduced parking demand; (4) associated driving cost savings; and (5) safety and security assessment on city roads. An analysis of each factor will be described after a calculation of the mileages driven by transit and personal vehicles.

Tiger Transit Passenger Mileage: Transit mileages are the product of the number of buses, daily revenue miles on each route and the number of days buses operated. In fall 2004, Tiger Transit operated for 78 days instead of the normal 81 school session days due to the effects of Hurricane Ivan. The passenger mileages are shown in Table 1:

Passenger mileage= (Number of Buses)x(daily revenue miles)x(Number of school days)

Table 1: Tiger Transit Mileages

Bus Route	Number of Buses*	Daily Revenue Miles*	Days of Operation	Total Revenue Miles
External Lines				
Aqua-Rose-Harper	3	312	78	24,336
Chocolate-E. University	4	764	78	59,592
Gold-Wire Road	2	338	78	26,364
Purple-Webster	2	570	78	44,460
Silver-North Donahue	2	327	78	25,506
Sky-South	2	322	78	25,116
Olive-Airport	1	169	78	13,182
Strawberry-Longleaf	4	649	78	50,622
Tan-Magnolia Extension	2	276	78	21,528
Charcoal-Museum	1	119	78	9,282
Terra Cotta-N.Ross-Harper	3	237	78	18,486
Internal Lines				
Navy-East Campus	1	94	78	7,332
Orange-Central Campus	2	140	78	10,920
Green-West Campus	2	180	78	14,040
Blue-Park and Ride	2	193	78	15,054
Plum- C Zone Loop	1	82	78	6,396
Guaranteed Ride-Home	5	86	78	6,708
Security Night Transit				
Internal West	2	122	78	9,516
Total				388,440

Note: *obtained from Tiger Transit Services, spring 2005.

At Auburn University, the bus facility and parking space is 7.32 miles away from the campus, a 14.6 mile round trip. This distance is known as the deadhead miles and every day buses travel this distance with no passengers on their way to and from campus. The deadhead miles cost around 5% of the total revenue miles. Here, transit mileages consist of the combined revenue miles and deadhead miles. The total passenger miles for this semester are 409,000 (See Appendix A for details of this calculation).

Estimated personal vehicle mileage shifted by Tiger Transit: Passengers were counted on an hourly basis on board the buses and the average daily ridership determined for each route. In fall 2004, the average daily ridership was as shown in the second column of Table 3 and in Appendix B. In 2002, Skipper Consulting Inc. conducted the first

assessment of Tiger Transit. Their on board survey found the results shown in Table 2 for the likely trend of personal driving if Tiger Transit had not been available.

Table 2: Possible trend of personal accessibility to Campus

Route	Walk	Drive	Carpool	Bicycle	Vehicle Occupants
External Route	-	59%	37%	4%	96%
Internal Route	34%	62%	-	4%	62%

In the above survey results, for the internal routes (around campus), the vehicle occupancy ratio would be 0.62 (62%) due to individuals disliking carpooling, whereas for external route vehicle occupancy ration is 1.63 [(Drive + Carpool)/Drive].

Table 3: Estimated Personal Mileages

Bus Route	Average Daily Ridership*	Personal Vehicles	Route Miles*	Days of Operation	Total Personal Passenger Mileage
External Lines					
Aqua-Rose-Harper	807	475.29	1.6	78	59,316.0
Chocolate-E. University	1681	990.04	2.2	78	169,890.3
Gold-Wire Road	346	203.87	1.7	78	27,021.1
Purple-Webster	412	242.65	2.4	78	45,424.1
Silver-North Donahue	475	279.75	1.6	78	34,913.4
Sky-South	461	271.51	2.6	78	55,062.1
Olive-Airport	12	7.07	2.6	78	1,433.3
Strawberry-Longleaf	1755	1,033.62	2.9	78	233,804.8
Tan-Magnolia Extension	702	413.45	1.6	78	51,598.3
Charcoal-Museum	723	425.82	1.6	78	53,141.8
Terra Cotta-N. Ross-	481	283.29	1.8	78	39,773.7
Internal Lines					
Navy-East Campus	192	119.04	1.0	78	9,285.1
Orange-Central Campus	1213	752.06	0.8	78	46,928.5
Green-West Campus	1023	634.26	0.9	78	44,525.1
Blue-Park and Ride	910	564.20	0.8	78	35,206.1
Plum- C Zone Loop	169	104.78	0.5	78	4,086.4
Guaranteed Ride-Home	48	28.27	2.1	78	4,520.4
Security Night Transit					
Internal West	177	109.74	0.8	78	6,847.8
Total	11587	6,938.62			922,778.2

Note: * obtained from Tiger Transit Services, spring 2005.

Personal passenger mileages are the product of personal vehicle occupants and daily revenue miles. Personal vehicle occupants are the product of personal vehicle occupation

ratio and total vehicle occupants. In Table 2, the vehicle occupants are not all personal vehicle owners but are expected either to be in their personal vehicles or to ride with someone else. The total estimated mileages pre-empted by Tiger Transit are 922,778 miles and approximately 3,500 (n= 6,938~ 7000/2 vehicle trips) personal vehicles would have been driven to campus which meant 7,000 (n= 6,938) one-way trips would have been made.

A comparison of the personal passenger mileage 922,778 vs the public transportation passenger mileage (409,000) shows a direct driving saving, with 7000 one way trips by personal vehicles being replaced by 24 buses on the city's streets. The next sections discuss this assessment in terms of fuel economy, environmental impact, reduced parking space demand, reduced associated driving cost, and the safety and security of traffic on city roads.

1.1.1Fuel Economy

Fuel economy is a measurement of the fuel consumed by a vehicle as it travels a particular distance. There are two types of fuel economy: (1) city mileage; and (2) highway mileage. City mileage is primary urban driving in city traffic, whereas highway mileage is driving on rural roads as well as highway driving, using a steady speed rather than the "Stop and Go" driving typical of city driving (www.fueleconomy.gov). Tiger Transit operates within the city limits and all the personal and transit vehicles experienced city driving, therefore the fuel economy is considered to be city mileage throughout this study. Generally, vehicles' fuel economy is measured in miles/gallon, whereas bus fuel economy is measured in gallons/hour. Transit buses make frequent stops in traffic and at bus stops, stand at bus stops for long periods while idling their

engines and operating their with air conditioning systems at the bus terminal. In this situation, buses consume more fuel, which results in lower fuel economy and explains why it makes sense to measure bus fuel economy on a per hour basis rather than per mile. Based on a per mile/gallon fuel economy measure unit, although the buses were expected to consume 65,000 gallons during the semester, their actual fuel consumption was 75,000 gallons of diesel (actual figure obtained from Groom Transportation Inc; who operates the buses). A Gallon of diesel cost was $1.73 during the fall of 2004, so a total of $ 129,000 was expended on fuel.

On campus, many different vehicle types, including passenger cars, SUVs, station wagons, trucks, and minivans, are driven by students and their fuel economies range between 15 and 30 mpg. The average student vehicle fuel economy was obtained through an analysis of the vehicle distribution according to the vehicle types registered with Auburn University Parking Services that semester. The average city mileage of each vehicle was obtained from the government's Fuel Economy website—www.fueleconomy.gov. In fall 2004, there were 13,977 student vehicles among the 16,648 registered with Parking Services. As a result of the analysis, a personal vehicle's average fuel economy was taken to be 19.4 mpg (Appendix C). At this rate, 46,400 gallons of gasoline would have been required, which cost $ 75,630 at $1.63 per gallon of gasoline. This cost is only 58.6% of the cost of the fuel actually used by Tiger Transit.

1.1.2 Environmental Impact

Environmental impact is a significant aspect of transit as it is expected to be environmentally beneficial. However, quantifying the environmental impact is a challenging task due to the existence of several different pollutants, different measuring

units for pollutant calculation for different types of vehicles, driving conditions, fuel and fuel technology (Litman, 2006). Air pollutants and noise pollutants are directly noticeable pollutants as compared to water pollutants from mobile sources of pollution. Here, the most common air pollutants are carbon dioxide (CO_2), carbon monoxide (CO), particulate matters ($PM_{10,}$ $PM_{2.5}$), hydrocarbons (HC), lead, methane (CH_4), sulfur oxides (SOx), volatile organic compounds (VOCs) , nitrogen oxides (NO_x), and ozone (O_3). For this study, four major air pollutants were studied: VOCs, CO, NO_x and CO_2 for gasoline and diesel vehicles of mobile sources. The harmful effects, source and impact scale for these pollutants are summarized in Table 4.

Table 4: Vehicle Pollution Emissions

Emission	Description	Sources	Harmful Effects	Scale
Carbon Dioxide (CO_2)	A byproduct of combustion	Fuel productions and engines.	Climate change	Global
Carbon monoxide (CO)	A toxic gas that undermines the blood's ability to carry oxygen.	Engines	Reduced ability to transport oxygen to organs and tissues in human body, Climate change	Very Local
Nitrogen Oxides (NO_x)	Various compounds, Some are toxic, and all contribute to ozone	Engines	Human health, ozone precursor, ecological damage	Local and regional
Volatile organic hydrocarbons (VOC)	A variety of organic compounds that form aerosols	Fuel production and engines.	VOC and NO_x combine to create smog, which causes coughing, choking and stinging eyes, damages lung tissues, and exacerbates respiratory illness, and is an ozone precursor.	Local and regional

Source:1. Litman, Todd (2002), Transportation Cost Analysis, table 5.10-1 pp 5.10-1
2. Shapiro R.J & Others (2002),Conserving Energy and Preserving the Environment, pp.8,9

Vehicles also emit sulfur dioxide, which is harmful to human health but is not generated in significant amounts by mobile sources. Table 5 shows a comparison of the average estimated emissions.

Table 5: Average Emission in short tones fall 2004 (Appendix C)

Vehicle Type	VOC_s	CO	NO_x	CO_2
Tiger Transit	1.039	5.22	5.36	1077.47
Personal Vehicle	2.18	24.01	1.74	490.51

Note: This table is based on year 1999 emission data. The latest data for 2004 will be available in 2007
Source: Shapiro R.J & Others (2002), Conserving Energy and Preserving the Environment table 16a (pp21), table 18 (pp22)

In this comparison of average estimated emissions, Tiger Transit emitted more VOCs, NO_2, and CO_2 than personal vehicles would have emitted, but personal vehicles would have emitted 18.77 short tons more carbon monoxide than Tiger Transit. Traffic also creates noise pollution. A diesel bus is noisy due to its large engine and low power to weight ratio, producing the noise equivalent of 5 to 15 personal vehicles (Delucchi and Hsu (1998), Staiano (2001) as cited in Litman, 2006). During fall 2004, an average of 35 buses were in operation daily. Assuming 10 round trips for each bus, this corresponds to 350 round trips. This compares with the 3500 round trips made by the personal vehicles, which would produce a noise equivalent to a whole fleet of transit buses if we consider 1 bus to produce noise equivalent to 10 personal vehicles.

Table 6: Recommended Pollution Cost in Fall2004 Dollars (Appendix C, Tables 4 C to 6 C)

Vehicle Types	**Pollution Cost**
Tiger Transit	$61,350
Personal Vehicle	$44,999

Note: This cost includes energy, air, and noise and water pollutant.
Source: Littman,(2006)

Water pollution also occurs due to oil run off from vehicular systems. As the monetized air, noise and water pollutants in Litman's study demonstrate (Litman 2006, Table 25 pp 46), Tiger Transit had a negative impact on Auburn's environment which could cost approximately $ 24,000 more than that due to personal vehicles. The recommended pollutant cost is shown in Table 6 above.

Transit bus emission exhaust:

The transit bus exhaust is located on the lower right hand side of the rear of the bus. In additions to the odor emissions, a diesel exhaust contains fine particulate matter of which diesel is the largest source. Fine particles create serious health problems as they can enter the body directly through the throat and nose. Fine particles from vehicle emissions are a major source of lung cancer (www.epa.gov).

1. Vehicle exhaust and passengers.

As a transit bus waits for riders at the bus terminal, the atmosphere of the terminal becomes polluted because of exhaust emissions and their unwanted odor and noise for riders, as well as pedestrians. The transit exhaust is indicated by a red square in the above photographs. In some cases, this may be an indirect issue that defers riders from using mass transit.

1.1.3 Parking Space Demand Impact

Increasing parking space demand in the campus core means a loss of land development opportunities for new research buildings, green space (landscaping, wildlife habitat, farmland), aesthetic degradation, increasing environmental protection (storm water management, emission reduction cost, noise reduction) and increasing traffic congestion cost, as well as decreasing safe pedestrian movement. In fall 2004, Auburn University Parking Services issued 21,130 parking permits, with 13,977 parking permits issued to students. There were a total of approximately 10,000 spaces available in fall 2004, with 6,500 designated for student use. The number of parking spaces changes all the time due to changing parking requirements for visitors, service vehicles and on campus construction work, which often results in road blockages and the loss of parking lots due to building construction. The majority of student parking spaces are located on the periphery of the core campus. Parking space costs include construction, maintenance and management costs. Research into the cost of parking conducted for an Auburn University FTA research grant indicates that to the construction cost of a new parking space is $ 3,550 (in year 2004 dollars).

Table 7: Cost of Providing Parking facility (Appendix D)

Types of Cost	***Cost***
Construction Cost:	$ 4,110,112
Management Cost:	553,132
Maintenance Cost	141,500
Parking Permit Cost*	- 1,178,753
Citation Revenue**	-598,212
Total	$ 3,027,779
Cost per space per year for 10,000	$ 302.77
Cost per space for fall 2004*	***$ 113.53***

Note: *, ** Parking Permit Cost and Citation Revenue is the income to university.
*** Fall semester is of 4.5 months.

As shown in Table 7, the parking cost per space on campus was $ 113.53 for fall 2004. Tiger Transit reduced the demand by 3,500 spaces, which would otherwise have cost Auburn University $ 397,355. A parking permit price was $ 11.25 ($30 for a year and fall semester was 4.5 months long). At this parking price rate, $ 39, 375 was saved by students. If 3,500 additional vehicles had been competing for the existing parking spaces (13,977 parking permits vs 6,500 student parking spaces), a worsening of the parking chaos through additional parking violations would have occurred. More parking violations create an adverse effect on social behavior.

1.1.4 Other Associated Driving Cost Saving

Vehicle driving costs not only include the capital investment and fuel expenses, but also hidden costs such as insurance, licensing, registration, maintenance and tires, travel time, road maintenance, traffic congestion, pollution, land use impact, waste disposal, resources consumption and barrier effect costs. These costs can be replaced by a full scale public transit system at a city level. As Tiger Transit is not available to the public but is limited to serving the university population, only some of the hidden costs related to it can be replaced. Todd Litman of Victoria Transportation Policy Institutes extensively studied transportation costs (Litman, 2006). Many online calculators to calculate the cost of driving are available over the Internet, such as commutesolutions and piercetransit. These calculators are based on an earlier study by Todd Litman (2002). Here, the maintenance and tire, accident congestion, barrier effects on pedestrian and bicycle costs are assumed to be the direct cost savings due to Tiger Transit. If a large number of vehicles (3500 personal vehicles vs. 35 buses) had been driven on city roads,

the loss of opportunity for saving a direct cost of $ 139,340 could have resulted. The pollution cost was considered in Section 1.1.2 above.

Table 8: Associate cost saving (Appendix E)

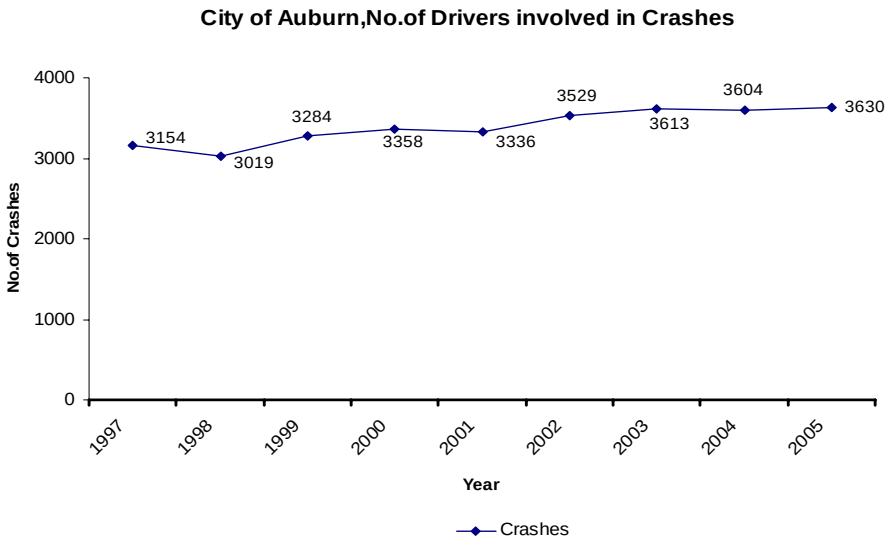
Types of Cost	Cost per mile
Maintenance and Tires	5.9¢
Accidents	5.0¢
Barrier Effects on Pedestrian and Bicycles	0.9¢
Congestion	4.2¢
Total Cost	15.1¢
Personal vehicles miles	922,778 miles
*Total cost saving**	*$1,39,340*

Source:www.commutesolutions.org.calc.htm
Note: * Total cost saving is multiplication of Total cost and Personal vehicle miles.

1.1.5 Safety and security assessment on city roads.

Any reduction in the number of vehicles traveling on city streets will result in fewer accidents.

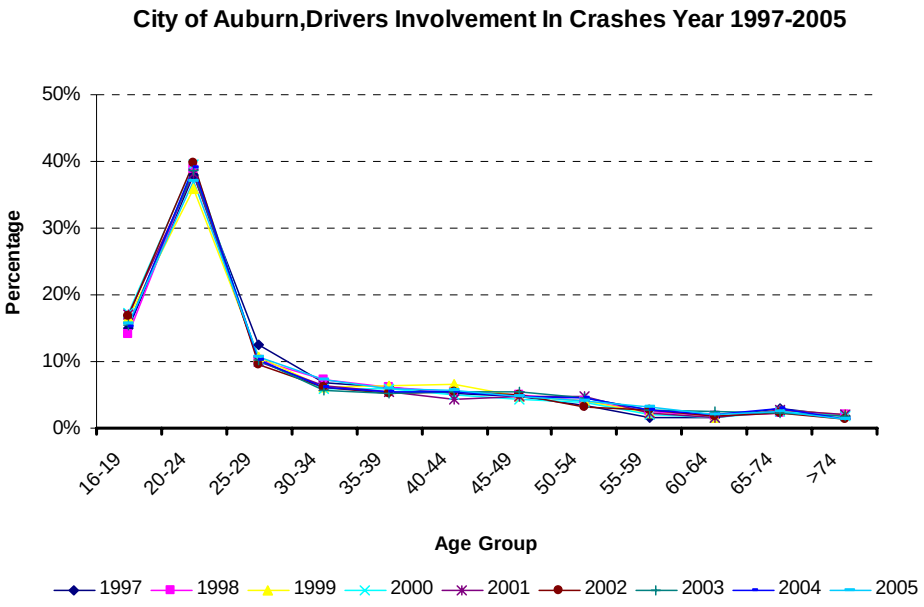
Graph 1



Source: Information Technology Dept. City of Auburn.
Note: Tiger Transit initiated in year 1997

Tiger Transit reduces the traffic on streets in and around the campus by 3,500 vehicles and 7,000 one way trips everyday. Students as a group tend to be less experienced drivers and this age group (18-24) has the maximum involvement in vehicular crashes. The City of Auburn records from 1997 to 2004 were studied to determine whether the availability of Tiger Transit had any significant impact in terms of a reduction in the number of road accidents. Between 1997 and 2004, accidents have gradually increased (see Graph 1). The age group 20-24, which is primarily composed of Auburn University undergraduates, were involved in a disproportionally high number of accidents, at 35 to 40%, and this remains high for all years (See the graph below). The age group makes up 50% of the population of the City of Auburn.

Graph 2



Source: Information Technology Dept. City of Auburn.
Note: Tiger Transit initiated in year 1997.

In the study reported here, the results showed that the 350 Tiger Transit trips saved the almost 7,000 one-way personal vehicle trips, implying that Tiger Transit reduced the

number of accident opportunities significantly. In this sense, Tiger Transit is a safer way for students to commute to the university.

Conclusion:

The efficiency study measures the outcome of Tiger Transit from input sources by comparing it with personal vehicle use. The comparison is summarized in Table 9. The comparison is converted into monetary value for convenience.

Table 9: Comparison between Tiger Transit and Personal Vehicles, Fall 2004

	Tiger Transit	**Personal Vehicles**
Input resources		
1.Fuel Economy	$ 129,000	$ 75,630
2.Pollutant cost	$ 69,573	$ 45,151
3.Parking Permit Cost	-	$ 39,375
4.New Parking provision cost	-	$ 673,080
5.Associate driving cost	-	$ 139,340
6.Transit operating expenses*	$ 1,106,901	-
Total cost	*$ 1,176,474*	*$ 972,576*
Output		
Miles Driven	409,000	922,778
Vehicle Round Trips*	350	3,500

Note: * the actual expenses provided by Tiger Transit Staff.

In Table 9, for comparisons 1 to 6, Tiger Transit is the more expensive commuting choice. Tiger Transit consumes more fuel, emits more gases, and requires significant operating expenses. Tiger Transit thus requires more input resources and gives less output compared to personal vehicles. However, the output comparison is not direct because Tiger Transit also reduces the traffic volume and frequency. Its capacity to transport more riders is a significant benefit and it helps to promote public safety by

reducing the incidence of vehicular accidents. It is also successful in meeting one of its main objectives— to reduce on campus parking demand. If Tiger Transit can achieve the same service level and provide the same input as the personal vehicles it replaces, then it will become truly efficient. In short, as shown in the table, the total cost of Tiger Transit and the personal vehicles it replaces should be the same for the same output. The following concerns should also be considered to make this transit truly efficient:

1. The environment is a key component and the university needs an environmentally friendly transit system.
2. The current fuel economy is poor and needs to be improved.
3. Alternate fuel options should be explored to reduce detrimental emission elements such as CO, CO_2, VOCs and NO_x.
4. The current noise level needs to be reduced.
5. The bus engine design should be improved. In particular, the vehicle exhaust should be moved to the bus roof, away from pedestrians.
6. To increase output, further action should be taken to increase ridership.

1.2 Effectiveness assessment through Geographical Information System:

A geographical information system is a computer based system that links spatial data (streets, buildings, vegetation etc) and tabular data, making it possible to analyze, store and query the data in map format. During the last decade, the transportation sector has emerged as the fastest growing user of GIS technology. Effective and efficient transit agencies are more responsive to rider demand and shifting land use. Due to GIS's ability to support operations, planning, management, and customer service, it has become a very powerful tool with which to analyze effectiveness (TCRP 55, 2004). In this study, a GIS was used as a simple tool for analysis, rather than to its full potential as an enterprise implementation. This was a unique application of GIS tracking student riders, their residential locations, buses and changes in land use.

Traditionally, transit riders are tracked and the bus routes designed based on students residential locations' zip codes (Bates, Toni & Others However, this method is not very effective for a relatively small college town such as Auburn where the zip code is the same for the entire city except the university and unincorporated municipal area. Consequently, the traditional way to determine the students' residential locations is to visit apartment complexes, observe the students' vehicle frequency on particular streets, contact the local housing reality companies, keep an eye on new apartment development projects and conduct informal surveys. Students often have vehicle number plates with a university logo or stickers and it is thus easy to identify their vehicles. However, a new methodology was required for the effectiveness assessment in order to design bus routes that are more reliable, time efficient and inexpensive. The use of a GIS can provide the optimum bus route distance; identify student residences, bus stops and their proximity

coverage, types of land use, road and pedestrian characteristics. Thus, it was chosen as the new methodology for this effectiveness analysis. The GIS organizational set up and its required information collection is a critical part of this study.

The city wide GIS data was obtained from the Information Technology Department, City of Auburn, during fall 2005; the majority of Auburn's students reside within the city limits. A transit data set for Tiger Transit (bus route, bus stops, bus shelters and bus timings) and students' residential locations was created independently. Tiger Transit data was available on its website, which was converted into GIS map format.

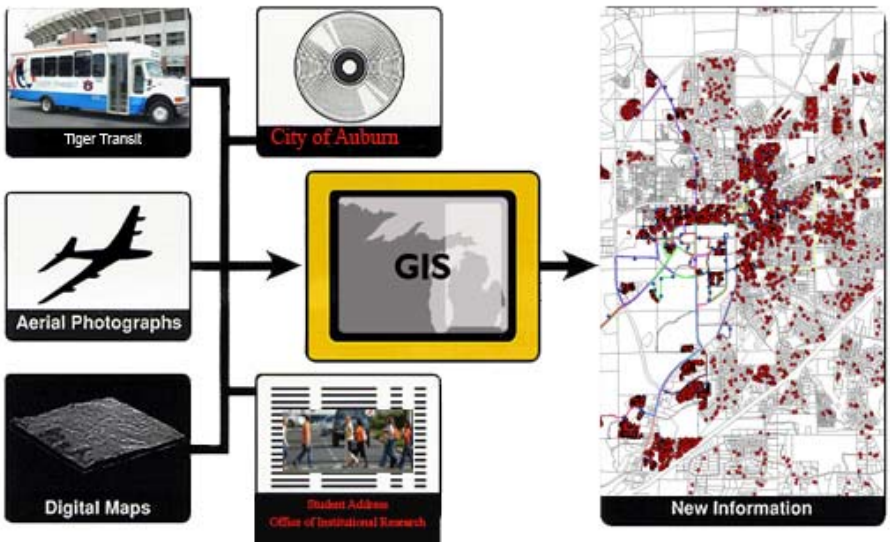


Figure 1: GIS Organization Structure

In the transit data set, bus stops were inspected on-site and geo-referenced on the map. Students addresses were obtained from the university's parking service department, who had the most recent and maximum reported number of student addresses in the university record. In fall 2005, there were 23,333 students enrolled, of whom 13,104 had reported their local addresses and these were available in tabular format. As shown in Figure 1, the

information was provided in a range of different formats (student addresses (tabular), Tiger Transit (map and tabular), ariel photographs (picture), street names and apartment names (tabular), and digital maps (line diagrams), all of which had to be transformed into GIS (New Information), the final format, for the analysis.

Table 10: Student statistics for GIS fall 2005

Total enrollment	No. of available student addresses	Plotted student addresses on the map	Errors in addresses
23,333 (100%)	13,104 (56.16%)	12,305 (52.73%)	799 (3.42%)

A total of 12,305 (52.73%) students were plotted on the map out of the 13,104 (56.16%) addresses provided; the remaining 799 (3.42%) contained errors. The 13,104 students shown on the map were considered to represent 100% of the student population for the purpose of further analysis. Students commuting to the university from outside the city were in negligible numbers and so were not considered for analytical purposes. The GIS map was divided into four quadrants, with College Street and Glenn Avenue as the axes. Dividing the map in this way enabled quick and detailed analysis, with map details presented in depth. On the map, the students are shown as red dots and bus stops as in four types of dots (large star, small star, square or blue circle). A transit rider is expected to walk up to a quarter of a mile comfortably to catch a bus. According to this principle, a quarter mile buffer zone (shown on each map by a yellow circle) was created around each bus stop and the number of students located in each buffer zone calculated. Based on this calculation, 16086 (70%) of the students were found to be covered by Tiger Transit. A comparison of the total number of students and the number of covered students is shown in Table 11.

Table 11: Student Coverage by Tiger Transit Fall 2005

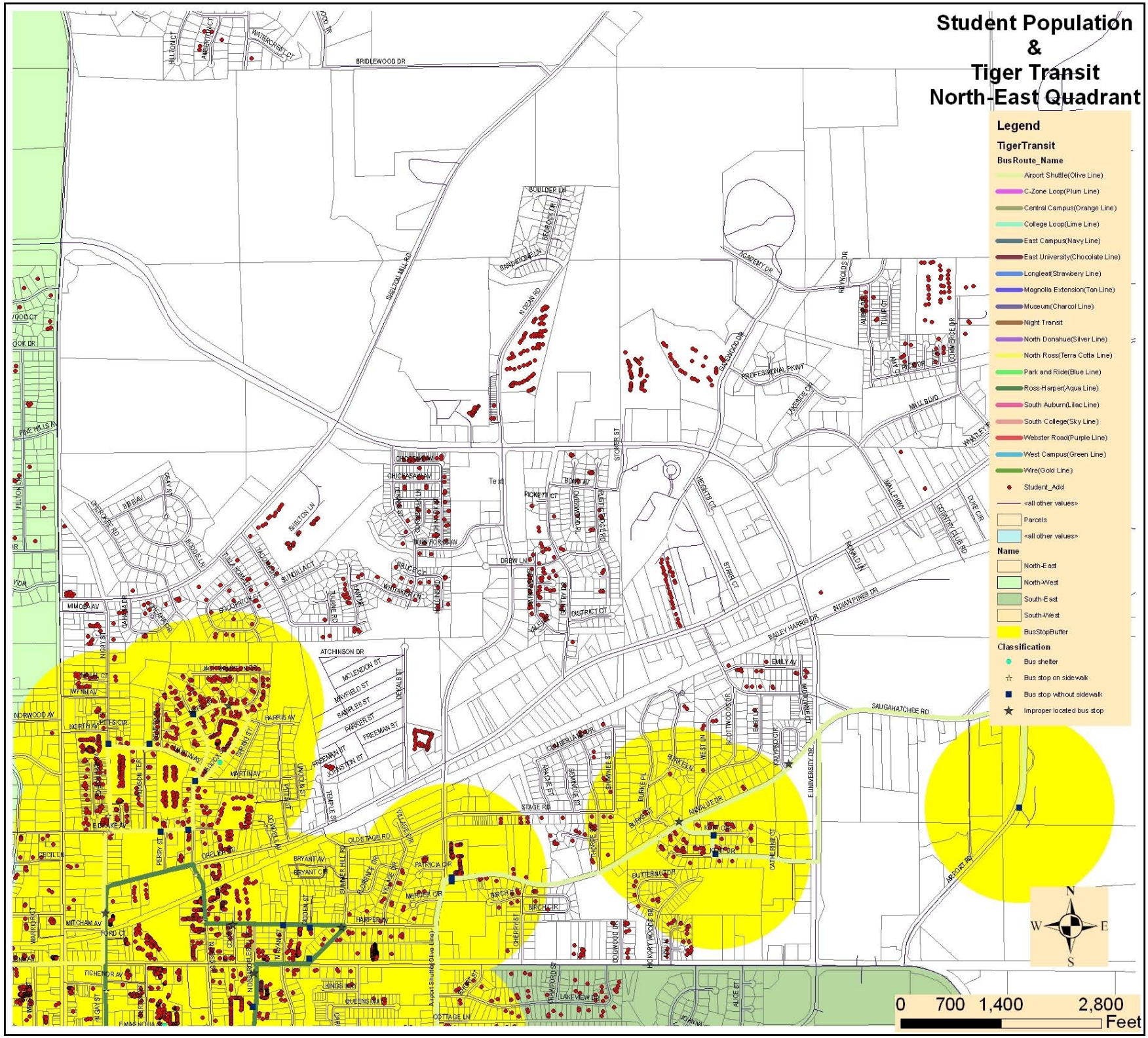
Quadrant	**% of located Students** (no. of students)	**% of Student covered by Tiger Transit** (no. of students)
North-East	15.03% (3457)	9.85% (2256)
North-West	8.05% (1852)	4.01% (992)
South-East	25.92% (5962)	17.72% (4076)
South-West	49.95% (11,489)	42.21% (9708)

Quadrant 1: North-East

This quadrant covers the north-eastern part of Auburn and is served by three routes: (1) North Ross (Terra Cotta Line); (2) Ross-Harper (Aqua Line); and (3) the Airport Shuttle (Olive Line). A total of 3,457 students live in this area, of whom 2,256 are covered by Tiger Transit. The North Ross (Terra Cotta Line) covers North Gay, E Drake, North Ross, Madox and Martin streets. The route is well designed, but the bus stops are in very close proximity to each other, which increases the travel time and head way of the buses. There were 807 daily riders (one-way trips to and from campus) on this route. The Ross-Harper (Aqua Line) covers part of Glenn Avenue and North Gay, North Ross, Harper, North Debradelben and Magnolia Avenue. Again, this is a well designed route but the bus stops are in close proximity to each other. The daily ridership was 481. The Airport Shuttle (Olive Line) covers Dean Road, Annalue Drive and Saugahatchee Road, which extends to Opelika-Auburn airport. This is the second longest route and had the lowest ridership (12 riders a day), but due to an aviation management class that is held at the airport, the transit service has to be provided. Four major student residential pockets; (1) Fox Den on North Dean Road (60 students); (2) Drew Lant at Harvard (180 students); (3) Arbros at Meadow Brook on North Dean (157 students); (4) West Shore Landing on E University Drive (59 students); (5) Village at Lakeside on Glennwood (50

students) and (6) the trailer park on Opelika Road (59 students) remained uncovered. The map for this quadrant is attached below.

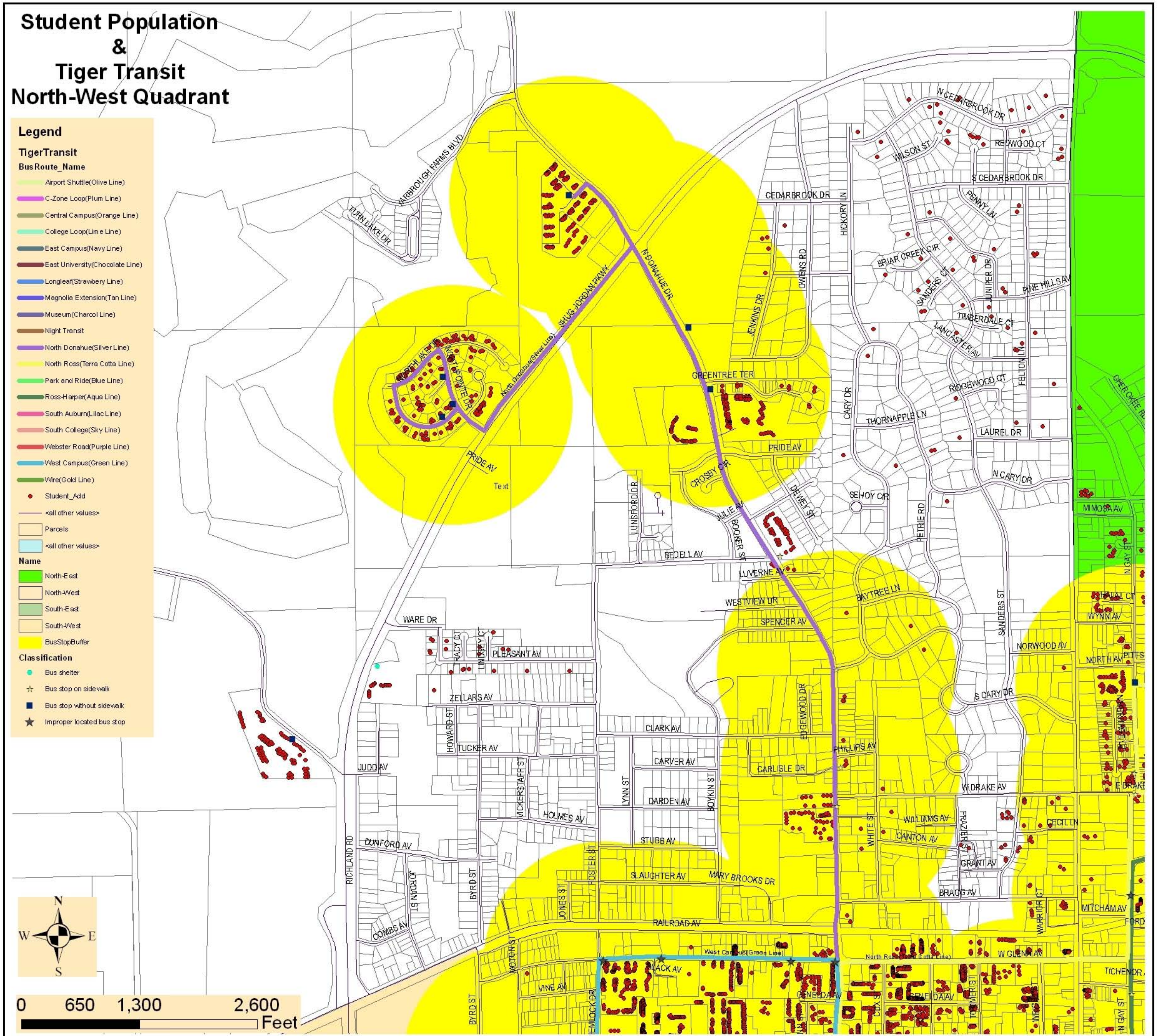
Map 1: North-East Quadrant


Student Population
&
Tiger Transit
North-East Quadrant
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
<all other values>
Name
North-East
North-West
South-East
South-West
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
N
W
E
S
0 700 1,400 2,800
Feet

Quadrant 2: North –West

This quadrant consists of the north-western part of Auburn and is covered by the North Donahue (Silver Line). This is a mainly family residential area, although students live in certain areas. A total of 1852 students live in this area, of whom 992 covered by Tiger Transit during 2004-2005. The daily ridership was 475. There were poor locations of bus stops in the 2004-05 schedule and two major student living pockets (1) Village West Apartments and (2) Edgewood Terrace, were not covered. In the current bus schedule 2005-06, the bus stop locations have been improved and Tiger Transit now covers Village West Apartments and Edgewood Terrace. The student coverage has been increased to more than 95% of the students who reside in this area and ridership has increased to 571 daily riders. The map for this quadrant is attached on the next page.

Map 2: North-West Quadrant

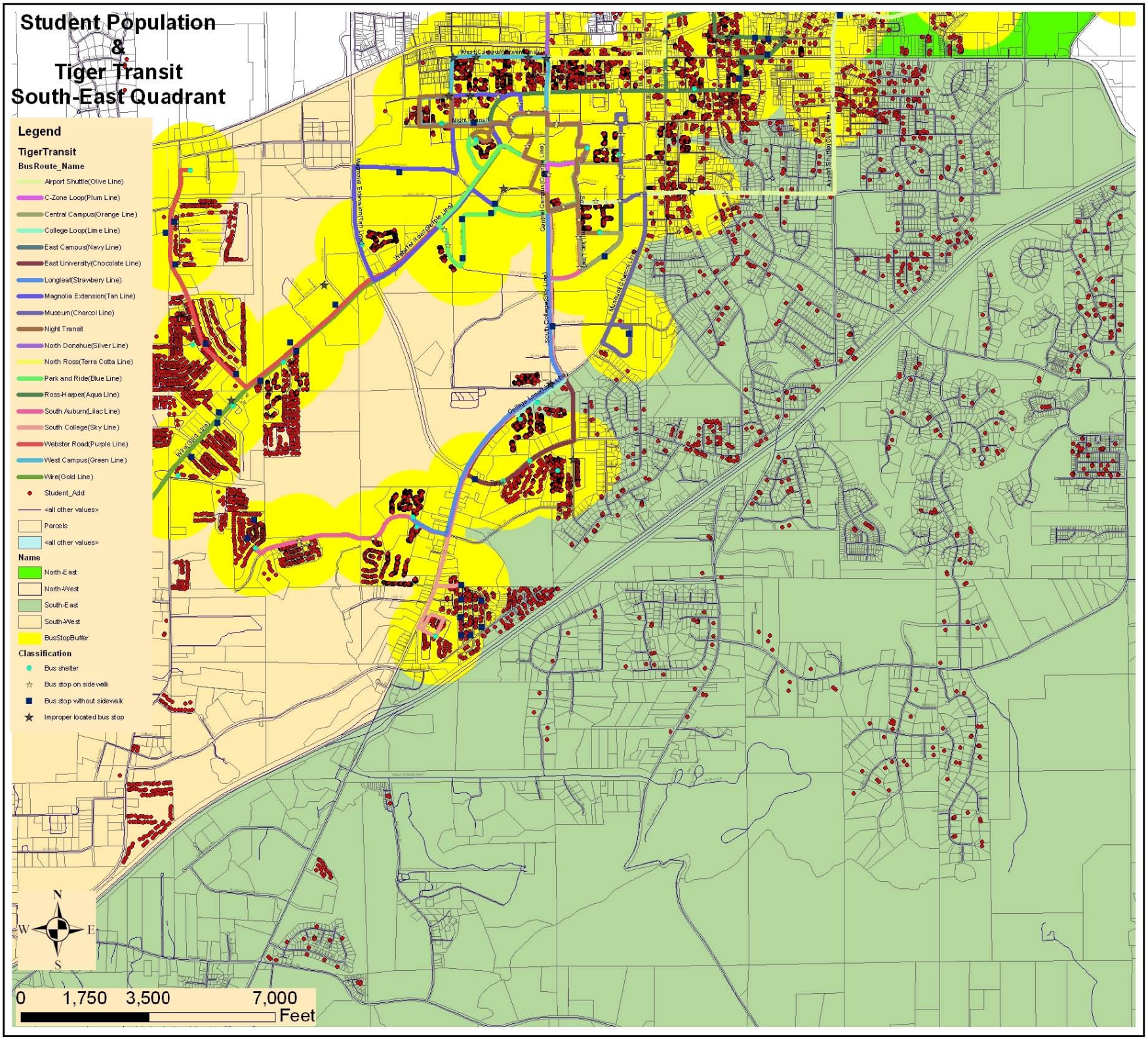


Student Population
&
Tiger Transit
North-West Quadrant
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
<all other values>
Name
North-East
North-West
South-East
South-West
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
N
W
E
S
0 650 1,300 2,600
Feet
N DONAHUE DR
SHUG JORDAN PKWY
PRIDE AV
RICHLAND RD
RAILROAD AV

Quadrant 3: South –East

This quadrant covers the south-eastern part of Auburn. There are 5,926 students residing in the area, of whom 4,076 are covered by Tiger Transit. Students were spread across the whole area. This area is served by Museum (Charcoal Line), E University (Chocolate Line), South College (Sky Line), Airport Shuttle (Olive Line), and College Loop (Lime Line). This is the largest and the most popular residential area, and includes both old residential areas developed inside Interstate I-85 and newly developed residential areas on the other side of Interstate I-85. The majority of the university students live either on South College Street or on those streets that are walkable to university, such as Gay, Magnolia, Armstrong, and Thach. The bus routes are devoted to particular student apartments, such as: (1) South College for The Edge, Steeplechase, Savanah Square, Harmon Duplex, (2) Lime Line for The Reserve and Auburn Trail, and (3) E University for Lakewood Commons # 1 & 2, Southern Edge and Garden District. A total of 175 students located on E University Drive in between Kimberly Drive and Azalea Drive are not covered. The South College and Lime Line and other routes of the South-West Quadrant overlap with each other. The map for this quadrant is attached on the next page.

Map 3: South-East Quadrant


Student Population
&
Tiger Transit
South-East Quadrant
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
<all other values>
Name
North-East
North-West
South-East
South-West
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
N
W
E
S
0
1,750
3,500
7,000
Feet

Quadrant 4: South-West

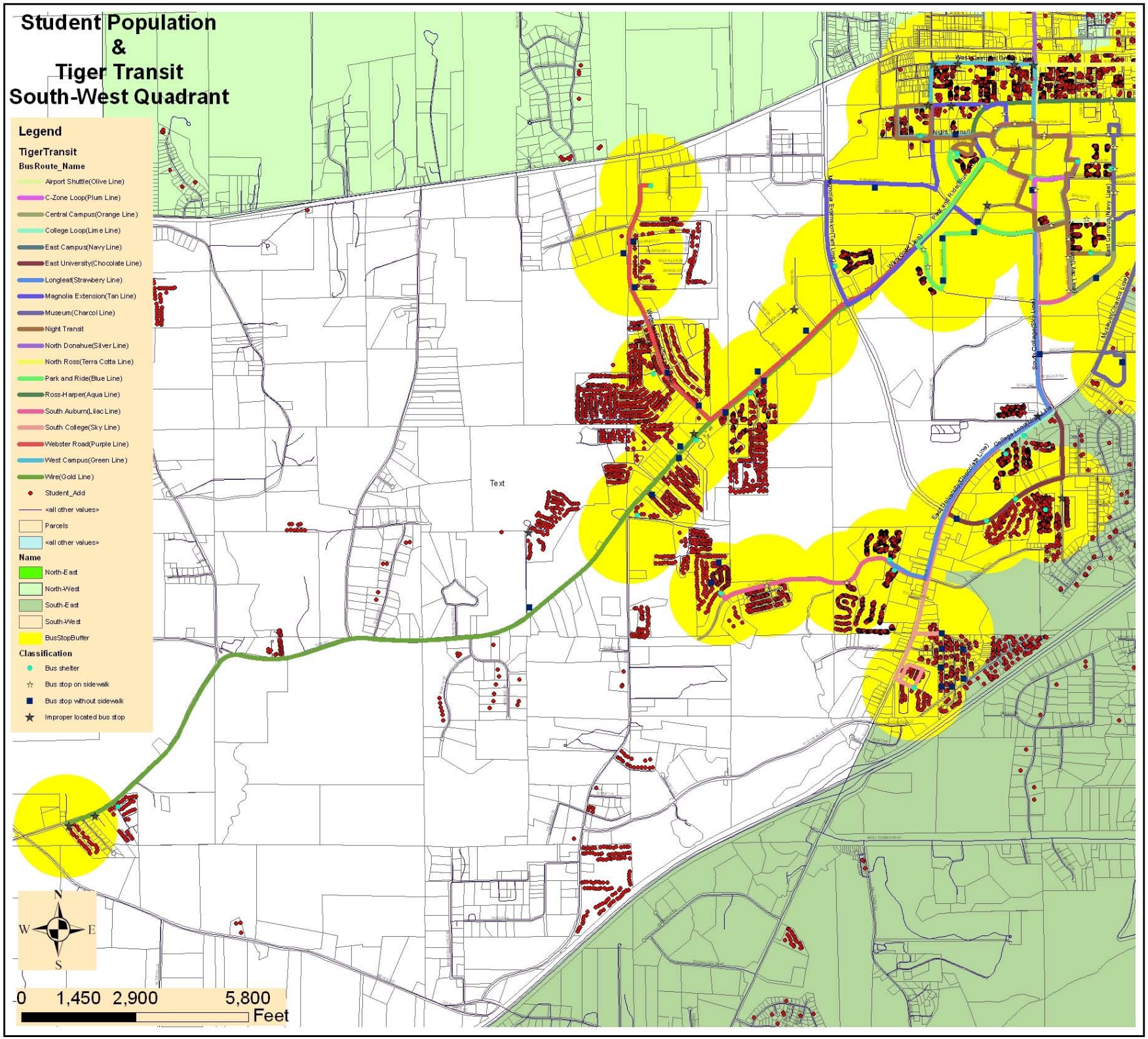
This quadrant consists of the south-western area of Auburn and around 50% of all students live in this quadrant, including on campus housing. A total of 11,489 students reported living in this area, of whom 9,708 are covered by Tiger Transit. The students are concentrated on Wire Road and West Longleaf. The Wire Road student residences are mainly mobile homes, whereas the West Longleaf residences are apartment complexes and condominiums.

The Wire Road student housing is covered by Wire Road Express (Sunflower Line), Wire Road (Gold Line), and Webster Road (Purple Line). The bus stops in between Cox Road and Stone Gate Drive are in close proximity. The Wire Road Express was the longest route and serves 338 students. The daily ridership reported was only 71 and the average per passenger cost was the second highest of any route. The students residing on Cox Road in mobile homes such as Swann Trailer Park (78 students), Dawson Trailer Park (31 students), and Windover Farm Mobile Home Park (191 students) are not served, even though they are located closer to campus than those on the Wire Road Express route. The students further down Swann Drive (150 students) and Stonegate Drive (280 students) are outside the quarter mile radius which is considered a walkable distance buffer. The students located on streets such as OleMiss Av, Georgia Av, Vanderbilt Av, Tulane Av, Miami Av and Chateugay Av (totaling around 447) are also beyond the quarter mile limit.

Students located on West Longleaf Road housing, namely Eagles Landing, Downs Way and The Villas, are covered by South Auburn (Lilac Line). The Exchange and Campus Point Apartment complexes are covered by Longleaf (Strawberry Line). The

Campus Point Apartment complex is a relatively large development and approximately 647 students reported residing there. The transit bus stop located at the entrance of the complex is within easily walkable distance for 117 students, but the remaining 530 students are not within that bus stop's quarter mile radius. Again these two routes overlap on South College Street with the South-East quadrant routes. The map for this quadrant is attached on the next page.

Map 4: South-West Quadrant


Student Population
&
Tiger Transit
South-West Quadrant
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
<all other values>
Name
North-East
North-West
South-East
South-West
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
Text
N
W
E
S
0
1,450
2,900
5,800
Feet

Conclusion:

The Geographical Information System based analysis provided extensive information about the ground operation realities of Tiger Transit which is a useful measurement of its effectiveness. It helped to identify the student housing areas, and it is important to note that students typically prefer to live in groups, which offers a good opportunity for the transit system to serve them effectively and in a timely manner. The issues found during the analysis are:

1. Some of the student housing areas are not served by the transit system.
2. Bus stops are either improperly located or are too closely located to each other.
3. The easily walkable distance between the nearest bus stop and student residences may be too long in some cases, so the students prefer not to walk.
4. Some of the bus routes run inside neighborhoods while others do not, even though large student populations are known to live there.
5. The routes overlap on some routes.
6. Some of the bus routes are devoted to specific apartment complexes and during the off peak period could be converted into general routes.
7. The two longest routes were found to have the lowest riderships.

Tiger Transit vehicles are not equipped with a GIS based Location Referencing System or Automatic Vehicle Location, which provides the exact location of a moving bus over the internet. This could help to provide better service with accurate travel times. Specific strategies such as the modification of routes, bus stops and bus frequencies for specific and general routes may increase the student coverage and ridership without the need to

expand the system. These strategies will be discussed in Chapter 3 after the supportive infrastructure study.

Chapter 2

Supportive Infrastructure and Financial Aspects Assessment Page

Introduction:

Transit buses not only travel on city streets but also need the support provided by specialized programs, along with the facilities to enable them to operate both efficiently and effectively. These specialized programs, facilities and management resources are referred to as 'Supportive Infrastructure'. For Tiger Transit, the specialized programs consist of transit oriented policies, existing and future development plans that take into account the need to provide transit, university time schedules, and publicity, while the facilities consist of bus stops and transit friendly streets. The facilities are the fixed infrastructure, whereas the specialized programs are the floating infrastructure. The specialized programs provide guidance, show commitment and built confidence in the system. The facilities provide the physical resources needed to support the system. This chapter reports on a comprehensive survey of the bus stops. The city streets are not yet developed to be either transit oriented or multimodal transportation oriented (for example by providing bike facilities) and so will not be considered here, but a specialized program class schedule, various development plans suggested by the city and the university, and publicity issues were examined for this report. Supportive infrastructure helps transit services to become more convenient and efficient. The chapter concludes with a discussion of the financial aspects, including current expenses and average daily ridership cost, and predicts future expenses.

2.1. Supportive Infrastructure

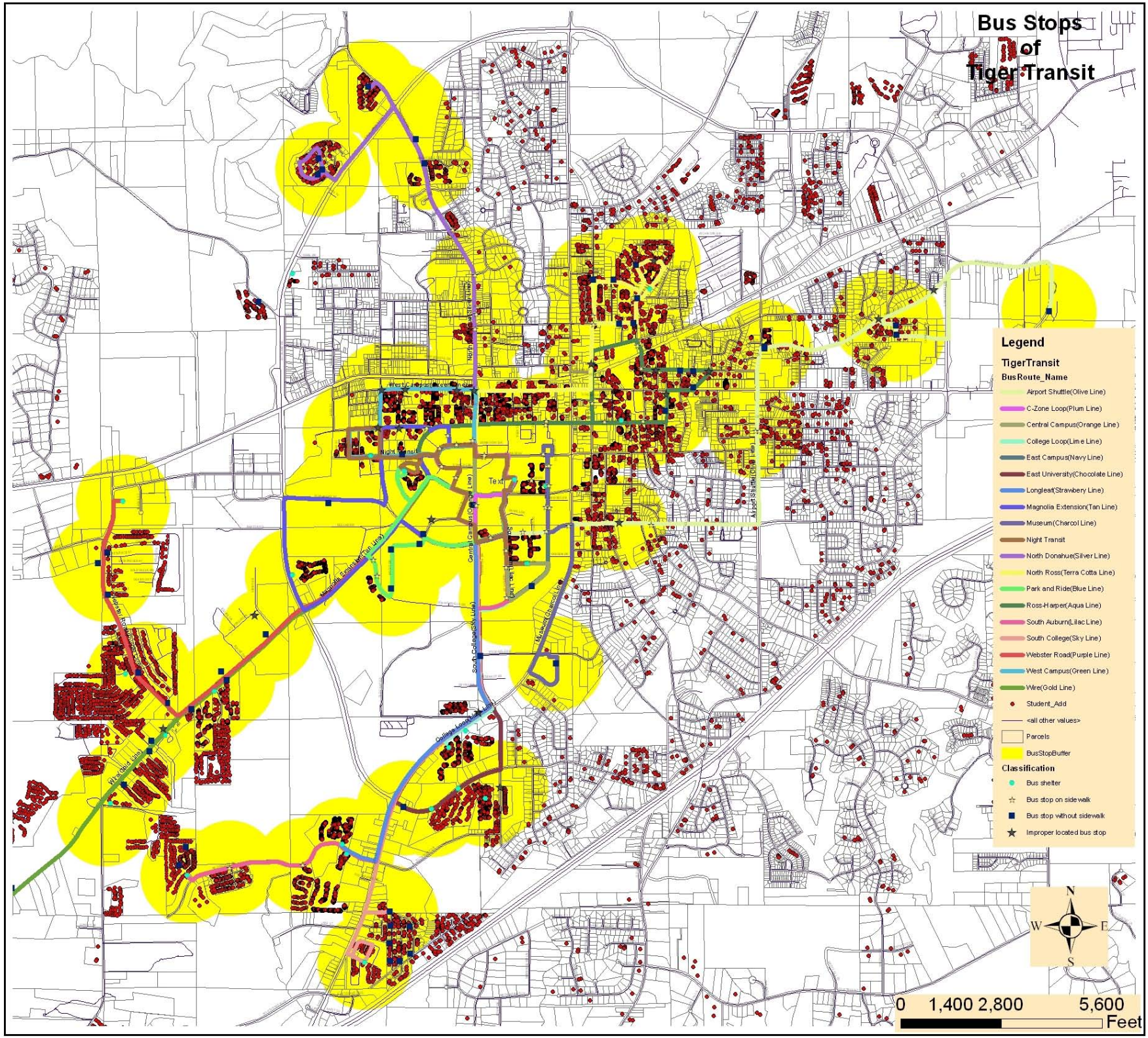
2.1.1 Bus Stops

Bus stops are important, and noticeable pieces of integral street furniture in pedestrian friendly communities that are needed to make public transit work. Riders may spend the same amount of time or more in waiting to catch their bus at a bus stop as they do traveling on the bus. Bus stops are needed because: (1) riders need to know where they can board buses in order to plan their trip; (2) they help avoid possible accidents due to flag stops; (3) they provide suitable locations for disabled riders; and (4) they help control the travel time by not allowing people to get on and off at any time and any location (www.the-bus-stops-here.org). Bus stops should be accessible to people with disabilities and should bear the transit logo, along with appropriate route numbers, maps and schedules. “Location of bus stops is affected by: potential traffic delays, impact on signalization, proximity to other bus stops, pedestrian linkages, space for bus maneuvering, automobile turning movements, right-of-way configuration, adjacent sight distance, types of stops, ridership and neighborhood impacts” (Kiesling, Michael. CNU, p 1, www.solarcentury.co.uk.pdf). It is a growing trend to develop the bus stop as a community and activity center beyond its function as simply a place to wait for buses (Kiesling, CNU). Bus stops may provide facilities such as bus shelters, bike racks, benches, trash cans, newspaper racks, telephones, ash trays, interactive information systems, water fountains etc.

Tiger Transit has 146 bus stops, which are located on and off campus, with 37 bus stops located on university streets. The types of bus stops observed on site are flag stops,

regular stops, transit center stops and layover stops (Appendix G). The map is attached below.

Map 5: ***Bus stops and bus routes***


Bus Stops
of
Tiger Transit
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
N
W
E
S
0
1,400
2,800
5,600
Feet

Here, bus stops are classified into four categories: (1) Bus shelters, (2) Bus stops with side walk, (3) Bus stops located on the road edge and (4) Improperly located bus stops (See Appendix G). **Classification (1):** Bus stop with shelter: This type of bus stop has a shelter for waiting but may not have all types of furniture, such as benches, a garbage can, cigarette stand, telephone etc (See photograph 2 below). There are 24 bus stops in this classification.

2. Bus shelter

3. Bus stop with sidewalk

Classification (2): Bus stop with sidewalk: This type of bus stop is located on roads where sidewalks already exist. In this kind of bus stop, riders have enough space to stand comfortably and safely (see photograph 3 above). There are 44 bus stops in this classification.

Classification (3): Road edge bus stop: This kind of bus stop is located right on the curb where sidewalks are not available, but provides enough space for the passengers to stand comfortably. It is not necessarily very safe, however (see photograph 4 below).There are 56 bus stops in this classification.

Classification (4): Improperly located bus stop: This kind of bus stop is located in an

4. Road edge bus stop

5. Improper located bus stop

improper place, and may be effectively invisible, with no space for passengers to stand, and with parking spaces or vegetation located in front of it, or electrical equipment surrounding it (See photograph 5). There are 22 bus stops in this classification. Under these classifications, the number of bus stops on each route are shown in Table 12.

Table 12: Bus Stop Classification

Bus Route	Bus shelters	Bus stops with Sidewalk	Road edge Bus stop	Improper located bus stops	Total bus stops
External Lines					
Aqua-Rose-Harper	2	7	5	4	18
Chocolate-E. University	4		1	1	6
Gold-Wire Road	4	1	6	0	11
Purple-Webster	4		8		12
Silver-North Donahue	2	4	11	1	18
Sky-South Auburn	2	1		7	10
Olive-Airport	1	3	1	7	12
Strawberry-Longleaf	3	1			4
Tan-Magnolia Extension	2	2	2	2	8
Charcoal-Museum	1	8	1		10
Terra Cotta-N. Ross-	2	3	7	2	14
Lime –College loop	3				3
Sunflower Wire Express	2	1		3	6
Lilac-South Auburn	2	2		2	6
Internal Lines					
Navy-East Campus	2	13		1	16
Orange-Central Campus	2	3	3		8
Green-West Campus	1	4		5	10
Blue-Park and Ride	2	2	4		8
Plum- C Zone Loop	1	4	2		7

Tiger Transit frequency depends on the number of riders and class schedules. It is not a fixed time designated service. The riders are therefore not able to estimate the time they will have to wait at the bus stop. The majority of the bus stops lack sitting provisions and shelter, being located on side walks. Only 24 bus stops have bus shelters and one bus stop shelter has no bench (Refer Appendix G, Table G 4, bus stop # 8), while two of the bus stops without shelter have a bench to sit upon while waiting for a bus. The city streets are not transit friendly and only 2 bus stops have a pull over space to take the bus out of street traffic while passengers are boarding or alighting. Even the university has only 4 pull over spaces. At some bus stops, bike lanes serve as a pull over space (see photograph 7 below).

6. Bus stop with a garden bench in front of one sorority house

7. Bus stop and bike lane

Bus stop design

The logo on a bus stop and its design are important parts of the bus stop's overall design. A board mounted on the bus stop can provide information about bus timings, contact information, type of transportation, and reminders to bus drivers, riders and road traffic

about its existence, and advertisement space. The advertisement space on a bus stop can generate revenue which can be used to finance capital improvements for the bus stops.


8. Typical Tiger Transit Bus stops and visual impairment

The size and height of Tiger Transit bus stops are the same as those of standard road signages, and thus often visually merge with the road signage. They do not indicate the transit schedule or contact information.

2.1.2 Class Schedule Study

Campus life at a university is based around the class schedule. The pedestrian and vehicular movement around campus, a student's individual life, energy consumption, transit service, city wide business and the whole economy of a city is affected by the class schedule. Students are constantly moving on and off campus, for example going to a job soon after a class. Although this is seldom an issue for the university staff, students and faculty alike (around 90% of the university populations) are affected by the schedule. Since Auburn University has become a pedestrian campus (at least on the core campus), the class schedule is a great concern and even present issue for the university administration (ref. Appendix H). There is a 10 minute gap between classes, which are held in buildings scattered throughout the campus. As the university core campus is

pedestrian, students may have to walk from one end to the other. To reach a class on time is critical due to the current class time gap of 10 minutes (Appendix H).

Table 13: Class schedule and enrolled students: Fall 2005

Class Time	Monday	Tuesday	Wednesday	Thursday	Friday
6.00 AM		15		15	
6.30 AM		15		15	
7.00 AM	288	47	30	42	57
7.30 AM	304	129	46	124	73
8.00 AM	5740	5954	5456	6157	5102
8.30 AM	5819	6015	5544	6206	5181
9.00 AM	8722	5502	8730	5737	7944
9.30 AM	8780	8137	8764	8451	7944
10.00 AM	9009	8387	9256	8550	8530
10.30 AM	9094	7377	9230	7333	8545
11.00 AM	9006	8121	8564	8022	8051
11.30 AM	8913	8029	8462	7944	8007
12.00 PM	7010	6989	7080	6891	5842
12.30 PM	6899	7599	7006	7589	5707
1.00 PM	7563	8438	7544	8184	6125
1.30 PM	7455	7539	7436	7198	6092
2.00 PM	7209	8272	7158	7603	4824
2.30 PM	7103	8055	7071	7399	4824
3.00 PM	5293	6896	5893	6593	2610
3.30 PM	5244	4860	5470	3853	2572
4.00 PM	4313	5068	4150	4049	1574
4.30 PM	4110	3937	3940	3497	1434
5.00 PM	2405	2993	1749	3048	274
5.30 PM	2305	2881	1626	2818	274
6.00 PM	2087	2709	1418	2859	126
6.30 PM	1561	1499	1367	1586	126
7.00 PM	1282	1264	1137	1329	29
7.30 PM	1067	1063	979	1065	14
8.00 PM	722	562	611	585	14
8.30 PM	392	439	574	439	14
9.00 PM	133	224	104	170	0
9.30 PM	92	27	53	33	0
10.00 PM		1		1	
10.30 PM		1		1	

Source: The Office of Institutional Research, Auburn University.

Here, the class schedule was studied in relation to Tiger Transit. Tiger Transit starts in the morning at 7.00am to bring the students to campus before the major classes start at 8.00 am. The regular bus timings end at 6.00 pm. Tiger Transit's guaranteed ride home provides a service to take students in late classes home to their apartments. The guaranteed ride home provides service from 6.15pm to 10.00pm. In the late afternoon classes, from 4.00 pm to 7.00pm, students remain on campus in significant numbers (ref. Table 13). Some of the professional classes start at 4.00pm and end at 6.15pm. After a class, students often chat with classmates, see the professor about any difficulties, go to the library, check their email at computer labs and so on, so it takes at least 15 to 20 minutes for students to reach the nearest bus stop. As the regular bus service ends at 6.00, they often miss the bus. Because the guaranteed ride home service is not a fixed route service, providing only a demand response service, it takes considerably longer to reach home. Up to 7.30, around 1,000 students still remain on campus. The parking service regulations remain in force until 5.00 pm, so students arriving on campus at 4.00pm have a hard time finding a legal parking space. If they use Tiger Transit to come to campus, they cannot use the regular transit service to return home. The 5.00am to 7.00pm class times, therefore, lead to critical issues for campus accessibility, which result in considerable rider dissatisfaction with the transit service (ref. Table 13 pp.49). In reality, this is a class schedule issue rather than a transit issue. In this case, either the transit timings need to be extended or all major classes should end by 5.45pm.

2.1.3 Development Plans and Media

Development plans and publicity shape the future of supportive infrastructure and, ultimately, the transit system. Development plans address issues related to future and existing capital improvements area wide. Tiger Transit needs a significant commitment to infrastructure improvements, particularly transit friendly streets and bus stops. Development plans incorporate the changes and the publicity helps to bring them to the attention of potential riders. Transit is an element of transportation planning. Here, three development plans' transportation elements have been studied for transit: (1) Auburn University development plans, which are specifically for the university; (2) the Auburn 2020 plan developed by the City of Auburn (1998), which addresses the issues at a city level and (3) the Auburn-Opelika 2030 Long Range Transportation Plan Update (Auburn-Opelika MPO, 2005), which addresses regional level transportation issues.

1. Auburn University development plans:

Auburn University has addressed a wide range of planning topics since its land grant university status and physical planning is an important part of planning practice.

Table 14: Transportation Related Topics in Campus Planning Efforts, 1961-present

Planning Topics	Year						
	1961	1965	1979	1988	2001	2002	2003
Land area		*	*	~	*	*	
Land use		*	*	*	*	*	~
Additional Buildings	*	*	*	*	*	*	*
Housing	*	*	*	*	~	~	
Additional Roads	*	*	~				
Road Closures		*	*	*	*	*	*
Parking	*	*	*	*	*	*	*
Transit			*	*	~	~	*
Bicycle					~	~	~
Handicap Access					~	~	~
Landscaping		*	~	*	~	*	~
Open Space		*	*	*	*	*	~
Pedestrians		~	*	*	*	*	~

Note: * Topic Addressed, ~ Topic mentioned. Source: Rollins, Frost (2005) pp43.

The transportation planning's four elements, namely transit, parking, pedestrian and bicycle plans, have been addressed aggressively since 1979 and remain important elements of current and future physical planning. As the university is an independent agency, it is easier to implement these plans in comparison to any civic city.

2. Auburn 2020, The City of Auburn

Auburn 2020 is a long-range plan developed by the City of Auburn which provides guidelines for future development, and sets new goals and policies. To prepare Auburn 2020, seven taskforces composed of technocrats, elected officials, city staff and citizens were created. These task forces focused on education, growth development, intergovernmental relation, transportation, utilities and technology, family and community and public safety (City of Auburn, 1998). These taskforces set up 22 goals for the City of Auburn's future development.

Public transportation is one of their goals:

> *"In conjunction with the Alabama Department of Transportation, Auburn University, and other local governments, expand the mass transit program so that all citizens will have access to public transportation."(www.auburnalabama.org)*

Each taskforce was responsible for recommending projects, policies and programs that can be adopted by the city for development. Even though mass transportation is included in the taskforce's vision, a bicycle plan has also been adopted for implementation as it offers an easy, convenient and economically viable option to meet short term goals in comparison to transit.

3. Auburn-Opelika 2030 Long Range Transportation Plan Update

Transportation planning is a regional level activity and is created at that level. This plan is a long range transportation plan produced by the Lee Russell Council of Governments for the Auburn-Opelika Metropolitan Planning Organization. A transit system is mentioned in its "transportation needs and strategies section", which suggests the following strategies for public transportation:

> *"An opportunity exists to promote greater integration between Auburn University's Tiger Transit and LETA services."* (Auburn-Opelika MPO, 2005, p35)

This document urges Auburn-Opelika MPO's transit system 'LETA' to expand their operation hours. It also suggests local MPO meetings, and county wide government meetings. This plan emphasizes 'LETA' as it focuses on the needs of local citizens rather than students and covers the entire Auburn-Opelika MPO. Tiger Transit is the university service, so it is not appropriate for it to be addressed aggressively in this plan.

Media

Publicity, in the form of radio, television and print media is the major source of information for students on campus. The university newspaper regularly addresses planning related issues and policies, including both academic planning and physical planning. Parking, construction and transit are favorite topics for many students. A selection of articles that have appeared in local newspapers are attached as Appendix H. Sometimes reporters, commentators, or "Letters to the editor" make valuable suggestions to solve planning issues or for new initiatives. How this functions will be discussed in Chapter 3.

Conclusion

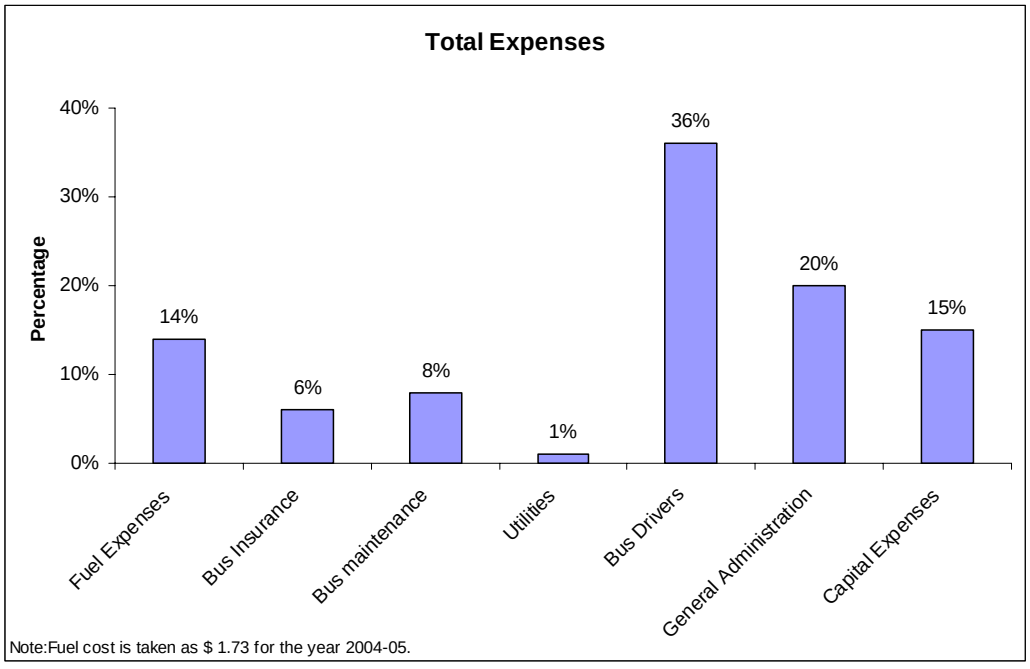
This supportive infrastructure study has provided both micro and macro level details about transit related planning issues and policies. The bus stop study can be categorized at the micro level, providing details which address specific transit issues. The class schedule, development plans and media can be categorized as providing macro level details. Both these aspects have a significant impact on the transit service. Issues addressed in this topic can be summarized as follows:

1. A bus stop is a critical transit element and Tiger Transit's bus stops need significant improvement. This could be a large scale capital improvement program.
2. To identify responsibility for the development of bus stops is a critical task. Improving the collaboration between various agencies such as the university, city and private developers, will require a major effort.
3. The class schedule plays an important role in transit planning. There is a need to raise transit concerns regarding the class schedule, as it will help to guide a possible transit expansion.
4. The transit system is only specifically addressed and implemented in the university plans; city and region wide plans failed to address it significantly. This may cause some delay in developing the capital improvement program needed to create transit friendly streets. It may require strong representation by Auburn University in local government forums to present the university's transit concerns effectively.

2.2 Financial Aspects Assessment:

Financial aspects have two major components: (1) expenses and (2) revenue. These components each have various subsets. The expense subset is classified into three categories: (1) operating elements, (2) administrative elements and (3) capital elements (NMHD 1990, Curtis & Chaudhari 2005, See Appendix H). The revenue's subset can be classified into three categories: (1) passenger revenue, (2) advertising revenue and (3) assistance from governmental sources. The operating element is comprised of five basic types of expenses: (1) fuel cost, (2) bus maintenance, (3) utilities, (4) bus insurance and (5) drivers. The administrative element is a crucial part of a transit system consisting of the transit director, manager, transit planner, office assistance, supervisors and other personnel, depending upon the type of management system. The capital element consists of (1) vehicles and (2) fixed facilities such as bus terminals, the bus garage, administrative office, bus stops etc (Curtis & Chaudhari, 2005, and Appendix H).

Graph 3



The average expenses for Tiger Transit are as shown in Graph 3. The assessment of these subsets is known as financial aspect assessment. This assessment looks at the current cost, types of cost, revenue sources, and future projected expenses.

Tiger Transit is a totally outsourced system. The company that runs it, Groome Transportation Inc., provides the service and covers the operating and capital element. Tiger Transit has an administrative wing which oversees the system in terms of planning and management. Tiger Transit's financial aspect assessment includes a consideration of two aspects: (1) current operating expenses and revenue; and (2) Average passenger cost, which is related to ridership statistics. This assessment will help to identify present sources of funding and present spending, predict future expenses, and allow an exploration of alternate financial mechanism options.

(1) Current Operating Expenses and Revenue:

Tiger Transit's revenue source consists of the mandatory fees for transit paid by all Auburn University students. At the time of the study, this mandatory fee was $ 49/semester. For the academic year 2004-05 the average number of students enrolled for fall and spring was 23,000 and for the summer was 10,000. The approximate collected fee was therefore $ 2, 793, 000. The expenses were the administrative cost and the charge levied by Groome Transportation. The administrative expenses included the payroll for the transit director, transit manager, office assistance and student workers, and office expenses and came to $ 164,750. For Groome Transportation, the major expenses were the payroll for drivers, cleaners, managers, office assistance and, mechanics and operating expenses such as fuel and buses maintenance. The expenses and revenue are shown in Table 16. During the 2004-05, Groome Transportation charged $ 811,146 for

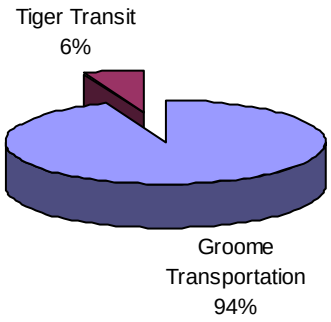
fixed overheads due to a sharp rise in fuel prices and shortage of drivers, as fuel prices went up from $ 1.73/gallon to $ 2.64/gallon for diesel. Fluctuations in the price of fuel are a real, important and frequent component of transit operation. The actual required number of drivers is 90, but the system is run using 56 drivers on average. The shortage of drivers creates real concerns for the transit agency. If fuel prices and driver pay exceed, the budget amounts, the transit service can be paralyzed.

Table 16: Tiger Transit expenses: 2004-2005

Type of Expenses	**Cost** (In Dollars)
Groome Transportation Inc.*	
Payroll	$ 1,150,363
Operating Expenses	355,605
Administrative Expenses	51,474
Taxes	52,068
Fixed overhead	811,146
Net Income	117,534
Tiger Transit**	
Administrative expenses	1,49,750
Office expenses	15,000
Total Budget	$ 2,702,940
Revenue***	$ 2,793,000
Profit	***$ 90,060***

Note: * Actual expenses obtained from Tiger Transit on 6/6/2005
** Derived through a personal discussion with the Transit Director. Ref. Appendix H, Administrative Element.
*** Revenue: Student mandatory transit fees $49/semester.

Graph 4
Current Transit Expenses



The expenses share is shown in the above graph. Due to fixed passenger revenue, Tiger Transit was able to save $ 90,060. This amount is akin to a rainy day funds, where it would be available in a financial crisis.

(2) Average cost per passenger

The average cost per passenger depends on bus route, bus route length, number of buses operated, ridership, and number of bus stops, fuel price and types of bus. During 2005-06, three new routes, Lime-College loop, Lilac-South Auburn and Sunflower- Wire Express were added. The average daily ridership increased from 11,587 to 13,244. The current average cost per passenger is shown in Table 15 below.

Table 15: Average Daily Ridership study

Routes	Year 2004-05	Year* 2005-06	Average cost per passenger*
External Lines			
Charcoal-Museum	723	108	$ 3.59
Lime –College loop		1847	$ 0.73
Chocolate-E. University	1681	1038	$ 1.29
Sky-South College	461	466	$ 1.92
Strawberry-Longleaf	1755	1946	$ 0.82
Lilac-South Auburn		567	$ 2.01
Terra Cotta-N. Ross	481	655	$ 1.36
Aqua-Rose-Harper	807	717	$ 1.24
Gold-Wire Road	346	414	$ 2.15
Purple-Webster	412	585	$ 1.53
Sunflower Wire Express		71	$ 9.75
Olive-Airport	12	35	$11.11
Silver-North Donahue	475	571	$ 1.56
Tan-Magnolia Extension	702	809	$ 1.10
Internal Lines			
Blue-Park and Ride	910	1185	$ 0.75
Navy-East Campus	192	135	$ 2.88
Orange-Central Campus	1213	456	$ 1.96
Green-West Campus	1023	831	$ 1.61
Plum- C Zone Loop	169	521	$ 1.49
Guaranteed Ride-Home Security Night Transit	177	184	$ 5.05
Total	11587	13244	

Note: * Information obtained from Tiger Transit which was prepared by Skipper Consultant Inc.

The higher ridership resulted in a lower average cost per passenger. The average passenger cost of all routes was $ 1.41 (Skipper Consultant Inc, 2006). Any cost beyond $ 1.41 is considered to be expensive. At the current level of operating cost, to drive personal vehicles to campus would have been cheaper than riding Tiger Transit. The Charcoal-Museum, Gold-Wire Road, Sky-South Auburn , Navy-East Campus (Internal route) were relatively expensive routes, whereas Sunflower Wire Express and Olive Airport were the most expensive routes. These relatively expensive routes might needed modification and the most expensive routes either need to be closed or major modification made to control costs. If Tiger Transit is to retain the same level of service, mandatory fees will have to be increased. The geographically possible modifications in the bus routes are shown in Table 15 with various routes grouped by color. The expensive routes could be accommodated by other routes in the same color group. The higher operating costs are the major issue here. For the 2004-2005 bus route schedules the future projected costs were as shown below in Table 16 (also see Appendix H). To cover the rising operating costs, the mandatory student transit fee was increased from $ 49 to $ 51.

Table 16: Future projected cost for 35 buses (Appendix H)

Type of costs	**Year 04-05**	**Year 05-06**	**Year 06-07**	**Year 07-08**	**Year 08-09**	**Year 09-10**
Operating cost	2,788,321	2,955,620	3,132,957	3,320,935	3,520,191	3,731,402
Operating cost per hour	33	35	37	39	42	44
Fuel Cost	1.73	1.83	1.94	2.06	2.18	2.32

Note: This cost is based on the created model “Transit Operating Cost Model” which is discussed in Appendix I.

In the foreseeable future, the operating costs will remain high. For the 2005-2006 schedules, the future projected cost is $ 4,160,348.10. At this projected cost, the student transit fees will have to be $ 87.50 per semester (Skipper Consultant, 2006, Appendix J).

The transit service was totally outsourced, so the transit service had to pay regardless of it necessity. The outsourced option is the most expensive option and the greater obstacle to the control of the operating costs.

Conclusion:

This financial aspects assessment detailed the types of transit expenses incurred by Tiger Transit. The operating cost are impacted by both on route design and bus stop design. To control operating costs, route modification remains one of the viable options to increase ridership. Increasing ridership, in turn result will in decreasing ridership costs. During the assessment the following issues were identified:

1. The fuel price hike resulted in increased operating costs.
2. The difference between the expenses and revenue was very small which created an issue due to the need to increase the mandatory transit fee or decrease the level of service.
3. The total driver requirement was 90 but the system was run on 56, which affected the level of service. The shortage of drivers was a major concern for the transit operating company.
4. The Oliver-Airport Line and Sunflower-Wire Road Express were the most expensive routes and the Charcoal-Museum, Gold-Wire Road, Sky-South Auburn , Navy-East Campus (Internal route) were relatively expensive routes, primarily due to low ridership. The issue of low ridership raised concerns over the current transit system's route design.
5. The transit service had to pay a fixed operating cost to the outsourced company regardless of the requirements of the buses, which resulted in the university having no control over the transit system.

Chapter 3

Recommendations, Strategies and Suggestions for further research Page

Introduction:

The assessment conducted for this study was presented in four sections in chapters 1 and 2. These sections examined Tiger Transit's efficiency based on a survey, its effectiveness based on a Geographical Information system; its supportive infrastructure; and its financial aspects. Several issues and themes emerged from the assessment that could help to make the transit system more effective, efficient and convenient compared to its current level of service. Both Short term and long term strategies are required in order to deal with the issues and concerns raised during the assessment. The short terms strategies can be formulated in-house and implemented immediately with in-house management, whereas long term strategies are more comprehensive in nature and require the involvement of the university, local, regional, state and federal governments. Regarding short term strategies, the transit service can generally make such changes itself without any need for consent or input from superior authorities. However, as the current system is totally outsourced, some aspects of the effectiveness and supportive infrastructure cannot be addressed immediately and will require long term planning. For example, environmental concerns have been raised became the present diesel buses emit more emissions than private vehicles. The diesel buses can be changed or alternate fuel technology can be tested experimentally, although both strategies would require constant effort to make a successful transit system. Issues related to the effectiveness and financial aspects of assessment, which are under total control of the transit service, can be dealt with using short term strategies, for example route planning, the level of service, increasing or decreasing the number of bus stops etc. In short term strategies, new route planning will be discussed that could increase Tiger

Transit's effectiveness in terms of coverage and shall help control the cost per passenger. In long term strategies, improvements in the supportive infrastructure, projected financial aspects, and efficiency assessment issues such as environmental issues, parking, safety, and alternative fuel technology will be discussed.

3. 1 Short term strategies:

Short term strategies can be implemented in house which is defined here as in-house management. In-house management means that Tiger Transit can make these changes with the service itself and does not require either consent from superior authorities or cooperation from outside governmental or private agencies. The issues and concerns raised during the assessment are:

(1) The current student coverage is only 70% (16,100 students).

(2) The student living pockets in north eastern quadrant are not covered even though they are relatively dense areas.

(3) There is no access to commercial areas.

(4) Some of the bus stops are too close which unnecessarily lengthens the trip times.

(5) Some of the routes overlap.

(6) The two longest routes (a) Airport and (b) Wire Road Express were found to have the lowest ridership and highest average cost per passenger.

However, the main strategy recommended here is to decrease the cost per passenger by increasing the ridership, and improving accessibility, with no additional operating expenses.

Recommendations:

(i) To conduct a yearly assessment of effectiveness. This should provide input for the design of better routes.

(ii) The average cost per passenger assessment should be calculated out every semester to guide required changes in the system.

(iii) Redesign the bus routes to increase ridership and student coverage.

(iv) Install benches at as many bus stops as possible, as per the requirement mentioned in Appendix H.

(v) To encourage private developers to build bus shelters for apartment complexes. Bus shelter design should match the existing road and surrounding buildings' typology.

(vi) To install an Automotive Vehicle Location (AVL) system, which is a web based system that provides real time locations of buses over the internet. This will help students to plan their travel time.

The next sets of recommendations are related to bus route design. The following major changes take into consideration the concerns raised while designing new bus routes.

(1) None of the bus routes provides the access to retail locations.

(2) The Lime Line college loop should be removed. The Reserve (on College Street) should be added to the Museum line, thus increasing the route's ridership. The Auburn Trail apartment complex should be added to the E University route as it has access from South Donahue which would help to add more riders on the E University route.

(3) Sky Line's new bus stop should be at Wal Mart to access commercial facilities. The Edge apartment complex which is served by Skyline should be added to Museum line due

to it is on right of way location while going to the Reserve. On this line, the travel time will remain the same.

(4) Magnolia Extension- the Tan Line will no longer be needed, as the Wire Road Express and Park and Ride service should be extended to Auburn Crossing. The Wire Road express should also cover W Magnolia and Facilities, which will increase the ridership of Wire Road Express and Auburn Crossing will have two bus routes in service, thus improving travel times.

(5) Airport Route will have new route which will cover N Dean Road and E University Drive along with Colonial mall. Airport will have two buses instead of one.

Table 17: Proposed New Bus Routes

Route	Proposed Name Change and / or Service Modification
1. Airport (Olive Line)	Proposed name change: Airport-Colonial Mall (Olive Line) Proposed service modifications: (1) The routes should start from the Mell Street Bus Terminal to decrease travel time. The present route starts from Jordan Hare Stadium and runs on E/W Samford and then to Dean Road where student density is less. (2) The proposed route should pass along E Thach Avenue to meet Dean Road, which will cover Mary Martin Hall and Foy Union. (3) The route will be extended up to E University on N Dean Road instead of turning on Annalue Drive. On North Dean Road, the first bus stop will be Fox Den Apartment at Opelika Road, the second will be Drew Lane at N Dean, and the third will be Arbors

	at Meadow Brook. (4) After turning from North Dean Road, on to E University Drive, the first stop will be West Shore Landing, the second stop will be the Village (at Lakeside) at Gatewood Drive, and the third will be at Colonial Mall. (5) The route should cover the trailer park at the junction of Opelika Road and Saugahatchee Road, and on Saugahatchhe Road the bus stop should be East Lane before reaching the Airport. (6) Returning from the Airport, the route should pass along Annulue Drive, where the first stop should be at Kalypso Cir, the second should be at Kurt Cir, and the third should be at Courtyards at Auburn. (7) After leaving the Courtyards at Auburn, the bus should return to campus along E Thach Avenue.
2.Museum (Charcoal Line)	Proposed name change: Museum-College Loop (Lime Line) Proposed service modifications: (1) The Museum line bus should be extended to cover S College St; the first bus stop should be at The Edge, and the second should be at the Reserve.

3.South College (Sky Line)	Proposed name change: South College (Sky Line) Proposed service modifications: (1) This route should make a stop at Wal-Mart while returning to Campus. (2) The Edge stop should no longer be on this route.
4. E University (Chocolate Line)	Proposed name change: East University (Chocolate Line) Proposed service modifications: (1) The College & E University Dr. bus stop should be removed. (2) While returning to campus, it should make stop an additional at Auburn Trail. It should enter Auburn Trail from the S Donahue Dr entrance and should return to campus along S College St.
5. Longleaf (Strawberry Line)	Proposed name change: Longleaf- Strawberry Line Proposed service modifications: (1) Instead of returning directly to campus from W Longleaf Dr, the bus should enter the Campus Pointe Apartment complex and should make three stops in the complex. (2) The bus should enter S College St from South Parker Road instead of W Longleaf Road.
6. Park and Ride (Blue Line)	Proposed name change: Park & Ride Pkwy (Blue Line) Proposed service modification: (1) This route should be extended to Auburn Crossing and should return to campus along Lem Morrison, Biggio Dr, W Samfard and Duncan Drive.

7. Webster Road (Purple Line)	Proposed name change: Webster Road (Purple Line) Proposed service modification: (1) While returning to campus, the route should pass through Tennessee Av, Ole Miss Av, Auburn Av, and Alabama St. (2) In the mobile home park, the bus stop should be at the junction of Ole Miss and Auburn Av and Alabama St and Kentucky Av.
8. Wire Road (Gold Line)	Proposed name change: Wire Road (Gold Line) Proposed service modification: (1) This route should be extended to the Conway mobile home park where it should bus stop in the mobile home park and another at the entrance.
9. Wire Road Express (Sunflower Line)	Proposed name change: Wire and Cox Road Express (Sunflower Line) Proposed service modification: (1) The bus route should start from the Haley Center depot, and pass along N Thach Cir onto W Mangnolia and reach the 3-D Art Center via Hemlock Dr and W Samford. (2) From the 3-D Art Center, it should arrive at Auburn Crossing on Shug Jordan Pkwy. (3) From Auburn Crossing, it should go directly to Cox Road along Wire Road. (4) On Cox Road, it should make bus stops at Swann's Trailer

Park, Dawson Trailer Park, Dawson Dr, and Widower Farm Mobile Park.

(5) It should return via the same route to campus.

Map6: Proposed new bus routes

Conclusion

As a result of the route modifications proposed here, the university should enjoy following benefits:

(1) It will increase the current coverage from 70% (16,100 students) to 80.20% (18,446 students) without decreasing bus frequency.

(2) Tiger Transit will no longer be only a commuter service but will provide access to other destinations. On campus students and students who do not a own vehicle will no longer have to depend on other drivers. It should provide access to Wal-Mart, the Cinema and Colonial Mall, which are major destinations for student.

(3) Four fewer buses will be required, even though the current level of service will be increased.

(4) Two bus routes, Magnolia Extension (Tan Line) and College Loop (Lime Line), will be removed.

(5) The Museum (new route: Museum-College Loop) and Wire Road Express (new route: Wire & Cox Road Express) route will have two buses instead of one, which will increase their efficiency.

(6) An Automotive Vehicle Location (AVL) system will provide accurate distance of traveling bus, reducing the time that students will spent waiting at bus stops.

The increased student coverage and frequency, reduction in the number of buses and routes, and the new access to other commercial destinations will aaverage cost per passenger.

3.2 Long term strategies:

In the upcoming year, the university will have to resolve the following issues.

- In year 2010, the present outsourced system's contract will expire. In 2010, the university will have to decide what kind of system they prefer to adopt for transit. The university will have two choices, namely whether to own the system wholly or continue the current system.
- The current system has proved to not be pollution free. Environmental concerns will thus be an important factor when deciding on a new system.
- Whichever type of transit service the university selects (totally out sourced or to own the system), the supportive infrastructure such as bus shelters and transit friendly streets will have to be developed.

To deal with these issues, the university has to work closely with various internal departments as well as cooperating with local government agencies. Some of the issues, such as class schedules, fixed route system development, and so on can be done within the university's authority. However, supportive infrastructure must be developed in conjunction with local government. Here, the recommendation are pitched at two levels; (1) university level long term strategies, which the university can develop as part of their ongoing planning efforts; and (2) comprehensive level strategies where the university must insert their planning program into local government or work's cooperatively with them to coordinate development.

3.2.1 University level Long term strategy:

(1) The classroom schedule issue, the planning for which is currently underway in the provost's office and is expected to be implemented in spring 2008, needs to take into account the transit service while planning and formulating policies. It should also keep in mind that the present transit contract will expire in the year 2010 and new system is likely to be in effect by then.

(2) The university is planning to build new student housing, after which all freshmen will be expected to stay on campus and vehicles may not be allowed. The university will have to start providing a bus service on weekends and major holidays to fixed destinations such as Huntsville, Montgomery, Birmingham, Dothan, and Mobile to take students safely to their homes. In this case, the transit buses can be used outside normal school hours. This program can be funded under Surface Transportation Program (Highway "Flex" Funds) (ref. Appendix J).

(3) The current system is relatively expensive and inflexible to run (Graph 4, Appendix I). The university will have two options in the year 2010 of whether to wholly own the system or to out source it. The positive and negative aspects of these options are discussed in length in Appendix I. If the university decides to own the whole transit system, there will be a huge investment needed capital, administrative and operational costs. As the university is a public entity, it is eligible to receive various federal appropriations. Federal Transit Administration administers the SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) funding program section 5309 (Major Capital Investment Program), 5307 (Urban Area Formula Program for more 200,000 population), 5311 (Non-urbanized Area Formula Program)

and 5338 (Job Access and Reverse Commute Program). The university is eligible to receive funds for capital and operational costs from section 5309 and 5311, although only 50% of the operating costs can be awarded (Appendix J). To cover the remaining of the 50% operating costs, another source of funding will have to be found. SAFETEA-LU is a five year funding program (FY 2004-FY 2009) so the university will have to start the process of grant writing and planning immediately as only two years of fund eligibility remain. In receiving these kinds of funds, the local government councils and metropolitan planning organizations also play important roles. Once, the university completes its own transit planning process with the above mentioned concerns, the next step will be to deal with local government and private developers. The recommendations provided below are relevant to this aspect.

3.2.2 Comprehensive level long term strategy

In the comprehensive level strategies, the university must play a role either as a leader or by working closely with other organizations. The study's recommendations related to this:

(1) To explore alternate fuel technology.

As discussed in the above topic, the university will have to find alternative sources for the remaining 50% of the operating costs. One option is for this to be obtained from alternate fuel technology funds. The City of Hoover's police department took this route and how utilizes alternate fuel for its patrol vehicles. Auburn University should explore this option as research into alternate fuel technologies already is being conducted on campus that has received nationwide attention (Appendix H).Governor Bob Raily mentioned in his

manifesto for 2006 election a proposals to support alternate fuel technology and tax exemptions based on alternate fuel technology. Auburn University can play important role in drawing up this bill and securing appropriations for university transportation based on alternate fuel technology would thus be very appropriate. In this strategy, the bus operation's fuel costs could be received from the state government, which would provide more opportunities to expand the system (Appendix H). This strategy would require a strong political effort by the university.

(2) To develop a city wide parking plan in conjunction with the university. Non transit covered students often park their vehicles on residential streets and walk in or take an internal transit route to reach this campus destination.

(3) To make transit friendly streets, changes are necessary to the building bylaws of the City of Auburn that make the inclusion of a bus shelter and pull over space for buses compulsory in any new development.

(4) Join hands with local government to develop a city wide transit plan if it is required.

(5) To develop a supportive infrastructure plan.

This development plan should include bus stop development. As described in Section 2.1.1, bus stops are an integral and crucial part of any transit system. The university will have to develop them regardless of the type of transit system it selects whether totally out sourced or a wholly owned system. A detailed inventory for each bus stop is provided in Appendix G. In the appendix each bus stop is surveyed and its improvement action priority and potential developer specified. As shown in Table 18 below, the improvement action priority is categorized in terms of high priority, priority and low priority. The potential developers are Auburn University, private developers or

some type of partnership with developers and the City of Auburn. The university can encourage private developers to build bus shelters wherever students live in private housing. This way, 44 bus stops can be developed. For the remaining bus stops, the university will seek to receive grants under various funds as mentioned in Section 3.2.1 or can earmark money from its general fund.

Table18: Bus Stop Improvement-Action Required and potential developers

Bus Route	Action Required			Developers		
	High Priority	Priority	Low Priority	Auburn University	AU + Partnership (City/Private)	City/Private Developers
External Lines						
Aqua-Rose-Harper	10	3	4	2	8	7
Chocolate-E. University	1		2		2	1
Gold-Wire Road	4		5	1	3	5
Purple-Webster	5	3	2	1	1	8
Silver-North Donahue	1	3	5		2	7
Sky-South	1					1
Olive-Airport	2	4	5	1	8	2
Strawberry-Longleaf			1	1		
Tan-Magnolia	1	1	2	2	2	
Charcoal-Museum	2		4	6		
Terra Cotta-N. Ross-Lime–College loop	3	4	4		6	5
SunflowerWireExpress	1		1		1	1
Lilac-South Auburn	2	1				3
Internal Lines						
Navy-East Campus	3		6	9		
Orange-Central	1	2	1	4		
Green-West Campus	6		3	5		4
Blue-Park and Ride		1	5	6		
Plum-C Zone Loop	4	1	2	7		
Total	47	23	52	45	33	44

In the first phase, the university can developed 44 bus shelters rated as high priority. The benches and bike racks can be facilitated for the priority and low priority action required bus stops. Benches will be helpful to sit on while waiting for a bus.

Students who live beyond the comfortable walking zone to a bus stop can ride their bike to bus stop, park the bike at the bus stop, and then ride the bus to campus. The university can also generate a substantial amount of revenue by selling advertisement spaces on bus stops.

Conclusion:

Long term strategies, including the development of the transit system's core elements, namely capital, administrative and operating elements have been discussed in this section, along with some of the supportive infrastructures' soft elements such as classroom schedules. Long term strategies lay out the conceptual plan framework and generate ideas to support the future development of Tiger Transit. Grant appropriations and any further grant eligibility will increase the associated administrative burden as will the need to implement the discussed recommendations; so the university will need to increase the specialized workforce in its current administrative structure. Even some of the long terms strategies, such as the development of bus stops, can be conducted immediately as an in-house project (Tiger Transit Administration) as funds become available. A strong commitment and political backing will be the most important factors for the development of this long term development plan.

Further Research Opportunities:

The research conducted for this study included various datasets and various methodologies. Further research can be conducted on many of these topics which would be helpful for the transit development program, and new methodologies could be established. Some of the possible topics are listed below.

(1) Efficiency assessment using Geographical Information system.

This methodology will provide a more accurate analysis of efficiency by making it possible to determine the precise number of students living on each route.

(2) Federal transit appropriations and process to obtain the fund.

The topic would provide meaningful information about various appropriations, grant writing process and the necessity for the administrative structure to obtain and maintain federal grants.

(3) Assessment of a potential area wide joint transportation system for the Auburn-Opelika Metropolitan Planning Organization.

This is a vast topic and various social, financial, and administration assessments from different local governments' perspective can be discussed.

(4) The development of fixed route service to other cities in Alabama from Auburn University on weekends and holidays.

It would be helpful to conduct an inquiry into the success of this kind of College Oriented Drive Home Safely Program at other universities, focusing on the bus fleet requirements, types of service, frequency, schedule, fares and so on.

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Appendices

Appendices

Appendix: A

Table A 1: Tiger Transit Passenger Mileage

Bus Route	Number of Buses*	Daily Revenue Miles*	Daily Deadhead Bus Miles**	Days of Operation	Total Deadhead Bus Miles	Total Revenue Bus Miles	Total Revenue Miles
External Lines							
Aqua-Rose-Harper	3	312	7.32	78	1,712.9	24,336	26,048.9
Chocolate-E.	4	764	7.32	78	2,283.8	59,592	61,875.8
Gold-Wire Road	2	338	7.32	78	1,141.9	26,364	27,505.9
Purple-Webster	2	570	7.32	78	1,141.9	44,460	45,601.9
Silver-North	2	327	7.32	78	1,141.9	25,506	26,647.9
Sky-South	2	322	7.32	78	1,141.9	25,116	26,257.9
Olive-Airport	1	169	7.32	78	571.0	13,182	13,753.0
Strawberry-Longleaf	4	649	7.32	78	2,283.8	50,622	52,905.8
Tan-Magnolia	2	276	7.32	78	1,141.9	21,528	22,669.9
Charcoal-Museum	1	119	7.32	78	571.0	9,282	9,853.0
Terra Cotta-N.Ross-	3	237	7.32	78	1,712.9	18,486	20,198.9
Internal Lines							
Navy-East Campus	1	94	7.32	78	571.0	7,332	7,903.0
Orange-Central	2	140	7.32	78	1,141.9	10,920	12,061.9
Green-West Campus	2	180	7.32	78	1,141.9	14,040	15,181.9
Blue-Park and Ride	2	193	7.32	78	1,141.9	15,054	16,195.9
Plum- C Zone Loop	1	82	7.32	78	571.0	6,396	6,967.0
Guaranteed Ride-	5	86	0	78	0	6,708	6,708.0
Security Night							
Internal West	2	122	7.32	78	1,141.9	9,516	10,657.9
Total						388,440	408,994.4

Note:*Daily deadhead bus miles: Distance traveled by bus between garage and campus.
**Daily Revenue bus miles: Travel Distance on all route bus each bus

Appendix B:

Table B 1: Estimated Personal Vehicle Mileage shifted by Tiger Transit:

Bus Route	Average Daily Ridership*	Average Auto Occupancy Ration*	% of expected Personal drive**	Expected Personal Vehicles***	Route Miles**	Days of Operation	Total Personal Passenger Mileage
External Lines							
Aqua-Rose-Harper	807	1.63	96%	475.29	1.6	78	59,316.0
Chocolate-E. University	1681	1.63	96%	990.04	2.2	78	169,890.3
Gold-Wire Road	346	1.63	96%	203.87	1.7	78	27,021.1
Purple-Webster	412	1.63	96%	242.65	2.4	78	45,424.1
Silver-North Donahue	475	1.63	96%	279.75	1.6	78	34,913.4
Sky-South	461	1.63	96%	271.51	2.6	78	55,062.1
Olive-Airport	12	1.63	96%	7.07	2.6	78	1,433.3
Strawberry-Longleaf	1755	1.63	96%	1,033.62	2.9	78	233,804.8
Tan-Magnolia Extension	702	1.63	96%	413.45	1.6	78	51,598.3
Charcoal-Museum	723	1.63	96%	425.82	1.6	78	53,141.8
Terra Cotta-N. Ross-Harper	481	1.63	96%	283.29	1.8	78	39,773.7
Internal Lines							
Navy-East Campus	192	1	62%	119.04	1.0	78	9,285.1
Orange-Central Campus	1213	1	62%	752.06	0.8	78	46,928.5
Green-West Campus	1023	1	62%	634.26	0.9	78	44,525.1
Blue-Park and Ride	910	1	62%	564.20	0.8	78	35,206.1
Plum- C Zone Loop	169	1	62%	104.78	0.5	78	4,086.4
Guaranteed Ride-Home	48	1.63	96%	28.27	2.1	78	4,520.4
Security Night Transit							
Internal West	177		62%	109.74	0.8	78	6,847.8
Total	11587			6,938.62			922,778.2

Note: *Average auto occupancy for home to university as per Skipper Consulting-2002

** Percentage of Expected Personal Drivers: If Tiger Transit were not provided, these riders would have driven as per survey of Skipper Consulting-2002

*** Expected personal vehicle: Total expected daily ridership is multiplied by the expected personal drivers divided by the average vehicle occupancy ratio.

Appendix C:

The types of vehicle registered on campus were Cars, Station Wagons, SUVs, Minivans, Vans, Buses and Pick up trucks. The brands included Toyota, Honda, Chevrolet, Jeep, Hyundai, Kia, VolksWagon, Dodge etc. Average city mileages are found for each vehicular category by multiplying by number of cars and city mileages. The vehicles and their respective average city mileages are as shown in the table. City mileages of each vehicle type are taken from the US Government's Fuel Economy website.

Table C 1: Average City Gas Mileage for Student Vehicles

City Gas Mileage	**Number of Registered Student Vehicles**				
	Cars	*Station wagons*	*SUVs*	*Minivans, vans & buses*	*Pick up trucks*
13 mpg			34		
14 mpg					
15 mpg				106	793
16 mpg			1,313	55	1,829
17 mpg			1,313	32	
18 mpg	369	32	879	106	
19 mpg	1,492	29	372	13	
20 mpg	1,193		87		
21 mpg	1,413				
22 mpg	1,076	22	364		
23 mpg	3,473				
24 mpg	-				
25 mpg	253				
Total no.	*9,269*	*83*	*4,362*	*312*	*2,622*
Average city mpg	*21.4*	*19.4*	*17.5*	*16.6*	*15.7*

To find the overall average personal vehicle mileage, the number of vehicles in each category was multiplied by the category average city gas mileage and their sum divided by the total number of vehicles. In the following table, the overall mileage is 19.38.

Overall Average Vehicle Mileage = (322,692/16,648)

Table C 2: Overall Average Vehicle Mileage

Vehicle Types	Category Average City Gas Mileage	Number of Vehicles	Total Vehicle Mileage
Cars	21.40	9,269	198,357
Station wagons	19.4	83	1610
SUVs	17.51	4,362	76,379
Minivans, vans & buses	16.56	312	5,207
Pick up trucks	15.69	2,622	41,139
Overall	*19.38*	*16,648*	*322,692*

Appendix D

The available relevant data on emissions for the comparison between diesel buses and personal vehicles was for the year 1999. The data is shown in Table D1. The year 2004 data will be available in 2007.

Table D 1: Average Emission, Grams/Vehicle Mile based on year 1999*

Vehicle Type	VOC_s	CO	NO_x	CO_2
Bus	2.30	11.60	11.90	2,389.90
Automobile	1.88	25.29	1.84	451.49
SUVs, light trucks	2.51	21.45	1.56	521.63

Source: * Shapiro & Others (2002), Conserving Energy and Preserving the Environment: The role of Public Transportation. Table 18,pp22

Table D 1 emission data is multiplied the estimated mileages, as shown in Table D 2. Estimated mileages are divided into two sections, taken from Table C 3 (Appendix C).

Table D 2: Emission, Grams/Vehicle Mile at Auburn

Vehicle Type	Estimated* mileages	VOC_s	CO	NO_x	CO_2
Bus	409,000	940,700	4,744,400	4,867,100	977469100
Automobile	518,398	974,588.24	13110285.42	953,852.32	234051513.02
SUVs, light trucks	404,379	1014991.29	8673929.55	630831.24	210936217.77

Note: * Estimated mileages are multiplied to respective emissions data from Table D1.
Ref: Table D1

The emission in Grams/Vehicle Miles is converted into short tons for easy to read

Table D 3: Average Emission, Short tons based on year 1999

Vehicle Type	VOC_s	CO	NO_x	CO_2
Bus	1.039	5.22	5.36	1077.47
Automobile	1.07		1.05	258.00
SUVs, light trucks	1.11	9.56	0.69	232.51

Note: Table D 2 data is converted into short tons. 1 short tons = 907 184.74 grams

Table D 4: Average total emission in short tons

Vehicle Type	VOC_s	CO	NO_x	CO_2
Bus	1.039	5.22	5.36	1077.47
Personal Vehicle*	2.18	24.01	1.74	490.51

Note: *Personal vehicles are the sum of automobiles, SUVs, and light trucks from Table D 3.

Table D 5: Recommended Pollution Costs (Cents per vehicle mile)*

Vehicle Type	Estimated mileages*	Suburban
Bus	409,000	15¢
Automobile	518,398	3¢
SUVs, light trucks	404,379	6¢

Ref: * Litman, Todd (2006) Evaluating Public Transit Benefits and Costs, Table 25 pp 46

Table D 6: Pollution Costs at Auburn

Vehicle Type	Estimated Cost*
Bus	$61,350
Automobile	$20,736
SUVs, light trucks	$24,263

Ref: Estimated mileage is multiplied with the suburban pollutant cost from Table D 5.

Table D 7: Estimated Pollution Costs at Auburn Fall 2004

Vehicle Type	Total Cost
Bus	$61,350
Personal Vehicle *	$44,999

Ref: Personal vehicles are the sum of automobiles, SUVs, and light trucks from Table C 6.

Appendix E

The cost of parking includes the construction, management and maintenance costs. It excludes parking permit and citation revenue (parking violations).

Construction cost: The construction cost for each parking space depends on the type of parking space, its landscaping, location, construction technique, soil condition etc. At Auburn University's main campus, the cost of a parking space in a surface lot ranges from $ 2,200 to 5,500, depended on the location. The average cost per space is $ 3,551 for a surface parking lot and for a parking deck is $ 12,000 (The average cost for the recently built parking deck in the Math section lot).

Table E 1: Construction Cost of Providing Parking at Auburn University

Type of parking lot	***Surface Lot***	***Parking Deck***
Number of spaces	9,658	342
Construction cost (per space)	$3,551	$12,000
Amortization period	25 years	20 years
Interest rate	4%	4%
Total cost (per space)	$9,467	$26,293
Per year cost	$379	$1,315
Total (number of spaces x yearly cost)	$3,660,382	$449,730
Total yearly expense*	$4,110,112	
Total no. of spaces	10,000	
Average cost per year	*$411*	

Note: * Sum of Surface lot and Parking deck total cost

Management cost: Parking management costs include staff salaries and enforcement expenses. The management team consists of the director, parking manager, 17 full-time staff, and 2 part-time staff. Enforcement expenses include the capital cost of

enforcement vehicles, insurance, maintenance, fuel consumption, office stationary expenses, telephone, camera and its associated expenses etc. For the FY 2004-2005 the total expenses were $ 553,132 (Christy Story, Auburn University).

Maintenance Costs: The maintenance cost of parking includes monitoring, cleaning and sweeping the lots, lighting, emergency telephones and landscape maintenance. The maintenance cost per space is $ 14.15, and for 10,000 spaces totals $ 141,500/ semester (Jann Swaim, Auburn University).

Parking Permit and Citation Revenue: The parking service generates revenue through parking permits and citations, which are parking regulation violation fines. The table below shows the revenue received during FY 2004-05 for different types of parking permit.

Table E 2: Parking permits revenue FY 2004-05

Types of Parking	Permit Revenue
A	$ 127,660
B	22,180
C	432,830
G	8,000
J	3,680
K	1,729
M	1,803
S	330
Total	*$ 598,212*

Source: Parking Services, Auburn University.

During the FY 2004-05, a total of 28,998 violations occurred and 83% of the violators paid their fines. Revenue of $ 1,178,753 was recovered, which is shown in table E 3.

Table E 3: Parking Citation Year 2004-2005

	Fall	Spring	Summer	*Total*
Number of Citations	11,972	13,975	3,051	*28,998*
Number of Paid Citations	9,773	11,814	2,535	*24,122*
Fines billed	$545,466	$708,353	$165,310	*$1,419,129*
Fines recovered	$438,490	$605,853	$134,410	*$1,178,753*

Source: Parking Services, Auburn University.

Appendix F:

Table F 1: Direct Costs

Cost per mile	Types of cost
9.4¢	Fixed costs: Insurance, registration, licensing, motor vehicle tax
6.4¢	Finance Charges (20% down; loan@ 8.5%/4 years)
28.6¢	Depreciation
5.9¢	Fuel and Oil
5.9¢	Maintenance and Tires
4.6¢	Residential Parking
1.7¢	Parking, Tolls-user-paid
18.8¢	Travel Time (with average delays)
5.0¢	Accidents (minus net Insurance disbursements above)
86.3¢	**Total**

Ref: http://www.commutesolutions.org/calc.htm

Table F 2: Societal Costs

Cost per mile	Types of cost
3.5¢	Accidents (minus net insurance disbursements and direct costs as
0.8¢	State and local construction improvements and repair (2000)
0.4¢	State and local highway maintenance and operations (2000)
4.8¢	Parking (commercial and employer-paid, including government taxes)
0.2¢	Waste disposal
4.0¢	Air pollution damage (health costs, crops, trees, materials, etc.)
1.7¢	External resources consumption costs
0.8¢	Road pollution (property value decrease and abatements)
1.1¢	Co_2 reduction (motor vehicle only)
1.3¢	Water pollution and hydrologic impacts
0.5¢	Transportation diversity and equity
0.9¢	Barrier effects on pedestrians and bicycles
5.6¢	Land use impact costs
2.4¢	Roadway land value
4.2¢	Congestion costs
32.9¢	**Total**

Ref: http://www.commutesolutions.org/calc.htm

The Following provides an explanation as given in http://www.commutesolutions.org/calc.htm for the selected costs:

Maintenance and Tires: Out of pocket expenses for car maintenance is estimated at $533 per year, and tires, are estimated at $ 234 per year (based on an average 13,000 vehicle miles traveled per year).

Accidents: Because accidents are infrequent, drivers tend to ignore or underestimate these costs. Accident rates per mile have decreased over the years, but the risk remains level as the number of miles driven continues to increase. Insurance only compensates for roughly one third of the accident cost borne by the drivers (i.e. pain and suffering, death, injuries, and disabilities). In 2001, Caltrans reported 174,882 accidents on California state highways alone, costing drivers and society an estimated $ 3.1 billion in lost lives, property, and productivity.

Barrier Effects on Pedestrian and Bicycle: Roads are considered transportation links, yet automobile infrastructure ultimately impacts the mobility and safety of pedestrians and bicyclists. The costs of these barriers tend to affect mostly disadvantaged populations, including children, the elderly, and those with disabilities, creating further transportation inquires.

Congestion: Congestion occurs during peak hours when traffic volumes reaches a roadway's capacity. This congestion results in increased vehicle operating costs, increased driver stress, lost productivity, and increases due to increased accident risk, and slowed delivery of business products.

Appendix: G

Type of Bus stops (As defined by the Bus stop website—the-bus-stops-here.org)

1. Flag Stop: This is an unmarked stop that is served on request for the passenger. The term originated with the railroads where there were stops along the route that were served only when a flag was raised.

2. Regular Stop: This is a standard bus stop marked with a sign and having one or more additional facilities.

3. Transit center: This is an area that is designed for several bus or rail routes. These may either be simple on street stops, or very complex off street facilities. One common feature of transit centers is for various routes to have individual stops; not all transit centers are set up this way, but many are. Transit centers will usually have multiple places where passengers can buy passes and get printed schedules. There might also be sanitary facilities for the drivers who have breaks at this point.

The following is a detailed study of each bus stop located on the Tiger Transit bus routes. The detailed study is presented in Table G1 through Table G 19, each of which covers an individual bus route. The first column in each table represents the bus stop name, as designated in the Tiger Transit Guide 2005-2006, and the street name. The second column shows a photograph of each bus stop. The third represents the potential riders (number of riders) living within the quarter mile buffer for each bus stops. The fourth is for general observations made on each bus stop and its classification. The fifth represents the kinds of actions required to improve that bus stop and who should be responsible for its development. The action priorities are decided based on factors such as

the number of students served by each bus stop, location, the present condition of the bus stop, the proximity of adjacent bus stops, and potential developers.

General observations were made during the site visits to each stop and from the photographs. Bus stops are classified in the following categories.

Classification (1): Bus stop with shelter: This type of bus stop has a shelter for waiting but may not have all types of furniture, such as benches, a garbage can, cigarette stand, telephone etc. There are 24 bus stops in this classification.

Classification (2): Bus stop with sidewalk: This type of bus stop is located on roads where sidewalks already exist. In this kind of bus stop, riders have enough space to stand comfortably and safely. There are 44 bus stops in this classification.

Classification (3): Road edge bus stops: This kind of bus stop is located right on the curb where sidewalks are not available, but provide enough space for the passengers to stand comfortably. It is not necessarily very safe, however. There are 56 bus stops in this classification.

Classification (4): Improperly located bus stop: This kind of bus stop is located in an improper place and may be effectively invisible, with no space for passengers to stand, and with parking spaces or vegetation located in front of it, or electrical equipment surrounding it. There are 22 bus stops in this classification.

The number of students served by each bus stop was determined for off campus bus stops because less than 10 % of the students live on campus in residential buildings that are within walking distance of academic buildings. A transit rider is expected to walk up to a quarter mile comfortably to catch a bus. According to this principle, the potential riders reside within a quarter mile radius of each bus stop (a quarter mile radius buffer

(shown in the map with yellow shading) developed in GIS for each bus stop). In the following map, the each yellow colored area represents the quarter mile buffer to each bus stop (in various shape dots). The students (red color dots) within each yellow color area are potential riders (number of served students) for the respective bus stop (blue dot located in the center of each yellow color area).

Map: ***Bus stops and bus routes***

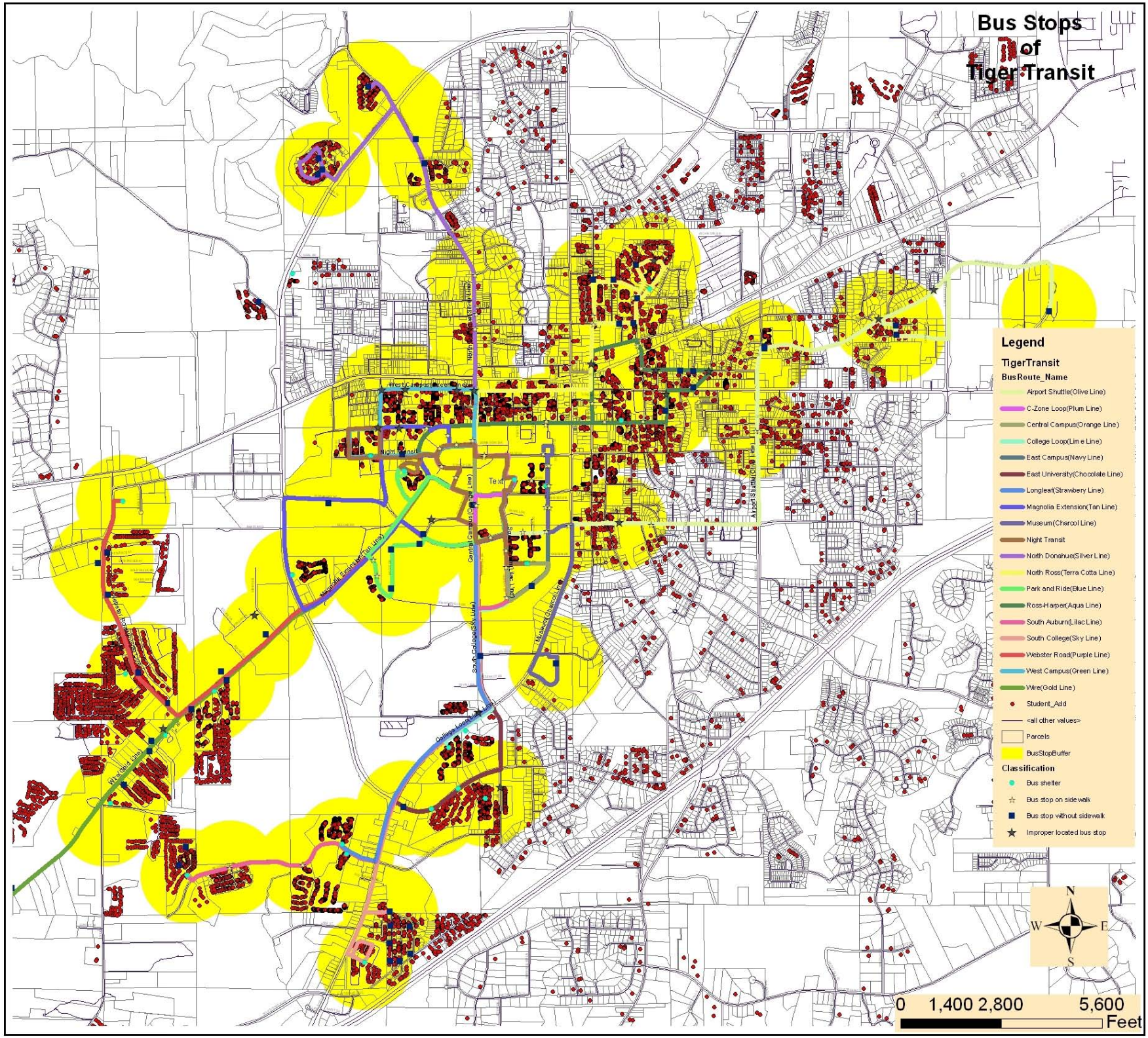

Bus Stops
of
Tiger Transit
Legend
TigerTransit
BusRoute_Name
Airport Shuttle(Olive Line)
C-Zone Loop(Plum Line)
Central Campus(Orange Line)
College Loop(Lime Line)
East Campus(Navy Line)
East University(Chocolate Line)
Longleaf(Strawbery Line)
Magnolia Extension(Tan Line)
Museum(Charcol Line)
Night Transit
North Donahue(Silver Line)
North Ross(Terra Cotta Line)
Park and Ride(Blue Line)
Ross-Harper(Aqua Line)
South Auburn(Lilac Line)
South College(Sky Line)
Webster Road(Purple Line)
West Campus(Green Line)
Wire(Gold Line)
Student_Add
<all other values>
Parcels
BusStopBuffer
Classification
Bus shelter
Bus stop on sidewalk
Bus stop without sidewalk
Improper located bus stop
N
W
E
S
0
1,400
2,800
5,600
Feet

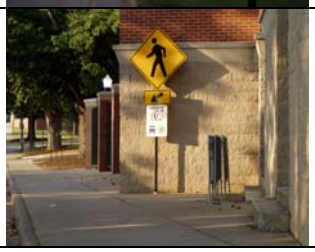
Table G1: East Campus: Navy Line (Internal Campus)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Terrel Dining Hall (O.P.Davis st.)			Bus pull over from regular traffic. This bus stop can serve as prototype. (Type 1)	Not required.
2. Forestry and Wildlife (Duncan Drive)			Bus Stops Located on Landscaped island which can be converted into bus pull over. (Type 2)	Low priority (Auburn University)
3.AUMedical Clinic (Lem Morrison Dr.)			Building canopy acts as shelter. (Type 2)	Not required.
4.Hilton Band Field (C-Zone Parking) Poultry Science Lot (Lem Morrision Dr.)			Located on curb, heavy traffic street, no sidewalk and ADA accommodation. (Type 3)	High priority (Auburn University)
5. Mell Street at W. Samford Avenue (Mell St.)			Located on sidewalk, tree acts as shelter (Type 2)	Low priority (Auburn University)
6.Ag Hill Upchurch (Mell St.)			Located on side walk and this is a drop off location. (Type 2)	Not required.

8. Quad Center (Quad Dr.)		Located on side walk and yellow lines indicate bus stop. (Type 2)	Low Priority (Auburn University)
9. RBD Library (Mell St.)		Located on sidewalk and tree acts as shelter. This is a drop off bus stops. (Type 2)	Not required.
10. Foy Student Union & Samford Hall		Located on Sidewalk, tree acts as shelter. (Type 2)	Low Priority (Auburn University)
11.RBD Library (Mell st.)		This bus stop emerged as the most important after route design. Adjacent street furniture is heavily used as waiting area. (Type 2)	High priority (Auburn University)
12. Mell Street at Roosevelt (Mell St.)		Newly developed bus terminal. This bus stop can serve as prototype. (Type 1)	Not required.
13. Ag Hill Corley Hall (Mell St.)		Located on Sidewalk. (Type 2)	Low Priority (Auburn University)
14. Mell Street at Samford (Mell st.)		Located on sidewalk, tree acts as shelter. (Type 2)	Low priority (Auburn University)

15. Goodwin Music Hall (Samford avenue)			Designated space to pull bus out of traffic and located on sidewalk. (Type 2)	High priority (Auburn University)
16. Lieschuck Residence Hall (Duncan Dr.)			Located on side walk, bench is installed as street furniture. (Type 2)	Not required.

Table G2: Orange Line-Central Campus (Internal Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Terrel Dining Hall (O.P.Davis st.)			Bus Shelter, Bus pull over from regular traffic. (Type 1)	Not required.
2. Lieschuck Residence Hall (Duncan Dr.)			Located on side walk, bench is installed as street furniture. (Type 2)	Not required.
3. Sewell Residence Hall (Samford Avenue)			Located on heavy traffic street. Bicycle lane acts as bus pull out space. (Type 3)	Priority (Auburn University)
4. Plainsman Park (S Donahue Dr)			Located on heavy traffic street. Corner of the building could act as waiting space (Type 2)	Not required.

5.Haley Center (Duncan Dr)		Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
6. Athletic Complex (Duncan Dr.)		Located on heavy traffic street, , no sidewalk and ADA accommodation. (Type 3)	Priority (Auburn University)
7.AUMedical Clinic (Lem Morrison Dr.)		Building canopy acts as shelter. (Type 2)	Low Priority (Auburn University)
8.Hilton Band Field (C-Zone Parking) Poultry Science Lot (Lem Morrison Dr.)		Located on curb, heavy traffic street, no sidewalk and ADA accommodation. (Type 3)	High priority (Auburn University)

Note: This is the Internal Routes which covers Students from Athletic Building

Table G3: West Campus- Green Line (Internal Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan drive)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Nichols Center, Wallace (N. Thach Cir)			Located on dense parking lot and corner of the street junction. (Type 2)	High Priority (Auburn University)

3. Max Morris Parking lot (S. Thach Cir)			Space to pull out bus. Emergency phone is installed. (Type 2)	High priority (Auburn University)
4. Farmhouse (W.Thach Av)			Located on low profile street. Potential high priority bus stop after student housing construction. (Type 3)	Low Priority (Auburn University)
5.Old CDV Laundry (W.Thach Av)			Located on low profile street. Building Canopy acts as a bus shelter. (Type 2)	Low priority (Auburn University)
8. Hemlock (W.Magnolia Av.)			Located on low profile street. Potential high priority bus stop after student housing construction. (Type 4)	Not required till the new housing construction is finished.
9. Logan Square (W. Glenn Av)		637	Located on road side trench and street is loaded with heavy traffic. It is in close proximity to campus. (Type 4)	High priority (Private Developer)
10. Stadium Edge (W. Glenn Av)		1337	Located on road side trench and street is loaded with heavy traffic. It is in close proximity to campus. (Type 4)	High priority (Private Developer)

11.Village Green University Condos (W. Glenn Av)		1242	Located on road side trench and street is loaded with heavy traffic. It is in close proximity to campus. (Type 4)	High Priority (Private Developer)
12. Peachtree/ Brownstone (W. Glenn Av)		1405	Located on heavy traffic street. It is in close proximity to campus. (Type 4)	High priority (Private Developer)
13. Lowder Business Building (S. Donahue Dr.)			Acts as a drop off internal bus stop as it is located on campus street. Space to pull over a bus. (Type 2)	Low priority (Auburn University)

Note: Bus stops 6 and 7 are removed due to student housings demolition.
Bus stops 9,10,11, and 12 are served for off campus housing.

Table G4: Park and Ride- Blue Line (Internal Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr.)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	
2. Athletic Complex (S. Donahue Dr.)			Located on heavy traffic street, , no sidewalk and ADA accommodation. (Type 3)	Priority (Auburn University)

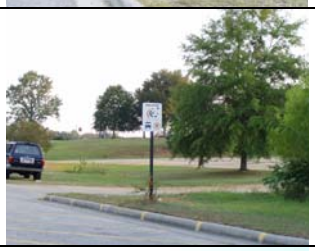
3. McWhorter Women's Athletic, Softball Complex, (W Samford Av)		Located on curved road. no sidewalk and ADA accommodation (Type 3)	Low priority (Auburn University)
4. Delta Chi House (Biggio Drive)		Located on curb and sign board is missing. (Type 3)	Low priority (Auburn University)
5. Intramural Field (Biggio Drive)		Located along the road. (Type 3)	Low Priority (Auburn University)
6. Lem Morrison Drive (Biggio Drive)		Located on opposite side of street to student housing. (Type 2)	Low priority (Auburn University)
7. Lem Morrison Drive (Wire Road)		Located near street junction. The bench is installed as street furniture. (Type 2)	Not required.
8. CDV Extension		Located on side of student housing parking lot and shelter is provided but bench is not installed. (Type 1)	Low priority (Auburn University)

Table G5: C-Zone Loop- Plum Line (Internal Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr.)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	
2. Nichols Center, Wallace (N. Thach Cir)			Located on dense parking lot and corner of the street junction. (Type 2)	High priority (Auburn University)
3. Max Morris Parking Lot (North Thach Circle)			Located on dense parking lot and equipped with emergency telephone. Space to pull over bus. (Type 2)	High priority (Auburn University)
4. South Thach Circle			Located on dense parking lot and space to pull over bus. (Type 2)	High priority (Auburn University)
5. North Coliseum Parking Lot (Coliseum Dr)			Located on dense parking lot and equipped with emergency telephone. Space to pull over bus. (Type 2)	High priority (Auburn University)
6. East Coliseum Parking lot. -Athletic Complex (S Donahue Dr)			Located on heavy traffic street, no sidewalk and ADA accommodation. (Type 3)	Priority (Auburn University)

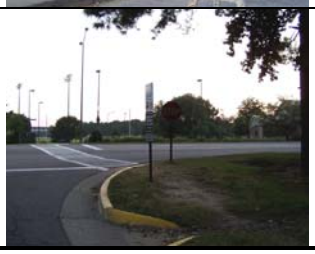
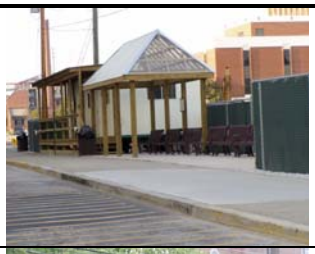
7. Student Activities Center (Biggio Dr)			Located on construction zone and parking space is in front of it. (Type 4)	Low priority (Auburn University)
8. McWhorter Womens Athletic, Softball Complex, (W Samford Av)			Located on street junction near stop sign. (Type 3)	Low priority (Auburn University)

Table G6: Aqua Line- Ross Harper

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Biggin Hall Ramsay Hall			Acts as an internal and last bus stop to get on bus for north side routes. (Type 2)	High priority (Auburn University)
3. Auburn City Hall (N Gay St)		777	Designated space to pull bus out of traffic and located on sidewalk. It is also LETA bus stop. (Type 2)	High priority (Auburn University + City of Auburn).
4. Hyatt House (N Gay St)		498	Bus stop is located on sidewalk near electric equipment. No space to stand. Not clearly visible. (Type 4)	Priority (Private Developer)

5. Auburn Post Office (N Ross St)		742	It is located on sidewalk. (Type 2)	High priority (Private Developer)
6. Dudley Crum Apt. Regency Square Apt.* (N Ross St)		920	It is located on sidewalk. (Type 2)	High Priority (Private Developer)
7. Harper at Cook* (Harper Av)		900	Located on curb, and street junction, no sidewalk or space to stand. (Type 4)	Low priority (Auburn University + City of Auburn)
8. Harper at Ryan Street* (Harper Av)		751	Located on curb, and street junction. (Type 3)	High Priority (Private Developer)
9.Highland* (Harper Av)			This bus stop is in close proximity to bus stops 7 and 8. (Type 3)	Low Priority (Private Developer)
10. Harper at Summer Hill (Harper Av)		559	Located on curb, and street junction, no sidewalk or space to stand (Type 4)	High priority (Auburn University + City of Auburn)
11. Deerwood Apartments (Summer Hill Rd)		593	Located on curb, and street junction near dumpster. (Type 3)	High Priority (Auburn University + Private Developer)

12. Cabana Apartments (N Debardeleben St)		721	Located near sewer inlet. Not clearly visible due to vegetation. (Type 4).	High priority (Private Developers)
13. Kingsport Apartments (N Debardeleben St)		858	Located on curb, and on street parking make it inconvenient to get on board. (Type 3)	High priority (Private Developers).
14. Magnolia Woods &Greystone Apt. (N Debardeleben St)		1056	Located on curb, and street junction. (Type 3)	High priority (Auburn University + Private developer)
15. Burton House Plainsman Apt (E Magnolia Av)		958	Very well developed bus stop with ADA accommodation. (Type 1)	Not required.
16. Magnolia at Gay (E Magnolia Av)		905	Located on busy street curb and in close proximity of campus. (Type 2)	Priority (Auburn University + Private Developer)
17. Biggin Hall, Ramsay Hall (W Magnolia Av)			Act as a drop off internal bus stops as it is located on downtown street. Space to pull over a bus. (Type 2)	Low priority (Auburn University + Private developers)
18. Lowder Business Building			Act as a drop off internal bus stops as it is located on campus street. Space to pull over a bus. (Type 2).	Low priority (Auburn University)

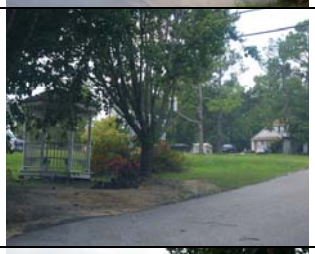
Note: *Bus stops are in close proximity to each other so only appropriate bus stop is selected according to its geographical location.

Table G7: Chocolate Line-East University (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1. Mell Street at Roosevelt (Mell St.)			Newly developed bus terminal. This bus stop can serve as prototype (Type 1)	Not required.
2. College St. & E.University (E.University Dr.)		115	Located on side curb. (Type 3)	Low priority (Auburn University + Private Developer)
3. Lakewood Commons I (E. University Dr.)		304	Very well developed bus stop which can act as a prototype. (Type 1)	Not required.
4. Lakewood Commons II (E. University Dr.)		710	Very well developed bus stop which can act as a prototype. (Type 1)	Not required.
5. Southern Edge (S. Donahue Dr.)	Not available	847	There is no designated bus stop sign at site. (Type 4)	High Priority (Private Developer)
6. Garden District (S. Donahue Dr.)		734	Building canopy acts as a bus stop shelter. (Type 1)	Low priority (Private Developer)

Table G8: Gold Line / Wire Road

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required
2. Crossland Downs, Large Animal Clinic (Wire Rd)	Not available		There is no designated bus stop sign at site. It is a drop off located opposite side of Crossland Downs apartment (Type 3)	Low priority (Auburn University)
3.Gentilly # 2 (Wire Rd)		463	Located on road side curb. (Type 4)	Low Priority (Auburn University + Private Developer)
4. Convey Acres (Wire Rd)		540	Located on road side curb. (Type 3)	High Priority (Auburn University + Private Developer)
5. Barrons Tailor Park (Wire Rd)		124	Provided bus stop located inside compound (Type 1)	Low priority (Private Developer)
6. Mr. Friendly (Wire Rd)		235	Located on curb, and street junction, no sidewalk. (Type 3)	Low Priority (Auburn University + City of Auburn)

7. Campus Trailer Park I (Wire Rd)		336	Located on curb and no sidewalk. (Type 3)	Low Priority (Private Developer)
8. Campus Trailer Park I (Wire Rd)		336	Bus shelter is located on lower off road and invisible from road side. (Type 1)	High priority. (Private Developer)
9. Hearthstone (Wire Rd)		453	Located on heavy traffic street junction and curb. (Type 3)	High priority (Private Developer)
10. The Brookes (Wire Rd)		646	Located on main street with any obstacles on road. (Type 1)	Not required.
11. Crossland Downs (Wire Rd)		281	This bus stop is located on curb and is also used by veterinary students who must cross from opposite side of road. (Type 3)	High priority (Auburn University + Private Developer)

Note: Bus stop 7 and 8 are in close proximity of each other.

Table G9: Purple Line / Webster Road

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required
2. Greene Hall (Vet College)	Not available		There is no designated bus stop sign at site. (Type 4)	Priority (Auburn University)
3. Crossland Downs, Large Animal Clinic (Wire Rd)	Not available		There is no designated bus stop sign at site. It is a drop off located opposite side of Crossland Downs apartment (Type 3)	Low priority (Auburn University)
4. Gentilly Station (Webster Rd)		386	Located on street junction. There is no bus stop in close proximity. (Type 3)	High priority (Private Developer)
5. Gentily Park (Webster Rd)		579	Located on street junction. There is no bus stop in close proximity. (Type 3)	High priority (Private Developer)
6. Webster Crossing # 1 (Webster Rd)		751	Located on street junction. There is no bus stop in close proximity. (Type 3)	High priority (Private Developer)

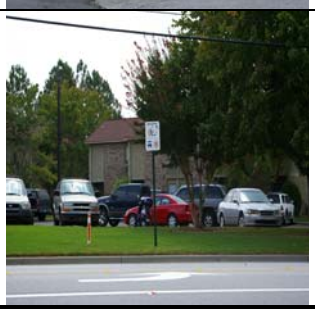
7. Webster Crossing # 2 (Webster Rd)		333	Located on curb, and street junction, no sidewalk. (Type 3)	Priority (Private Developer)
8. University Park (Webster Rd)		108	It is the last bus stop on this route. (Type 1)	Not required.
9. Bellwood (Webster Rd)		82	Located on street junction. (Type 3)	Low priority (Private Developer)
10. Ridgewood Village (Webster Rd)		65	Well developed bus shelter but needs to be closer to main road. (Type 1)	Priority (Private Developer)
11. Hearthstone (Wire Rd)		453	Located on heavy traffic street junction and curb. (Type 3)	High priority (Private Developer)
12. The Brookes (Wire Rd)		646	Located on main street without any obstacles on road. (Type 1)	Not required.
13. Crossland Downs (Wire Rd)		281	This bus stop is located on curb and is also used by veterinary students who must cross the opposite side of the road (Type 3)	High priority (Private Developer)

Table G10: Silver Line/North Donahue (External Route)

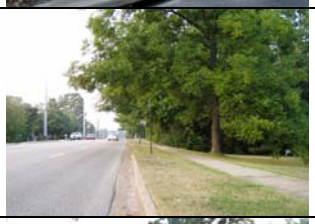
Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required
2. Brookside Apartments (N Donahue Dr)		107	Located on Sidewalk. (Type 2)	Low priority (Private Developer)
3. Cloister Apartments (N Donahue Dr)		104	Bus stop is located on sidewalk near electric equipment. No space to stand. (Type 2)	Low priority (Private Developer)
4. Tiger Inn Apartments (N Donahue Dr)		21	Located on sidewalk. Bicycle lane acts as a pull over space for bus. (Type 2)	Low priority (Private Developer)
5. Woodland Hills Apartments (N Donahue Dr)		73	Located on side walk. Bicycle lane acts as a pull over space for bus. (Type 3)	Low priority (Private Developer)
6. Tamarack Habitat Apartments (N Donahue Dr)		240	Located on curb. (Type 3)	Priority (Private Developer)

7. North Donahue at Greentree Lane (N Donahue Dr)		224	Located on curb. (Type 3)	Priority (Auburn University + Private Developer)
8. Donahue Crossing (N Donahue Dr)		238	Located on curb. (Type 3)	Priority (Private Developer)
9. North Point (Shug Jordan Pkwy) (Five Stops)		242	Located on curb. (Type 3)	High priority (Private Developer) * There are five stops which required different action according to their geographical location.
10.Village West (Shug Jordan Pkwy)		149	Located on curb. (Type 3)	Low priority (Private Developer Or City of Auburn)
11. Edgewood (Shug Jordan Pkwy)		25	Mailbox acts as a bus stop. (Type 1)	Not required.
11. Lowder Business Building (N.Donahue Dr)			Acts as a drop off internal bus stop as it is located on campus street. Space to pull over a bus. (Type 2)	Not required.

Table G11: Sky Line/ South College (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1. Mell Street at Roosevelt (Mell St.)			Newly developed bus terminal. This bus stop can serve as prototype. (Type 1)	Not required.
2. The Edge (Camp Auburn Rd).	Not available	311	Bus stop does not exist due to road construction. (Type 4)	High Priority (Private Developer)
3.Steeplechase & Savannah Square		135	Bus stop serves both the purpose- 1. Bus stop and 2. Mailbox. (Type 1)	Not required.
4. Harmon Duplex (Harmon Dr) Seven Stops		584	Located on curb. (Type 3)	Private Developer. (Action required based on individual bus stops' geographical location.)

Table G12: Olive Line/Airport (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Samford Avenue at Moore's Mill (E Samford Av)		427	Located on stop close to traffic signal. It is in close proximity to campus. (Type 2)	Priority (Auburn University + City of Auburn)
3. Dean Road at Mckinley Avenue (S Dean Rd)		218	Located on side walk and bicycle lane acts as a pull over space for bus. (Type 2)	Priority (Auburn University + City of Auburn)
4. The Courtyards (Annalue Dr)		177	Located on road side curb. (Type 4)	Low priority (Private Developer)
5. Kalypso Circle at Annualue Dr (Annalue Dr)		25	Located on road side curb and bicycle lane acts as a pull over space for bus. (Type 4)	Low priority. (Private Developer)
6. Opelika-Auburn Airport (Airport Rd)			Located on curb. (Type 3)	Priority (Auburn University)

7. Kent Drive at Reede Street (Kent Dr)*		144	Located towards downhill curb and road turning. (Type 3)	Low priority (Auburn University + Private Developer)
8.Reede Street at Kurt Circle (Kent Dr)*		128	Located on uphill curb and road turning. (Type 3)	High priority (Auburn University + Private Developer)
9. Kurt Circle at Annualue Dr (Annualue Dr)*		144	Located on storm water drainage. (Type 4)	Low priority (Auburn University + Private Developer)
10.The Courtyards at Auburn		177	Located on road curb. (Type 4)	Priority (Auburn University + Private Developer)
11. Dean Road at McKinley Avenue		218	Located on side walk near to public library (Type 2)	High priority. (City of Auburn)
12. Samford Avenue at PineDale Drive		427	Located on curb and in close proximity of campus. (Type 4)	Low priority (Auburn University + City of Auburn)

Note: * Bus stops 7, 8 and 9 are on close proximity to each other.

Table G13: Strawberry Line/ Long Leaf (External Route)

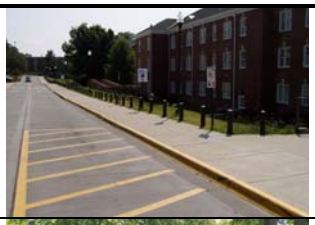
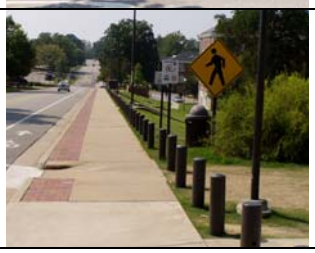
Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan dr)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Exchange Apartments (W Longleaf Dr)		772	Very well developed bus stop but parking spaces in front of it are obstacles in accessibility. (Type 1)	Not required.
3. Campus Point (W Longleaf dr)		117	Very well developed bus stop. (Type 1)	Not required.
4. Donahue at Woodfield			Located on curb. Tree acts as a canopy. (Type 3)	Low priority. (Auburn University)

Table G14: Tan Line/ Magnolia Extension (External/Internal Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Auburn Crossing		319	Located on parking lot in apartment complex. (Type 1)	Not required.
3. 3-D Arts Center (Facilities, W Samford Av)			Located on curb. (Type 3)	Priority (Auburn University)
4. Hemlock at Magnolia		33	Located on low profile street. Potential high priority bus stops after student housing construction. (Type 4)	Not required till the new housing construction will be finished.
5. The Edge West		309	Located on curb and invisible due to vegetation. Students often park vehicles in front of it on narrow street. (Type 4)	Low priority (Auburn University + Private Developer)
6. Stadium Edge Apartments		235	Located on side walk. (Type 3)	Low priority (Auburn University + private developer)

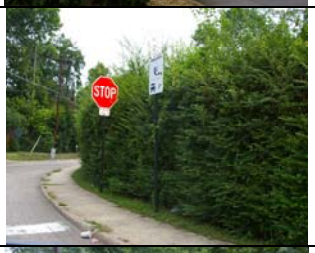
7. Federal Credit Union			Located on sidewalk of a student parking lot. (Type 2)	Not required.
8. Max Morris Parking Lot (N Thach Cir)			Located on dense parking lot and space to pull over bus. (Type 2)	High priority (Auburn University)

Table G15: Charcoal Line / Museum (Internal route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1. Quad Center (Quad Dr.)			Located on side walk and yellow lines indicates bus stop. (Type 2)	Low Priority (Auburn University)
2. RBD Library ((Mell St.)			Located on sidewalk, tree acts as shelter. (Type 2)	Not required.
3. Foy Student Union (Samford Hall)			Located on sidewalk, tree acts as shelter. (Type 2)	Low Priority (Auburn University)
4.RBD Library (Mell st.)			Located on sidewalk, adjacent street furniture is heavily used as waiting area. (Type 2)	High Priority (Auburn University)

5. Mell Street at Roosevelt (Mell St.)		Newly developed bus terminal. This bus stop can serve as prototype. (Type 1)	Not required.
6. Ag Hill Corley Hall (Mell St.)		Located on Sidewalk. (Type 2)	Low Priority (Auburn University)
7. Museum (Jule Collins Smith Art Museum)		Located in museum campus away from university on its property. It is used mainly by visitors. (Type 3)	High priority (Auburn University)
8. OLD KA lot, Life Science Building (W. Samford Av)		Located on sidewalk, tree acts as shelter. (Type 2)	Low priority (Auburn University)
9.Ag Hill Upchurch (Mell St.)		Located on side walk. (Type 2)	Not required.
10.Spidle Hall (Mell St.)		Located on campus street and is a drop off bus stop. (Type 2)	Not required.

Table G16 Terra Cotta Line- North Ross (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Hyatt House (N Gay St)		498	Bus stop is located on sidewalk near electrical equipment. No space to stand. Not clearly visible. (Type 4)	Priority (Private Developer)
3. Gay at Drakes (N Gay St)		530	Located on chaotic road junction and sidewalk. It acts as drop off bus stop. (Type 2)	Low Priority (Auburn University + City of Auburn)
4. Drakes at Perry (E Drake Av)		716	Located on curb. (Type 3)	High Priority. (Private Developer)
5. Drake at Ross (E Drake Av)		742	Located on street junction in close proximity to Bus stop 4. (Type 3)	Priority (Auburn University + City of Auburn)
6. Ross at Martin (N Ross St)		500	Located on curb. (Type 3)	High priority (Auburn University + City of Auburn)
7. Gazebo Apartments (N Ross St)		344	Developed bus stop. (Type 1)	Not required.

8. Ross at Mary Lane (Mary Lane)	Not available	344	Bus stop does not exist on site. (Type 4)	Low priority (Private Developer)
9. Mary Lane at Harris Avenue (Mary Lane)		344	Located on road side curb and in close proximity to Bus stop 8. (Type 3)	High priority (Private Developer)
10. Martin at Center Place (Martin Av)		138	Located on curb of a community entrance. (Type 3)	Low priority. (Private Developer)
11. Martin at Gay (N Gay St)		302	Located in road side curb. (Type 3)	Priority (Auburn University + City of Auburn)
12. Gay at Drake (N Gay St)	Not available	530	Located on side walk. (Type 3)	Priority (Auburn University + Private Developer).
13. Biggin Hall, Ramsay Hall (W Magnolia Av)			Act as a drop off internal bus stop as it is located on downtown street. Space to pull over a bus. (Type 2)	Low priority (Auburn University + Private developers)
14. Lowder Business Building			Act as a drop off internal bus stop as it is located on campus street. Space to pull over a bus. (Type 2)	Not required.

Table G17 Lime Line/ College Loop (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1. Mell Street at Roosevelt (Mell St.)			Newly developed bus terminal. This bus stop can serve as prototype. (Type 1)	Not required.
2. The Reserve on South College		479	Located on apartment complex. (Type 1)	Not required.
3. Auburn Trail		262	Located on apartment complex and building canopy act as a shelter. (Type 1)	Not required.

Table G18 Sunflower Line/ Wire Road Express (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Convey Acres (Wire rd)		33	Located on road side. (Type 3)	Low priority. (Auburn University + City of Auburn)

3. Orchard Way (Wire Rd)	No available	184	Bus stop does not exist on site. (Type 4)	High priority. (Private Developer).
4. Saddlebrook 1 (Wire Rd)		19	Bus stop does not exist on site. (Type 4)	Not required.
5.Saddlebrook 2 (Wire Rd)	Not available	38	Bus stop does not exist on site. (Type 4)	Not required.
6. Arrowhead (Wire Rd)		64	Temporary bus shelter is provided. (Type 1)	Not required.

Table G19:Lilac Line/South Auburn (External Route)

Bus stops (Street Name)	**Photographs**	**No. of Served Students**	**General Observation** (&Classification)	**Action Priority** (& Developers)
1.Haley Center (Duncan Dr)			Due to construction of Student Union, the bus stop is temporarily established. (Type 1)	Not required.
2. Eagles Landing (W Longleaf Dr). Three stops.		300	Located on entrance of a community. Internal bus stops are used more. (Type 1)	Priority. (Private Developer)
3. Downs Way at Longleaf (W Longleaf Rd)		218	Located on sidewalk. (Type 2)	High priority. (Private Developer)
4. The Villas at Longleaf (W Longleaf Rd)		584	Located on side walk. (Type 2)	High priority. (Private Developer)

Appendix H: Newspaper article study

1. Alternative Fuel Technology:

Live to Ride
Auburn Riders motorcycle club rides into its first fall
PAGE B6

Classifieds
Campus Calendar
Back in History
B
October 5, 2006

Bush consults AU expert on ethanol

Oct 5, 2006

Paul Morse / WHITE HOUSE

President George W. Bush speaks about alternative fuel and its importance at a new alternative fueling station to provide E85 in Hoover Thursday. In Bush's statement to the press he made reference to Auburn University as a leader in alternative fuel research.

President meets with professor on alternative fuel use

By MARY HOOD
Assistant Campus Editor

David Bransby represented Auburn University in a briefing to President Bush about alternative fuel in Hoover last Thursday.

The fuel, called E85, can be used to replace oil, helping both the economy and the environment.

Bransby, professor of agronomy and soil, was invited by the White House to attend the briefing.

"What I was told was that the White House contacted (Auburn University President Ed Richardson's) office in Samford Hall and requested that I'd be involved," Bransby said. "I was asked to talk on ethanol produced from fibrous type of material."

Bransby is an expert in switchgrass and bioenergy, which he has been studying for 20 years.

He said there were five people included in the briefing — Gov. Riley, Hoover Mayor Tony Petelos, Phillip Weidmeyer from Central Alabama Clean Cities, Hoover Fleet Manager David Lindon and himself.

The day before the briefing, a rehearsal was held, and the participants went through a dry run of the presentation, Bransby said.

"At least we knew where we were going to be and there weren't any major surprises," he said.

One of Bransby's main objectives in his brief, he added, was to inform Bush that the University is a leader in alternative fuel research.

In a report he sent to Auburn University, Bransby said he told Bush that Auburn plans to be active in his Advanced Energy Initiative.

Richardson has committed $3 million to the expansion.

Bransby said he hopes the money will go toward projects like genetic improvement of switchgrass, development of forest resources for energy, conversion of pulp and paper mills to biorefineries and a strong emphasis on commercializing cellulosic ethanol.

"I wanted to let him know that up front," Bransby said.

He said he also talked to Bush about what was needed at the national level.

Bransby made reference to Bush's State of the Union address in which the president said he would like to replace 75 percent of the oil imported from the Middle East with cellulosic oil.

Bush focused on turning corn into ethanol, but realizes the need for more ways of producing it.

Bransby also told Bush of a small company in Mississippi that he had just visited.

This company has begun to build a commercial plant for alternative fuel. It is only halfway finished, but if the funding comes through, the plant can be functional in a year.

After explaining this, Bransby told Bush cellulosic oil may become commercial, with his help, before Bush leaves office.

Bransby said if Bush would like to meet this goal of switching from oil to ethanol by his target date, 2025, the switch needs to be a quick one.

"I told him about stuff that he wasn't really aware of," Bransby said.

In his report, Bransby mentioned that he told Bush there were two technologies for producing ethanol from biomass and what the difference is.

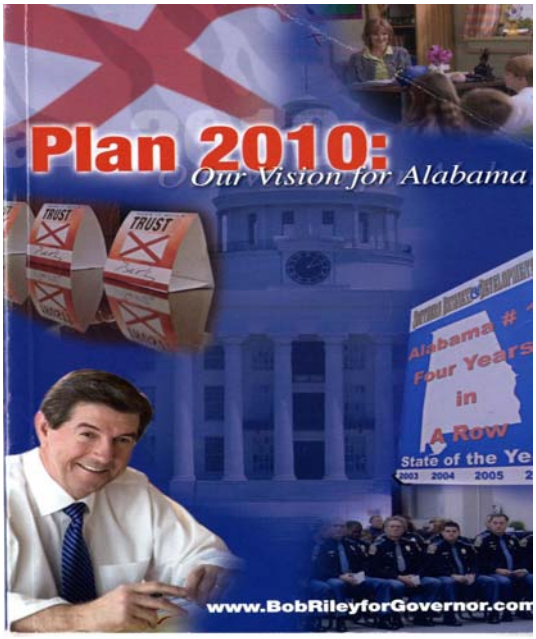
"He was encouraged by what I had to tell him," Bransby said, adding that he was honored to be part of the briefing.

"I felt it was a privilege and an incredible opportunity, personally rewarding and professionally rewarding," he said.

Turn to BRANSBY, B2

Bransby

2. **Alabama Alternate Fuel Act.2007**



1. Alabama Governor Election Manifesto

our quality of life

CONSERVATION

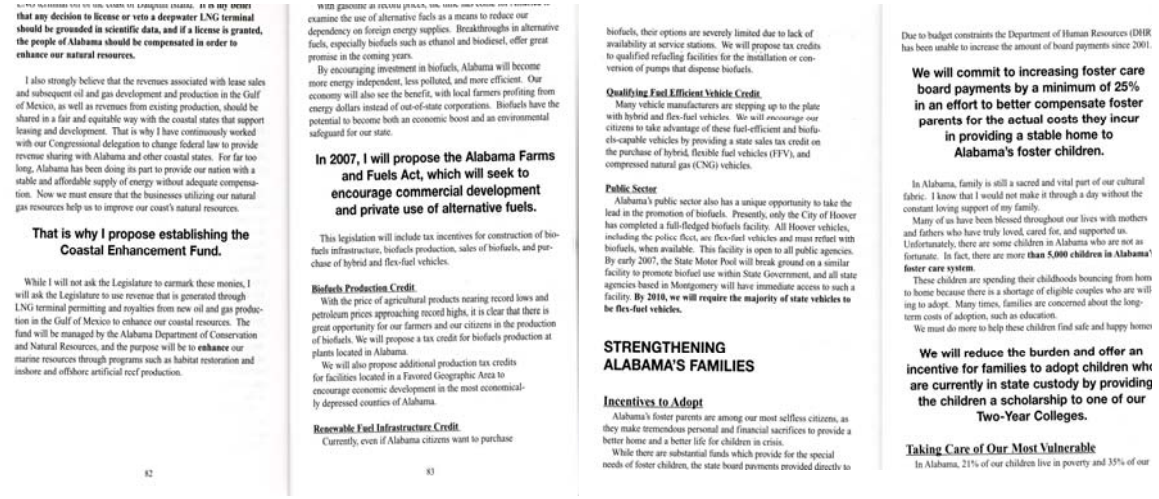
Alabama's abundant natural resources stretch from the Tennessee Valley to the Gulf of Mexico. I strongly believe that it is our responsibility to conserve, protect, and enhance these valuable assets in a manner that encourages sustainable economic development and promotes the responsible stewardship of our environment.

Over the past few years, the development of liquefied natural gas (LNG) terminals as well as new oil and gas exploration and production off of our coast has become a hot topic across the country. I recognize that the stability and growth of our economy is dependent on affordable and readily available energy supplies. I absolutely believe that we must continue to explore ways to reduce our dependency on foreign sources of energy and increase our domestic supply. I strongly support the development of alternative energy sources, but I recognize that non-renewable sources of energy, such as coal, oil, and natural gas, will continue to be – at least in the short-term – our primary source of energy. Unlike many other states, Alabama is proud to be a significant contributor to our nation's security and economic wellbeing through its onshore and offshore oil and gas production. You can rest assured that, as long as I'm Governor, the State of Alabama will continue to support a balanced, reasonable, and environmentally sound energy program, including additional oil and gas exploration and the development of LNG terminals, as long as it is fair and equitable to our citizens.

While I support the development of LNG terminals in the Gulf of Mexico and elsewhere, I believe that it is extremely important to proceed with caution as we consider permits for "open loop" deepwater LNG terminals. Most scientists remain concerned about the impact

81

2.Conservation



that any decision to license or veto a deepwater LNG terminal should be grounded in scientific data, and if a license is granted, the people of Alabama should be compensated in order to enhance our natural resources.

I also strongly believe that the revenues associated with lease sales and subsequent oil and gas development and production in the Gulf of Mexico, as well as revenues from existing production, should be shared in a fair and equitable way with the coastal states that support leasing and development. That is why I have continuously worked with our Congressional delegation to change federal law to provide revenue sharing with Alabama and other coastal states. For far too long, Alabama has been doing its part to provide our nation with a stable and affordable supply of energy without adequate compensation. Now we must ensure that the businesses utilizing our natural gas resources help us to improve our coast's natural resources.

That is why I propose establishing the Coastal Enhancement Fund.

While I will not ask the Legislature to earmark these monies, I will ask the Legislature to use revenue that is generated through LNG terminal permitting and royalties from new oil and gas production in the Gulf of Mexico to enhance our coastal resources. The fund will be managed by the Alabama Department of Conservation and Natural Resources, and the purpose will be to **enhance** our marine resources through programs such as habitat restoration and inshore and offshore artificial reef production.

82

examine the use of alternative fuels as a means to reduce our dependency on foreign energy supplies. Breakthroughs in alternative fuels, especially biofuels such as ethanol and biodiesel, offer great promise in the coming years.

By encouraging investment in biofuels, Alabama will become more energy independent, less polluted, and more efficient. Our economy will also see the benefit, with local farmers profiting from energy dollars instead of out-of-state corporations. Biofuels have the potential to become both an economic boost and an environmental safeguard for our state.

In 2007, I will propose the Alabama Farms and Fuels Act, which will seek to encourage commercial development and private use of alternative fuels.

This legislation will include tax incentives for construction of biofuels infrastructure, biofuels production, sales of biofuels, and purchase of hybrid and flex-fuel vehicles.

Biofuels Production Credit

With the price of agricultural products nearing record lows and petroleum prices approaching record highs, it is clear that there is great opportunity for our farmers and our citizens in the production of biofuels. We will propose a tax credit for biofuels production at plants located in Alabama.

We will also propose additional production tax credits for facilities located in a Favored Geographic Area to encourage economic development in the most economically depressed counties of Alabama.

Renewable Fuel Infrastructure Credit

Currently, even if Alabama citizens want to purchase

83

biofuels, their options are severely limited due to lack of availability at service stations. We will propose tax credits to qualified refueling facilities for the installation or conversion of pumps that dispense biofuels.

Qualifying Fuel Efficient Vehicle Credit

Many vehicle manufacturers are stepping up to the plate with hybrid and flex-fuel vehicles. We will *encourage* our citizens to take advantage of these fuel-efficient and biofuels-capable vehicles by providing a state sales tax credit on the purchase of hybrid, flexible fuel vehicles (FFV), and compressed natural gas (CNG) vehicles.

Public Sector

Alabama's public sector also has a unique opportunity to take the lead in the promotion of biofuels. Presently, only the City of Hoover has completed a full-fledged biofuels facility. All Hoover vehicles, including the police fleet, are flex-fuel vehicles and must refuel with biofuels, when available. This facility is open to all public agencies. By early 2007, the State Motor Pool will break ground on a similar facility to promote biofuel use within State Government, and all state agencies based in Montgomery will have immediate access to such a facility. **By 2010, we will require the majority of state vehicles to be flex-fuel vehicles.**

STRENGTHENING ALABAMA'S FAMILIES

Incentives to Adopt

Alabama's foster parents are among our most selfless citizens, as they make tremendous personal and financial sacrifices to provide a better home and a better life for children in crisis.

While there are substantial funds which provide for the special needs of foster children, the state board payments provided directly to

Due to budget constraints the Department of Human Resources (DHR has been unable to increase the amount of board payments since 2001.

We will commit to increasing foster care board payments by a minimum of 25% in an effort to better compensate foster parents for the actual costs they incur in providing a stable home to Alabama's foster children.

In Alabama, family is still a sacred and vital part of our cultural fabric. I know that I would not make it through a day without the constant loving support of my family.

Many of us have been blessed throughout our lives with mothers and fathers who have truly loved, cared for, and supported us. Unfortunately, there are some children in Alabama who are not as fortunate. In fact, there are more **than 5,000 children in Alabama's foster care system**.

These children are spending their childhoods bouncing from hom to home because there is a shortage of eligible couples who are will ing to adopt. Many times, families are concerned about the long-term costs of adoption, such as education.

We must do more to help these children find safe and happy homes

We will reduce the burden and offer an incentive for families to adopt children who are currently in state custody by providing the children a scholarship to one of our Two-Year Colleges.

Taking Care of Our Most Vulnerable

In Alabama, 21% of our children live in poverty and 35% of our

3. Alternate Fuel Act

3. Alcohol influence

DUIs ruin lives

driving drunk.

Driving under the influence of alcohol can result in large fines and jail time

By ASHLEY HUNGERFORD
Assistant State & Local Editor

During Labor Day weekend, the Auburn Police Division made nine DUI arrests.

This weekend, Auburn police officers are preparing for another big football weekend.

Capt. Tom Stofer with the Auburn Police Division said he usually sees a rise in DUIs in the fall, especially on home game weekends.

"Normally in the fall, the number of DUIs increases," Stofer said. "It's a direct relationship to the return of students, and many of the DUI arrests are students."

Most of the arrests happen late at night during the peak party hours, especially once bars and restaurants start closing.

In Alabama, the legal limit is a blood alcohol level of .08. For anyone younger than 21, the limit is .02.

Blood alcohol level can depend on the amount of food a person has eaten, body weight, the period of time drinking and the type of alcohol drank.

Gary Black, an Auburn attorney, said fines for DUIs increase with each offense.

First DUI conviction can result in imprisonment for up to one year, a fine of not less than $600 but not more than $2,100 or both a fine and imprisonment.

Stofer also said the director of public safety can revoke a driver's license for 90 days.

A second offense within five years carries a $1,100 to $5,100 fine, up to one year in jail, mandatory five days in jail or at least 30 days of community service and the loss of a license for a year.

Fines and jail time increase with each conviction. The fines do not include court costs, mandatory alcohol classes and attorney fees.

Black said DUI convictions usually carry a 180-day jail sentence that is usually suspended if the person pays the fines and completes alcohol classes.

A fourth DUI conviction is considered a Class C felony. If convicted, a person faces a $4,100 to $10,100 fine, not less than a year and day in jail, up to 10 years in prison and the loss of your driver's license for five years.

Black said a law just went into effect in Alabama that allows certified DUI convictions in other states to be used

> Turn to DUI, A4

When Auburn Police Officer Amy Schreiner suspects a driver of driving under the influence, she takes them through a field sobriety test like walking a straight line.

4. Night Shuttle

Thursday, Aug. 31, 2006 The Auburn Plainsman B3

Night owls use late shuttle to get safely to and from bars

By NATALIE CROWE
Staff Writer

Since a week before the first day of classes this fall, students have been using the new addition to the Auburn University Tiger Transit system — the Night Security Shuttle Van Service.

After a three-week trial-run of the service in April, the University decided to implement the program this fall.

The service, which started as a branch of the security program at the University, will take students to and from any on-campus location.

Two vans run from 10 p.m. to 3 a.m. seven days a week during the regular school year except on home football game nights, according to the Tiger Transit Web site.

Rex Huffman, manager of Transit Services, said students should call 707-2004 or 707-2005 to have a van pick them up from any location on campus.

"When you call one of these numbers, you are talking directly to the driver who is going to pick you up, not a dispatcher — which I think is a big plus," Huffman said.

Students are able to explain to the driver exactly where they are and can even wait in their car until the van arrives, he said.

This is just one way the service tries to maintain security for students, Huffman said.

Daniel Church, security monitor for the night security shuttle services, drives for the program full-time.

"That is our main concern — security and safety for the students," he said.

However, freshman Michael Metz, who frequently uses the night shuttle, said he and his friends use the system mainly for convenience.

"We call the shuttle every time we go out on the weekends," he said.

He said he usually takes the shuttle from The Commons to Fraternity Row.

He said a lot of his friends use the shuttles to pick them up when they are going to bars or parties after they have been drinking.

"They call it the 'drunk bus,'" Metz said.

Although many students ride the shuttle after they have been drinking, Church said he does not see this as an abuse of the service.

He said the shuttle service keeps many students from driving under the influence of alcohol. By preventing potential road accidents, Church said he feels the shuttle promotes student safety not just for those who ride the van but for others on the road.

According to the Auburn Police Division, there were 376 DUI arrests in Auburn last year.

Church said he believes the new shuttle system will decrease the number of drunken drivers on the road this year.

"The kids are going to party," he said, "but if we can keep even just one of these kids from getting behind the wheel, then it is worth it."

Although a lot of the students may be legally drunk, Church said as far as he knows the drivers have not had any behavioral problems with any of the passengers. He said he has been impressed with the gratitude and friendliness of the students.

"I love this job," Church said.

He said the attitude and appreciation of his passengers make him enjoy his job that much more.

Church said the busiest nights are Wednesday, Friday and Saturday, which average 300 students per night between the two shuttles.

He said a third shuttle might be needed soon, even on other nights of the week.

Huffman said he has also been pleased with the popularity of the system.

"The Night Security Shuttle has been a great success so far," he said.

But not all this success has come from the vans carrying students to parties.

Huffman said the system originated to take students, especially female students, from the library and other buildings to their cars or dorms when they have to be on campus late for studying or research.

On most weeknights, Church said he is sure a large number of students who ride the vans are using the shuttle for this purpose.

Even though the vans are being called "drunk buses" on certain nights, students on campus who have a safety concern will be given priority over those merely waiting to go to a fraternity party or to the Ramsey Hall area, from which students walk to the bars.

Church said if a student is alone on campus or feels threatened or nervous for any reason, when the student calls, he or she should let the driver know and the shuttle will come immediately.

However, he said some party-goers might have to wait a little longer than 10 minutes to be picked up depending on the night and the time.

Michael Friedman / PHOTO STAFF

The Night Security Shuttle Van Service picks students up from any location on campus from 10 p.m. to 3 a.m. seven days a week. The shuttle is commonly used for safety reasons around campus and by students refraining from driving after drinking.

5. University enrollment

University ranks highly in number of out-of-state students

By SARAH DAY OWEN
Assistant Campus Editor

For 40 percent of students, before they enrolled in Auburn this state wasn't their "Sweet home Alabama."

Auburn University has one of the largest percentages of out-of-state students at public universities in the country.

John T. Fletcher, assistant vice president of Enrollment Management Services for Auburn, said a few reasons Auburn has a large percentage of out-of-state students are Auburn's strong regional reputation, reasonable cost to attend, a safe campus, a small-town environment and outstanding University faculty.

He said another main reason, especially for students from neighboring state Georgia, is its location — a mere 30 miles from the state border.

From 2001 to 2005, Auburn had an average 683 Georgia residents of an average 3,870 new students enrolled, according to a report by the Office of Institutional Research and Assessment.

The report also showed other out-of-state students come by the hundreds from Florida and Tennessee, the runners-up in out-of-state enrollment.

Fletcher said Enrollment Management Services spends time recruiting in Florida, Tennessee, Mississippi, Louisiana and Texas, and recently hired a separate recruiter for Georgia who is a Georgia resident.

"Essentially, our entire staff covers the state of Alabama," Fletcher said.

Mike Waldrop, Auburn admissions adviser, said it takes the entire fall to cover Alabama. The state is divided into 10 territories, and each person is assigned to one or more territory, he said.

They attend as many areas as they can, Waldrop said.

They also hit top feeder schools in the South, he said.

Beyond the South, Waldrop said they rely on alumni contacts to recruit students.

"If a student is interested in coming to Auburn, they absolutely must apply."

John Fletcher
assistant vice president of Enrollment Management Services

For out-of-state recruiting, Fletcher said the University purchases names from testing agencies to send students recruiting materials, participate in college fairs and make some private visits.

Fletcher said War Eagle Days, led by Student Recruiters, generally have more in-state prospective students.

The goal, Fletcher said, is to enroll 60 percent in-state students and 40 percent out-of-state.

The two main reasons for this percentage goal are to bring diversity to Auburn and for the revenue out-of-state students bring to the University, Fletcher said.

Out-of-state students pay three times the amount in-state students pay for tuition, he said.

Recent tuition figures for in-state students are $2,724 per semester, or $5,448 per year.

Out-of-state students pay $7,724 per semester on average, or $15,448 per year.

Some in-state students will pay less in 2007, with $2 million in scholarships for Alabama residents set aside during the last Board of Trustees meeting.

Waldrop said one way to get more in-state students is to add scholarship money.

As far as admissions go, all students are admitted according to the same standard, he said.

New students admitted in the fall 2006 semester had an average ACT score of 24.3 and an average GPA of 3.56, Fletcher said.

The past five years, the Office of Institutional Research and Assessment reported a difference of less than one point in ACT scores between in-state and out-of-state students in the freshman class.

Fletcher said some students were admitted with lower scores and GPAs.

"If a student is interested in coming to Auburn, they absolutely must apply," Fletcher said.

3.6% 835
0.6% 148
61.9% 14,456
13.9% 3,242
4.4% 1,023
Auburn student enrollment by state
Source: Office of Institutional Research and Administration
Design: Jon Culver
61.9% Percentage of total enrollment
Home Number of students

Auburn enrollment by the numbers

New freshmen enrollment 2006:
In-state: 2,472
Out-of-state: 1,620
Total: 4,092

Average ACT score for freshmen 2005:
In-state: 24.2
Out-of-state :23.9
Average: 24.1

Enrollment percentages for 2005:
In-state: 62 percent
Out-of-state: 38 percent

More info: Office of Institutional Research Web site: www.oira.auburn.edu

www.theplainsman.com

6. Bike and its parking

More bikes, more racks

By MIRANDA MATTHEIS
Associate Campus Editor

Students and faculty who ride bikes to campus will soon not have to worry about finding a place to park their bikes. Last Thursday, more bike racks were added on the Haley Concourse.

Lindy Biggs, director of the Sustainability Initiative at Auburn, said the number of bike racks on the Concourse was almost doubled with the new additions.

Biggs said the idea to increase the number of bike racks came when she heard the bike racks were filling up during the day.

"This is not acceptable to have no parking for bikes," Biggs said.

With an increasing number of bike riders, the additional racks are needed.

"This fall, it was apparent that more students and faculty were riding bikes," Biggs said.

The Concourse is not the only place with additional bike racks. Within the next few weeks, Biggs said bike riders can expect to see bike racks at the new science buildings, Spidle, Parker, Dudley, Lowder, Thach and Broun halls, Sewell residence hall, Funchess, the forestry and wildlife buildings, Wallace and the band hall.

The 12 places on campus to receive bike racks were selected by student requests.

Some Tiger Transit buses also have racks on the front so students using transit can bike once they get on campus.

Katie Trammell / PHOTO STAFF

An increased number of cyclists on campus led to plans for new bike racks, like this one at the aerospace engineering building.

Not all the buses on all the routes have racks, though.

Biggs said this can be difficult for students to handle, because they don't know if the next bus on their route will have a bike rack.

Until all transit buses have bike racks, work is being done to move transit buses around so that all buses on the same route will have racks.

The routes that initially get bike racks will depend on student safety.

> *"This is not acceptable to have no parking for bikes."*
>
> **Lindy Biggs**
> *director of Sustainability Initiative*

"We want to target the routes where it might be more dangerous to bike from," said Matt Williams, program assistant for the Sustainability Initiative.

The routes that initially get bike racks will depend on which buses can be on which routes, since some routes require bigger buses. If transits already have racks, those racks will not be removed to be put on another bus.

A demo rack will be placed on the Haley Concourse so students can practice loading their bikes before attempting to use the racks on the transit buses.

When the Roosevelt concourse is complete, bike racks will also be found there.

Biggs said by the end of this academic year, the University will be installing a multi-use bike and pedestrian walk path along Donahue Drive, beginning at College Street.

"There is a growing interest on the part of the Campus Planning Office to make this a bike-friendly campus," Biggs said.

Also, it is now free to register bikes on campus.

The University is considering putting a bike shop in the new student union, Biggs said. She said she thinks there are almost twice as many bikers this year.

"The more bike riders you have out there, the safer everything becomes," Biggs said.

7. Route Change **8.Tiger Transit update**

TIGER TRANSIT | *Re-routing students*

Students line up to board the College Loop transit during the first week of class. Tiger Transit moved the Haley Center bus station and added a new station on Mell Street because of construction for the new student center.

Construction prompts changes in transit routes

BY TORI ALLEN
Staff Writer

Many baffled Auburn students might find themselves left standing at the bus stop this fall.

Tiger Transit relocated its bus stations on campus after the destruction of the Haley Center parking lots.

One of the stations is behind Ralph B. Draughon Library at the corners of Mell and Roosevelt streets, while the other is next to the Haley Center in front of the stadium.

Fourteen lines go to the Haley Center drop-off, two go to Terrell Dining Hall, and the remaining four, including South College, East University and College Loop, go to the Mell Street side.

"I think it's a good idea to have two separate stops," Tiger Transit driver Regis Ledroit said.

The previous Tiger Transit Depot was torn down to accommodate the new Student Center, which is set to be completed in 2008.

The two stops were created to keep traffic at a minimum.

Pedestrian traffic might see an increase, however. Students riding the buses that stop at the Mell Street side must now walk farther than before, Tiger Transit supervisor Jay Moss said.

Moss also said students are concerned about where to go for their pick-up and drop-off locations.

"Right now I don't like it because I'm not used to it, but it could be worse."

> Turn to TRANSIT, A3

The construction of the new student center caused Tiger Transit authorities to re-route some buses to a new Mell Street Station. Fourteen lines stop at the new Haley Center bus shelter.

TRANSIT

Students wait for the transit to unload at the new Haley Center transit station.

Welcome Back 2006 The Auburn Plainsman Pag

Campus transit gets updat

By ANTRENISE COLE
Staff Writer

When students, faculty and people with disabilities need a ride to class, a football game or anywhere on campus, one of the best ways to get there is the Tiger Transit.

There are 41 buses for this school term, an increase from last year's 38 buses.

The Tiger Transit has a total of 20 lines.

Fifteen of the lines begin and end at the Haley Station. The other five lines are located at the Mell Street Station.

The five routes that begin and end at the Mell Street Station include East University, South College, College Loop, Museum and East Campus.

The Blue Bird Line has three routes including South Auburn, Campus Pointe Express and the recently added route Wire Road Express. These buses will pick up in front of the pharmacy building on west Thach Avenue and Duncan Drive.

The Tiger Transit has made many improvements for the fall and spring semesters.

The Wire Road Express route was added to accommodate the students who live in the trailers past Highway 57.

Also added is the D-Zone parking route, which is for people with disabilities, employees and visitors. It picks up at the new parking deck by the stadium and goes straight across to the Haley Center.

The C-Zone route added a second bus to its one-bus route.

The Park and Ride route also had a bus addition.

Bike racks have been added to 20 of the buses to benefit students who like to ride their bikes on campus.

There are night transits t operate after 6 p.m. The campus night transit drops at all external Tiger Transit tinations until 10 p.m. on M day through Friday. The cam night transit has three fi routes and runs until 3 a daily.

The Tiger Transit has a fo ball game-day shuttle ser that gives fans a ride to the dium and back to their vehic

Some of the seven shu service locations include Ti Town shopping mall off I Kmart and Colonial Univer Village shopping mall.

The Tiger Transit rider's gu includes the designated dr off and pick-up destinations every route.

Copies of the brochure ca found on the transits o www.auburn.edu/transit.

9. Class Time Schedule Policy

New scheduling policy suggested

Sept. 21, 2006

By JESSICA OTWELL

Managing Editor

Arriving to swimming class out of breath and a little sweaty isn't an uncommon occurrence for Lydia Cash, a sophomore in music education.

"I have 10 minutes to get from Goodwin to the Cofrin," Cash said. "I practically have to run to get to class, and once I get there, I have to swim laps."

A new classroom scheduling policy, designed to help Cash and other students who experience these hassles, could go into effect as early as fall 2007.

"This policy allows for 15 minutes between each class, meaning class times must be rearranged to start and end at different times.

"We can't just cut the class down five minutes, or we'll lose SACS accreditation," said Sharon Gaber, associate provost for academic administration.

Gaber had been working on the policy this semester because the new Banner registration system will be used for scheduling classes next fall.

Gaber said the new policy is similar to the existing policy in that the Office of the Provost will be flood-filled with 15-minute intervals between classes.

The new policy has class times beginning as early as 6:40 a.m. and other class times starting and ending at the usual quarter time, such as 8:35 a.m., 2:30 p.m. or 4:25 p.m.

"If we are going to have a 9 (a.m.) to 9:50 (a.m.) class, the next class will have to start at a later time, which would be stretching the day long. It's a tradeoff," Gaber said.

The number of class periods and instructors would stay the same with the new policy.

The Office of the Registrar, the official department for scheduling classrooms, is still evaluating the policy. Nothing is concrete yet.

"If we find that this is a problem, we won't go through with it," Gaber said.

John Mouton, senior advisor to the president, is also involved with this project from the campus planning standpoint.

Mouton said this policy comes from Tiger Feedback last spring, in which students expressed concerns about getting to classes on time on Mondays, Wednesdays and Fridays, but not on Tuesdays or Thursdays.

"The real question is, do we have a problem, and if there is, what are the alternatives?" Mouton said.

"One way is to leave it the way it is, and that can be done if that is the people's preference."

In the end, the decision is

➤ Turn to SCHEDULE, A5

MWF: 8:50am 9:55am 11:00am 12:05pm 1:10pm	TR: 9:35am 11:00am 12:30pm	A & B are peak hours C & D are normal E is special scheduling
MWF: 6:40am 7:45am 2:15pm 3:20pm 4:25pm	TR: 8:00am 2:00pm 3:30pm 5:00pm	MWF: 5:30pm or later TR 6:30pm or later

SCHEDULE

➤ From A1

an administrative issue determined by the Office of the Provost.

However, Mouton said there will be plenty of opportunities for the Student Government Association and University Senate to provide input.

"SGA Administration Vice President Hendry Groves said SGA is calling for validity of plans right now and looking forward to thinking logistically about the plan if it is in the best interests of the students."

As far as classroom occupancy, Gaber said the new sciences centers and Haley Center will be more occupied. With various renovation and construction efforts across campus, students may be moved to alternate buildings.

"This will affect students campus wide," Gaber said. "Even architecture and forestry students have core classes."

Gaber and Mouton have worked together on this policy to manage cam-

10. Class Schedule planning on hold

SCHEDULE

➤ From A1

ing to make a decision about a new policy and will begin looking into more plans to meet students' needs, Gaber said.

"We've come up with some alternative ideas about how it could work in the future," Gaber said.

SGA President George Stegall said the plan will continue to go through more revisions.

"We just needed more time to gather more information," Stegall said.

Gaber said she realizes that the campus is growing, so it will take students more time to move between classes, and a change may be necessary.

"I think the issue is we're stretching campus in all directions," Gaber said.

Gaber said if a student has a class in Haley Center, she calculates approximately three minutes to get out of the building, and that only leaves seven minutes for a student to travel to their next class.

However, increasing the break between classes will lead to a longer day.

"If you add an extra five minutes between class periods, the day gets stretched out," Gaber said.

Stegall said 11 classes are held on Mondays, Wednesdays and Fridays, so a 5 minute addition between each would lengthen the day.

"That's a 55 minute difference in your workday," Stegall said.

Now, Stegall, Gaber and others are looking into plans for a change in the scheduling policy for spring 2008.

"It's still being discussed and worked on," Stegall said.

Gaber said she is getting information on ideas to determine if the change is feasible.

A decision about a change for spring 2008 doesn't have to made until May 2007.

"It's something to help students, and if it's not going to do that, we're not going to do it."

Sharon Gaber
associate provost for academic administration

With construction on campus, Gaber said it's necessary to accommodate students while things are being built.

"It's not fair to put anyone at an unfair advantage in class," Stegall said.

He said there are certain departments and people on campus that a change will influence more, such as a student majoring in Ag-Economics.

"It does affect certain smaller groups of students," Stegall said.

Gaber said there is a lot of concern about the new scheduling policy, and the decision to wait on making a change will allow more time to look into all options.

"It's something to help students, and if it's not going to do that, we're not going to do it," Gaber said.

Date: Oct 19, 2006

tics of the choir tours, and

Scheduling plan on hold

By MIRANDA MATTHEIS
Associate Campus Editor

A scheduling plan that would allow longer breaks between classes has been put on hold until the University can work out kinks.

The plan, which was suggested during Tiger Feedback last spring, would increase the time between classes from 10 minutes to 15 minutes, giving students more time to travel between buildings.

"If people don't want this, it's not meant to be a punishment," said Sharon Gaber, associate provost for academic administration.

The plan was originally set to take effect in fall 2007.

The University had to make a quick decision about the new scheduling policy because of the new Banner system, Gaber said.

However, the University is not rush-

➤ Turn to SCHEDULE, A5

11. Parking problem across the City **12.Parking Forum**

The Auburn Plainsman

STATE&LOCA

SAME STORY | *New victim* Oct 5, 2006

Photo illustration by Jon Lonier / DESIGN EDITOR

Parking problem spreads to Sundays

By BETHANY KIRBY
Assistant State & Local Editor

On a typical Sunday morning, Alan Long gets ready for church with his family. He dresses up like the regular churchgoer — khakis, a nice polo and dress shoes. But he can't forget the most important part — a fluorescent green vest.

Long, a network administrator for Intercall and faithful member of Auburn United Methodist Church, volunteers to help direct traffic on Sunday mornings.

Auburn United Methodist on Gay Street is one of many churches downtown that faces a shortage of parking on a weekly basis.

On Sundays, Long directs parking lot traffic for the 9:30 a.m. service and the 11 a.m. service.

"You can spot us from anywhere," he said of the bright green vests.

The combined services bring approximately 1,500 people to Auburn United Methodist on a weekly basis.

"The 9:30 (service) is packed every Sunday," Long said. "Every week that parking lot's full."

The overflow parking usually goes to Auburn Bank, Compass Bank and Tiger Rags, Long said.

St. Michael's Catholic Church is just around the corner from Auburn United Methodist and has similar problems, only with fewer parking spaces.

"Parking is a problem for each of the masses," said Patty Abrahams, facilities coordinator for St. Michael's. "We spill over into the streets with just about every mass."

Abrahams said the church has five service times for mass: Saturday at 5 p.m. and Sunday at 8 a.m., 10:30 a.m., 5 p.m. and 9 p.m. Typically, the most crowded is at 10:30 Sunday morning.

Abrahams said the ushers have counted heads at the 10:30 a.m. mass before.

"They counted over 500, and that doesn't leave a seat for a lot of them, much less a parking space," Abrahams said. "I'd say (St. Michael's has) places for about 80 cars. Maybe 80 to 100, but that's a stretch."

Abrahams said some people teach religious education classes for the children and have to be there early. Because of this, a family of three might take two cars, which only exacerbates the parking problem.

"It's pretty hectic, and there's a lot of congestion, pretty much all through the morning on Sunday," Abrahams said.

At Auburn First Presbyterian Church on the corner of Thach

➤ Turn to SUNDAY, A4

Michael Osborn / PHOTO EDITOR

Lee Bourque, principal of parking consulting company Carl Walker, answers students' questions at Tuesday's parking forum, which was designed to help both Parking Services and students.

University holds parking forums

Sept 2006

By MARY HOOD
Assistant Campus Editor

Parking forums for faculty and students were held Tuesday, Sept. 19, to inform students on target problems and to hear their opinions on what needs to be changed.

Another forum for staff was held Wednesday, Sept. 20.

Cathy Love, an engineer with Campus Planning, said this is the second time she's been involved. The first forum took place in 2002.

Before the meeting, Love predicted the most prevalent issues to be discussed at the forum.

"(Students will) probably complain about walking too far and traffic congestion," she said.

John Mouton, senior adviser to the president, said before the meeting that a big issue to be addressed will be residential parking.

The University is planning to build more residential housing, Mouton said, and parking problems will naturally accompany the new developments.

Love and Mouton were both looking forward to student responses, especially concerning traffic and parking.

Mouton said he realized the two were closely related, and fixing one will help fix the other.

"A big piece of (the issue) is traffic and parking," Mouton said. "They are definitely linked together. Change parking then you'll change traffic."

The forum began with a presentation by Lee Bourque. Bourque is the principal of Carl Walker, parking consult-

➤ Turn to FORUM, A5

Thursday, Sept. 21, 2006 The Auburn Plainsman A5

FORUM

➤ From A1

ant company.

Love said Carl Walker is nationally recognized.

Bourque began by saying the two objectives for the forum were to educate people on parking strategies and options and to open the floor to get student responses.

"Parking is amazingly complex," Bourque said, as he explained all the components involved in assessing a parking situation.

"Parking isn't about cars," Bourque said. "It's about people."

He explained that the University's parking system is a broad zone system. Auburn has six parking zones, each of which offers large lots.

Bourque said the broad zone system is the most common for universities and the most efficient use of available parking.

Bourque said the goal of the consultant is to manage existing resources. There may not be construction of extra lots, but rather the goal is finding a system to make what we have work.

"Technically, there is enough parking on campus," Bourque said.

He proved this by the results of an occupancy survey taken during the peak times on campus.

The results showed that more than 2,000 parking spaces were unoccupied. This includes all of the parking zones.

Bourque addressed ways to approach capitalizing the parking the University offers.

He gave many examples, such as assigning specific lots to students, faculty, and employees, or having a free-for-all method of parking.

Students who attended the meeting chimed in toward the end of the presentation, which led into the open forum designed for student responses.

Students were concerned with residential parking, the Tiger Transit and parking at the fields at the corner of Donahue and Lem Morrison.

Students spoke of the annoyances that arise from living on the Hill and the Quad having limited parking.

"Parking isn't about cars. It's about people."

Lee Bourque
principal of Carl Walker parking consultants

The issue of the fields at Lem Morrison and Donahue began with a question about the gameday visitors parking their RVs on the fields beginning Wednesday afternoon of every home game.

Starting Wednesday, the fields are closed to students who want to park and pose a problem for those who regularly park there.

Even though the fields aren't zoned, students still get ticketed and towed.

Mouton quashed this argument by saying those fields were never intended to be used for student parking, nor are they zoned.

Mouton said the plan is to close down the field, making it unavailable as campus parking.

He projected the shutting down of the fields to occur near Christmas break.

The Tiger Transit issue is linked to parking and traffic, Bourque said. Parking problems cause traffic problems which causes delays in the Transit routes.

Students requested having a Transit forum to address many of the complaints involving the Transit.

Students also brought up that bicycling could solve a lot of traffic and parking problems.

Bourque said an increase in bicyclists could save the University $10,000 to $15,000 by reducing the need to construct new parking lots.

Bourque said he was pleased with the responses he got from the students.

Appendix I: Transit Operating Model:

(This article is prepared by Jaydeep Chaudhari and Dr. Christine Curtis and in process of editing for its final text. Any of the text or paragraphs publication is prohibited by the authors.)

"Transit Operating Cost Model" and Management Types

Abstract

Sustainability and parking issues are the key discussion of a transportation plan of American University campuses. Multimodal transportation is the most commonly implemented element of the plan. Bus transit is a widely used and common mode of mass transportation in this regard. Many universities are in the process of initiating the transit system or expanding the current system or collaborating with local transit providers for effective means of transportation. Before taking any action, the financial, social and regulatory aspects need to be studied. The purpose of this paper is to discuss of the process to determine the operation cost and types of management systems of transit through a judgmental data process which is derived from actual data, experience and intuition of decision makers and transit management authority.

Key words: Financial analysis, transit operation cost, transit management, Transit operation cost model

Introduction

"American universities are grappling with the influx of personal vehicles invading their campuses and the street surrounding the campuses." (Dober, 1963, 1996 as cited in Curtis 2004). "In college and university communities, land use, travel patterns, density and centralized policy control often provide the basis for innovative solutions that are designed to provide transit and other non-auto solutions to address contemporary mobility issues. Many campus communities from traditional "college towns" to large urban areas, have implemented or are studying policies to manage parking, provide

transit and shift mode choice" (TCRP 39, 2002, pp 3). University authorities traditionally control the land use, transit and parking services so innovative transportation planning solutions can be seen on campuses as implemented. Auburn University is not an exception either. "Auburn University is a preeminent land-grant and comprehensive research institution with more than 23,000 students and 6,500 faculty and staff. Ranked among the top 50 public universities nationally, Auburn is Alabama's largest educational institution, offering more than 230 undergraduate, graduate and doctoral degree programs" (www.auburn.edu).

" In response to a shrinking supply of parking, Auburn University initiated a transit system in 1997, funded by a mandatory student transit fee, to serve the student on campus and off campus in areas adjacent to campus" (Curtis, 2004). A transit system is a huge capital and operation investment to own. The universities use primarily either a purchased or an owned transit system. In a purchased system, a university outsources a complete system limited to a university or receives the service from existing local transit providers by giving contract to it (e.g. Clemson University and Clemson city). In an owned system, a university limits service for its own purpose and sometimes it sells the services to local community (e.g. University of California-Davis and Davis city). Auburn University has a purchased transportation system since its beginning.

Under Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the various federal funds are available to the universities for capital and operational investment of their transit services. Federal Transit Authority (FTA) administers fund sections of 5309 (Major Capital Investment Program), 5307 (Urban Area Formula Program), 5311 (Non-urbanized Area Formula Program),

5338 (Job Access and Reverse Commute Program) etc. as part of SAFETEA-LU (www.athenstransit.com). Other than this, Congestion Mitigation and Air Quality Improvement (CMAQ) Program is also to improve air quality and to manage traffic congestion. The common objectives of these various earmarks are social well-being, economic development and environmental quality (Talley & Anderson, 1980). The earmarks can be used for capital expansion and improvement that increase ridership and bicycle and pedestrian facilities (www.ntdprogram.com). Auburn University's purchased transportation contract expires in year 2010 and the university is looking for different alternatives of its transit service. The purpose of this paper is to discuss different alternatives of management system of transit and their pros and cons. These alternatives are based on the operation cost analysis. For the analysis, the 'Transit Operation Cost Model' has been developed by the authors. This model is useful to understand (1) basic elements and variables of a transit system, and (2) impact and comparison of the major variables to the operation cost. In short this model is a financial analysis of the operating cost. "The financial analysis establishes (1) the funding requirements for both the capital and operating costs of each alternative, (2) the projected yields from existing sources of funds used to support transit, (3) the potential yield from other possible funding sources in cases where existing resources are not sufficient, and (4) measures the feasibility of the alternative financing packages assembled for each alternative" (Edwards, 1999. pp.325).

The paper is divided in mainly two sections. The first section presents the model structure. The model's elements and their variables are discussed in depth. This section is followed by the design approach. The second section presents the discussion of

the types of management systems based on the first section. Finally, a summary and conclusion section is presented.

Model Development Approach

The model is designed for a decision making purpose. The design approach of this model is the same as the one pioneered by John Little of MIT in the late sixties. He describes “A model that is to be used by a manager should be simple, robust, easy to control, adaptive, as complete as possible and easy to communicate with. By simple is meant easy to understand, by robust, hand to get absurd answer from, by easy to control, that the user knows what input data would be required to produce desired output answers, adaptive means that the model can be adjusted as new information is acquired, completeness implies that important phenomena will be included even if they require judgmental estimates of their effect, and, finally, easy to communicate with means that the manager can quickly and easily change inputs and obtain and understand the outputs.” The database of this model is based on judgmental data. “Judgmental Data is derived from experience, actual data and intuition which decision makers carry in their heads and which they use in any event to arrive at the final decision”(Ballou & Mohan,1980 pp 126-127). This model requires only minimal input data. The input data “variables” is discussed in the next following topics in Auburn University context. Even though the involved many mathematical calculations can be done by a simple calculator, a computer spread sheet is a useful tool. Microsoft Office Excel or other similar software is useful to design a spread sheet for easy and quick calibration because some of the variables change very often. In addition, the spread sheet will be useful to create charts for different comparisons and analyses.

1. Model Structure:

The transit operating cost is a total sum of those expenses associated with operation, administration and capital investment. The expenses include are but not limited to: drivers' wages, bus repair labor costs, fuel consumption costs, maintenance costs, traffic and advertising, insurance and safety, administration and capital cost of fixed facilities. The cost is classified in various ways in different literature. American Public Transportation Association (APTA) classifies it in two ways (1) on function or activity basis or (2) object classes. A function is an activity performed or cost center of a transit agency. A function base cost is a sum of four basic function vehicle Operation, vehicle maintenance, non-vehicle maintenance, and general administration. An object class is a grouping of expenses on the basis of goods and services purchased. The object classes are the sum of salaries and wages, fringe benefits, material and supplies, fuel and Lubricants, tires and other, utilities and etc (www.apta.com). In Nation Transit Database reporting' 2004 aggregate profile, the operating cost is divided in to four sections (1) Salary, Wages and Benefits (77%); (2)Material and Supplies(9%); (3)Purchased Transportation(6%); and (4)Other operating expenses (8%). Here, transit operating cost is classified as three elements of the model (a) Operating element, (b) Administration element and (c) Capital element (The New Mexico State Highway and Transportation Department (NMHTD), 1990). The stated expenses by APTA are considered as variables and segregated as per their best fit into three elements, which is shown in Figure 1.

The variables described in each element are basic variables which are direct expenses on transit system regardless of a system's size. Whether a system is ten vehicle fixed-route service or demand-response service in a college community, small town, and

metropolitan area. The following variables are to be significant in cost calculation but are not regular expenses: overtime hours worked, vehicle depreciation cost, taxes increment, traffic congestion on city streets, environmental impact cost, annual snowfall etc. A bus fleet requirement and the bus operation hours are the primary basis of the model design. To calculate the bus operation hours, the number of buses, bus routes and operation timings are necessary. The fleet requirement is the essential component to calculate the bus operating hours. The different transit models and equations can be used to determine a fleet requirement. At Auburn University, we estimated the fleet requirement consulting with the Transit and Parking Director shown in Table 1. Our estimation is based on experience and the current growth of the transit services of Auburn University. In the next three sections, we discuss the elements of the model in detail. The cost estimates are for the existing fleet requirement. The projected cost to prepare a five year financial plan will be presented in the input and output data of a model topic following by the elements discussion.

(a)Operating Element:

The operating element is comprised of five basic variables (a.1) Fuel cost, (a.2) Bus Maintenance, (a.3) Utilities, (a.4) Bus Insurance and (a.5) Drivers and cleaners' salary. As shown in Graph 1, this element consumes 65% of the total cost. A proper utilization of this element in providing effective and efficient transit service is an art as well as science of management as it consumes a substantial amount of the cost. In dealing with this aspect of transit operation, "the transit management must maintain three broad objectives: (1)The maximum utilization of human resources must be obtained within the constraints of work rules, schedule and other operation conditions;(2)Drivers

must be provided a working environment that is clean, comfortable, and as safe as possible;(3)There must be an established framework for performance of the transportation function. This must be clearly communicated to the drivers. On street supervision should be provided, and an understood mechanism for dealing with failure to perform must be maintained" (Rango, 1979, pp 449).

The fuel cost and drivers and cleaner's salary are often varied and others are the fixed costs. Before discussing each element's individual variables, it is necessary to understand the units of cost. The transit cost can be calculated in terms of per mile cost, per hour cost, per day cost and so on. But in the majority of cases, transit costs are calculated on a per hour basis.

- **Rationale behind the transit expenses on a per hour basis**

The transit frequencies are depended on the ridership characteristics. The bus frequencies are scheduled more during the peak hours and less after non peak hours. The transit operating schedule is managed on hourly basis. There are two main expenses of transit services (1) Fuel and (2) The payment of service class employees like bus drivers, mechanics, cleaners etc. Both of the expenses are calculated on a per hour basis. These expenses range from 50% to 60% of the total transit operating cost.

(1)Fuel: The majority of transit buses use diesel as fuel. Fuel efficiency is measured by mileages driven per gallon. A large bus consumes a gallon of diesel for every 5 to 6 miles whereas a small bus it is 9 to 10 miles depending on bus type, model, and its condition. But in case of a transit bus, it is not logical to measure fuel efficiency on mileage basis due to following reasons: (1) A transit bus makes frequent stops and wait till passenger's

on and off board activity; (2) Drivers keep on a bus engine at bus terminals while having their refreshment; (3) A heavy traffic congestion on city streets, bus drivers has to wait till traffic to be cleared. Thus transit mileages are measures by per hour basis. A transit bus consumes 2.5 gallon diesel per hour on the city roads. A fuel price fluctuate very often which impacts on transit operating cost.

(2)The payment of service class employee: Transit services pay their service class employees like drivers, mechanics, supervisors and cleaners on per hour basis rather than on a fixed payroll. This service class has more number of employees than any other section of personnel. The universities do not prefer a unionized driver organization and to deal with employment issues. A university's primary responsibility is to educate the future generation and conduct the research rather than to be engaged in the management issues of a transit. Sometimes, a university hires students for part-time as drivers, supervisors, office employees or hires private agencies to provide service class employees. In this case, payment is made on a per hour basis, and it takes 30% to 40% of total operating cost. If a university hires these large numbers of employee on a permanent basis for a transit service, it will have to pay all required fringe benefits as per employment regulations of the state and federal governments. To hire this class employee on permanent basis will result in a greater the transit operating cost. The college towns of land grant universities like Auburn experience a shortage of drivers and mechanics. Auburn University transit system provides service from early morning to late night on different schedules and it needs various personnel on the different timings. It would be a lot easier to handle a mass of spectators on a collegiate game day than the daily operation of a transit system and drivers management.

A fuel consumption and payment of service class employees can be determined through the transit operating schedule. Before any further discussion on the cost, the bus operating hours have to be calculated. To calculate the bus operating hours, the following attributes are required : (1) Operating hours of day, evening and night timings for fall, spring and summer; (2) Number of operation days in each semester and (3) Number of buses (B_n) in operation. In universities, usually fall and spring semesters are considered as regular semesters and student enrollment are almost the same. At Auburn University, the transit buses are operated for 81 days in each fall and spring semester. In summer semester, the buses are operated for 53 days and the students' enrollment is dropped from 23,000 to 10,500. The operating timings are also different for a summer semester. The numbers of buses are scheduled as per requirement of each designated route and a headway between two buses on each route. When more buses are in operation during peak hour periods, additional bus drivers are necessary in emergency, during shift replacement and to relieve drivers for refreshment. Auburn University's bus schedule is shown in Table 2 with number of buses and required number of bus drivers.

From the table 1, one can figure out total operating hours and bus drivers' hours. The mathematical formula is to calculate operating revenue hours:

$Oh_d = Oh_s * B_n$

Oh_{fs} = (Oh_d of spring and fall * D_{fs})

Oh_{ss}=(Oh_d of summer $*$ D_s)

Now,

Total operating revenue hours (Oh_r)= Oh_{fs} + Oh_{ss}

Where,

Oh_d = Daily Operating Hours

Oh_s = Number of daily operating hours in each segment of a schedule

B_n = Number of buses in operation

Oh_{fs} = Total operating hours of fall and spring semester

D_{fs} = Total days of operation in fall and spring

Oh_{ss} = Total operating hours of summer semester

D_s = Total days of operation in summer semester

Oh_r = Total operating revenue hours

As mentioned before, a transit system needs more drivers than the number of buses. To calculate bus drivers hours, in the above three formulas, the number of drivers will be replaced instead of the number of operating buses. At Auburn University, the bus maintenance premises is located six miles away from the main campus. Before the first bus arrives at the designated bus terminal for boarding passengers, it has to leave 15 to 30 minutes before from its maintenance department. These six miles are known as the dead head miles. Although, the dead-head miles are not revenue miles, it significantly adds a cost to transit. Thus the dead-head miles and their associated cost should be calculated along with operating revenue hours. In the above mentioned formula, the operating timings will be changed according to the dead-head miles traveling timings and preparation of bus for operation.

Now,

Total operating hours (Oh_t) = (Oh_r + total dead head miles operation hour)…….Step1

The accuracy of the transit operation cost depends on how carefully both the attributes are calculated. In existing transit service of Auburn University, the total operating hours (Oh_t) are 88,238 per year and bus driver hours are 104,138 per year.

a.1. Fuel cost: In the earlier discussion of *"Rationale behind the transit expenses on a per hour basis"* elaborately discussed about the fuel and concluded that the bus mileages are on the basis of per hour.

Now, Fuel cost (F_c) = Operating hours (Oh_t) * Current fuel rate (F_r)

Fuel cost is the most fluctuated variable of the operating element. When the model was prepared for Auburn University, the cost was $ 1.73/gallon and at this date January 29, 2006 it is $ 2.12/gallon.Because a public university is considered as a government entity, it might be eligible for a tax exemption. Thus, a fuel cost could be lower than a current commercial market price.

E.g. Fuel cost = Oh_t * F_r where Oh_t = 88,238 and F_r= $1.73

= (88,238 X $1.73)

= $ 381,629/yr……Step2

a.2 Bus maintenance: Bus maintenance include but are not limited to servicing and cleaning; inspection; body repairing; engine assembly; breaking system; electrical system; air system; air conditioning and heating system; drive train; suspension and

steering system; cooling system; vehicle accessories; tires and tubes and lubricants. Public transit agencies do not use a common maintenance reporting system. Some operators consider a maintenance cost as actual costs based on the individual mechanic's wage rates; other use average costs; some limit costs to labor expenditures; others include materials and overhead costs (Drake & et.al, 1988). Bus maintenance is an important factor in making decision of a capital investment of buses. At Auburn, due to a shortage of mechanics ,they are hired as permanent employee. The maintenance cost excludes the labor cost.

Bus maintenance cost (BM_c) = (Average maintenance cost (M_c) * Number of buses (B_n))

= ($ 6,000 * 35)

= $ 210,000…….. Step 3

a.3 Utilities: Utilities are related to the maintenance of fixed facilities. Fixed facilities are the investment of a maintenance shop, servicing facilities, transfer station, high pressure bus washers, energy saving equipment like a solar generator and heat curtains, and communication equipments like telephones, radios and advertisement boards etc (Drake & et. al, 1988). At Auburn , the utilities include fixed facilities' maintenance, electricity and water bill which costs $ 12,000/yr. The communication equipment costs $ 3,600/yr.

Total Utilities Cost ($U_{c)}$ = (Fixed facilities maintenance +

Communication equipments maintenance)

= ($ 12,000 + $ 3,600)

= $ 15,600 per year……...Step 4

a.4 Bus Insurance: Bus Insurance cost depends on the types of vehicle, installed safety equipment, age of bus drivers, age of vehicle, types of coverage etc. If a university hires student drivers, an insurance cost is expected to be higher than usual. The estimated average the insurance cost is $5,000/yr for large buses and $3,000/yr for small buses. As shown in Table 1, Auburn University transit fleet has 29 large and 6 small buses.

Bus Insurance = ($ 5,000 * Number of large buses) + ($ 3,000 * Number of small buses)

= ($ 5,000* 29) + ($ 3,000 * 6)

= ($ 145,000) + ($ 18,000)

= $ 163,000 per year……...…… Step 5

a.5 Bus drivers and cleaners: Though bus drivers drive either a small bus or large bus, a transit service has to pay the same amount regardless of a bus size. This service class labor plays vital role in the problems and opportunities transit management faces in serving the public (Jennings & others, 1979). Auburn University provides a transit service since morning 6:30 am to late night 3:00 am. A transit company hires the almost 90 full time and part time drivers to run the bus system for 35 buses. The organized and permanent driver employees may create labor issues which are prevalent. As mentioned before about the shortage of drivers and a recent strike of New York city are the example of it. A transit industry also faces various constrain under include general federal and

state labor laws, transit-specific labor law, and local employee policies. If a university hires the full time drivers, cleaners and mechanics, it has to pay the fringe benefits. These service class employees cost 30 % to 40% of the total. But if a university provides a benefit package, the cost will increase up to 35% to 45% .The organize driver force can exercise its rights and argue against any activity which may have negative affect on them as well as a transit service (NMSHTD, 1990). As we discuss in previous topic, *'Rational behind the transit expenses on a per hour basis'* bus drivers hours can be calculated from total operating hours. Auburn University has total 104,138 drivers operating hour's derived form the formulas to calculate total operating hours. In those formula, number of buses are replaced by number of bus derives. Sometimes, the students use carpooling and do not wait for a transit services and more buses may not be required. When the buses are pulled of from services, drivers clean the buses in their free time so the cleaners are not needed. We assume $ 9.5 wages to drivers.

Now, Total Drivers payment cost =

(Drivers operating hours (Do_s) *average wages per hour basis)

= (104,138 X $ 9.5)

= $989,306……Step 6

(b)Administrative Element

Transit management is the crucial part of a university administration. A general administration is inclusive of transit director, manager, office assistant, and other personnel depend upon the type of management system and administrative structure established by a university. A successful transit service's manager must be knowledgeable in wide array of management components like maintenance, insurance, marketing, route planning and scheduling, finance, accounting, personnel training, safety etc. Additionally, a manager or director sets up the line of regular communication with numerous elected and appointed officials of local, state and federal government (Ringo,1979) Auburn university's transit service is part of auxiliary services. The administrative hierarchy is shown in the Figure 2.

Auburn University has the total outsourced transit system, where a transit management is administer the system and it does not need to hire the service class personnel. If a university owns the system, it has to hire the mechanics, supervisors, genitors etc as per the system size. The director is administrative head of both service but they are treated as separate agencies. In the present administrative structure, a transit manager is responsible to cooperate with a transportation agency to manage a bus schedule. The director's responsibilities are previously stated as a transit manager. The director's pay is shared by both the services equally. A cost of administrative element is including of the employee pay, the office facilities & supplies and overhead expense. The overhead expenses are including drivers and employees training, license fees, and auditing which is usually 10% of total employee pay. The actual administrative expense

can be easily obtained form a transit services. As this cost is fixed and calculated on a yearly basis.

Now

Cost of Administration element (C_A) = $W_E + O_E + O_{HE}$

Where,

W_E = Total pay of all employee

O_E= Total yearly office expenses

O_{HE} = Overhead expense.

Again,

W_E = Actual Pay of each employee + fringe benefits ……Step 7

The student workers are considered as part-time employee so any fringe benefits are not awarded to them. Here, the overhead expenses are including office facilities and supplies. In case of Auburn, the administrative element cost is determined $ 537,046 as a university operates the system.

(c) Capital Element

Capital element is an investment of (c.1) Vehicle and (c.2) Fixed Facilities. This investment includes equitation and installation of a property for a long time.

c.1 Vehicle capital cost: A vehicle capital cost includes of buses, para-transit service vehicles vans etc. A bus size on each route is varied as per passengers and their travel time. During the peak hour, the large buses are needed. To maintain frequency schedule, a small bus can be provided during off-peak hour on a same route. Thus, a transit agency requires various sizes of buses and other vehicles. At Auburn University, there are 6 small scale buses of 20 passengers' capacity and 29 larger scale buses of 40 passengers'

capacity are required. An amortization period of the buses is considered as 10 to 12 years. To calculate annual capital investment, a small bus purchase price is taken $ 60,000 and for a larger bus the price is $ 100,000 according to the specification required by a transit system. After an amortization period, a bus value is considered as nil. American Public Transportation Association's "Standard Development Program" provides detail information for bus specifications and technical guidelines of the buses which can be obtained though www.aptastandards.com. In addition to this, "Small Transit Vehicle economics *(STVe)*" model is an economic model designed for transit planners and others making decision about the purchase of small transit vehicle (TCRPT61,2000).

Now,

Bus Capital cost (B_{cc}) per year =

(Initial purchase price + Interest of the purchase price) ÷ Amortization period

Here, we assume 10 years as the amortization period.

Small bus cost = (60,000 + (60,000*5%)) ÷ 10

= $ 6,300/year

Larger bus cost = (100000 + (100000*5%)) ÷10

= $ 10500/year

Total capital cost of bus per year = (Small bus cost* number of buses+

Larger bus cost* number of buses)

= ($6,300*6+$10,500*29)

= $ 342,300

c.2 Fixed facilities capital cost: Fixed facilities investments include following items:

(1) Land acquisition

(2) Design and development of major facilities like maintenance shops, servicing facilities, administrative building, bus terminal, bus stops etc.

(3) Installation of servicing equipment like high pressure bus washer, bus lift, communication system, engine crane etc.

(4) Installation of energy saving equipment like solar generators heat curtains etc. (Drake & et. al, 1988)

For Auburn University, the bus terminal and facility building are required. The facility building includes the maintenance shop, servicing facilities and bus parking. These estimated building's useful life is considered as 20 years.

Now,

Capital cost of fixed facilities = (Total building cost/ 20yrs)

= $ 1,500,000/20yrs

= $ 75,000 /yr

Total capital cost = (Vehicle capital cost + fixed facilities capital cost)

= ($ 326,000 + $ 75,000)

= $ 401,000/yr …….Step 8

Model input-output data and Analysis

The above discussion is summarized in tabular format as shown Table 3. A Microsoft Excel or any other software can be used to develop a spreadsheet in a more elaborative manner. As shown in Table 3, step 1 through step 8 act as input data and output data can be prepared as per requirement. In this model, a fleet projection is a crucial element in preparing a five year financial plan for a transit service. The frequent cost change in fuel also requires thoughtful consideration while preparing a financial plan. Graph 2 and Graph 3 show the cost distribution with capital cost and without capital cost respectively. The graphs show that the fuel cost and bus driver's payment consume almost 50% cost of the total expenses as discussed earlier. Another observation from graph is that the 55 to 65% cost is associated with personnel. The operation cost is shown in different units which can help to determine fares, cost per hour, cost per day, fuel cost per day, cost per bus etc. The next topic is discussed on the basis of the model's output data analysis.

(2)Types of management

In recent years, a transit service faces management issues like government grants, transit planning, market plans, personnel etc. The most influential issue is the personnel related because personnel prepare a system for a delivery to the prospective users. The actual bus preparation is in the hands of the rank-and-file workers of the transit system – the mechanics, supervisors, cleaners and most important vehicle drivers (Rango, 1988). The understanding of the employee problems, challenges and motivations is a basic part of management. Simply, a management system is divided into two types,

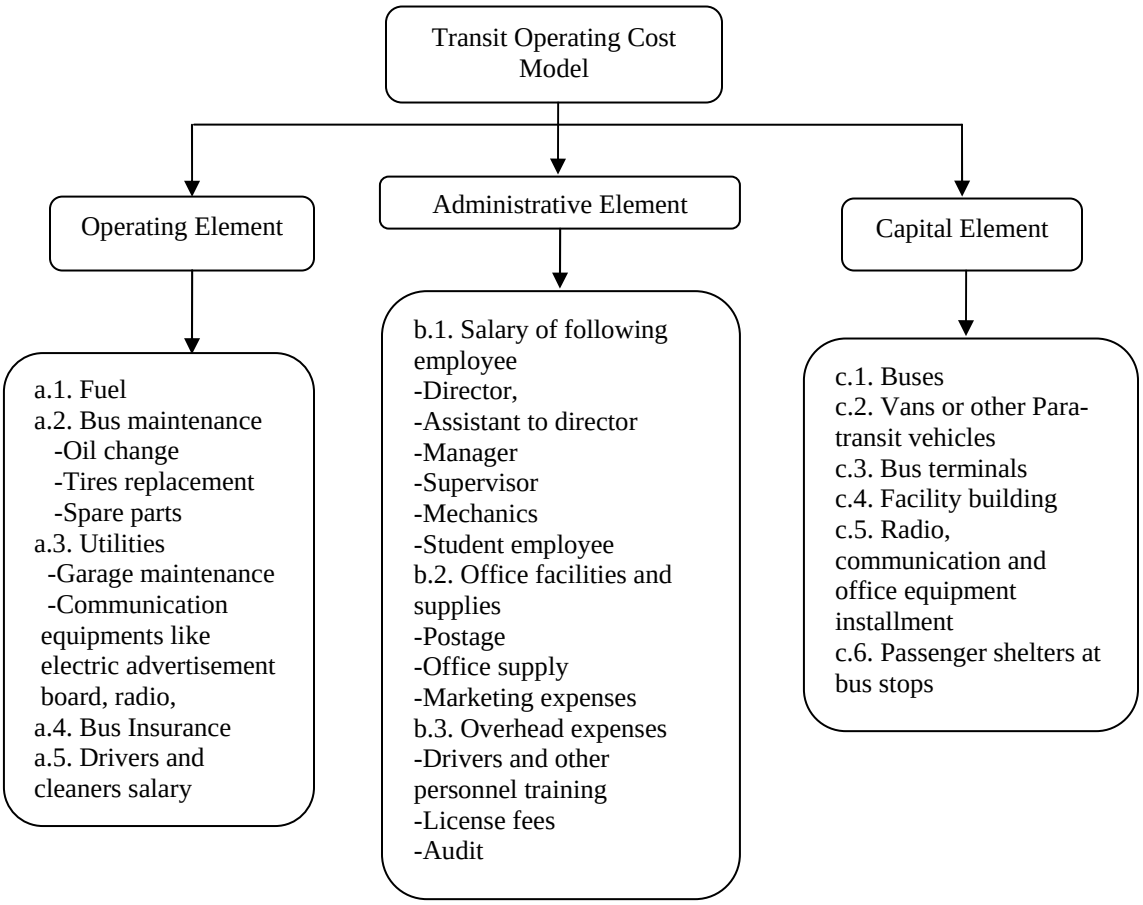
university owned system and total outsourced system. Virtually, the total outsourced system is more expensive option and a university can face the personnel issues more extensively than expected. To eliminate management issues, an outsourcing of the rank-and file workers- will result into a new management system. This new management system is named as partial outsourced. The intentions to seprate the rank-and-file workers are discussion in previous topic under the operating element. In short, the outsourcing of driver's management is to assign labor to equipment for 100% efficient production of a system. This production means a utilization of human resources to provide safe, timely and convenient transit service. The partial outsourced system is assumed less expensive than the total outsourced and more efficient than a university own system. As shown in Figure 3, the types of management are divided into three types, (1) University owned system, (2) Partial outsourced transit system, and (3) Total outsourced system.

(1)University own system: In this system, the whole transit is operated by a university. A university recruits all employees as mentioned as discussed in the administration element of model structure and drivers and cleaners. If a university recruits them, they are eligible to receive all fringe benefits offered by a university. In this case, an operation cost would be higher than other two management systems because the bus drivers' salary cost almost 30% to 40% of total operating cost including the capital cost. In addition to the payment issues, a university might face the labor issues in case the drivers are unionized. In this system, a university has total control over the system and operates the system as per its requirement. Other than the recruitment issue of bus drivers, training of the bus drivers on each change in the system needs constant effort and time. A model structure shown in Table 3 is for a university owned system.

(2) Partial out sourced system: To eliminate the bus drivers' issues, this huge workforce is out sourced through a private company. In this case, the bus drivers; cleaners; mechanics and supervisors will be hired by an outsourced company and a university will pay a management fee and overhead expenses. A management fee will act as a profit of a company and overhead expenses will be used to pay for personnel, drug tests, license fees, training and other miscellaneous expenses. In this system, a university will have same control over a system as its own operating system. An outsourced company management element will be the new component of a model structure for this management system. This component will have bus drivers (Step6), supervisors, mechanics, management fees and overhead expenses. The supervisors and mechanics will have to be removed from the administration as shown in Table 3. For Auburn University, the management fees and overheard expense are assumed as 10% each of total expenses.

(3) Total out sourced system: In this system, a university will outsource the whole system including capital cost, operating cost and some part of management. A university will have only a transit director, transit manager and office assistant to over look an entire system in terms administrative aspects. A mode of payment will be either per operating hour or other suitable method as per a contract. Sometimes a company charges a surcharge if a fuel price goes out an affordable limit. In that model structure, other than the administrative expenses everything will be payable amount to an outsourced company. The operating cost would be higher than both previous cases and a university will not have the same control to run the system as discussed before. A university might have to pay even if a transit is not required to be in an operation. A model structure of the partial outsourced will be useful to negotiate contract with an outsourced company.

Figure 1: Model Structure



Graph 1: Share of transit cost model's elements

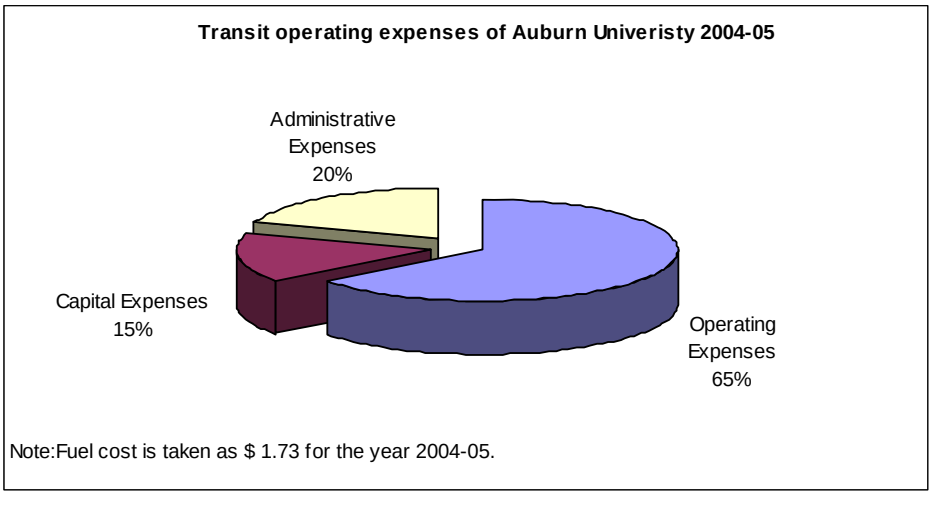


Table 1: Fleet Requirement

Types of Bus	Existing	Projected				
	Year (04-05)	Year (05-06)	Year (06-07)	Year (07-08)	Year (08-09)	Year (09-10)
Small bus	6	6	7	7	8	8
Large bus	29	32	34	37	39	42

Table 2: Bus Operation Schedule: (2004-05)

Operating revenue timings	**Number of Buses**	**Number of Drivers(FTE)**
Fall & Spring Timings **(Nos. of Operation days 81 each semester)**		
6.30 am to 6.30 pm	35	42
6.00pm to 7.30 pm	6	6
7.30 pm to 10.30 pm	5	4
10.30pm to 3.30 am	2	2
Summer Timings **(Nos. of Operation days 53 each semester)**		
6.30 am to 5.30 pm	24	28
5.00pm to 7.00 pm	2	2

Note: FTE: Full Time Employee

Figure 2: A hierarchy of administration

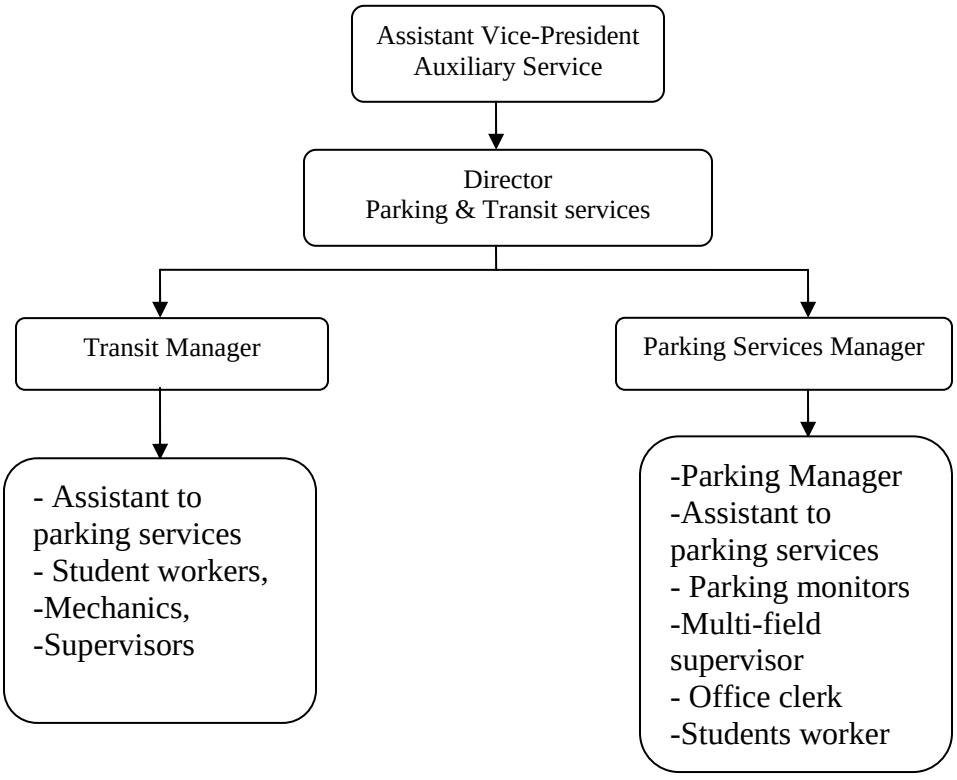
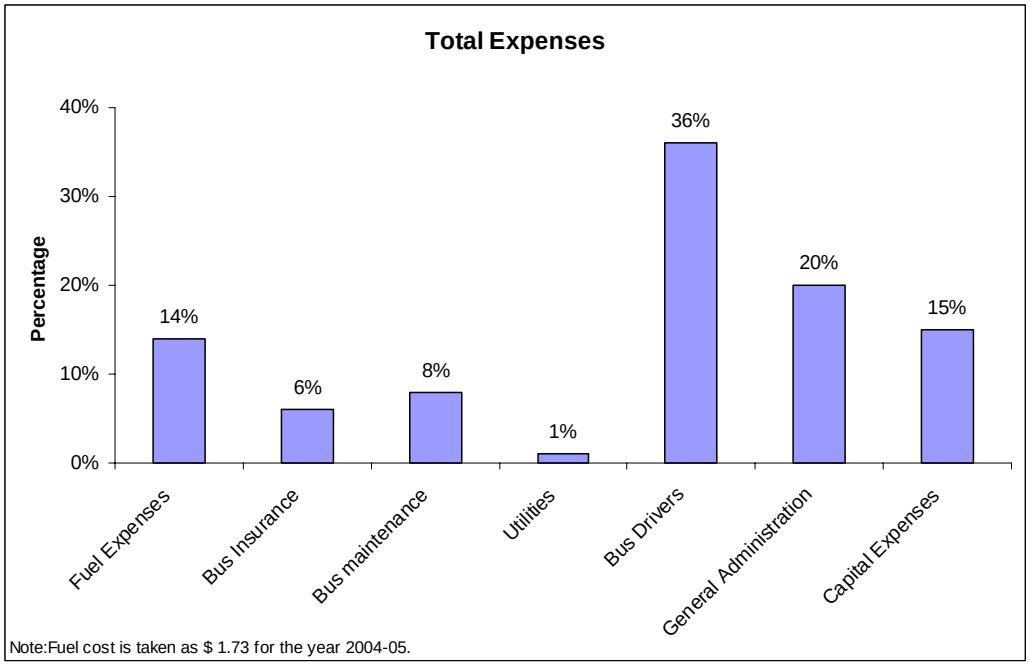


Table 3: Model Input and Output Data

	Step	Types of Expenses	Existing	Projected				
			Year (04-05)	Year (05-06)	Year (06-07)	Year (07-08)	Year (08-09)	Year (09-10)
Input Data		**Types of buses**	35	38	41	44	47	50
		Small	6	6	7	7	8	8
		Large	29	32	34	37	39	42
	Step 1	**Number of hours of operation/year**	88,238					
		Operating Element						
		Fuel cost (In dollars)	1.73					
	Step 2	Fuel cost/year @ 2.5gl/hour/bus(In dollars)	381,629					
	Step 3	Total bus maintenance(In dollars)	210,000					
	Step 4	Utilities(In dollars)	15,600					
	Step 5	Bus Insurance(In dollars)	163,000					
	Step 6	Bus Driver						
		Remuneration/hour	9.5					
		No.of Bus operated hrs by drivers/year	104,138					
		Total payment/year (In dollars)	989,306					
		Administration						
	Step 7	Total Management(In dollars)	411,900					
		Overhead Expenses (In dollars)	125,146					
		Capital Element						
	Step8	Capital cost (In dollars)	401,000					
Output Data		**Total Operation cost** (In dollars)						
		Total operating cost	2,697,581					
		Total operating cost per bus per year	77,073					
		Total operating cost per day	12,546					
		Operating cost per hour per bus	31					
		Operating cost per bus per day	358					

Graph 2: Cost Distribution



Graph 3: Cost Distribution with out Capital cost

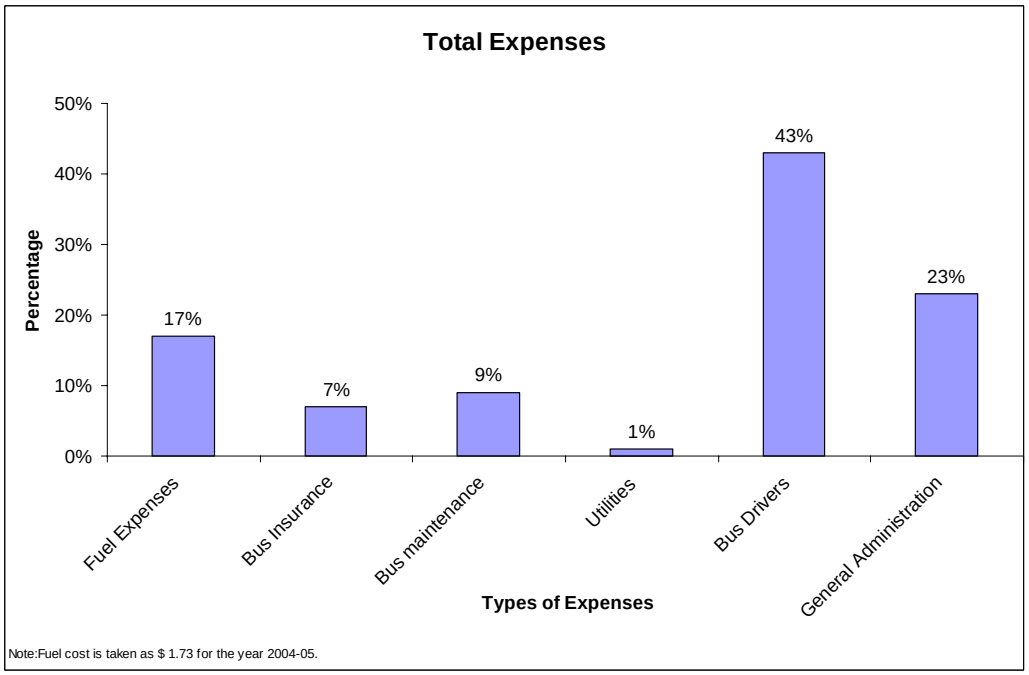
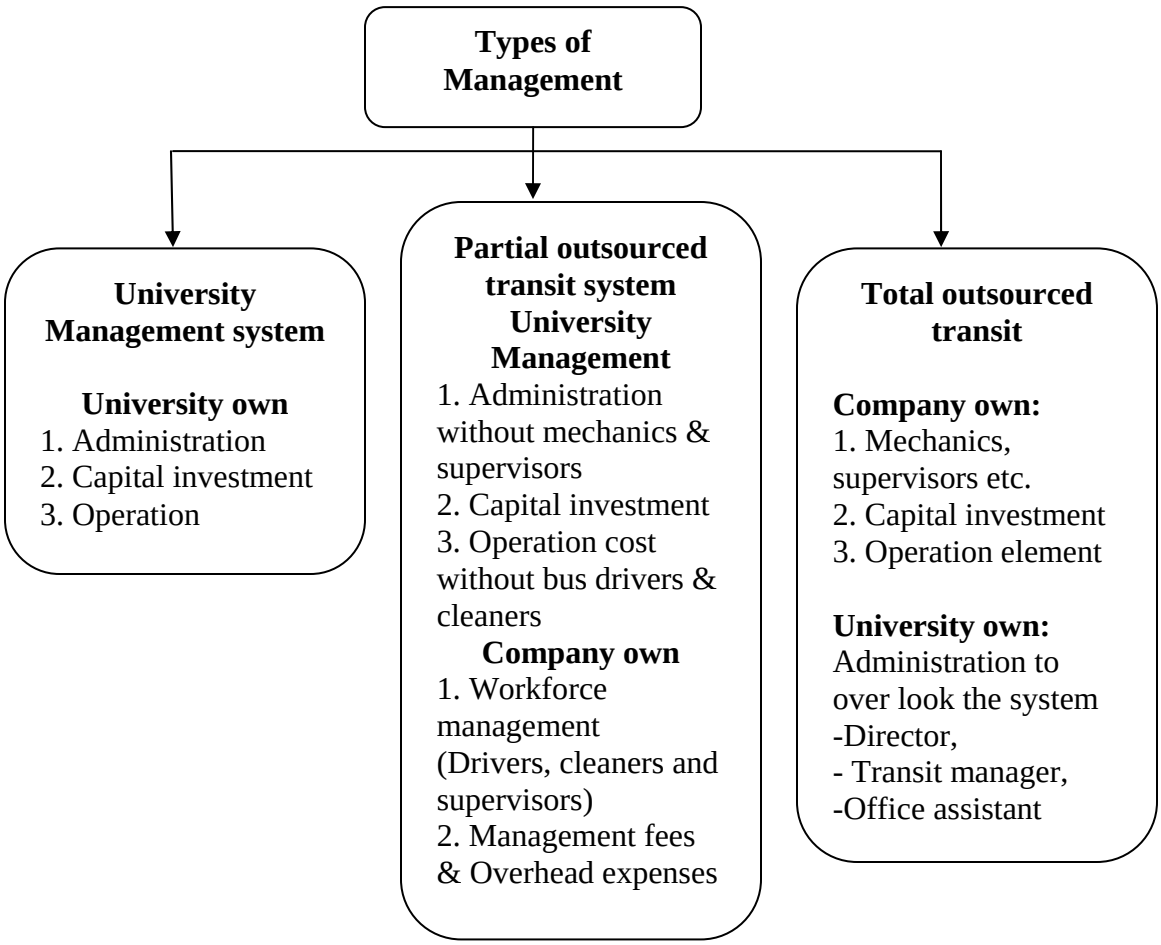
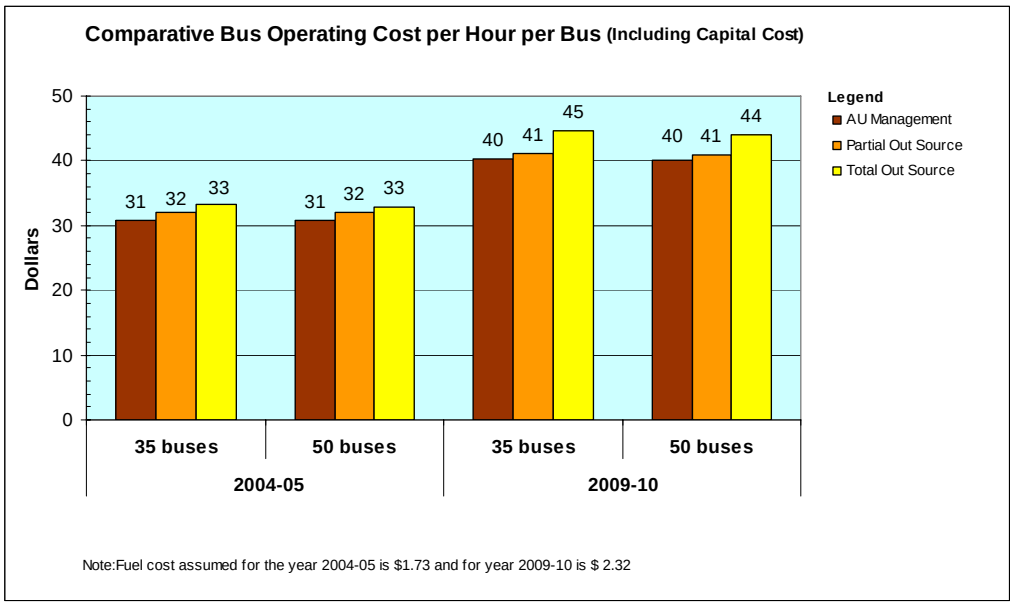


Figure 3: Management system



Graph 4: Cost comparison



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Appendix J: Federal Funds for Transit development

This appendix's information is obtained from the Athens Transit report 'Athens Transit System- Transit Development Plan' section 7.0-Finanacial Plan p 7-1, 7-2 and 7-3. This report can be obtained from http://www.athenstransit.com/tdp.html

Federal Funds:

FTA administers the following funding programs under SAFETEA-LU 2005 act. SAFETEA-LU is an extension of The Transportation Equity Act for 21st century with increase in federal fund. SAFETEA-LU bill includes authorization for funding for FY 2004 through FY 2009.

(1) Section 5309 Major Capital Improvement Program

The Major Capital Improvement Program provides transit capital assistance for major transit investment, including buses and bus related facilities. This federal source of funding can be utilized and relied upon heavily for transit vehicles and transit-related facilities such as intermodal centers, park and ride facilities, new or refurbished operations and maintenance facilities, and associated transit capital equipment. For the most part, this federal program provides 80% of the project cost, and requires a 20% State/local match.

(2) Section 5307 Urbanized Area Formula Program

The Urbanized Area Formula Program provides transit capital and operating assistance to urbanized areas with populations of more than 50,000. As Auburn University population is 30,000 so it is not eligible for this fund.

(3)Section 5311 Non-urbanized Area Formula Program

This program provides grants for transportation projects that are included in a State program of mass transportation service projects (including service agreements with private providers of mass transportation service) for areas other than urbanized areas. Eligible activities under the program include planning and marketing for intercity bus transportation; capital grants for intercity bus shelters; joint use stops and depots; operating grants through purchase-of-service agreements, user-side subsidies, and demonstration projects; and coordinating rural connections between small transportation operations and interncity bus carriers. A capital project under this section may not be more than 80 percent of the net cost of project. A grant to pay a subsidy for operating expenses may not be more than 50 percent of the net cost of the operating expense project. Under this section of fund, Auburn University is eligible to receive fund for the capital project of Transit.

(4) 5338 Job Access and Reverse Commute Program

Section 3037 of Title III outlines a grant program entitled “Job Access and Reverse Commute Grants.” Eligible projects include an access to job project, or a reverse commute project. FTA defines an access to job projects as one relating to the development of transportation services designed to transport welfare recipients and eligible low-income individuals to and from jobs and activities related to their employment. Tiger Transit is ride to school system so it will not eligible to receive fund under this section.

The following find is administered by Federal Highway Administration.

- Surface Transportation Program (Highway “Flex” Funds)

A key feature of the SAFETEA-LU bill is the flexibility provision that provides the option to State and local government of using some Federal Highway Administration funds for transit project. These flexible highway fund programs include the Surface Transportation Program (STP) which is the 80% federal share and may be used for all projects eligible for funds current FTA program. Use of flex funding is often utilized when there is a consensus in that would typically be reversed for highway projects to a transit projects. Therefore, project governments, transit operator and State DOT acting through local metropolitan planning process, include in subsequent TIPs. This funding source has potential for the park and ride lots, and possibly the operations and maintenance facility.