Greenlink
Comprehensive Operations Analysis

Final Report

August 2017

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EXECUTIVE SUMMARY

The Greenlink Comprehensive Operations Analysis (COA) is an analysis of the Greenlink bus network. Its purpose is to identify strengths and areas for improvement, and provide suggestions to improve efficiency and increase ridership while remaining revenue neutral.

Desired outcomes of the study include:

- Baseline data on performance to make decisions and measure future success
- Reintroduce Greenlink to key community stakeholders and public
- Identify opportunities for innovation and partnerships
- Improve efficiency, service levels, and credibility within the community
- Small wins to help build momentum for bigger things later

Outreach

Significant outreach efforts were conducted throughout the study in many ways, including an extensive community survey, public open house, and stakeholder interviews. Chapter 1 includes details on the outreach effort for the COA.

The community survey was conducted from February 20-March 28, 2017. A total of 1,371 responses were received. Among the findings:

- Greenlink riders make up roughly one-third of the total responses
- Over 90% of non-riders own a car, while less than 30% of riders do
- Frequency is the number one ranked improvement
- Non-riders asked for service expansion (e.g., route extensions, not go downtown)
- Riders were more supportive of expanded span of service (e.g., later weeknights, later Saturdays, Sunday service)
- Woodruff Road is overwhelming first choice for a service extension
- Real time arrival information and free Wi-Fi are top two desired amenities

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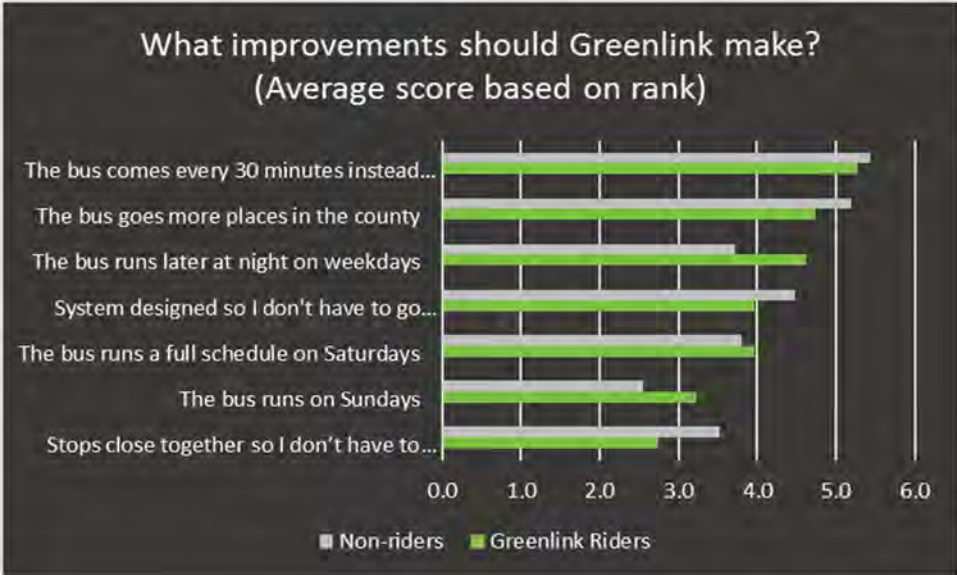
Fleet and Facilities
A brief review of Greenlink's fleet and facilities was conducted, and the results are provided in Chapter 2.

- Greenlink's current preventive maintenance (PM) program was reviewed and found to be adequate for the size of current fleet
- Greenlink has a smaller number of miles between road calls (MBRC) than most agencies, which could indicate operational issues with the maintenance program
- Fleet recommendations include
  - Creating a set of goals and objectives for the maintenance department
  - As fleet expands, consider developing a Standard Operating Procedure (SOP) book to streamline all fleet maintenance processes
  - If budget allows, hire a maintenance Quality Assurance manager
- The maintenance facility is undersized for the needs of the Greenlink fleet

Transit Market Analysis
Chapter 3 reviews demographics and transit market information for Greenville. Greenville is growing, and that growth is driving increased demand for transit in the region.

The culmination of this chapter is a transit propensity analysis. This analysis score was created to show the best places for transit investment in Greenville.

- Greenville has a dense but compact core area surrounding downtown with high transit propensity, but locations with high transit propensity are limited outside of this area
- Reinvestment in areas adjacent to the core is necessary to increase transit ridership
- Increases in housing and employment densities in the outer areas with lower transit propensity are needed to support future service expansion

Network Performance
In Chapter 4, route performance information was collected at the system, route, and stop level.
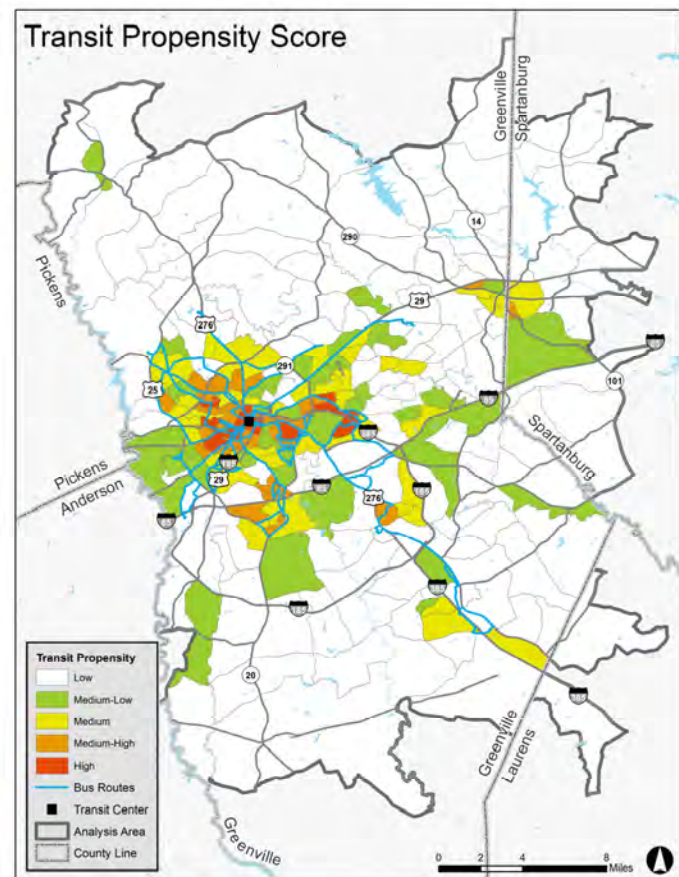
For the system-level analysis, a peer comparison was conducted, comparing Greenlink to five similar sized metros in North Carolina and South Carolina. Findings include:

- Greenville is underfunding its transit system. On average, its peers are operating much more service relative to area size, and are spending $10-12 million annually to do it (compared to Greenlink's $4.5 million).

- This underfunding means the system is not as useful or convenient as it could be. As a result, Greenlink is much less productive in attracting riders.

- Greenlink does better on cost efficiency and vehicle utilization. The agency gets a lot of service out of its funding and vehicles.

- Although Greenlink is spending money more efficiently than its peers, it us using FTA funds designed for capital to fund its operation expenses. These funds were designed for capital items such as vehicles, facility upgrades/additions, bus stop placement, and other equipment. By using these funds for operating, Greenlink is unable to fund a capital replacement plan.

Ridership data was collected to conduct route and stop level analysis. A ridecheck was performed in late February 2017. This ridership data, along with other information on cost and service, revealed the following:

- Best performing routes in the system are Route 2 (White Horse Road), Route 10 (Augusta Road), Route 3 (Poinsett/Rutherford), and Route 12 (Overbrook)
- Worst performing routes in the system are Route 16 (Circulator), Route 14 (Mauldin/Simpsonville), Route 6 (Anderson Road), and Route 9 (West Parker/Berea/Woodside)
- On-time performance was also assessed, because a pulse operation like Greenlink needs all routes to operate on time to be effective. It was found that Route 3 (Poinsett/Rutherford) is late 91% of the time, with Route 11 (Wade Hampton/Taylors) a distant second, being late 36% of the time.
- At the stop level, the analysis shows that many of best performing stops are outside of the Greenville core, and tend to focus to focus on large scale activity centers and key rider destinations like major shopping centers, Walmarts, hospitals, and education facilities.
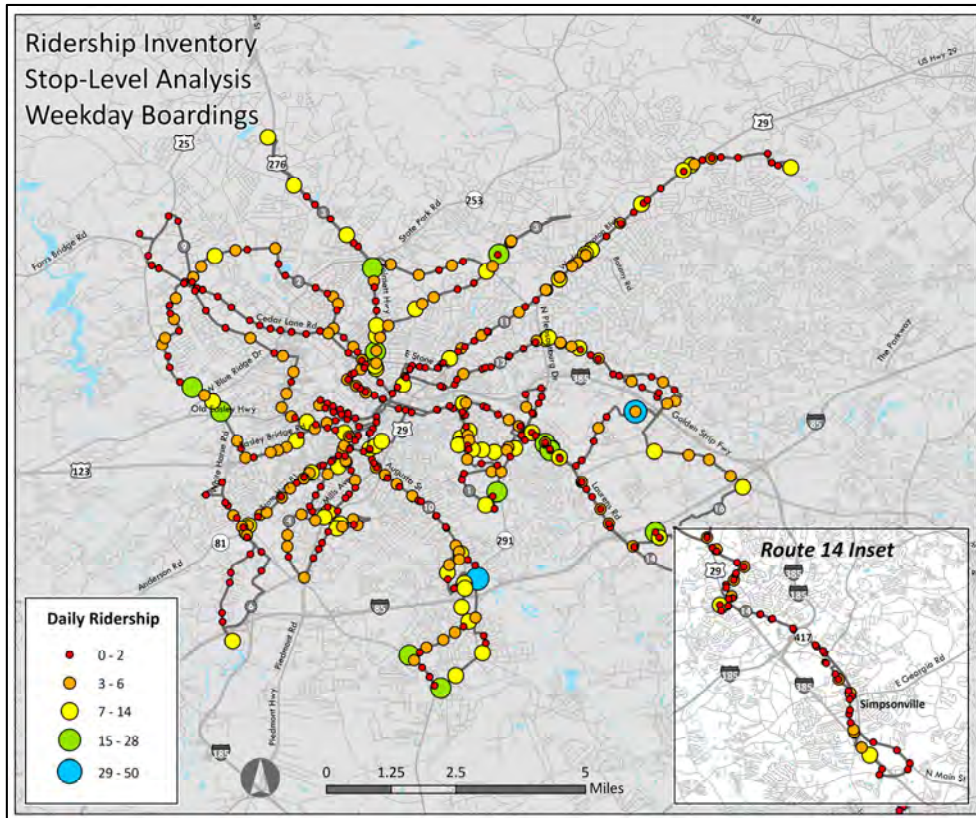
The top 10 stops in the system other than the transit center, and the routes that serve them are:

- Haywood Mall (Routes 12 and 16)
- S Pleasantburg Dr/Mauldin Rd (Route 10)
- Poinsett Hwy/Cherrydale Pt (Route 3)
- CU-ICAR (Routes 14 and 16)
- Laurens Rd/Perkins Mill (Route 14)

- Rutherford Rd/Stall St (Route 3)
- White Horse Rd/W Marion Rd (Route 2)
- White Horse Rd/Page Dr (Route 2)
- Wade Hampton Blvd/Rushmore Dr (Route 11)
- Woodruff Rd/Carolina Pt Pkwy (Route 16)

Proposed Network

Chapter 5 and the figure below present the proposed revenue neutral Greenlink network. After careful analysis of service delivery options, the Greenlink network was recommended to be structured as follows:
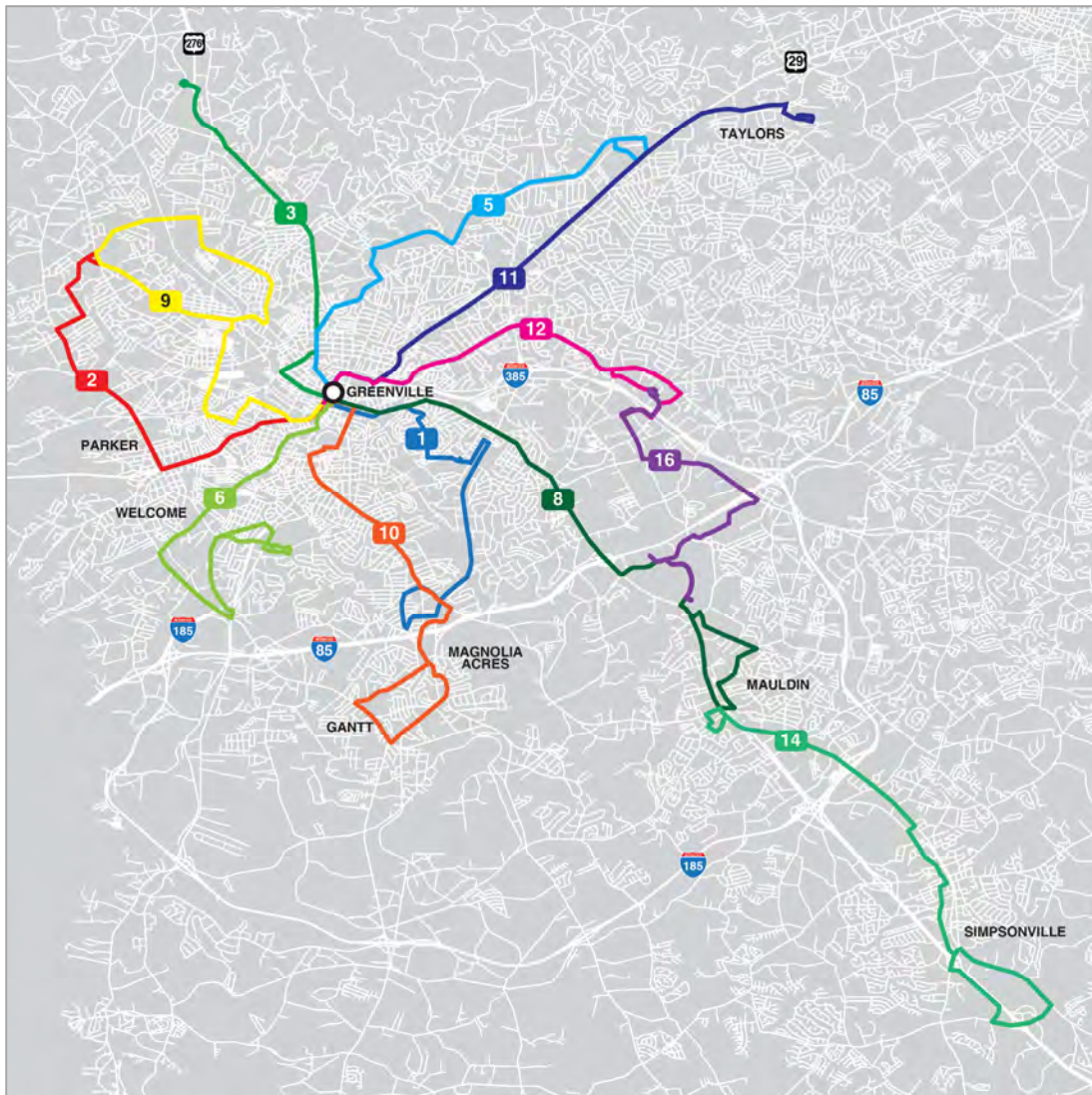
- Continue to operate a pulse, with an efficient connection to all routes through downtown Greenville's transit center.
- Continue to operate at 60-minute frequency, as resources do not allow for higher frequency service right now.
- Convert loop routes into bi-directional routes, where possible to do so without degrading service.

The proposed network was evaluated to determine how it improves Greenlink service:

- The proposed network is expected to increase bi-directional (service along both sides of the street) route miles by 63%.
- The revised routes results in a 7% reduction in the service area footprint. Of that 7%, 1% is in the City of Greenville and 6% is in Greenville County.
- However, only 2% of existing Greenlink riders are using the stops in the areas losing service. Of the 2%, less than 1% is in the City of Greenville and 2% is in Greenville County.
- There is a 50% increase in the number of route connections outside of downtown Greenville.
- To put it another way, the proposed network will still serve 98% of existing riders, while vastly improving the operation of routes through bi-directional service and route connections.

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Comprehensive Operations Analysis

CHAPTER 1 OUTREACH

This chapter presents the outreach efforts conducted in conjunction with the Greenlink COA. Three main efforts were completed. The first was a community survey conducted in February 2017. Another was public engagement via an open house in April 2017. The third, a series of stakeholder/focus groups, was also conducted in April 2017. Details of each effort follows in the sections below.

Community Survey

A community survey was conducted by consultant team in February and March 2017. Figure 1-1 shows the survey instrument in English. It was also available in Spanish. A total of 13 questions relating to transportation and travel in Greenville were asked on the survey. Because this was a community survey, the survey was structured so that Greenlink riders were asked two specific questions relating to transit travel (questions 8 and 9), while non-riders were asked one question regarding why they did not use Greenlink (question 7).

The survey was conducted from February 20, 2017 through March 28, 2017. It was promoted in three ways. First, paper copies were administered on-site at the Greenlink transit center and CU-ICAR campus. This was primarily to obtain responses from transit riders. Second, an online version was provided using Survey Monkey. The link to the online version was promoted on the paper surveys, as well as on the Greenlink website, announced via the Greenlink newsletter, promoted on the City of Greenville's social media pages, and sent to media outlets with a press release. The final way it was promoted was through Piedmont Health Foundation (PHF) outreach efforts, mailing hard copies to 35 non-profit and human services organizations.

A total of 1,459 survey responses were received, including:

- 224 from in person effort
- 791 from online version
- 444 from PHF outreach

After cleaning the data and eliminating blank and unfinished surveys, a total of 1,371 completed surveys were used for the analysis.

Figure 1-1: Community Survey Instrument

greenlink Community Survey

El encuesta está impreso en español en al reverso

Greenlink is evaluating ways to improve transit service! Please help us by completing this survey, if you haven't filled one out already.

1. What is your age? ☐ Under 18 ☐ 18-35 ☐ 36-64 ☐ 65 or older

2. What is the zip code of your primary residence? _____   3. What is the zip code of your work/school? _____

4. Which best describes your use of a car? (Choose one.)   5. When you leave the house, where do you usually go? (Choose up to two)

   ☐ I own my own car ☐ I can borrow a car when I need one   ☐ Work ☐ School ☐ Medical ☐ Errands

   ☐ I can sometimes find a ride ☐ I do not own a car   ☐ Shopping ☐ Recreational ☐ Other _____

6. Excluding the Trolley, have you used Greenlink in the past 12 months?   ☐ Yes (skip to question 8)   ☐ No (proceed to question 7)

7. If you are NOT a rider, what are your reasons you do not use Greenlink? (Check all that apply, then skip to question 10.)

   ☐ Doesn't come near my home ☐ Doesn't go where I need to go ☐ Doesn't run when I need it ☐ Takes too long

   ☐ I need my car during the day ☐ Don't feel safe ☐ Too expensive ☐ Other _____

8. How often do you ride Greenlink? (Check one.) ☐ 4-5 days a week ☐ 1-3 days a week ☐ A few days a month ☐ A few times a year

9. Which routes do you use on a regular basis? (Check all that apply.)

   ☐ Route 1 Pleasantburg Dr. / Cleveland Park ☐ Route 2 White Horse Rd. ☐ Route 3 Poinsett Hwy. / Rutherford Rd.

   ☐ Route 4 Dunean / Grove Rd. ☐ Route 6 Anderson Rd. ☐ Route 9 West Parker / Berea / Woodside

   ☐ Route 10 Augusta Rd. ☐ Route 11 Wade Hampton / Taylors ☐ Route 12 Overbrook / Pelham Rd.

   ☐ Route 14 Mauldin / Simpsonville ☐ Route 16 Circulator / CU-ICAR / University Center / Haywood Mall

10. If Greenlink made changes and improvements to service, but couldn't make every improvement you would like to see, which of these would be most important to you? Please rank these service choices with #1 being most important to you and #7 being least important:

____ The bus comes every 30 minutes instead   ____ The bus runs a full schedule on Saturdays   ____ The system is designed so I don't have to
    of every 60 minutes   ____ The bus runs on Sundays   go to the Transit Center downtown to
____ The bus goes more places in the county   ____ Stops are close to each other so I don't   catch a different bus
____ The bus runs later at night on weekdays   have to walk far to catch a bus

11. Which of these new areas would you most like Greenlink to serve?   12. What time would you prefer Greenlink weeknight service to end?

   ☐ Woodruff Rd. ☐ Pelham Rd. ☐ Greer ☐ Traveler's Rest   ☐ 7:30 PM ☐ 8:30 PM ☐ 9:30 PM ☐ 10:30 PM ☐ 11:30 PM

13. What amenities do you wish Greenlink had?

   ☐ Free WiFi ☐ See when bus arrives at my stop on my phone ☐ More comfortable seating ☐ Pay bus fare by phone

14. OPTIONAL: If you would like to receive information about public meetings as the study progresses, please provide your name and best way to contact you (email or mailing address) here. _____

https://www.surveymonkey.com/r/GreenvilleTransit

Survey Results

Demographics
Several of the survey questions asked about with rider demographics. Figure 1-2 and Figure 1-3   Figure 1-3 summarize the results. Key findings were as follows:

- While the survey was provided in both Spanish and English, 99% of respondents chose to respond in English (1% in Spanish)
- Greenlink riders made up 36% of the total responses (non-riders are 64% of respondents)
- Respondents who ride Greenlink tend to be younger than non-riders

Figure 1-2: Riders/Non-Riders	Figure 1-3: Age of Respondents
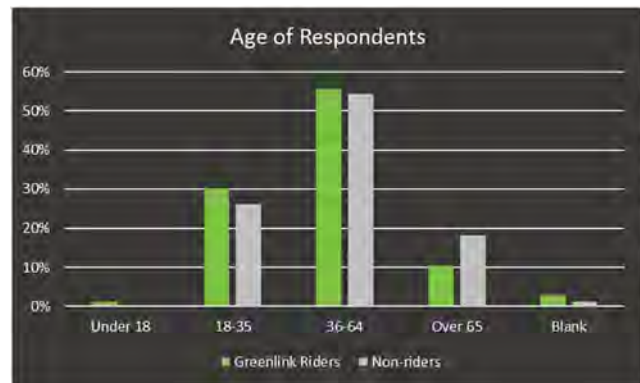
Travel Characteristics
Questions were asked about travel characteristics. The intent was to see how respondents travel in the region, including whether they own a car and their typical trip purpose. Figure 1-4 and Figure 1-5 summarize these results. Key findings were as follows:

- The majority (52%) of Greenlink riders do not own an automobile
- The majority (93%) of non-riders own an automobile
- The top two travel purposes were:
    - Work trips (64% of responses chose this answer)
    - Errands and shopping (46% of responses chose this answer)

Additional questions were asked on origin zip code and destination zip code for a typical day. Figure 1-6 maps these responses, with the orange and red areas having more responses and the yellow and green areas having fewer. The map shows that origin zip codes with the most responses are 29607 (downtown core) and 29609 (north side). The destination zip codes with the most responses are 29607 (downtown core) and 29601 (southeast side). This data supports the idea that much of the travel in the region is not to downtown, but through downtown to the outer parts of the city and county.

Figure 1-4: Car Ownership

Figure 1-5: Trip Purpose
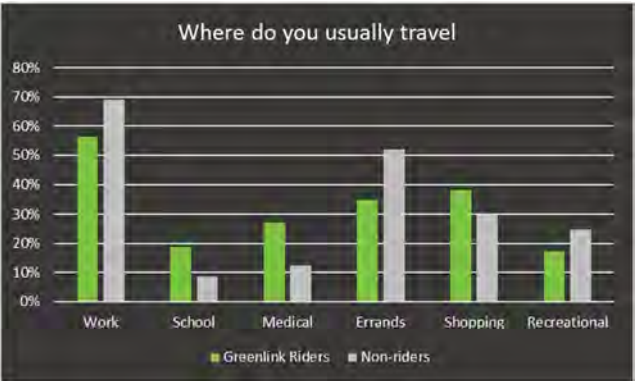
Figure 1-6: Zip Code Origins and Destinations
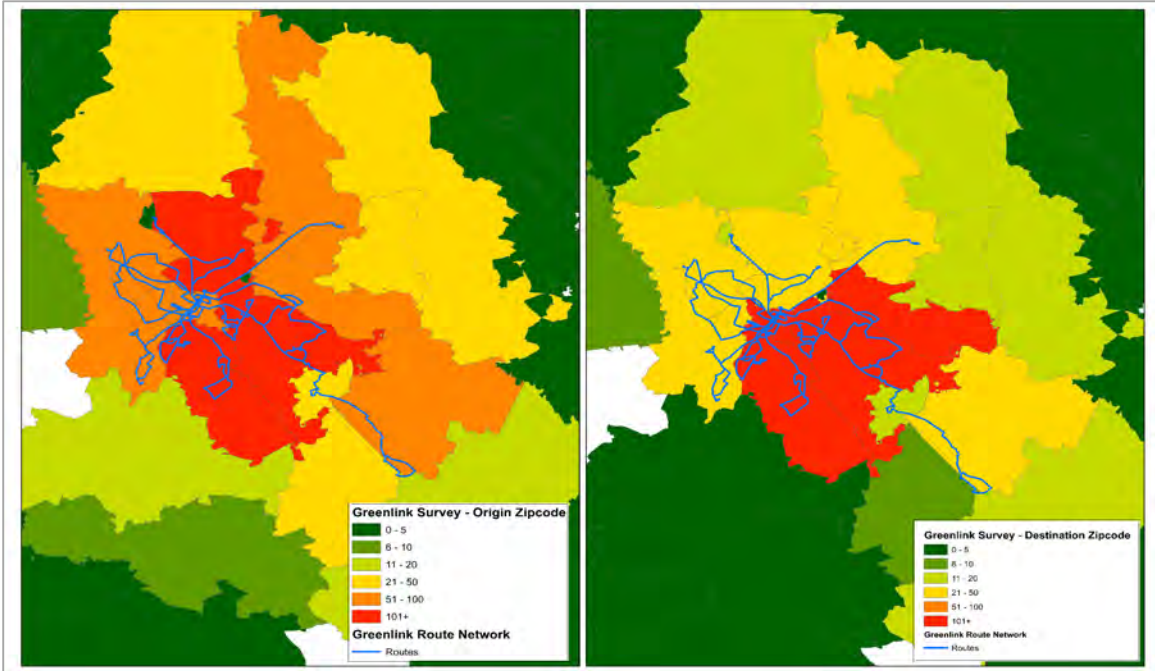
Non-Riders

Non-riders have three main issues for why they do not use Greenlink:

- Service doesn't operate where they live or need to go (78%)
- Isn't competitive with auto (57%)
- Does not operate when need it (27%)

Figure 1-7: Reasons for Not Riding Greenlink

Riders

Riders were asked about their habits using Greenlink. Figure 1-8 shows how often riders use the service. A plurality of riders (38%) use the service 4-5 days a week, and a majority (56%) of respondents are weekly users of the system.

Figure 1-8: Greenlink Usage
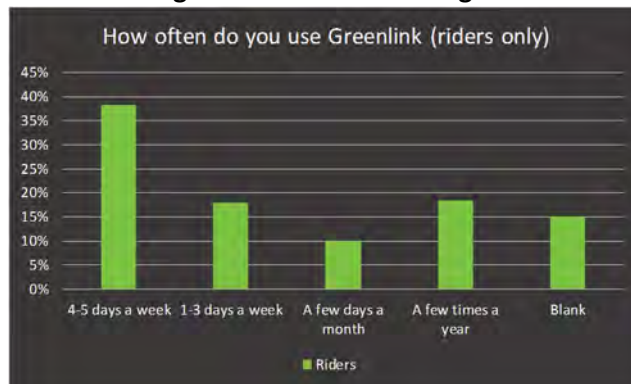
Riders were asked which route they use, with respondents allowed to choose as many routes as they want. Table 1-1 shows the breakdown by route. Most routes are represented in similar proportion to their ridership, but Route 1 (Pleasantburg Dr / Cleveland Park) and Route 16 (Circulator) appear overrepresented and Route 12 (Overbrook / Pelham Rd) appears to be underrepresented. Weighting was not part of this analysis.

Table 1-1: Route Usage

What routes do you use?	Total	Percent that use this route
Route 1 Pleasantburg Dr. / Cleveland Park	136	28%
Route 2 White Horse Rd.	126	26%
Route 3 Poinsett Hwy. / Rutherford Rd	111	22%
Route 4 Dunean / Grove Rd.	84	17%
Route 6 Anderson Rd.	53	11%
Route 9 West Parker / Berea / Woodside	54	11%
Route 10 Augusta Rd.	112	23%
Route 11 Wade Hampton / Taylors	98	20%
Route 12 Overbrook / Pelham Rd.	91	18%
Route 14 Mauldin / Simpsonville	118	24%
Route 16 Circulator	96	19%
Total Rider Responses	**1079**	

Service Improvements

The final four questions of the survey dealt with service improvements. Figure 1-9 through Figure 1-12 show the results of these four questions. Major findings of these questions include:

- Frequency is the number one ranked improvement for both riders and non-riders
- Non-riders asked for service expansion (route extensions, not go downtown), while riders were more supportive of expanded span of service (later weeknights, later Saturdays, Sunday service)
- Woodruff Road is overwhelming first choice for a service extension
- Real time arrival information and free Wi-Fi are top two desired amenities

Figure 1-9: Rank Service Improvements   **Figure 1-10: Service Span Improvement**
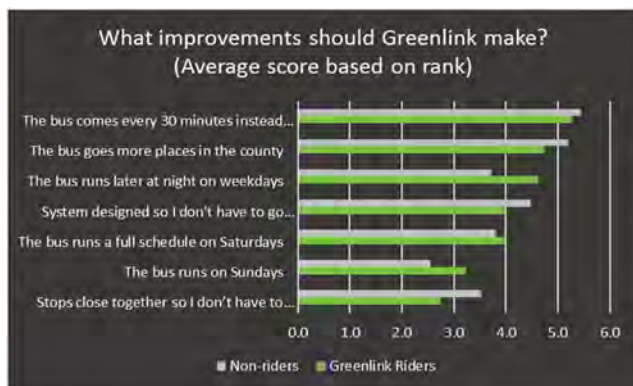
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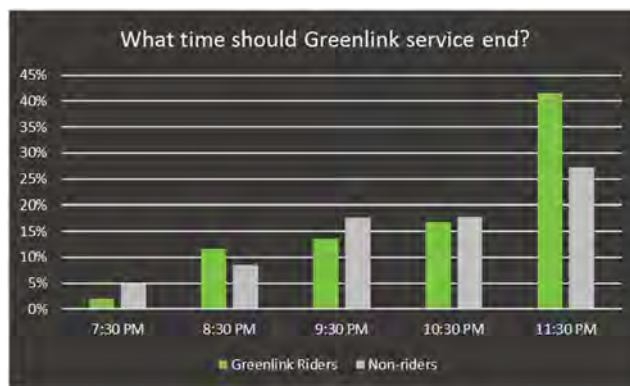
Figure 1-11: Desired Amenities   **Figure 1-12: New Service Areas**
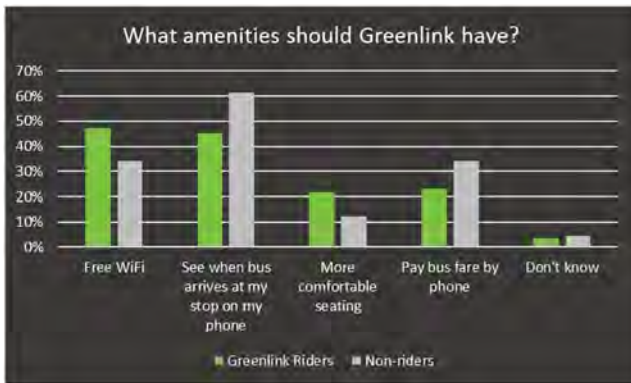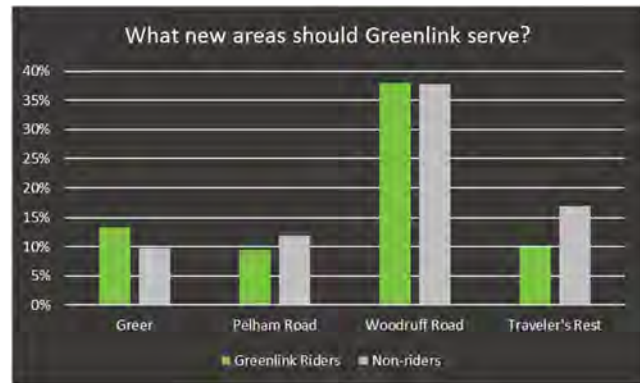
Public Open House Summary

The public open house was conducted from 3 to 6 p.m. on Thursday, April 27, 2017. It was held in the conference room of the Greenlink Transit Center, easily accessible to both riders and the public at-large. The meeting was publicized several ways: a press release, on the Greenlink website, in the Greenlink newsletter, and on the City of Greenville official Facebook and Twitter accounts. Further, those who responded to the community survey were mailed/called/emailed about the open house. Finally, flyers of the open house were placed in all Greenlink vehicles and in the transit center leading up to April 27th.

The open house presented the initial findings of the analysis (focusing on the community survey, demographic review, and network performance analysis). Consultants were on hand to answer questions from attendees.

What We Heard

Open house attendees were asked to record their comments on sheets. The following is a summary of comments heard at the public open house. The full comment sheets are provided in Appendix 1A of this report.

- Desire for Greenlink service to be extended along Woodruff Road
- Greenlink needs additional funding (both locally and at the state level)
- Route 14 (Mauldin / Simpsonville) can sometimes run early to CU-ICAR
- Technology improvements are wanted, including a smartphone app and Wi-Fi on buses
- Would like to see Greenlink partner with Bike Walk Greenville for cross promotion of services
- Add frequency improvements to all routes
- Please add park and ride lots with commuter service into downtown Greenville
- Would like to see reloadable farecards
- Furman students need an education session to know that Greenlink exists and is available to them

Stakeholder/Focus Group Summary

Stakeholder and focus groups were held on April 27-28, 2017. The intent of these meetings was to solicit input from those who are impacted by transit service in Greenville. While some of the people in the stakeholder groups may have filled out the community survey, their opinion on transit in Greenville is significant enough that additional involvement was desired. The list of stakeholders was created with direct help from the Greenlink COA steering committee.

The list included:

Hospital Networks
- Greenville Health System
- Bon Secours / St. Francis

Government Services
- Human Service Providers
- Education Providers

Government officials
- Greenville County Council
- Greenville City Government
- Suburban cities

Private Employers
- Manufacturing
- Hotels and Restaurants
- Greenville Chamber of Commerce

A summary of each meeting is provided in Appendix 1B.

CHAPTER 2 FLEET AND FACILITIES

This chapter provides a review of Greenlink's fleet and facilities. There are three sections to this chapter. The first section is a review of the existing Greenlink fleet. The second section is a preventive maintenance review that suggests ways to improve maintenance procedures. From an outside perspective, it appears that Greenlink's fleet has a low number of miles between roadcalls. The preventive maintenance section is a review of those procedures, with recommendations for improvements. The final section is an assessment of the existing Greenlink maintenance facility, and ways that the facility could be improved to the benefit of the agency. Appendix 2A includes pictures of the Greenlink maintenance facility.

Existing Greenlink Fleet

As shown in Table 2-1 and Table 2-2, the existing Greenlink fleet includes:

- Fixed route: 17
- Trolleys: 2
- Paratransit: 8
- Non-revenue vehicles: 9

Table 2-1: Existing Greenlink Fixed Route Fleet

Unit #	Make	Year	Length (feet)	Mileage	Miles per Year	Miles to 500k	Years to 500k	Fuel
				Fixed Route				
7203	Chance Coach	2002	35	381,869	25,458	118,131	5	Diesel
7206	Chance Coach	2002	35	290,696	19,380	209,304	11	Diesel
7210	Chance Coach	2002	35	453,563	30,238	46,437	2	Diesel
7214	Chance Coach	2002	35	485,214	32,348	14,786	0	Diesel
7215	Chance Coach	2002	35	302,193	20,146	197,807	10	Diesel
7301	Gillig	2011	35	293,120	48,853	206,880	4	Diesel
7302	Gillig	2011	35	324,865	54,144	175,135	3	Diesel
7303	Gillig	2011	35	354,388	59,065	145,612	2	Diesel
7304	Gillig	2011	35	302,901	50,484	197,099	4	Diesel
7306	Gillig	2011	35	355,860	59,310	144,140	2	Diesel
7308	Gillig	2011	35	329,126	54,854	170,874	3	Diesel
7310	Gillig	2010	35	345,502	49,357	154,498	3	Diesel
7311	Gillig	2010	35	339,452	48,493	160,548	3	Diesel
7312	Gillig	2011	35	341,218	56,870	158,782	3	Diesel
7401	Gillig	2012	35	279,805	55,961	220,195	4	Diesel
7402	Gillig	2012	35	269,154	53,831	230,846	4	Diesel
7403	Gillig	2012	35	285,348	57,070	214,652	4	Diesel

Table 2-2: Existing Trolley, Paratransit and Non-Revenue Fleet

Unit #	Make	Year	Length (feet)	Mileage	Fuel
Trolleys					
T7100	Freightliner	2014	33	28,179	Diesel
T7101	Freightliner	2014	33	28,914	Diesel
Paratransit (Cutaways)*					
7804	Ford	2003	22	221,460	Gasoline
7105	Ford	2012	27	122,574	Gasoline
7106	Ford	2013	27	125,784	Gasoline
7108	Ford	2013	27	95,213	Gasoline
7109	Ford	2013	27	104,878	Gasoline
7110	Ford	2016	27	34,335	Gasoline
7107	Ford	2013	22	190,071	Gasoline
7801	Ford	2011	27	257,374	Gasoline
Non-Revenue Vehicles (NRV)					
7001	Ford Tauras	1999	less than 20	134,507	Gasoline
7002	Ford Tauras	1999	less than 20	152,504	Gasoline
7003	Ford Explorer	2013	less than 20	43,260	Gasoline
7004	Ford Explorer	2013	less than 20	46,519	Gasoline
7021	Ford Van (15 pass.)	2003	22	241,740	Gasoline
7055	Ford F150	1999	less than 20	198,130	Gasoline
7056	Ford F350 **	1999	less than 20	79,998	Gasoline
7057	Ford F450 **	2014	less than 20	21,555	Diesel
7058	Nissan Frontier PU	2016	less than 20	17,925	Gasoline

Significant growth in the fleet is not anticipated in the short-term. A more pressing issue may be the mileage of fixed route vehicles available for service. FTA defines the useful life of a vehicle as 12 years or 500,000 miles. Many of Greenlink's vehicles are less than 12 years old, but will likely surpass 500,000 vehicle miles in the next three to four years. A comprehensive replacement plan may be necessary to avert future maintenance issues with the fleet.

Preventive Maintenance Review

As noted earlier, Greenlink appears to have a low number of miles between roadcalls (MBRC), averaging 3,395 MBRC. While averages vary due to many variables, most agencies tend to average between 5,000 and 15,000 MBRC. Therefore, a preventive maintenance review was completed to recommend ways to improve Greenlink's maintenance procedures.

Preventive maintenance documents provided by the Greenville Transit Authority (GTA) were reviewed by the consultant team. Documents provided include those regarding Performance Analysis, a fleet roster, and a December 2014 "Guide to Implementing Preventive Maintenance Programs." Information in each of the provided documents was reviewed and findings and recommendations are provided in the following text.

Findings and Recommendations

Goals and Objectives
Finding: The Goals and Objectives section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed with the following findings.

Goals and Objectives listed include the following headings with specific goals for each:

- Road calls
- Fuel consumption
- Air conditioners
- Preventive maintenance inspections
- Wheelchair lift failures

While these goals and objectives likely reflect items that have been an issue within the agency at some point, and therefore have validity, others should be considered to provide industry standard key performance indicators (KPI's).

Recommendation: GTA may want to consider adding some or all of the goals and objectives provided in Appendix 2B. The goals should be:

- Specific
- Measurable
- Attainable
- Relevant
- Established timeframe

Daily Service
Finding: The Daily Service plan provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to include fundamental information regarding daily operator inspections, cleaning and servicing, however a level of detail is missing.

Recommendation: Consider developing a detailed plan to a level that a newly hired person would understand. Consider the following in development of a revised plan:

- GTA may consider highlighting that drivers operate the wheelchair lift, especially on paratransit type vans. Because of the difficulty involved, this is not done in many cases.
- Consider promoting that "Daily Service" is part of the preventive maintenance program with the emphasis that the services provided are vital in meeting the goals of the agency.
- Consider stipulating under "servicing" that service personnel "bump" tires for no flats and look for missing or obviously loose lug nuts.
- Consider stipulating under "servicing" that service personnel alert maintenance management of any deviations from normal.
- Do GTA buses have "take one" holders that service staff need to fill? If yes, this should be reflected.

Monthly Servicing
Finding: The Monthly Servicing plan provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to include an acceptable level of information with exception to the following recommendations.

Recommendation: Add pressure wash of the battery compartment. At least once annually, usually in the Spring, an undercarriage wash should be performed.

Personal Protective Equipment (PPE) Program
Finding: The PPM program provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to be very in-depth and concise.

Recommendation: Consider developing the program into a standard operating procedure (SOP) and noted within a Maintenance Plan.

Preventive Maintenance and Inspection Services (PMI)
Finding: The PMI program provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and the mileage intervals and progression of PMI types appears acceptable. The following questions are intended for consideration to further enhance the PMI program:

- Is there a plus/minus mileage allowance for early/late PMI's?

- Are there PMI's past 22,000 miles that allow for items such as air dryer servicing, differential fluid change, etc.?

- Is coolant analysis ever performed?

- Are PMI's performed during day or evening shifts? There are merits to performing PMI's during a day shift.

- Is there a process in place for maintenance management to spot-check completed PMI's?

Recommendation: Consider the questions above and their possible implementation.

Repairs
Findings: The Repairs section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed with the following findings. A fundamental list of repair types and guidelines are provided, including Major, Accident, and Roadcalls. Included are in-house rebuild of engines which, according to the maintenance manager, is not the case.

Recommendations: Consideration may be given to revising this section to include the following:

- Guidance on minor repairs.

- Guidance on pull-out support repairs.

- Predictive maintenance in which certain components are repaired/replaced prior to a historical mileage failure.

- Spot-check of repairs by maintenance management.

- A ding and dent program in which vehicles exterior condition is monitored and recorded for planned/scheduled repairs.

- Consideration of updating and expanding this "Repair" section to one or more SOP's.

- Remove comments regarding in-house rebuild of engines and update other items as required.

Tire Program

Finding: The Tire Program section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed with the following findings. Contains measurement/replacement strategy and guidance on use of recaps on the rear only, all of which is correct. Items not addressed are listed under recommendations below.

Recommendation: Consider expanding the information in the section to include:

- How tire condition is monitored on a scheduled basis to include tread depth, unusual wear patterns, caps and stem access, and pressure.

- Add information on torqueing of lug nuts.

- Add information on tread depth uniformity.

- Add information on inflation/pressure amounts for various vehicles.

- Add information about proper tire inventory storage.

- Add information on tire mounting safety.

- Other applicable information.

Fuel Program

Finding: The Fuel Program section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and although the content was found to be pertinent, appears sparse and incomplete.

Recommendation: Review information and consider SOP development. Include information on minimizing idle time, diesel exhaust fluid (DEF), storage, bulk fuel deliveries (quality of fuel testing and security), inventory reconciliation, etc.

Vehicle Inventory

Finding: The December 2014 "guide to implementing Preventive Maintenance programs" section on vehicle inventory was reviewed and found to provide only two entries regarding how an inventory will be maintained and taken annually. Additionally, a fleet roster spreadsheet was provided and reviewed with the following recommendations.

Recommendation: Include the following

- On the fleet roster add the length of the vehicles

- Consider developing an SOP to address Vehicle Inventory, and meld in Vehicle Replacement Policies, and consider including information such as:
    - Specification development
    - Procurement
    - Inventory of spare parts

o   Disposal (and subsequent parts disposal)

o   Possible refurbishments

Fleet Management System
Finding: The Fleet Maintenance System section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to contain only fundamental information regarding use of the RTA system.

Recommendations: Consider expanding on the information to include concise instructions on levels of responsibility. Consider developing an SOP for this topic.

Repair Parts Inventory
Finding: The Repair Parts Inventory section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to be an acceptable representation of activities and responsibilities.

Recommendation: Revisit the sections contents with parts and maintenance personnel. Apparently missing is a procedure for new parts stocking during a new bus acquisition.

Vendor Repairs
Finding: The Vendor Repairs section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and found to be without enough detail.

Recommendation: Consider developing a start (why use a vendor) to finish (inspection of the vendors completed work) SOP to provide proper guidance on this topic. Include scheduled communication and sight visits with the vendor on progress, expected completion followed by a quality review of the work prior to the vehicle returning to the agency and return to service inspection and cleaning.

General Procurement Statement
Finding: The General Procurement Statement section provided in the December 2014 "guide to implementing Preventive Maintenance programs" was reviewed and the information in this section appears to be lacking a full explanation or guidance to the reader.

Recommendation: Review the information with appropriate GTA staff and organize and update as necessary.

Regarding "Performance Analysis" documents
Finding: The provided Performance Analysis documents were reviewed with the following findings:

The GTA Performance Analysis document to which the following comments pertain is the December 2016 version.

Total miles, total fuel, and subsequent miles per gallon are provided. These numbers are apparently representative of the combined fleet. This information can be monitored for any extreme deviation. The information is acceptable.

Accounting for 'system failures" and "miles system failures" is segregated by "major" and "minor." "Miles Major/Minor Systems" is interpreted as "Miles Between Roadcalls – Major or Minor." "Miles Major Systems" year-to-date is listed as 2,083 miles. "Miles Minor Systems" year-to-date is listed as 1,312 miles. Total of the two entries is 3,395.

There is no real industry standard for miles between roadcalls (MBRC). Variables are numerous and include:

•   Geographical (terrain) conditions

- Fleet type and age
- Level of maintenance

Many agencies exempt certain defects from their MBRC calculations such as those related to farebox or other IT related items such as camera systems. Other agencies segregate MBRC into Major and Minor categories.

MBRC numbers across the U.S. transit industry range from approximately 5,000 to 15,000 miles. The combined 3,395 for GTA appears to be on the low side, however no explanations were provided as to what Major and Minor failure defects consist of.

Recommendation: Consider developing a document that explains what defects are included in Major and Minor failure calculations. Also consider monitoring the following key performance indicators for bus maintenance:

- On-time performance of PMI's
- On-time performance of detailed bus cleaning
- ADA related failures
- Cost per mile

Standard Operating Procedures (SOP's)[1]
Recommendation: Consider the value of SOP development. An organized collection of SOP's can contain a variety of guidelines and rules that provide guidance and professionalism to the organization. SOP's may address anything from fundamental rules on visitors to a garage, smoking rules, proper disposal of oils and other fluids, or any number of like items. Staff members may have a great idea of how to affect a certain repair or a time saving means and an SOP can encapsulate the idea so it is not lost. Such SOP's become property of GTA and may be revised as needed.

Contacts
Recommendation: Consider a document containing contact information for key GTA staff, including name, office phone, cell phone, and email address.

Maintenance Training
Recommendation: Develop an SOP on GTA training occurrences and requirements and maintain a roster of training events and attendees. Maintenance training is most advantageously available during negotiations of a new bus procurement. Certain vendors may also provide training for products you routinely procure. Certain training may be "on the job (OJT), by maintenance management.

Quality Assurance (QA) Program
Recommendation: If budgets will not allow hiring a QA person, consider nominating an existing staff member. The QA person can perform spot-checks of PMI's or other work performed, check quality of parts procured, and numerous other efforts to improve overall quality of the fleet and maintenance department.

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[1] The following items were not identified within the GTA documents provided. It is recommended that GTA consider revisiting and revising the December 2014 "guide to implementing Preventive Maintenance programs" with the following information and/or consider some items for SOP development (see SOP below).

Warranty
Recommendation: A procedural document should be developed that outlines how warranty of parts and vehicles will be monitored and claims administered.

Ding & Dent Program
Recommendation: A program can be developed to monitor and document the amount and severity of exterior/body defects. At a prescribed level, the vehicle then goes to a body shop for repairs.

Red Tag – Out of Service Vehicles
Recommendation: Consider a documented program of tagging vehicles that are out of service as a safe guard.

DVIR (Driver Vehicle Incident Reports)
Recommendation: Consider development of a procedure that describes how DVIR's are completed and routed through the agency for attention to corrective action.

Predictive Maintenance
Recommendation: Predictive maintenance is repair or replacement of components or systems prior to their failure. Prediction of failure is usually done in hours and is based on historical maintenance data. Consider initiating a program to track key systems and/or components for predictive maintenance.

Closing Recommendation
Many of the GTA processes and procedures reviewed were likely produced as needed to meet a requirement of the time. As GTA evolves and grows it should consider developing a Maintenance Plan document which could encapsulate much of the information that would inform anyone, especially new hires, of the particulars of the agency. Following is a sample contents page from another agency's maintenance plan:

Section 1: Service Quality Parameters
Section 2: Technical Services and Quality Assurance
Section 3: Maintenance Organization
Section 4: Contacts and Locations
Section 5: Fleet Summary Report and Replacement Plan
Section 6: Peak Vehicle Requirements
Section 7: Maintenance Repair Alerts
Section 8: Driver Vehicle Inspection Reports (DVIR)
Section 9: Scheduled Maintenance and Servicing
Section 10: Predictive Maintenance Requirements
Section 11: Major Component Maintenance
Section 12: Warranties and Service Agreements
Section 13: Reduction of Unscheduled Maintenance
Section 14: Body Repair and Paint Program
Section 15: Time Standards
Section 16: Mid-Life Refurbishments
Section 17: Bus Cleaning Schedule
Section 18: Maximizing Useful Bus Life
Section 19: Standard Operating Procedures (SOP)

Additionally, GTA should consider developing standard operating procedures (SOP's) as described earlier. The intention of an organized manual of SOP's is to provide documented guidance and rules for staff to reference. SOP's can be developed for a variety of topics. Appendix 2C presents a sample list of administrative SOP's. Additionally, SOP's may also be developed for any specific technical procedure, including maintenance repairs, servicing or cleaning.

Maintenance Facility Assessment

The following is a high-level review of Greenlink's existing maintenance facility. This review is based on:

- Observations by CTG during a field visit January 26, 2017
- Discussions with Steve Myers, Greenlink Fleet Manager
- Fleet size and mix and organization chart provided by Greenlink
- Photos from various sources
- Google Map images

Existing Facility Conditions

Figure 2-1 illustrates the current maintenance facility and site configuration.

Figure 2-1: Existing Maintenance Facility and Site

The following observations were made on the existing facility.

1. Greenlink is Greenville's public transit system, operated by the City of Greenville, under contract to Greenville Transit Authority. Greenville Transit Authority (GTA) was created in 1974.

2. Greenlink's administration staff is located at 100 W. McBee Avenue.

3. The Greenlink fleet is maintained and operated from a facility is located on a 2.5-acre (approximate) site at 154 Augusta Street, Greenville, SC. It is located approximately 0.7 miles from the Greenlink Transit Center at 100 W. McBee Avenue.

4. The facility was originally a beer distribution warehouse before it was purchased and converted to GTA use in the 1980s.

5. GTA is a city department and all workers are city employees. The site is used only for GTA maintenance.

6. Greenville Fleet Services (Dept. of Public Works) is currently located at 360 S Hudson Street. It is understood that the City plans to build a new facility for Fleet Services on Fairforest Way (further to the southeast), due to issues with the current site (flood- prone and dilapidated). A previous study (by Michael Baker International in 2015) considered the Fairforest Way facility as an alternative location for Greenlink maintenance and operations.

7. Site:

    a. Located in the West End of Greenville, a neighborhood across the Reedy River from downtown and next to Fluor Field, home to the Greenville Drive minor league baseball team. There is some indication that the property may be under development pressure. Several multi-family residential buildings are under construction in the neighborhood.

    b. The site is approximately 2.49 acres, but its irregular shape and topography challenges   restricts it from being utilized efficiently.

    c. The West End Park and Ride lot (with 24 spaces) is located east of the bus parking area.

    d. Employee parking and non-revenue vehicle parking (38 spaces) is located immediately east of the maintenance building.

    e. A half-acre (0.5) lot is available between the West End Park and Ride lot and the employee parking lot. The lot is currently used by a construction company for material staging.

    f. Irregularly shaped, with the maintenance garage located on the southern end and overnight bus storage on the northern end. There is a significant elevation difference between the north and south ends of the parcel, with the buses parked at the top of a hill. This elevation difference is also pronounced between the bus parking area and West End Park and Ride and the available half-acre lot.

    g. Slow fill CNG fueling was installed in the bus parking area but is no longer used. The CNG compressor and storage tanks are still on site, just north of the maintenance facility on the north side of the drive. This equipment takes valuable space and there are no plans to use CNG in the future. This equipment should be removed.

    h. Site lighting (bus parking and employee parking) is poor.

    i. An active railroad track runs north/south immediately west of the site.

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j. Fluor Field is immediately west of the site, on the other side of the railroad track.

8. Storage Building. There is a pre-engineered metal building immediately north of the maintenance building backed along the west property line. The building is approximately 30 feet by 80 feet (2,400 square feet) and has two overhead doors facing east. The facility leaks and is used for storage of tires, windshields, glass, body panels, and drums of cleaner. The air compressor that feeds the Maintenance Building is in this building.

9. Maintenance Building

   a. The maintenance building is a pre-engineered metal building on the south end of the site. It is oriented north/south with two overhead doors on the north end and one overhead door on the south end. The building is approximately 70 feet by 160 feet (11,200 square feet).

   b. There have been no alterations to the building since it was used as a beer distributor warehouse.

   c. There are essentially two bays in the building running north/south. The west bay has an overhead door at the north and south ends and is used for bus washing (on the north end) and farebox vault pull (on the south end). Buses exit to the south, where there is a canopy covered area for fueling. The east bay has a maintenance bay (on the north end) and enclosed space on the south end for offices, drivers' area, parts storage, and restrooms. Even though mechanics can fit two vehicles in the maintenance bay (with very little room to work), it is only sized to accommodate one vehicle.

   d. Portable, wheel-engaging vehicle lifts are used in the maintenance bay.

   e. All buses are washed two times a week.

   f. Interior cleaning is done by hand (sweeping) with temporary manpower.

   g. Money is currently counted in the old beer cooler room. Note that the farebox used is the GFI Odyssey. A portable receiver is used to empty most fareboxes, however, four or five fareboxes are simply changed out so that each farebox can be counted separately.

   h. There is gas fired infrared heat in the bay areas that seems to be adequate.

   i. A new roof was installed in March 2016.

   j. Deficiencies include:

      i. Inadequate maintenance space.

      ii. The facility cannot be expanded due to site constraints.

      iii. Parts are stored in various places and need to be in one secure area for inventory control.

      iv. Brake parts are in a caged area adjacent to the Wash Bay. These parts should be in an enclosed, secure area with less humidity.

      v. There is a mezzanine above the office area, however, the floor needs to be checked. It was reported that the floor could give way in its current condition.

      vi. No showers or lockers available.

      vii. Not ADA compliant.

    viii.   No lunch room for employees.

    ix.   Ceiling tiles got wet and are badly molded and need to be replaced.

    x.   A floor drain runs the length of the wash bay. All floor drainage needs to be checked and confirm that it is routed through appropriately designed oil/water separator(s).

    xi.   No exhaust system with hoses to connect to buses in the repair bay.

    xii.   The compressed air lines from the compressor in the Storage Building are routed underground and collect water.

    xiii.   Above ground tanks (275-gallon capacity each) are provided for engine oil, engine coolant, and automatic transmission fluid (ATF). These tanks are placed in individual secondary containment bins that collect shop dirt and debris. A pump and reel are mounted on top of each tank. The tanks are along a short wall that separate the maintenance bay from the wash bay. Typically, lube tanks should be double walled and located in a separate room to isolate the noise generated by the air piston pumps.

10. Fueling

    a.   A canopy covered area is located immediately south of the west bay of the Maintenance Building.

    b.   There is a single hose diesel dispenser and a single hose gasoline dispenser.

    c.   The dispensers are controlled by a fuel management system.

    d.   There are two underground fuel storage tanks, one for diesel (20,000 gallons) and one for gasoline (10,000 gallons). It was reported that these tanks are the original single wall steel tanks installed in the 1980's and do not have cathodic protection against rust. The condition of these tanks needs to be examined and the tanks tested. The diesel tank is filled twice a month and the gasoline tank is filled every 10 to 12 weeks. Consideration should be given to replacing these tanks with above ground tanks.

11. Site Circulation

    a.   Buses enter the site from Augusta Street and proceed west (mixing with employee vehicle traffic), turn right heading north into the bus parking area. They make a 180 degree turn and head south, lining up outside the overhead door to the wash bay. The driver leaves the bus in this location and goes to turn in required reports before leaving in their private vehicle.

    b.   Service personnel drive the bus into the wash bay and hand wash it with a manual, portable, single vertical brush wash unit.

    c.   The bus is then pulled forward into the vault pull position and the vault is emptied or changed out.

    d.   The bus is then driven forward, outside the building to the fueling canopy and fueled.

    e.   The bus is then driven south, exits onto Field Street and immediately turns left and then another left onto Augusta Street heading north. The bus then re-enters the site and proceeds to the bus parking area.

f. Buses are backed into their parking spaces after being washed and fueled. Each bus parks in an assigned space.

g. The movement of buses at the entrance to the bus parking area is very tight as shown in Figure 2-1. The figure indicates two areas where major conflicts exist for bus circulation.

h. Note that the current configuration has buses being washed, then vaults pulled, and finally fueled. Typical transit operations have the buses pull into a fueling area where the bus is fueled, fluid levels checked, the interior cleaned, and the vault pulled (in a 6 to 7-minute dwell time) and then buses are washed (usually with an automatic washer) before returning to bus parking.

Analysis and Evaluation

Greenlink's Vision Statement states that it will support the region with safe and reliable public transit. Maintenance is one of the key elements needed to provide this service. The maintenance site and facility should be sized and configured to provide efficient and cost-effective maintenance.

The documentation of the existing condition contained herein illustrates the challenges the maintenance and operations staff face daily.

A preliminary space program has been developed to identify the building space requirements and site area requirements for a maintenance and operations facility based on the current fleet size and mix. This space program is shown on the following pages, starting with a summary and followed by the detailed space breakdown for each functional area.

> **Greenlink Transit Vision Statement**
>
> Greenlink supports the mobility, livability and economic viability of the Greenville region by:
>
> - Providing **convenient, safe, reliable, efficient, and financially sound public transit**, and
>
> - Playing an increasingly important role in the community's transportation system.

The summary shows the need for a total of 25,244 square feet of building area and a site of 2.28 acres of useable space (i.e. without the irregular shape and topography restriction of the current site) to accommodate existing fleet. The current facility has only 11,200 square feet.

The following should be considered:

1. Evaluate the possibility of acquiring the available half-acre lot and test fit the programmed elements on the expanded site. This should include determining the cost of grading the site to minimize the grade issues currently on the site.

2. Evaluate the alternative of acquiring a new site and developing a new maintenance and operations facility at the new site. Analysis by Wendel Engineering (expected in Fall 2017) will provide more specific recommendations on future facility needs.

3. Short term improvements to the existing facility, including the following:

    a. Improving the site lighting in bus parking and employee parking areas.

    b. Remove all remaining CNG equipment from the site.

    c. Repair or replace the roof of the storage building to stop the leaks.

    d. Installing a new automatic, gantry type bus washer to replace the manual washer.

    e. Install a vacuum system in the vault pull area to accommodate interior cleaning.

    f. Install overhead exhaust hose reel(s) in the maintenance bay.

g. Test existing underground fuel storage tanks and replace with above ground tanks if necessary.

h. Reconfigure the southeast corner of the facility to address the deficiencies noted (i.e. offices, lunch room, restrooms, and parts storage.

i. Replace damaged ceiling tiles.

j. Reroute compressed air piping to be above ground and add a refrigerated air dryer to eliminate water in the compressed air system.

k. Replace lube storage tanks with double wall, above ground storage tanks and locate the tanks and air piston pumps in a separate room to reduce noise in the maintenance area.

l. Renovate the maintenance bay area to improve efficiency and the work environment.

m. Remove access to the mezzanine (i.e. the stairs) to improve safety and provide additional usable space in the maintenance area.

n. Re-evaluate the current bus traffic flow on site to determine if it can be improved and made more safe and efficient.

Preliminary Space Program

The following space program is based on preliminary discussions with the Greenlink Fleet Manager and the consultant team's experience in planning and design of over 500 transit maintenance and operations facilities across the country in the past 35 years.

The program provides an estimate of the site and building area needed to support the current fleet. The program includes the following information for each space.

Description	The name of the space.
Space Standard	The standard for each space based on the function, equipment, and furnishings to be accommodated. The standards are given in square feet. Where the configuration of the space is critical, dimensions are given for the space. The size of the repair bays are commonly accepted industry standards.
Quantity	Identifies the number of spaces to be accommodated.
Area	Area in square feet for the proposed space. Note that where a space standard is given, the area equals the space standard times the quantity.
Remarks	Lists additional information about the space.

A summary of operations, maintenance, fuel and wash, and parking space needs is shown in Figure 2-2. Appendix 2D presents a detailed space program breakdown.

This space program in Figure 2-2 is based on Greenlink's existing fleet. A separate analysis (being completed by Wendel Engineering in 2017) is expected to make specific determinations on future space planning and facility needs.

Figure 2-2: Preliminary Space Program Summary

	Description	Space Standard	Qty	Area	Remarks
	Fleet	30' to 35' Buses	19		
		Paratransit	8		
		Total	27		
1	**Summary**				
2	Operations			8,546	
3	Maintenance			11,423	
4	Fuel and Wash			5,275	
5	**Subtotal Building Area**			**25,244**	
6	Agency Vehicle Parking			40,840	
7	Employee / Visitor Parking			24,000	
8	Other (Emergency Generator)			330	
9	**Subtotal Vehicle Parking / Other**			**24,330**	
10	**Subtotal**			**49,574**	
11	Site Circulation	75%		37,181	To be confirmed during design
12	Landscape / Setbacks	15%		7,436	To be confirmed during design
13	Stormwater Management	10%		4,957	To be confirmed during design
14	**Total Site Area**	Square Feet		99,148	
15		**Acres**		**2.28**	

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CHAPTER 3 TRANSIT MARKET ANALYSIS

Before analyzing the Greenlink route network, the COA must first understand the demographic and market conditions in Greenville city and county, specifically those that drive existing or future transit ridership on the Greenlink network. While people take transit for many individual purposes, almost all riders use transit to do something else (and not merely for the ride itself). Thus, the key to this market analysis is to understand what is the trip purpose and why someone chooses another way to travel within Greenville.

For short trips within the Greenville metropolitan area, automobile is typically the least costly way to travel due to subsidization from Federal, state, and local governments[2]. People will choose an alternative mode (walking, bicycling, or transit) if:

- the subsidization of auto travel ceases, and/or

- the alternative mode becomes competitive with auto travel times.

The most likely reasons people will switch to transit is if congestion results in severe delays, if parking costs go up, or if gasoline rises in cost. Considering the current state of the Greenlink system and the current cost of auto travel, most travelers in Greenville will continue to choose auto travel.

Given the above knowledge, this chapter reviews data to answer questions about the Greenville transit market, including where people begin their trip (their origin), where people end their trip (their destination), and what groups of people are most likely to take transit in the city and county.

Study Area and Data Sources

For this analysis, the study area was defined as the Greenville-Pickens Area Transportation Study (GPATS) boundary on the north, east, and south, and the Greenville County line on the west. Figure 3-1 shows the study area boundary, block groups, and existing Greenlink route network.

Data sources included the 2011-15 American Community Survey and the 2014 Longitudinal Employer-Household Dynamics (LEHD), each of which is provided by the U.S. Census Bureau. The principal geography of the analysis is the census block group. Based on the above boundaries, there are 264 census block groups in the study area.

Demographic Review

The demographic review used eight distinct datasets, each of which was selected because it helps predict transit ridership. Definitions for each dataset are presented in subsections below. While each dataset is part of the puzzle, full understanding of the transit market comes by considering all demographics together. This is explained in the transit propensity section at the end of this chapter.

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[2] Subsidization includes government backed roadway projects, free or reduced parking costs, and low gasoline costs

Figure 3-1: Block Group Analysis Area
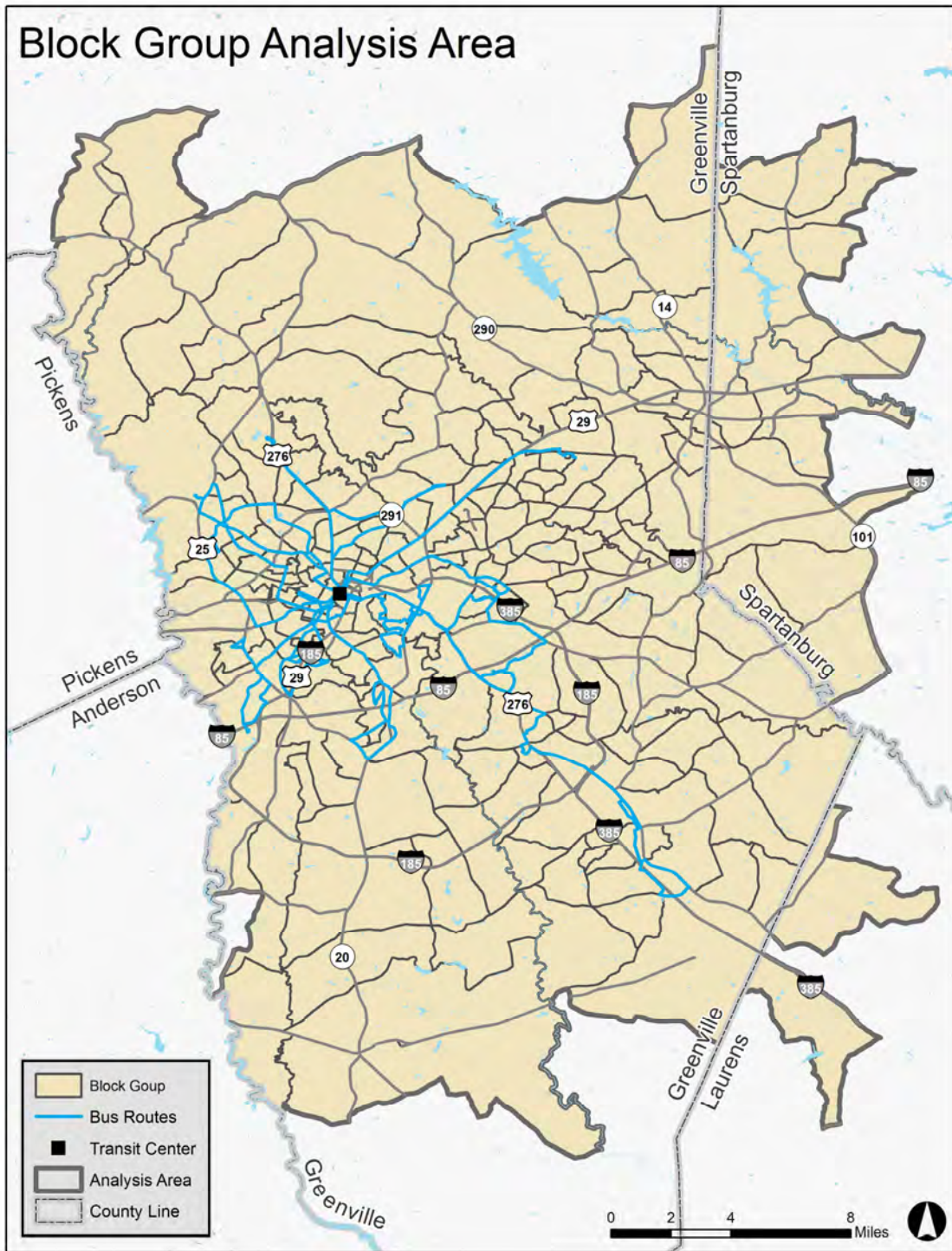
Population Density

As noted in the introduction, there are two geographic parts to a transit trip – the origin and the destination. Population density is a significant way to demonstrate where transit origins are occurring. There are two reasons for this. First, density means more people in a smaller geographic area. Thus, density means more people, which in turn means more trips. Second, the density itself means more traffic congestion, more parking constraints, which in turn means more people are likely to choose transit.

The transit service thresholds for various levels of household density are shown in Figure 3-2. Based on the chart, Greenville's population density indicates that most service should be at 60-minute frequency. There are a couple of caveats. First, this is only for one part of the trip, origins. Second, the density map is based on the 2011-15 American Community Survey. As Greenville continues to develop and densify, it is likely the demand will increase, which in turn means demand for higher frequency transit service.

The map in Figure 3-4 shows   Figure 3-4households per acre within the study area. It may be surprising that Greenville does not have a higher population density, especially in the core. There are only two zones with a household density about 5 households per acre in the study area. The reason for this is because Greenville is mostly comprised of single family homes and apartments in more suburban areas. This does not mean there are no transit riders in these zones, it just means there are fewer of them.

Figure 3-2: Transit Service Thresholds for Household Density
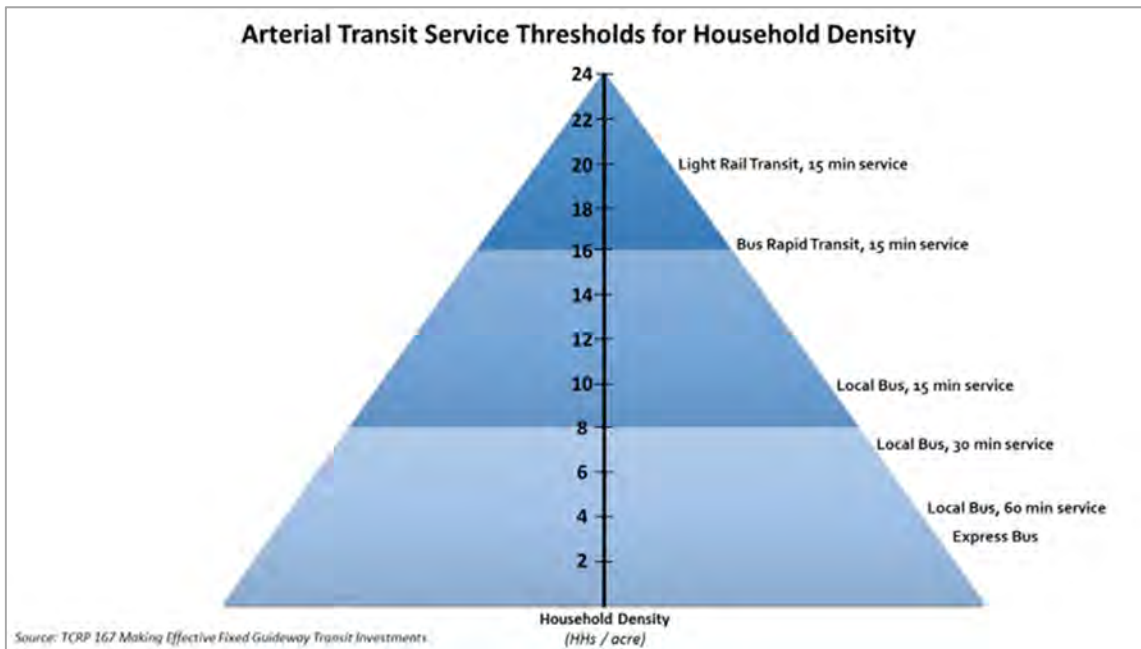
Employment Density

Employment density is a significant way to demonstrate demand for destinations. While not all trips are destined for work, data from the community survey indicate 65% of survey respondents travel for work in the Greenville region[3].

The transit service thresholds for various levels of employment density is shown in Figure 3-3. Based on the chart, Greenville's employment density indicates that most transit service should be at 30 to 60-minute frequency. However, it should be noted that downtown Greenville, with several adjacent zones of 10+ jobs per acre, may qualify for higher frequency service. As with the population density, this dataset is based on the 2011-15 American Community Survey. As downtown Greenville continues to develop and densify, increased demand may result in the need for higher frequency transit service and/or commuter service.

Employment density in jobs per acre within the study area is shown in Figure 3-5. Job density is concentrated in three main areas – downtown Greenville, Haywood Road (including Haywood Mall, Greenville Health Patewood Memorial Hospital, and St. Francis Eastside), and the near south side of the city (including Greenville Memorial Hospital and St Francis Downtown Hospital). Each of these areas has census blocks with more than 11 jobs per acre. The rest of the study area tends to be below 5 jobs per acre, with a few exceptions in the 6-10 jobs per acre category like Woodruff Road and Rutherford Road.

Figure 3-3: Transit Service Thresholds for Employment Density

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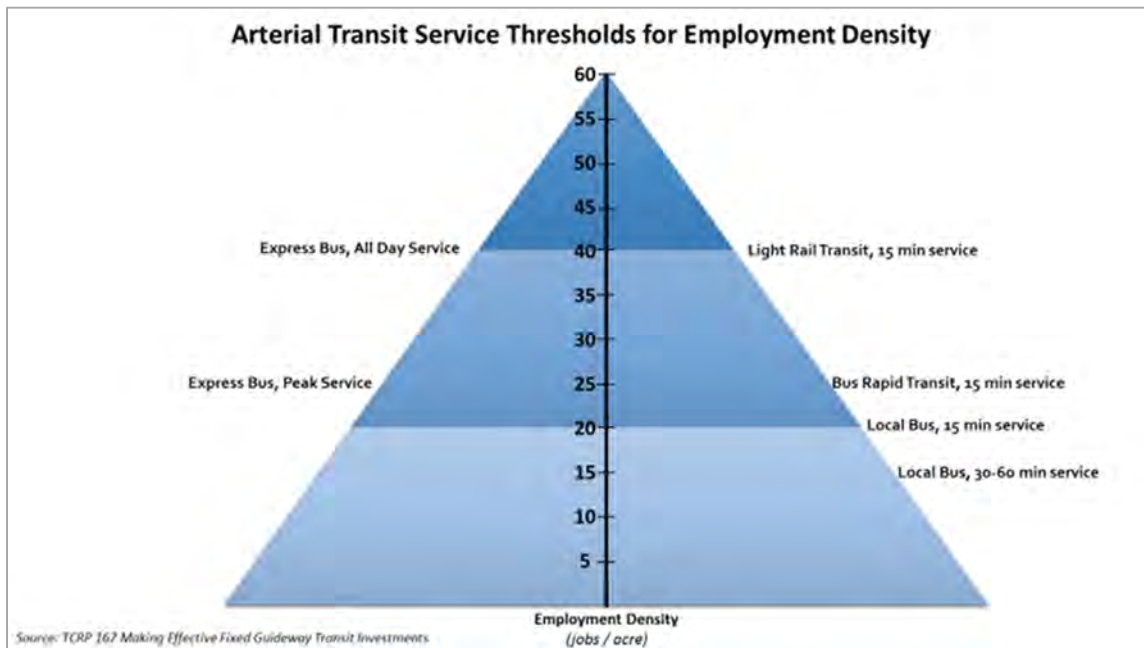
[3] See Chapter 1 for more information on the community survey

Figure 3-4: Household Density

Figure 3-5: Job Density

Household Density per Acre

HH per Acre
- 0 - 2
- 3 - 4
- 5 - 6
- > 6
- Bus Routes
- ■ Transit Center
- Analysis Area
- County Line

Job Density per Acre

Jobs per Acre
- 0 - 5
- 6 - 10
- 11 - 15
- > 15
- Bus Routes
- ■ Transit Center
- Analysis Area
- County Line
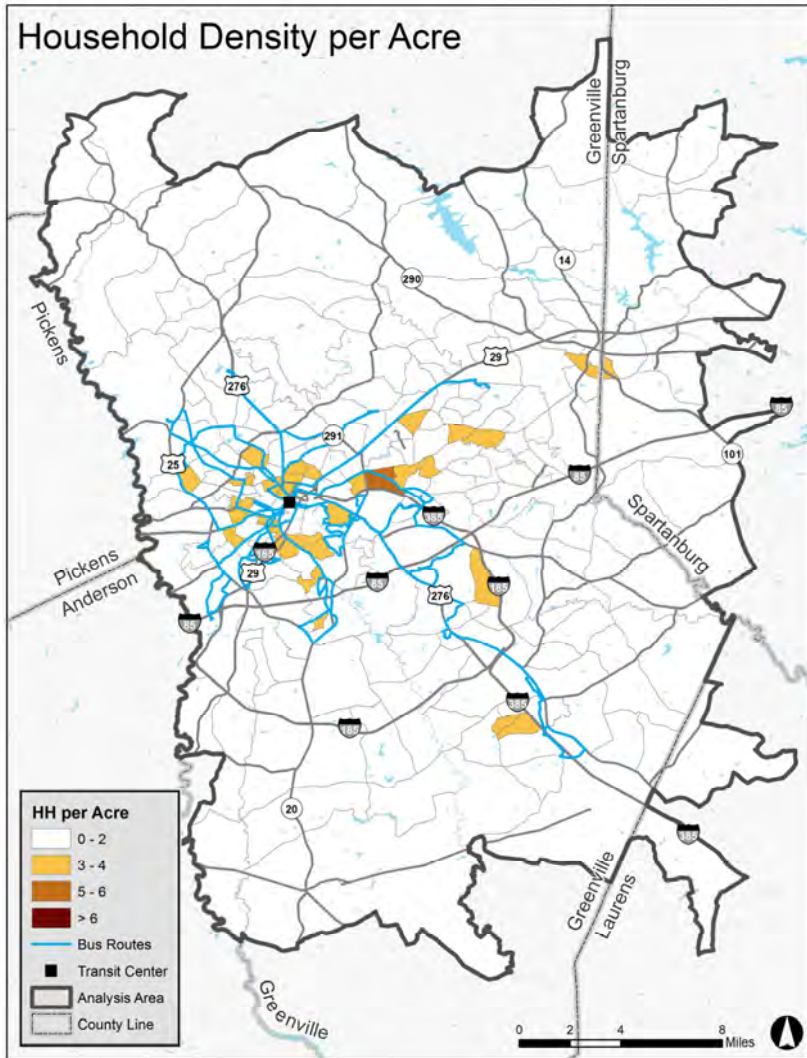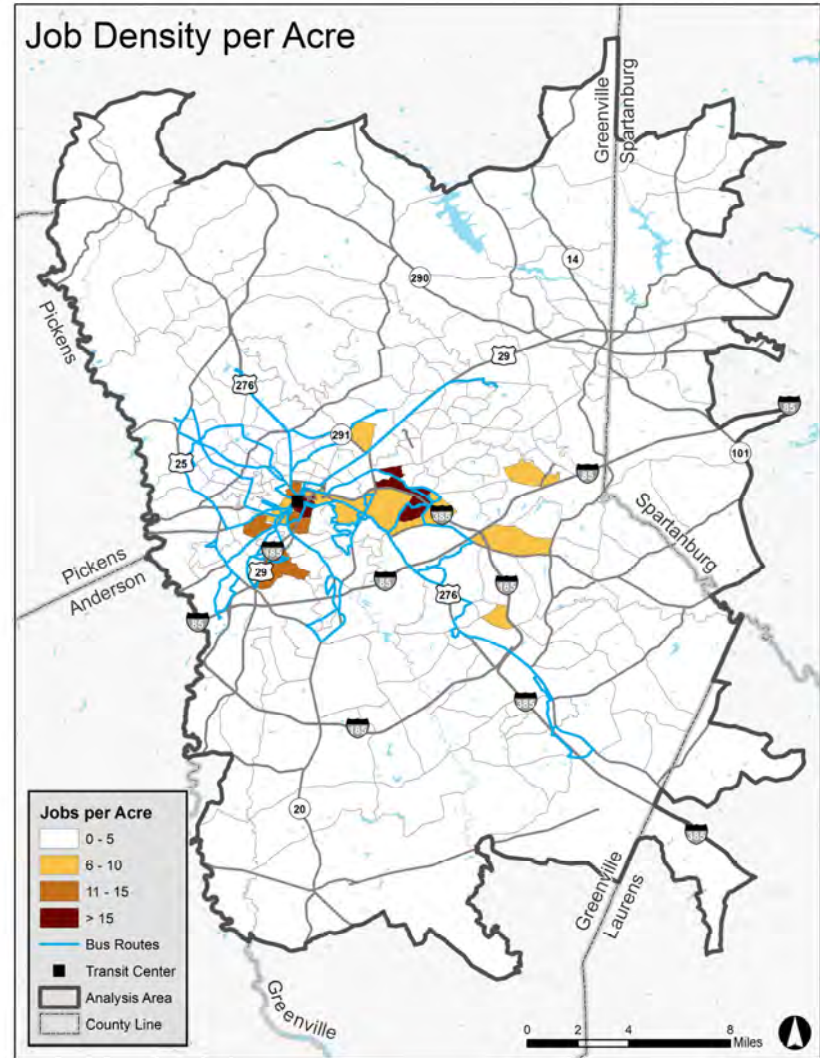
Age

Another indicator of potential transit ridership is age. Persons under 25 tend to ride in higher numbers because they are either in school or early in their careers and may not have the income to afford an automobile. There are also indicators that millennials (those born between 1981 and 1997) are not acquiring driver's licenses at the same rate as previous generations[4].

The under 25 population density in the study area is shown in Figure 3-6. As one would expect, the areas around Furman and Bob Jones universities have a high concentration of persons under 25. The City View neighborhood and North Street near Eastside High School are also areas with high concentration of under 25 population.

Persons over 64 is another group that tends to ride transit in higher numbers than the general populace. This is either because seniors are on a fixed income (and cannot afford an automobile) or because of mobility issues related to physical decline. Figure 3-7 shows the over 64 population density in the study area. The largest concentration is on the east side, in the area roughly between Wade Hampton Boulevard and Pelham Road. Also noticeable is a small but high concentration of over 64 persons in the neighborhoods of Greater Sullivan and Green Avenue.

Income

Income is a significant indicator of potential transit ridership. Persons at the lower end of the income scale who cannot afford to own and operate an automobile ride in higher numbers than the population at large.

The density of households with annual incomes under $30,000 is mapped in Figure 3-8. Household income and mode choice is a bit difficult to explain with a single metric because a 1-person household with income of $30,000 may own an auto, while an 8-person household with the same income is more likely to not own an automobile. So, this is only one piece of data among the larger analysis.

Incomes under $30,000 is concentrated mostly in the Greenville core. The good news is that most of these zones (except for a few in Greer and Taylors) are served with the existing Greenlink network. It is also noticeable that many of these zones are located not downtown, but in a ring around downtown Greenville. Anecdotal evidence of gentrification occurring in the Greenville core was part of the discussion with the public and stakeholder groups. Thus, it is possible these zones may shift outward (and concentrations lessen) as low-income families are displaced by future gentrification.

Unemployment Density

Unemployment density is a good transit market indicator for two reasons. First, those unemployed (like low income households) are more likely to transit riders because they cannot afford to own and operate an automobile. Second, transit can connect unemployed population to job opportunities, thus providing a public good for the region.

Unemployed persons per acre for the study area is shown in Figure 3-9. While the map shows a lot of zones with some unemployment, these densities are very low. The conclusion is that many zones in the region have at least a few unemployed persons, but that the regional economy is doing well and keeping the numbers low. Concentrations of unemployment include the City View, Berea, and Dunean neighborhoods, along with the areas around Furman and Bob Jones universities (which is logical since many college students do not work).

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[4] http://www.umich.edu/~umtriswt/PDF/UMTRI-2016-4_Abstract_English.pdf

Figure 3-6: Density of Persons Under 25 Years of Age
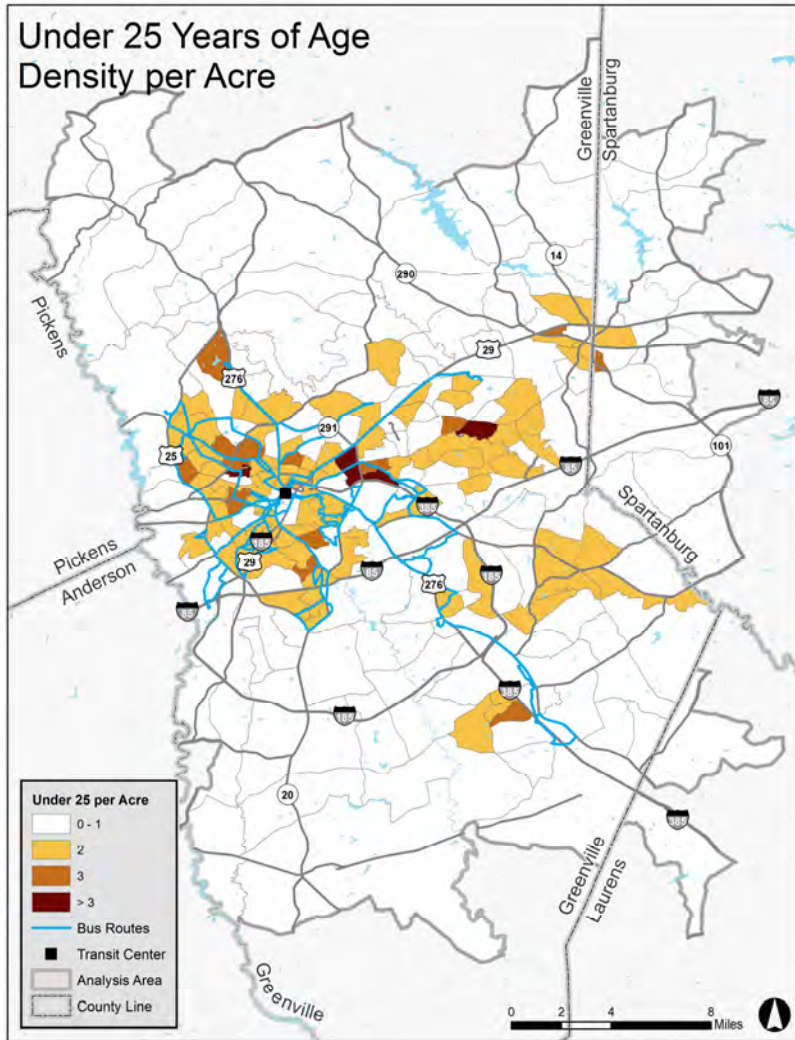
Figure 3-7: Density of Persons Over 64 Years of Age
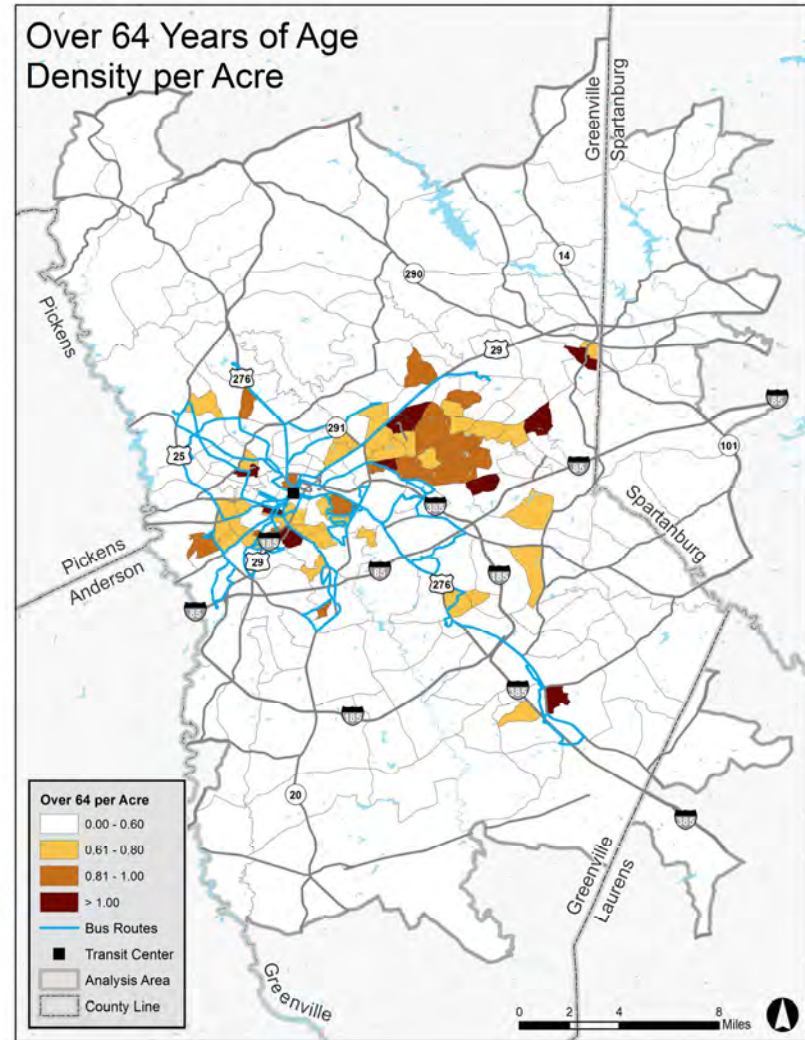
Figure 3-8: Household Income Under $30,000 Density
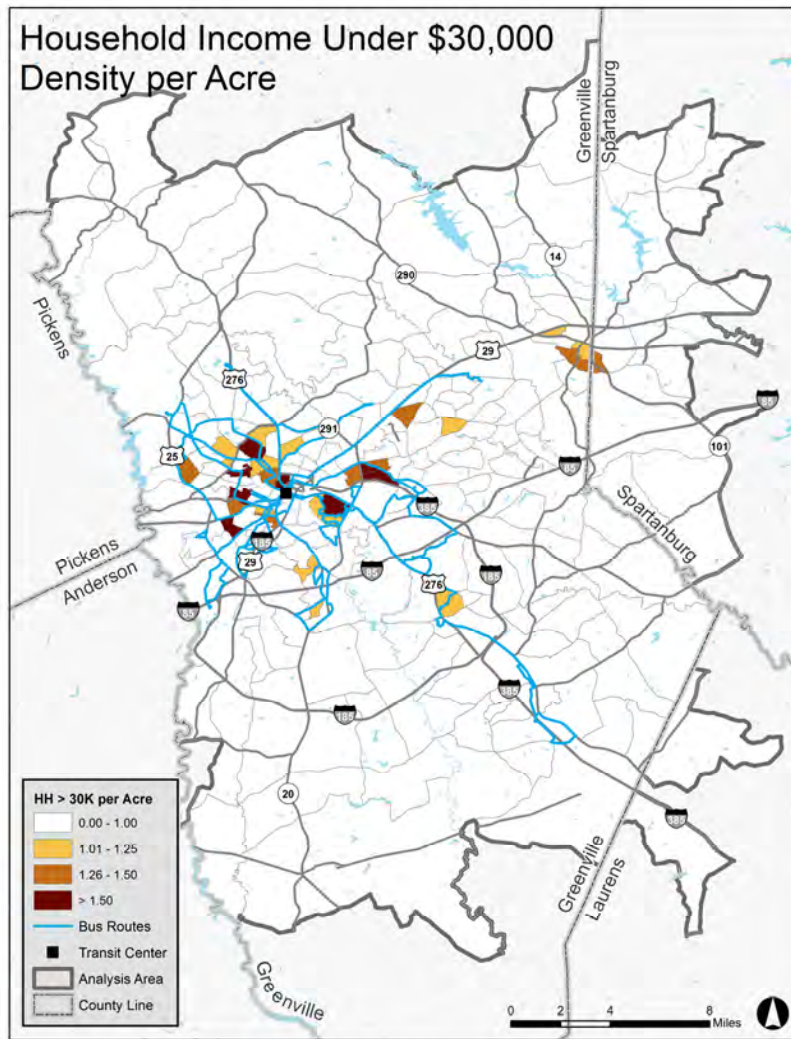
Figure 3-9: Unemployment Density
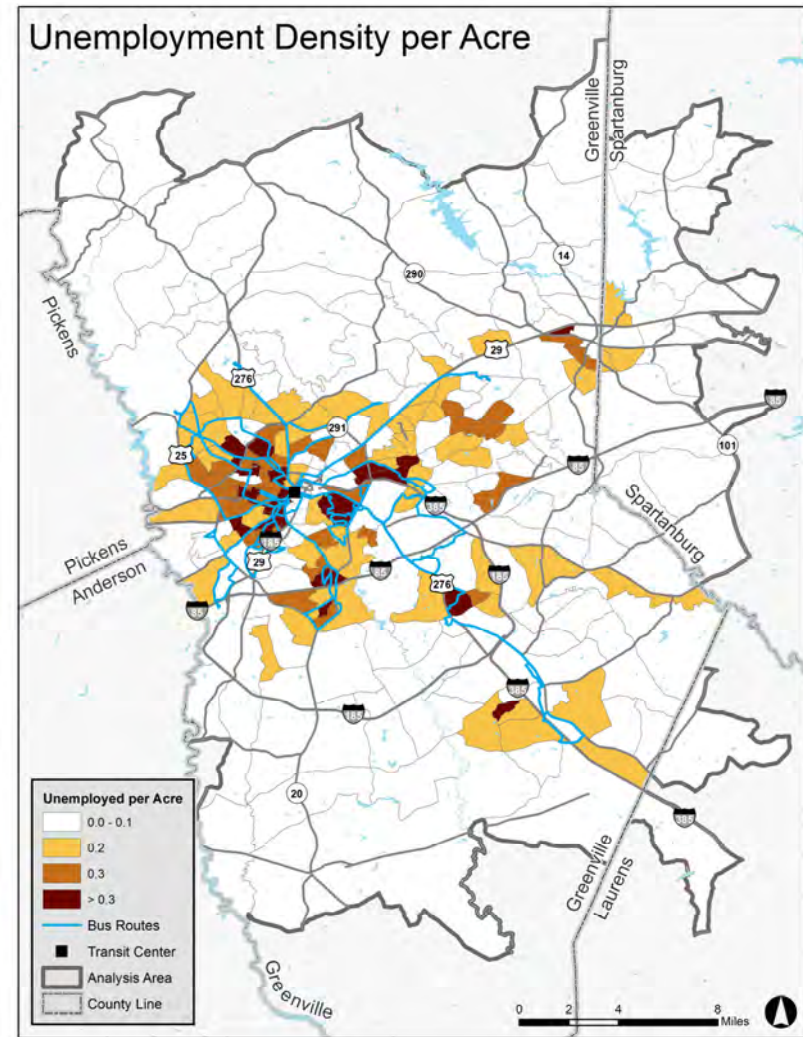
Disabled

The disabled population is a potential transit market since riders with physical or mental limitations rely on others (including transit service) to travel. Disabled persons ages 20-64 per acre for the study area is shown in Figure 3-10. The map shows a lot of zones with some disabled, but it should be pointed out these densities are very low. Concentrations include parts of the north and west sides of Greenville city, Nicholtown, Taylors, and a few zones in Greer.

For the most part, the Greenlink network serves the existing disabled population, except for those zones in Taylors (adjacent to North Street) and Greer.

Auto Ownership

It is self-evident that auto ownership (or lack thereof) is a chief indicator of transit market. The community survey conducted for this study indicated that 70% of Greenlink riders who responded to the survey do not own a car while 90% of non-riders who responded own a car. Thus, auto ownership is a fault line that indicates the likelihood of transit travel in Greenville.

Zero car household density in Greenville is mapped in Figure 3-11. This map echoes the income density map, which is logical since low income households are not likely to be able to afford an auto. Overall, zero car households are concentrated in the Greenville core, with a few zones in Mauldin and Greer. All zones except for Greer are served by the existing Greenlink network.

Race

Race can be an indicator of transit market. African Americans and (to a lesser extent) Hispanics tend to ride transit in higher numbers than the population at large. Some of this is correlated with lower income households. However, it is also a function of culture. All other things being equal, minorities find it more acceptable to ride transit than the population at large.

African American population density per acre is mapped in Figure 3-12. Concentrations are on the north and west sides of Greenville, the Nicholtown neighborhood, and Gantt community along Augusta Road. Most of these areas are served by the existing Greenlink network, except for parts of Gantt.

Hispanic population density per acre is mapped in Figure 3-13. Hispanics are more concentrated on the north side of Greenville, specifically in the Berea neighborhood and along Cedar Lane Road. There are a few other pockets of Hispanic population density, specifically Greer and Simpsonville.

Figure 3-10: Age 20-64 Disabled Population Density
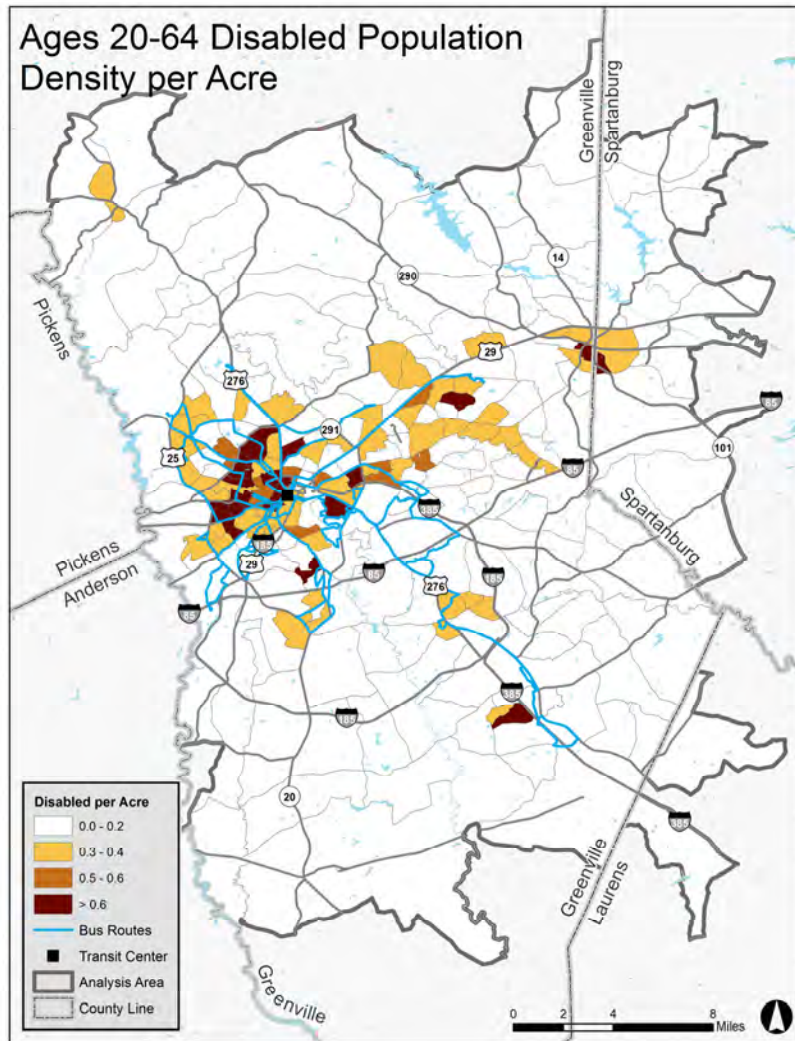
Figure 3-11: Zero Vehicle Household Density
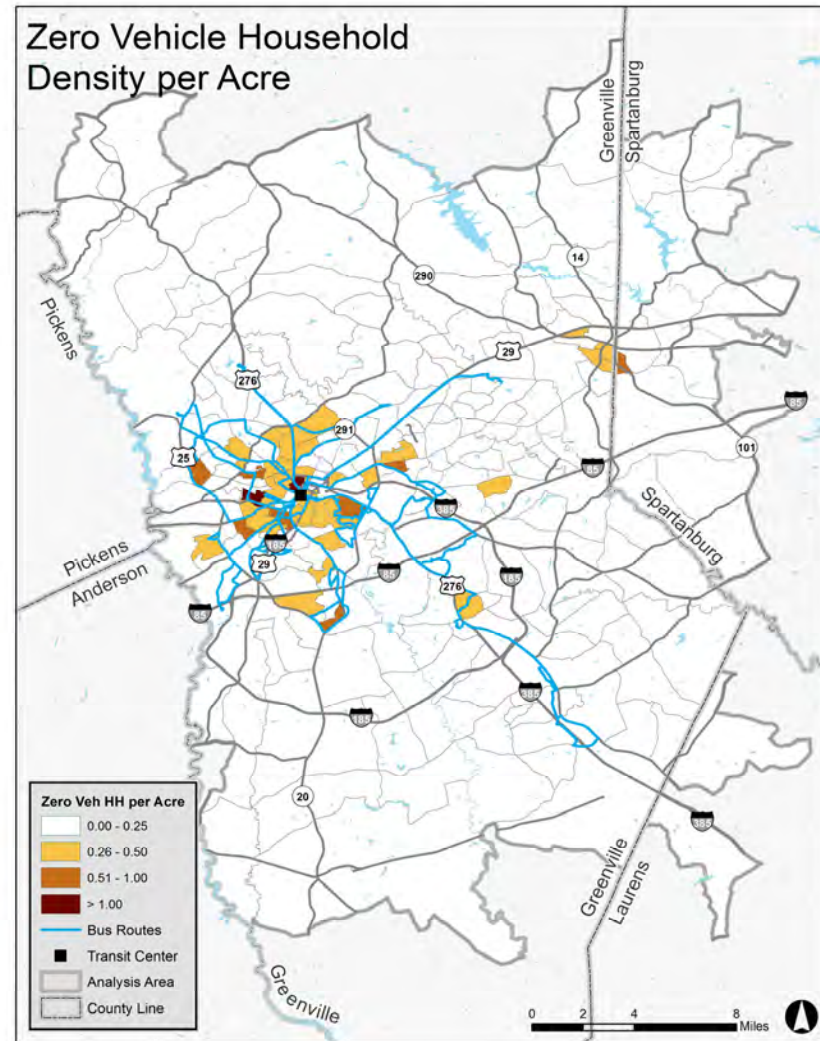
Figure 3-12: African American Population Density
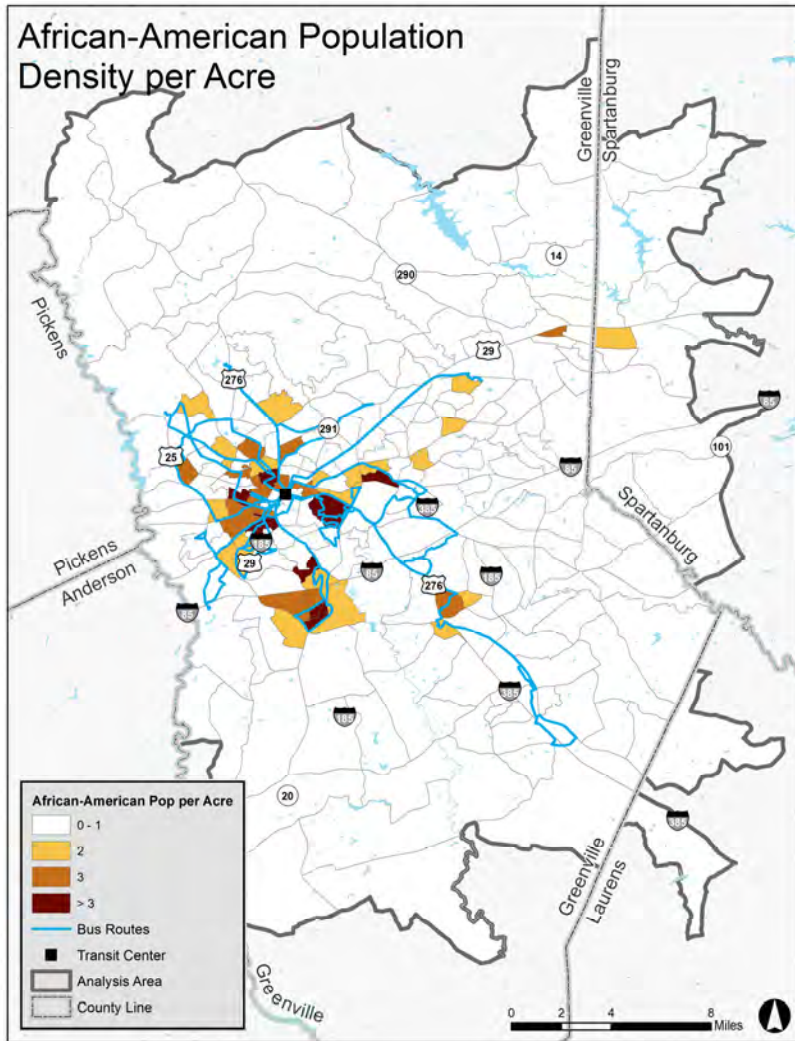
Figure 3-13: Hispanic/Latino Population Density
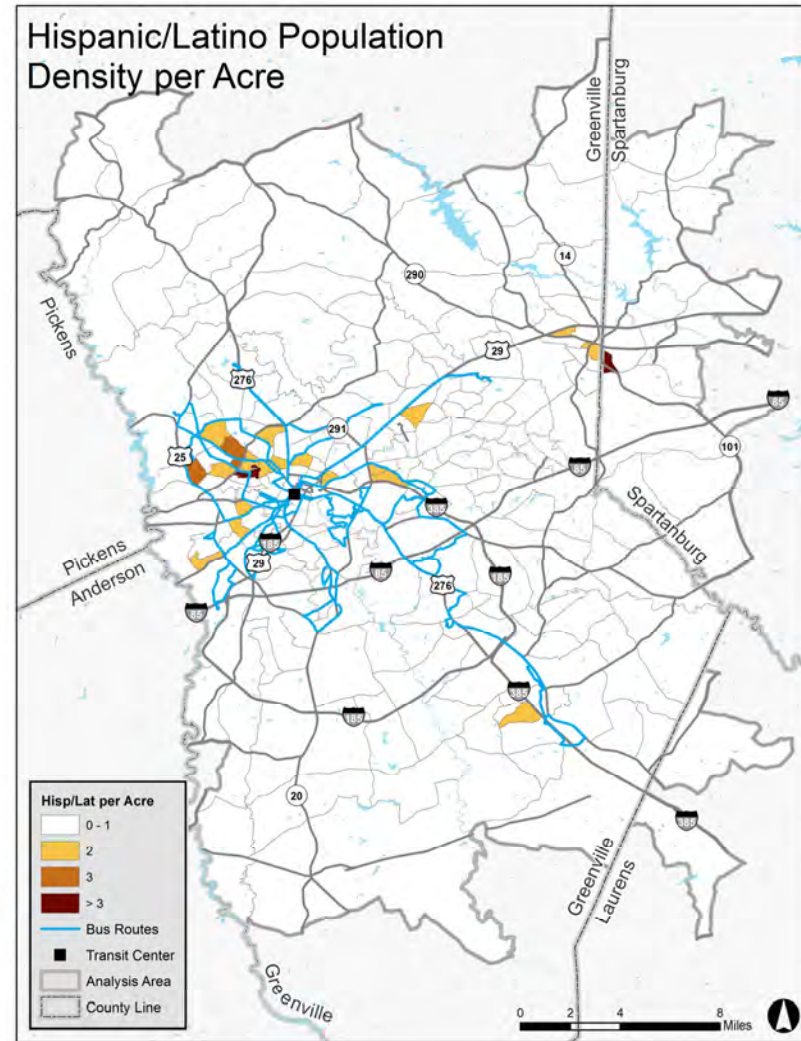
Transit Propensity Analysis

The demographics presented above are each data points that indicate potential transit market. A transit propensity analysis was undertaken to incorporate the above metrics into a single rating that shows where transit ridership is most likely to occur within the defined study area.

The transit propensity score includes both an origin score (how likely someone would use transit at their origin) and destination score (how likely someone would use transit to get to their destination).

For the origin score, incorporated data included the following:

- Population Density
- Age Under 25 Density
- Age Over 64 Density
- Minority Density
- Disabled Density
- 0-Car Household Percentage
- 1-car Household Percentage
- Households Receiving Public Assistance Percentage
- Households Under the Poverty Line Density
- Households Earning Less Than $30,000 in Income Percentage
- Unemployment Density

For the destination score, incorporated data included the following:

- Employment Density
- Employment Characteristics[5]

The imbalance between origin and destination data is because the U.S. Census reports a lot more information on where people live than on where they work. Nevertheless, the consultant team believes this scoring system includes enough information on both the origin and destination part of the trip to be useful in this analysis.

The transit propensity scoring from low to high is shown in Figure 3-14, along with the modes of transit most likely to be served with each level. A transit network with 60-minute frequency is viable when the transit propensity score is at a medium. Increased frequency generally becomes with a medium-high score (30-minute frequency) or high score (15-minute frequency).

The transit propensity score for the study area is mapped in Figure 3-15, along with the existing Greenlink bus network. The scoring shows a few areas of high scoring zones, with these concentrated in downtown Greenville, along Academy Street (near St. Francis Hospital Downtown Campus), Nicholtown, and the area of Pelham Road/Haywood Road. One of the findings of this analysis is that there are simply not enough high scoring zones to justify a network of 15-minute frequency routes.

The map also shows medium high zones in orange, mostly filling in the areas adjacent the red zones. Taken together, the overall picture of transit propensity shows a core centered on downtown Greenville with enough red and orange zones to support a limited 30-minute frequency network. Beyond this area, the transit propensity score indicates a 60-minute frequency service is more appropriate.

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[5] Employment characteristics is a rating based on several NAICS codes related to transit ridership, including employees making less than $1,250 per month and employees in the service industry.

The other finding of the transit propensity is the outer areas ripe for transit expansion. The community survey presented in Chapter 1 asked about expansion to four main areas – Greer, Woodruff Road, Pelham Road, and Travelers Rest. By far the most popular answer was Woodruff Road (38% of responses), with Travelers Rest second (14%). A review of the transit propensity map indicates that Greer has the most ridership potential, with Woodruff and Pelham roads rating about the same. The interesting finding is that Travelers Rest scores low, indicating very little transit ridership potential in this area.

Figure 3-14: Transit Propensity Scoring
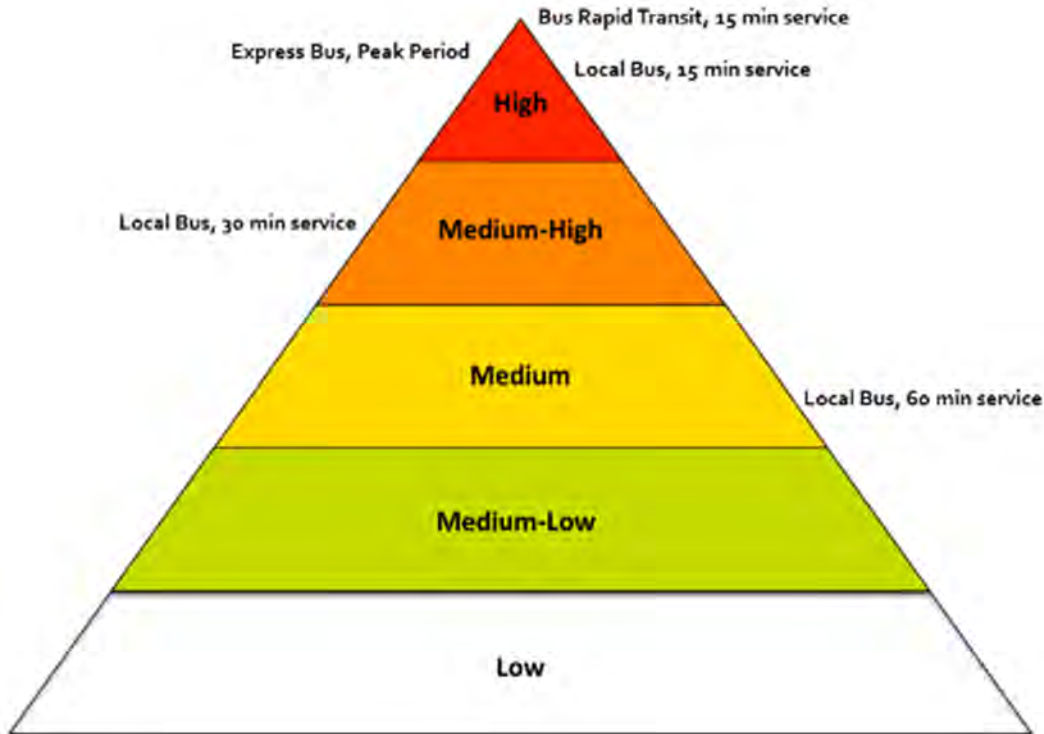
Figure 3-15: Study Area Transit Propensity Index
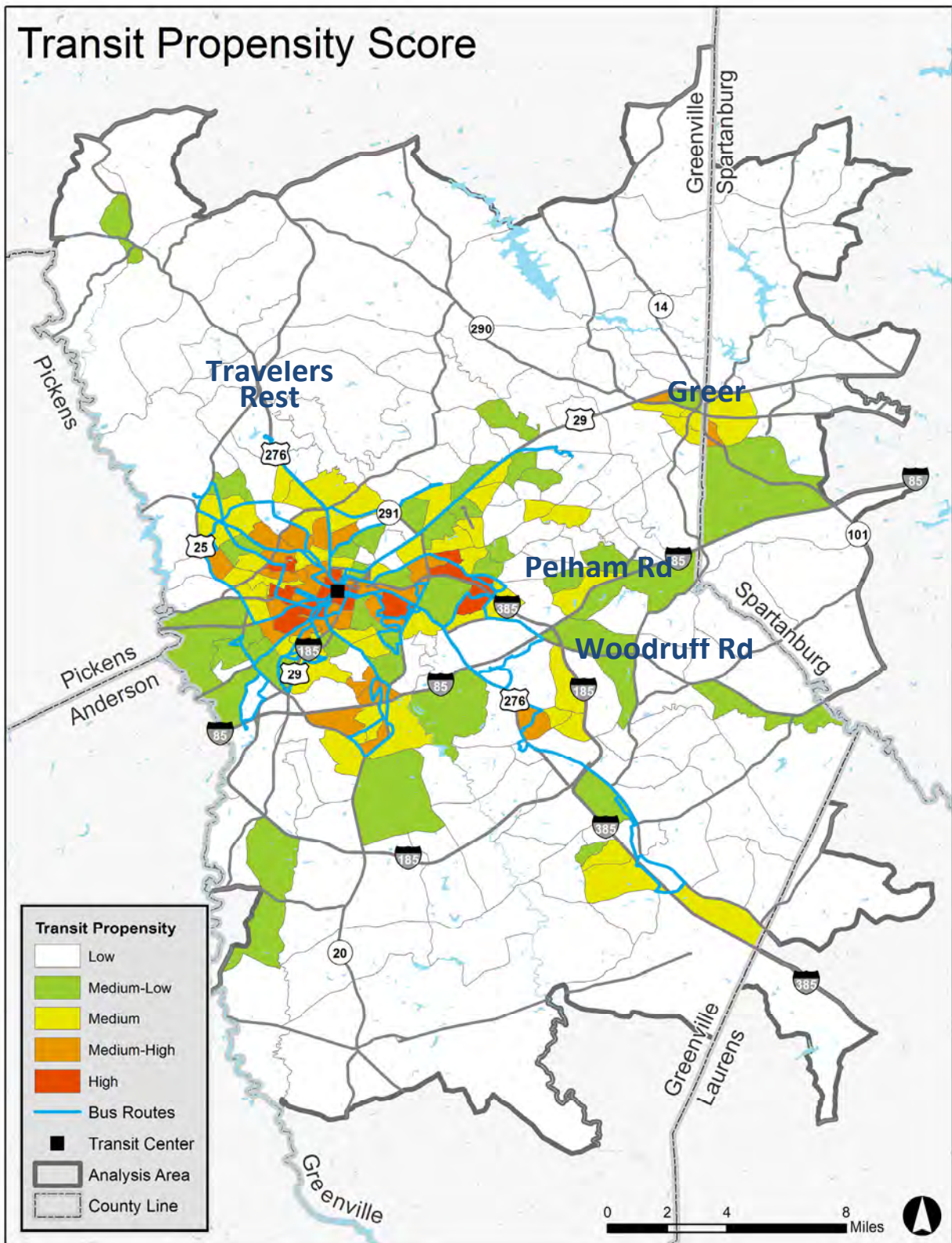
Conclusions

Overall this transit market analysis indicates several significant findings:

1. Most people in Greenville drive because subsidization and land use patterns have contributed to make auto travel the cheapest and fastest mode choice for most residents of the city and county.

2. Population density in the study area tends to be low, with population spread out in the region in single family homes or apartments constructed in suburban areas.

3. Employment density in the study area is more concentrated, especially in downtown Greenville and the Haywood Mall area.

4. Taken by themselves, population and employment densities generally indicate transit service levels in Greenville should be at 60-minute frequencies.

5. Other travel market indicators (income, car ownership, unemployment, disabled, age, and race) show concentrations in the core, especially on the north and west sides of the city, and in Nicholtown.

6. A transit propensity analysis was conducted to add together all transit market indicators.

7. When all indicators are considered, the Greenville core shows potential for the operation of a 30-minute frequency network. Beyond this core, the transit service area is generally more supportive of 60-minute frequencies.

8. Increases in population and employment densities over a larger area would help to support more frequent service.

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CHAPTER 4 NETWORK PERFORMANCE

This chapter presents data and findings for the network performance analysis conducted as part of the Greenlink COA. The three sections of this chapter work from general to specific, first considering Greenlink's overall network performance, then assessing how routes rank against each other, and finally reviewing data at the stop and segment level. The result is a complete picture of the Greenlink system that is the foundation for the proposed network presented in Chapter 5.

Peer Analysis

A peer analysis was conducted to compare how Greenlink performs compared to other transit systems in similarly sized cities. A total of five cities were selected for peer review:

- Columbia, SC
- Charleston, SC
- Winston-Salem, NC
- Greensboro, NC
- Asheville, NC

These five cities were selected because they are of similar size to Greenville, are located nearby geographically, and operate with similar local and state funding constraints.

Transit data from these five cities was obtained from the National Transit Database for fiscal year 2015, the most recent year available for public review. This data is provided in Table 4-1. Data for each peer city is shown, along with the peer average, and the Greenlink data.

In comparing the urbanized and service area, Table 4-1 shows the Greenville urbanized area population, size and density is like the peer average. However, when switching to the service area comparison we see differences, with Greenville service area having a slightly smaller population, a significantly larger service area, and therefore a less population density in the service area.

Turning to service characteristics, we see Greenlink operates much less service than most of its peers. Only Asheville (ART) operates fewer hours and miles of service. Also noteworthy is how much more service Charleston (CARTA) operates. Greenlink has the lowest operating costs, but also the lowest ridership of the peer group.

For service supplied, Greenlink is providing fewer service hours and miles relative to its service area. This is most apparent in service provided per square mile, with Greenlink averaging 288 revenue hours per square mile of service area, while the peer average is 1,284 revenue hours per square mile.

In the ridership productivity category, we see that Greenlink is much less productive than the peer average. Greenlink averages 4.3 trips per capita (peer average is 13.3), 0.9 trips per revenue mile (peer average is 1.7), and 16.5 trips per revenue hour (peer average is 22.4). Based on the size of Greenville, Greenlink should be more productive than it is.

For vehicle utilization, Table 4-1 shows that Greenlink operates more revenue hours per peak vehicle and more revenue miles per peak vehicle than the peer average. Greenlink is getting more service out of its vehicles than other similarly sized transit agencies.

The final category, cost efficiency, shows a varied result. Greenlink is spending less than its peers per capita, which indicates that the system is underinvested. However, on cost per revenue hour and cost per revenue mile of service, Greenlink cost less than its peers. This means Greenlink is running a lean system and is efficient with the dollars that are spent on the system.

Table 4-1: Peer Analysis Data (From 2015 NTD)

Category	Greensboro, NC GTA	Winston-Salem, NC WSTA	Asheville, NC ART	Columbia, SC The COMET	Charleston, SC CARTA	Peer Average	Greenville, SC Greenlink
Urbanized Area							
Population	311,810	391,024	280,648	549,777	548,404	416,333	400,492
Size (square miles)	185	323	265	380	293	289	320
Population Density	1,685	1,211	1,059	1,447	1,872	1,440	1,252
Service Area							
Population	269,666	199,555	83,393	254,000	543,209	269,965	188,191
Size (square miles)	127	108	45	129	137	109	87
Population Density	2,123	1,848	1,853	1,969	3,965	2,472	2,163
Service Characteristics							
Vehicles Operated in Maximum Service	41	36	16	36	73	40	17
Revenue Hours	159,584	131,946	64,345	138,974	206,088	140,187	65,443
Revenue Miles	2,075,635	1,537,221	949,550	1,596,625	2,794,908	1,790,788	1,133,604
Passenger Trips	4,270,997	3,240,427	1,458,306	2,059,884	4,748,310	3,155,585	1,076,667
Passenger Miles	16,614,178	7,874,238	4,681,162	4,751,310	22,222,091	11,228,596	5,491,002
Passenger Miles per Trip	3.89	2.43	3.21	2.31	4.68	3.56	5.10
Total Operating Expense	$14,161,628	$10,974,220	$5,208,630	$12,727,003	$15,319,028	$11,678,102	$4,502,817
Service Supplied							
Revenue Hours per Capita	0.59	0.66	0.77	0.55	0.38	0.52	0.35
Revenue Miles per Capita	7.70	7.70	11.39	6.29	5.15	6.63	6.02
Revenue Hours per Square Mile	1,257	1,222	1,430	1,077	1,504	1,284	752
Revenue Miles per Square Mile	16,344	14,234	21,101	12,377	20,401	16,399	13,030
Ridership Productivity							
Passenger Trips per Capita	15.8	16.2	17.5	8.1	8.7	13.3	4.3
Passenger Trips per Revenue Mile	2.1	2.1	1.5	1.3	1.7	1.7	0.9
Passenger Trips per Revenue Hour	26.8	24.6	22.7	14.8	23.0	22.4	16.5
Vehicle Utilization							
Revenue Hours per Peak Vehicle	3,892	3,665	4,022	3,860	2,823	3,470	3,850
Revenue Miles per Peak Vehicle	50,625	42,701	59,347	44,351	38,286	44,326	66,683
Cost Efficiency							
Operating Expense Per Peak Vehicle	$345,406	$304,839	$325,539	$353,528	$209,850	$307,832	$264,872
Operating Expense Per Revenue Hour	$88.74	$83.17	$80.95	$91.58	$74.33	$83.75	$68.81
Operating Expense Per Revenue Mile	$6.82	$7.14	$5.49	$7.97	$5.48	$6.58	$3.97
Operating Expense Per Passenger Trip	$3.32	$3.39	$3.57	$6.18	$3.23	$3.94	$4.18
Operating Expense Per Passenger Mile	$0.85	$1.39	$1.11	$2.68	$0.69	$1.35	$0.82
Operating Expense Per Capita	$52.52	$54.99	$62.46	$50.11	$28.20	$49.66	$23.93
Farebox Recovery (%)	23%	16%	13%	15%	18%	17%	21%

Peer Conclusions

The peer analysis provided four main conclusions on the performance of the Greenlink system:

- Greenville is underfunding its transit system. On average, its peers are operating much more service relative to area size, and are spending $10-12M annually to do it.

- This underfunding means the system isn't very useful. As a result, Greenlink is much less productive in attracting riders.

- Greenlink does better on cost efficiency and vehicle utilization. The agency gets a lot of service out of its funding and vehicles.

- Although Greenlink is spending money more efficiently than its peers, it us using FTA funds designed for capital to fund its operation expenses. These funds were designed for capital items such as vehicles, facility upgrades/additions, bus stop placement, and other equipment. By using these funds for operating, Greenlink is unable to fund a capital replacement plan.

Driver and Supervisor Interviews

Driver and supervisor interviews were conducted on Wednesday, April 26, 2017 from 12 p.m. to 2 p.m. at the Greenlink Transit Center. The interviews were conducted as an open house. The date, time and location were advertised with the instruction that drivers and supervisors could drop by to chat at any point during the two-hour window. Interviews were conducted by the consultant team without the aid of Greenlink staff to gain an honest opinion about the needs of the system.

A total of four persons (two drivers and two supervisors) attended the open house. The discussion tended to focus on operational issues with the current Greenlink system:

- Route 10 has trouble on the narrowest part of Augusta Street due to utility poles
- There is a tough left turn on Route 9 from Woodside Avenue to Parker Road
- There is a tough left turn on Route 10 from Old Augusta Road to Frontage Road
- There is a tough right turn on Route 2 from Lions Club Road to Eunice Drive
- Traffic issues on Stone Avenue during the PM inbound trips for Route 11
- There are requests from the public for service to manufacturing locations in Fountain Inn near I-385

The results of the interviews were incorporated into the route recommendations and proposed network presented in Chapter 5.

Route Level Analysis

The route level analysis assembled data on each individual route to compare route-level performance. This comparison demonstrates the stronger (and weaker) routes in the system, which is essential for identifying improvements and making recommendations.

Trend Analysis

Data from the National Transit Database was used to create a trend analysis for the Greenlink system. Table 4-2 shows data for six fiscal years, 2010 through 2015. The six-year trend shows a couple of interesting patterns:

- Greenlink has expanded service in recent years:
  - Revenue hours +66%
  - Revenue miles +113%
- While ridership has grown, when controlling for service added, ridership productivity has decreased:
  - Trips per revenue hour -7%
  - Trips per revenue mile -27%

Table 4-2: Greenlink Trend Analysis, 2010-15

Category	2010	2011	2012	2013	2014	2015	% Change 2014-2015	% Change 2013-2015	% Change 2010-2015
Peak Vehicles	13	11	11	14	16	17	6%	21%	31%
Revenue Hrs	39,487	36,142	44,000	48,543	46,962	65,443	39%	35%	66%
Revenue Miles	532,192	450,812	654,972	715,191	653,965	1,133,604	73%	59%	113%
Passenger Trips	695,959	497,337	800,965	855,310	996,071	1,076,667	8%	26%	55%
Trips per Rev Mi	1.3	1.1	1.2	1.2	1.5	0.9	-38%	-21%	-27%
Trips per Rev Hr	17.6	13.8	18.2	17.6	21.2	16.5	-22%	-7%	-7%
Operating Cost	$3,099,040	$3,259,971	$3,025,680	$3,859,870	$5,153,902	$4,502,817	-13%	17%	45%
Cost per Rev Hr	$78.48	$90.20	$68.77	$79.51	$109.75	$68.81	-37%	-13%	-12%

It should be noted that the above data includes both the main Greenlink network and the downtown Trolley. So expanded service hours and miles comes from both expansion of the Trolley, as well as the

extension of Route 14 to Mauldin and Simpsonville. Since the trolley operates in a small geographic area and is by all accounts successful, the downward trend in productivity would probably show a worse trendline if it was not for the Trolley. All told, the Greenlink system is becoming less productive than it was in 2010.

Route Rankings

Route data was collected for the Greenlink network for three broad categories: annual ridership and cost, weekday productivity, and Saturday productivity. These numbers are shown in Table 4-3, while Table 4-4 presents rankings that rank each route against the ten others in the system. Each table is color coded to show the strongest performance in each category in green and weakest performance in white.

The system route rankings (from best to worst):

1. Route 2   (White Horse Road)
2. Route 10   (Augusta Road)
3. Route 3   (Poinsett Hwy/Rutherford Rd)
4. Route 12   (Overbrook/Pelham Rd)
5. Route 11   (Wade Hampton/Taylors)
6. Route 1   (Pleasantburg/Cleveland Park)
7. Route 4   (Dunean/Grove Rd)
8. Route 6   (Anderson Rd)
9. Route 9   (West Parker/Berea/Woodside)
10. Route 14   (Mauldin/Simpsonville)
11. Route 16   (CU-ICAR Circulator)

One finding of this analysis is how consistent the rankings are across categories. For example, Route 2 scores the best overall, but it is also ranked first in 12 of 13 individual categories. Most routes in the network are consistently slotted regardless of the individual metric.

Another interesting finding is that weekday and Saturday productivity rankings are the same for all routes. This means there is little difference between who rides on weekdays and who rides on Saturdays, and which route they are taking. To put it another way, Greenlink is not likely attracting many commuters who only ride during the week but use their automobiles on the weekends.

Table 4-3: Productivity Metrics by Route

Route	Name	Total Annual Ridership	Total Annual Cost	Weekday Daily Avg Revenue	Weekday Riders per Rev Hr	Weekday Riders per Rev Mile	Weekday Subsidy per rider	Weekday Farebox Recovery	Saturday Daily Avg Revenue	Saturday Riders per Rev Hr	Saturday Riders per Rev Mile	Saturday Subsidy per rider	Saturday Farebox Recovery
1	Pleasantburg Dr / Cleveland Park	63,912	$290,223	$202	16.2	1.3	$2.48	26%	$105	11.8	0.9	$3.72	19%
2	White Horse Road	115,013	$294,597	$372	28.7	2.2	$1.01	48%	$246	26.6	2.0	$1.17	44%
3	Poinsett Hwy / Rutherford Rd	89,060	$331,639	$284	22.2	1.2	$2.01	31%	$185	20.2	1.1	$2.29	29%
4	Dunean / Grove Rd	54,366	$289,658	$163	13.6	1.1	$3.15	21%	$105	12.3	1.0	$3.57	19%
6	Anderson Rd	55,952	$306,592	$185	14.1	0.9	$3.21	23%	$112	12.0	0.8	$3.96	19%
9	West Parker / Berea / Woodside	58,384	$309,414	$185	14.7	1.0	$3.14	22%	$107	11.9	0.8	$4.09	18%
10	Augusta Rd	106,837	$305,487	$362	26.7	1.8	$1.21	44%	$227	23.4	1.5	$1.57	38%
11	Wade Hampton / Taylors	72,728	$327,053	$251	18.1	1.0	$2.52	28%	$157	15.8	0.9	$3.03	25%
12	Overbrook / Pelham Rd	70,566	$288,953	$216	17.8	1.4	$2.18	28%	$126	14.5	1.2	$2.88	23%
14	Mauldin / Simpsonville	75,123	$587,357	$244	9.5	0.5	$5.76	14%	$127	6.9	0.4	$8.25	10%
16	Circulator	23,082	$546,443	$61	4.6	0.3	$12.32	4%	$23	5.0	0.2	$15.98	3%

Table 4-4: Productivity Rankings by Route

Route	Name	Total Annual Ridership	Total Annual Cost	Weekday Daily Avg Revenue	Weekday Riders per Rev Hr	Weekday Riders per Rev Mile	Weekday Subsidy per rider	Weekday Farebox Recovery	Saturday Daily Avg Revenue	Saturday Riders per Rev Hr	Saturday Riders per Rev Mile	Saturday Subsidy per rider	Saturday Farebox Recovery	Overall Rank
1	Pleasantburg Dr / Cleveland Park	7	3	7	6	4	5	6	9	9	6	7	7	6
2	White Horse Road	1	4	1	1	1	1	1	1	1	1	1	1	1
3	Poinsett Hwy / Rutherford Rd	3	9	3	3	5	3	3	3	3	4	3	3	3
4	Dunean / Grove Rd	10	2	10	9	6	8	9	10	6	5	6	6	7
6	Anderson Rd	9	6	8	8	9	9	7	7	7	8	8	8	8
9	West Parker / Berea / Woodside	8	7	9	7	8	7	8	8	8	9	9	9	9
10	Augusta Rd	2	5	2	2	2	2	2	2	2	2	2	2	2
11	Wade Hampton / Taylors	5	8	4	4	7	6	5	4	4	7	5	4	5
12	Overbrook / Pelham Rd	6	1	6	5	3	4	4	6	5	3	4	5	4
14	Mauldin / Simpsonville	4	11	5	10	10	10	10	5	10	10	10	10	10
16	Circulator	11	10	11	11	11	11	11	11	11	11	11	11	11

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On-time Performance

The current Greenlink system is a 60-minute pulse, meaning all routes operate once an hour, and meet for transfers at the downtown transit center. Because all routes meet infrequently, on-time performance is critical. A single late bus means that all other buses must wait until that bus arrives so that transfers can occur and the buses can begin their next trip.

Data was collected for end to end run time of all weekday trips operated on February 22-23, 2017[6]. The data was then processed to measure on-time performance using the following thresholds:

- Early: -3 minutes from scheduled end to end run time
- On-time: -3 to +4 minutes from scheduled end to end run time
- Late: +5 minutes from scheduled end to end run time

Table 4-5 presents the results. Route 3 is by far the worst offender when it comes to being late, with 91% of daily trips being late during the data collection. Route 11 is the second worst performing route, but it occurs less than half as often as route 3. Running late is extremely harmful to the pulse because it results in a choice for the system. All other buses either wait for the late bus (thus making everyone late), or the buses leave, thus causing riders on the late bus to sit at the transfer center for an extra hour waiting for the pulse to return. Greenlink currently chooses for all buses to wait. As a result, the pulse tends to run later and later throughout each day as a domino effect occurs.

Table 4-5: Weekday On-Time Performance by Route

Route	Early	On-Time	Late
Route 1	62%	38%	0%
Route 2	50%	42%	8%
Route 3	0%	9%	91%
Route 4	46%	54%	0%
Route 6	33%	56%	11%
Route 9	8%	69%	23%
Route 10	8%	67%	25%
Route 11	14%	50%	36%
Route 12	0%	75%	25%
Route 14	77%	23%	0%
Route 16	19%	58%	23%

Table 4-5 also shows several routes that operate early, including three routes that operated more than half their trips early (routes 14, 1, and 2). Early can be just as damaging to the Greenlink network for two reasons. First, if early means that the bus is not adhering to its scheduled timepoints, then that means some riders are missing their trips.

Second, early performance indicates there is slack in the schedule, which means the route could be doing something else on its alignment. Slack in the schedule is sometimes necessary because a pulse requires a consistent cycle time (in Greenlink's case 60 minutes) even though traffic conditions are rarely consistent throughout the day. The question here is whether there is too much slack in each route, and whether the route could be doing something else to make up the time.

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[6] Data was collected as part of ride check effort. All Greenlink weekday trips were covered on one of these two days, thus providing a snapshot of the entire system

Comprehensive Operations Analysis

Transfer Analysis

A transfer analysis was also conducted at the system level. Farebox data was provided for Thursday, February 23, 2017, which is also the time boarding level ridership data was collected (see next section). Therefore, the transfer data presented here matches with the other information in this chapter.

Table 4-6 shows a transfer matrix, with the origin route on the left and the destination route across the top. The table highlights in green the strongest performing routes in the system.

The top eight pairs in the network are:

- Route 14 to Route 16
- Route 3 to Route 2
- Route 10 to Route 14
- Route 3 to Route 10
- Route 10 to Route 3
- Route 2 to Route 1
- Route 14 to Route 2

Figure 4-1 on the following page shows where transfers are occurring. Note the arrows do **not** represent precise origin and destination locations. They are simply generic locations of each route represented.

Table 4-6: Greenlink Transfer Matrix

		Destination Route										
		1	2	3	4	6	9	10	11	12	14	16
Origin Route	1		14	11	12	6	7	13	7	13	5	0
	2	19		17	9	7	2	15	14	17	19	0
	3	8	26		9	8	10	24	8	8	11	0
	4	10	13	12		5	10	7	10	13	14	0
	6	7	12	7	2		6	11	8	9	12	0
	9	7	4	11	9	2		8	9	12	16	0
	10	12	16	22	5	9	8		13	15	25	0
	11	8	12	11	6	4	6	15		5	11	0
	12	13	14	8	10	10	7	13	5		6	6
	14	3	19	14	11	5	7	14	9	6		36
	16	0	5	2	0	0	2	1	1	5	13	

A further analysis was conducted to determine how many transfers are occurring from routes that originate on the same side of the city to determine how many transfers might be able to be facilitated outside of downtown. To complete this analysis each route in the system was assigned a location (North, Northwest, South, or Southeast). Each origin/destination pair was assigned a combined location pair. For example, route 1 to route 2 was identified as Southeast to Northwest.

Table 4-7 shows these pairs by sector. The consultant team found that 17% (170 out of 1,013 transfers) were occurring between routes that operate on the same side of the city. The majority, 83% (843 out of 1,013 transfers), were occurring from one side of the city to another. This indicates that while there is a market for crosstown service (which would facilitate transfers outside of downtown), this market is smaller than the market for transfers that occur at the downtown transfer center.

Table 4-7: Transfer Pairs by Sector

Pair	ID	Number
SE-SE	O	106
SE-NW	DT	75
SE-N	DT	57
SE-S	DT	95
NW-SE	DT	90
NW-NW	O	6
NW-N	DT	51
NW-S	DT	50
N-SE	DT	51
N-NW	DT	54
N-N	O	19
N-S	DT	66
S-SE	DT	117
S-NW	DT	65
S-N	DT	72
S-S	O	39

Figure 4-1: Top Transfers in Greenlink System
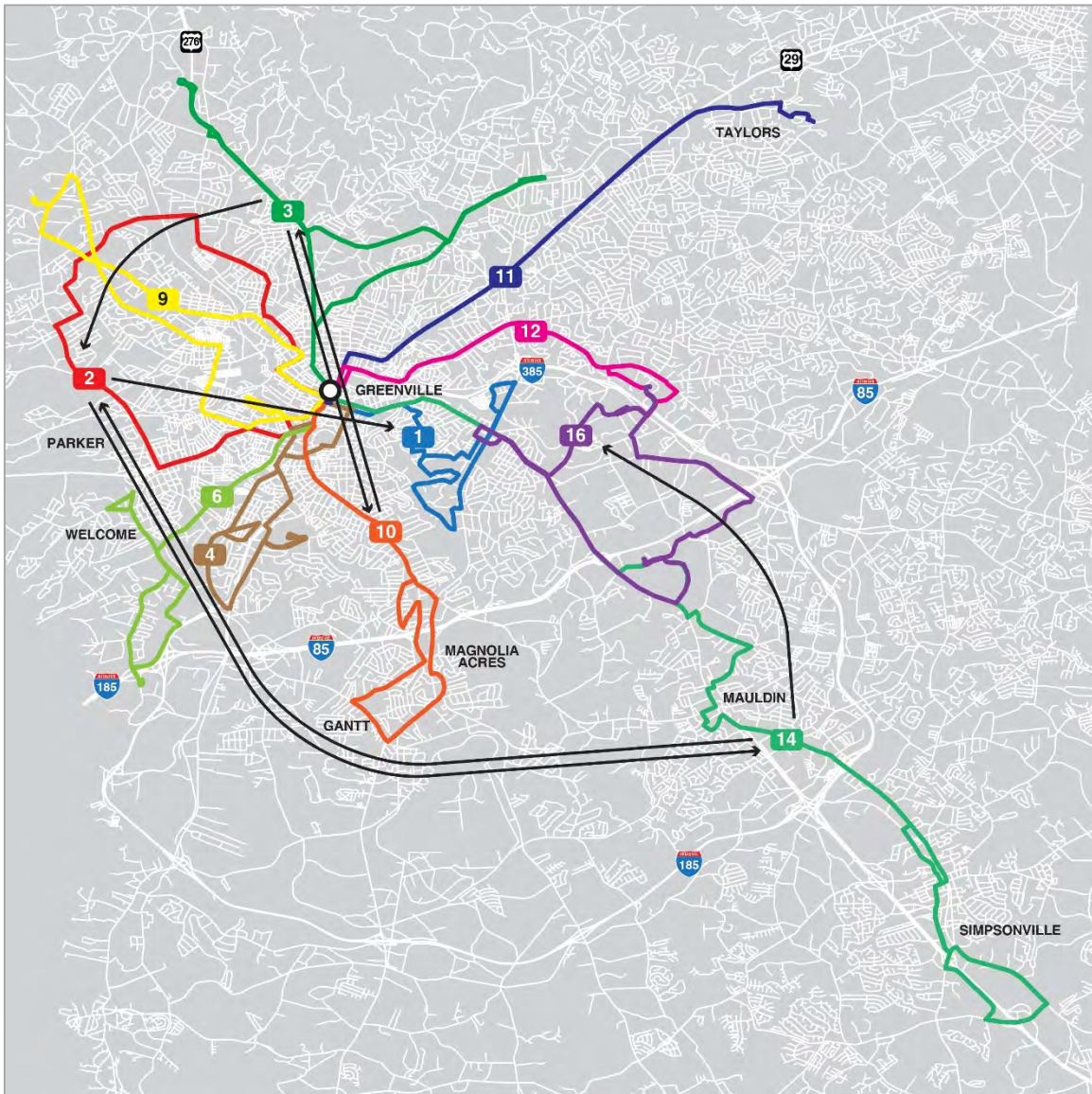
Stop and Segment Level Analysis

Route level data can provide a comprehensive picture of health on each route in the Greenlink system. The drawback to just looking at route level data is that there can be productive and unproductive segments of each route. To gain a full picture of Greenlink productivity and performance, the consultant team collected and processed data at the stop level. This section presents the findings of that analysis.

The final product of this analysis are route profiles for each Greenlink route. The profiles are provided in Appendix 5A.

Stop Level Ridership

Ridership data at the stop level was collected by the consultant team during February 2017. Data collected included every trip operated on every Greenlink route for all typical weekday and a typical Saturday. The result is a snapshot of how the system is performing. Figure 4-2 shows the weekday stop level boardings[7].

Figure 4-2: Greenlink Weekday Stop Level Boardings

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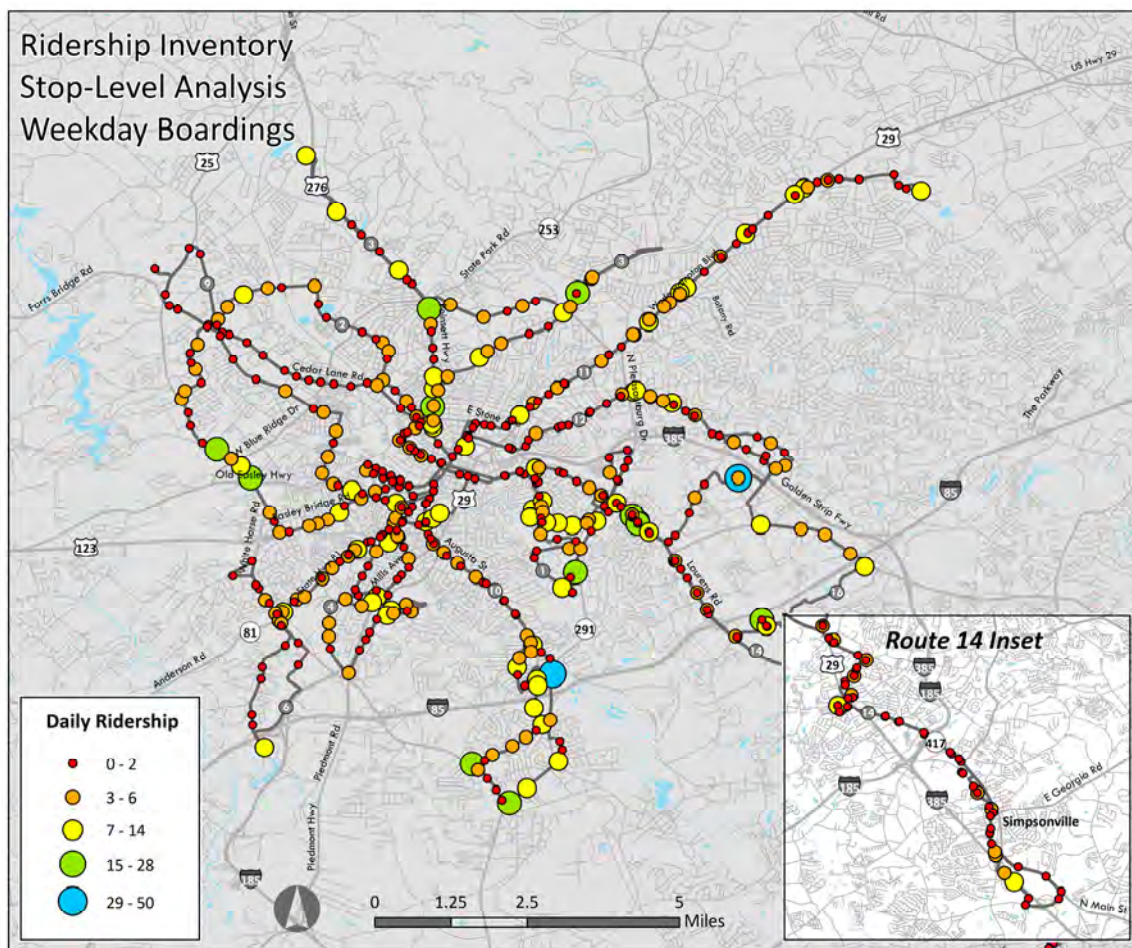
[7] The transit center was not included on this map, as it would dwarf all other results

The data in Figure 4-3 includes dots for each stop. The dots are color coded and sized to reflect the level of boardings. One noticeable trend is how many of the top boardings (the large green and blue dots) are outside of the Greenville core. This is despite transit propensity results in *Chapter 4 Demographic and Market Analysis* showing the core has the most transit ridership potential.

The top 10 boarding locations in the system are:

1. Haywood Mall (Routes 12, 16)
2. S Pleasantburg Dr/Mauldin Rd (Route10)
3. Poinsett Hwy/Cherrydale Pt (Route3)
4. CU-ICAR (Routes 14, 16)
5. Laurens Rd/Perkins Mill (Route14)
6. Rutherford Rd/Stall St (Route3)
7. White Horse Rd/W Marion Rd (Route2)
8. White Horse Rd/Page Dr (Route2)
9. Wade Hampton Blvd/Rushmore Dr (Route11)
10. Woodruff Rd/Carolina Point Pkwy (Route16)

Many of the top locations are where major destinations are located (Walmart, Haywood Mall, CU-ICAR). It is significant to note that many of these locations are outside of the core. Transit is most effective when it operates in a dense environment, with many boardings and alightings reflective of short trips. In the case of Greenlink it appears riders are transferring at the transit center downtown, but in reality are traveling back out to major destinations away from the core. In the 2015 NTD submittal, Greenlink reported 5,491,002 passenger miles and 1,076,667 passenger trips. The calculated trip length is 5.1 miles per trip, which is the longest of the peers (see above section for more detail). The longer trip length indicates a larger regional inefficiency of where riders live and where they are destined.

Segment Level Productivity

Beyond boardings and alightings, the consultant team also reviewed boarding productivity at the segment level. To calculate this metric, boardings were summed for each segment of each route (defined as between scheduled timepoints) and divided by the number of revenue miles operated on the segment.

The resulting metric – boardings per revenue mile – shows productivity by segment for the Greenlink system. Segment productivity is shown in Figure 4-3. The yellow and orange colors represent segments with higher than system average productivity. The blue represents segments with lower than system average productivity. The results show where the system is most productive. Parts of routes 1, 3, and 10 have the more orange, while route 2 has the longest uninterrupted stretch of above average productivity.

These findings reinforce the system level rankings, but they also demonstrate at a more precise level where routes are (and are not) productive. This information is critical to making improvements and recommendations to the Greenlink network.

Table 4-8 shows the number of above average segments by route. It is noteworthy that all routes have at least one above average segment (except for the Circulator). It is also interesting that route 4 has five above average segments, considering this route ranks seventh overall in the system level rankings. However, it reinforces the fact that segment and stop level information is necessary to make proposed improvements to the system.

Table 4-8: Number of Segments with Above Average Productivity (by route)

Route	Top Segments	Route	Top Segments
1	4	10	4
2	4	11	2
3	2	12	2
4	5	14	1
6	1	16	0
9	1		

Figure 4-3: Greenlink Weekday Segment Productivity
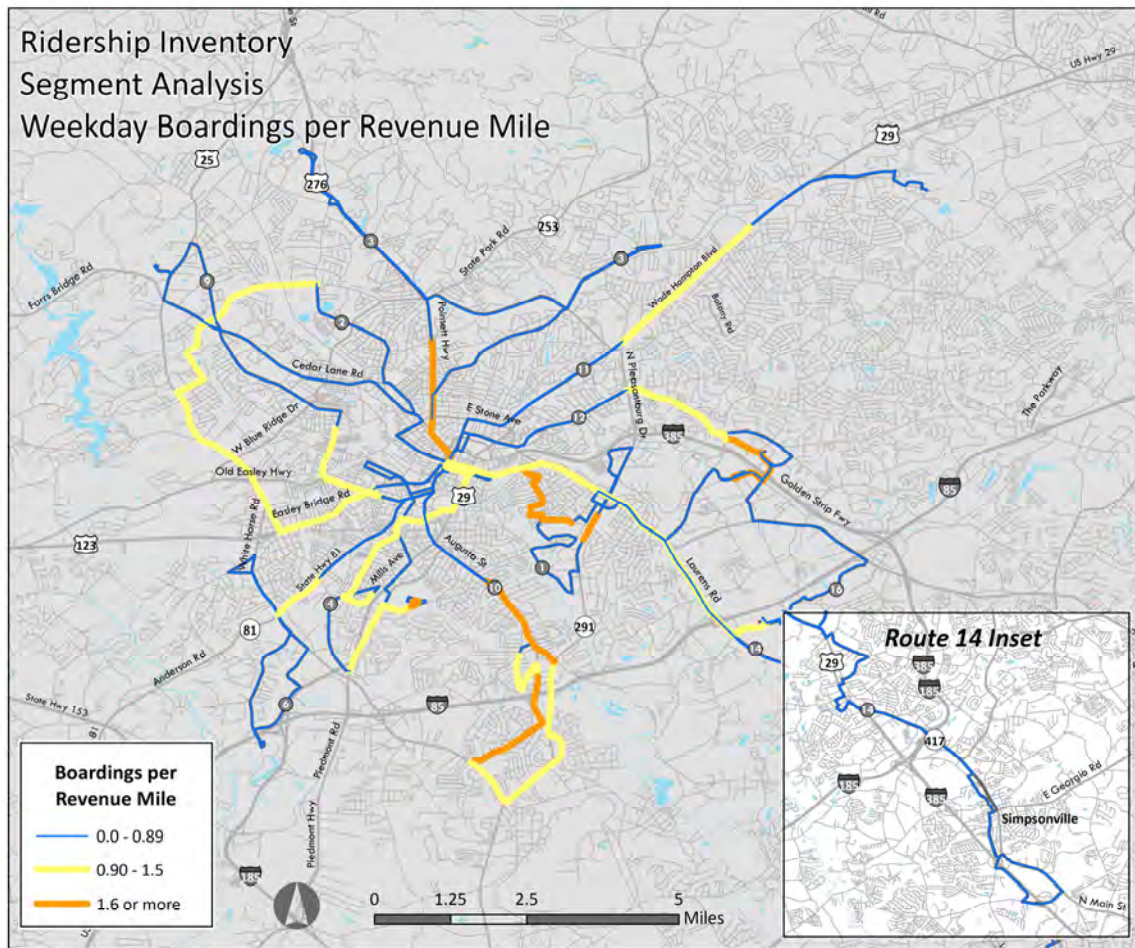
Conclusions

Based on data presented here, the following conclusions can be made of the Network Performance Analysis:

1. Greenlink is operating less service and spending fewer dollars on transit than its peer cities

2. Because the system is underinvested, it is generally unproductive compared to peer cities

3. The six-year trend shows Greenlink has increased revenue hours and miles of service, but that productivity has dropped over these six years.

4. At the route level, routes 2, 10, 3 and 12 are most productive, while routes 6, 9, 14, and 16 are least productive.

5. Route 3 is by far the worst offender in on-time performance measurement, arriving late at the transit center 91% of the time.

6. Most transfers at the transit center (83%) are people traveling across Greenville. Only 17% of transfers begin and end on the same side of the city.

7. The most heavily used stops in the network tend to be outside of the core, and include major destinations like Walmart, Haywood Mall, and hospital campuses.

8. The average passenger trip is 5.1 miles in length, which is by far the longest of the peer group. This indicates Greenlink riders must go long distances than typical to reach their destination.

9. All routes except for route 16 have at least one segment with above average productivity.

10. Routes 1, 2, 4, and 10 do the best on segment productivity.

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CHAPTER 5 PROPOSED NETWORK

Chapter 5 provides the proposed Greenlink network. These are the recommendations that were developed in a collaborative effort by the consultant team and Greenlink staff. This chapter includes three main parts. The first is called Service Delivery Analysis. Here we discuss the best way to deliver transit to Greenlink for the near term. The second section is detailed recommendations, wherein we present the specific changes to each route in the network.

The third and final section of the chapter is evaluation of the draft system. Since the draft system is different from the existing, the consultant team used several metrics to measure the differences and determine how effective the new system is in providing transit to residents in Greenville County.

Service Delivery Analysis

The service delivery analysis seeks to the answer the question, "what is the best way to provide transit in Greenville city and county?" Currently Greenlink operates a pulse where all routes operate at the same frequency and cycle time. These routes[8] meet in downtown Greenville once an hour to provide a transfer from one route to another. Thus, most parts of the current system are accessible with a single transfer.

Nonetheless, the consultant team heard comments during the public and stakeholder outreach asking whether another way to deliver service was possible. Comments related to service delivery tended to focus on three areas: pulse operations, frequency improvements, and service extensions.

Pulse Operations
A common sentiment heard over the course of the study was whether the pulse is the best way to deliver service in Greenville. The transfer analysis provided in Chapter 4 shows that 83% of existing Greenlink riders transfer through downtown Greenville. There is no doubt that providing crosstown service would help the 17% of riders that begin/end their trip on the same side of town. However, because this COA is cost neutral and resources are scarce, it was determined that crosstown service is a lower priority, and it was not included in the draft network.

Frequency Improvements
Another desire expressed during this study was to improve route frequency. Again, because improvements are to be cost neutral, frequency cannot be improved by adding additional service hours to the network. Instead, service could be improved by shortening the existing routes and making them operate with a higher frequency but the same number of service hours. For a 30-minute pulse network, routes could only operate three miles from the transit center before they would need to turn around and go back to meet the next pulse.

Table 5-1 shows the ridership with distance from the transit center. As the table shows, approximately 1,880 boardings and alightings occur within 3 miles of the transit center. This is only 53% percent of the existing Greenlink ridership. Thus, while frequency would greatly improve for these 53%, the other 47% of the network would be missing service completely.

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[8] Except for Route 16 Circulator

Table 5-1: Ridership by Distance from Transit Center

Distance from transit center	Boardings in band	Alightings in band	Cumulative Activity	Cumulative Percentage
Less than 3 miles	913	967	1,880	53%
3.0 - 4.5 miles	484	518	2,882	81%
4.5 - 6.0 miles	198	210	3,290	93%
6.0 - 9.0 miles	79	81	3,450	97%
More than 9 miles	39	50	3,539	100%

To take the analysis further, Figure 5-1 maps existing Greenlink stops with the distance from the transit center. Many key destinations are beyond the three-mile distance. In fact, six of the top 10 stops in the network are beyond three miles from downtown:

Top stops within 3 miles of transit center
- Rutherford Rd/Stall St (route 3)
- Poinsett Hwy/Cherrydale Pt (route 3)
- Laurens Rd/Perkins Mill (route 14)
- White Horse Rd/Page Dr (route 2)

Top stops between 3 and 6 miles of transit center
- Haywood Mall (routes 12, 16)
- S Pleasantburg Dr/Mauldin Rd (route 10)
- CU-ICAR (routes 14, 16)
- White Horse Rd/W Marion Rd (route 2)
- Wade Hampton Blvd/Rushmore Dr (route 11)
- Woodruff Rd/Carolina Point Pkwy (route 16)

Overall, the shortening of routes to improve frequency is not recommended.

Service Extension or Service Span Improvements
This COA is cost neutral. As such, there are not enough funds to maintain the existing service in the Greenville city/county core, while also expanding service. Therefore, extending routes to places like Greer and Woodruff Road was not considered during the COA. Service span was also not considered as part of the COA.

Figure 5-1: Stops by Distance from Transit Center
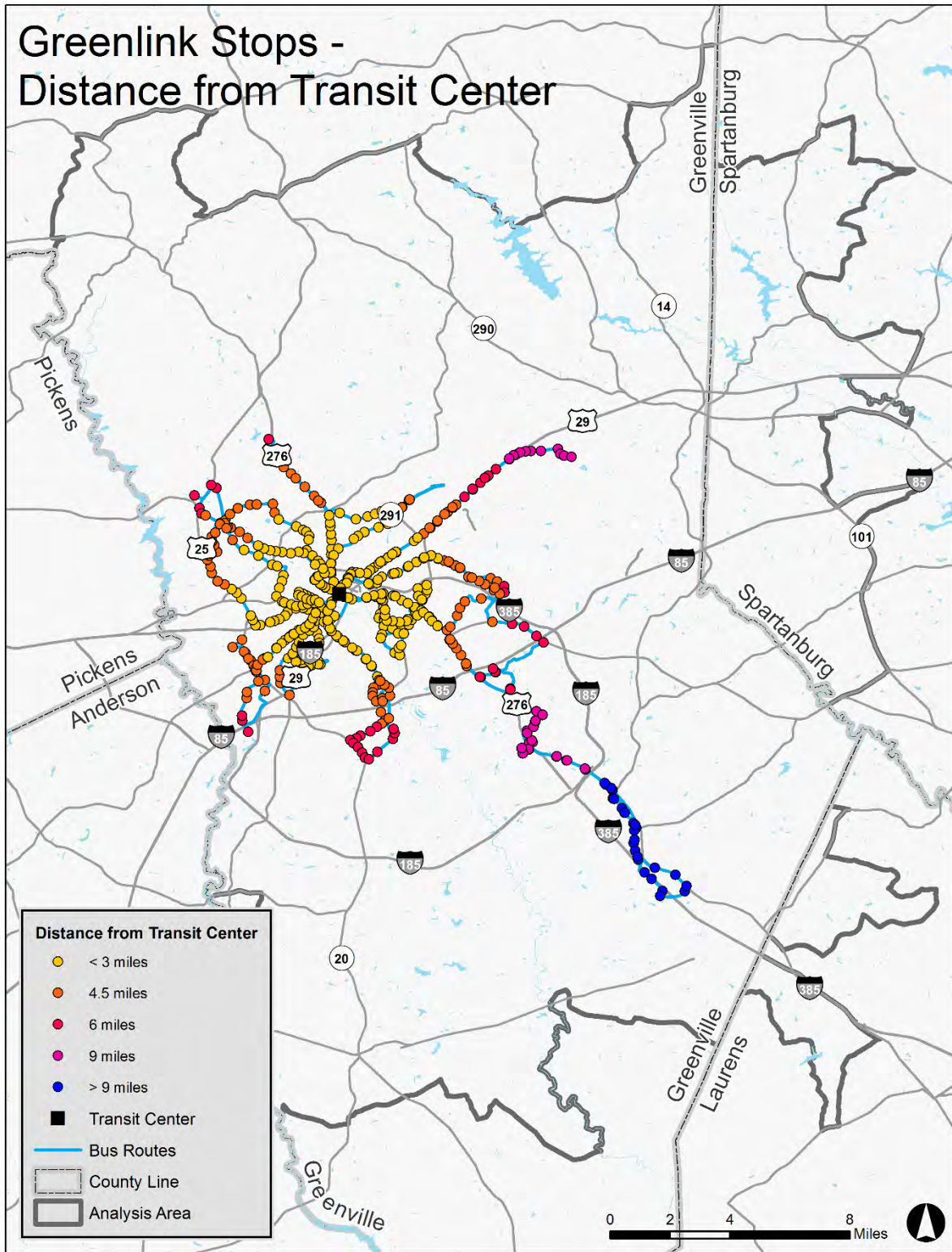
Bi-Directional Alignment

Another investigation conducted for service delivery analysis is the comparison of one-way loop alignments versus bi-directional alignments. The existing Greenlink network makes extensive use of one-way loops, including the entirety of routes 2 and 9, along with parts of routes 1, 3, 4, 6, and 16. The benefit of one-way loops is they provide coverage to a larger area. The drawback is that riders may have to travel far out of the way to get back to their original location. Figure 5-2 shows a comparison of bi-directional and loop services for the same destination. Travel from home and back on the loop route is estimated to take 60 minutes and requires a transfer. Travel on the bi-directional segment requires only 40 minutes of travel with no transfer.

Figure 5-2: Bi-Directional and Loop Alignment Comparison
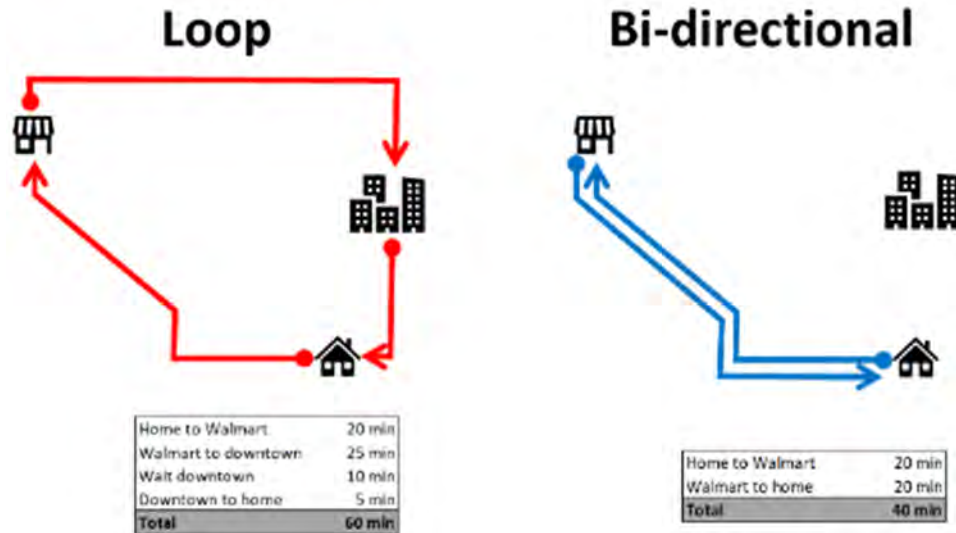
The larger point is that bi-directional routes are more beneficial to travel time savings, provided the existing service footprint can be service effectively.

Service Delivery Recommendation
Based on the analyses in this section, the following recommendations were used as a foundation to making route recommendations:

- Operating a pulse is the most efficient way to connect existing riders in the system.
- Based on the location of existing ridership, a 60-minute frequency network is best use of resources.
- Increasing frequency, extending service, or increasing service span is not possible due to the cost neutral nature of this COA.
- Look for ways to operate bi-directional route alignments, if possible.

Detailed Recommendations

This section provides details on the proposed Greenlink network. A two-day route workshop was conducted with the consultant team and Greenlink staff on May 23 and 24, 2017. During this meeting, the service delivery recommendations from the previous section were applied to plan the draft recommended network. The proposed Greenlink network is shown in Figure 5-3. Overall, the network is like existing. Route 1 still serves Nicholtown. Route 11 still uses Wade Hampton Boulevard. Route 2 serves the White Horse Road Walmart. The largest difference is the conversion of many routes to bi-directional service. As a result, the coverage area is slightly smaller while maintaining the 98% of the existing customer base. Individual route details by geographic sector are provided in the following section.

Because this is a revenue neutral exercise, the number of bus revenue hours for the proposed network matches the existing. The result is that Greenlink would spend the same amount on the proposed network as existing. Table 5-2 provides a summary of the operating statistics by category. The operating statistics were created using a spreadsheet model that takes inputs (travel speed, route distance, service span, and frequency) to create the number of revenue hours, revenue miles, and peak vehicles. A route model was constructed for both existing and the proposed system. The details of each model are provided in Appendix 5A.

Table 5-2: Operating Statistics Summary

Category	Weekday Existing	Weekday Proposed	Saturday Existing	Saturday Proposed	**Total Existing**	**Total Proposed**	**Difference**
Revenue Hours	46,920	46,920	6,120	6,120	**53,040**	**53,040**	**0**
Revenue Miles	717,822	741,734	93,681	96,461	**811,504**	**838,195**	**26,691**
Peak Vehicles	13	13	n/a	n/a	**13**	**13**	**0**

Note that revenue miles are projected to increase by 3% with the proposed system. This will likely have a small financial impact on the overall budget. The consultant team recommends Greenlink conduct additional research to determine this exact amount of this impact.

Figure 5-3: Proposed Greenlink Network
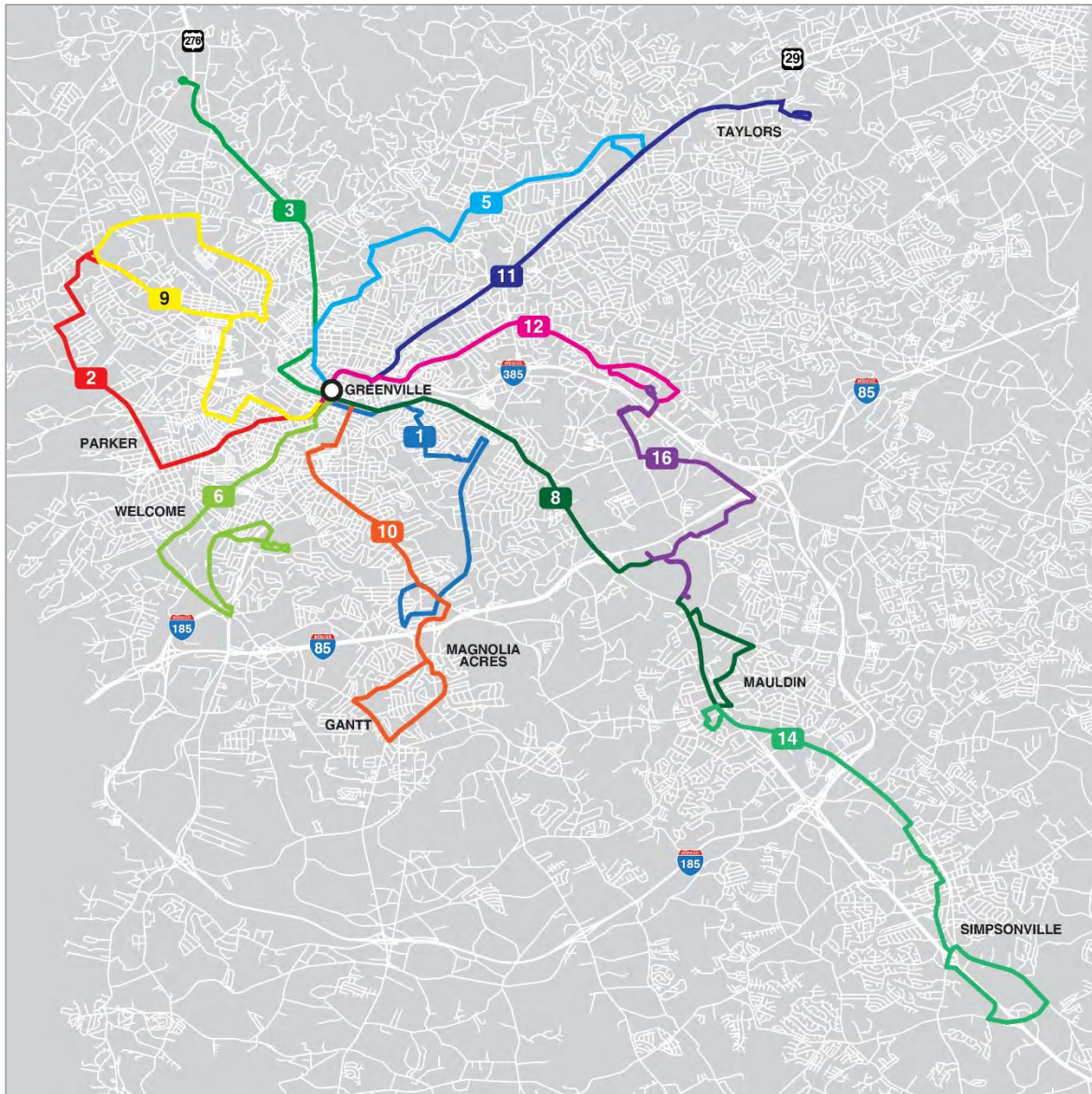
Recommendations by Sector

The draft network is presented here by sector. Each sector details the main changes and how the routes are expected to interact with each other.

Figure 5-4: Sectors for Analysis
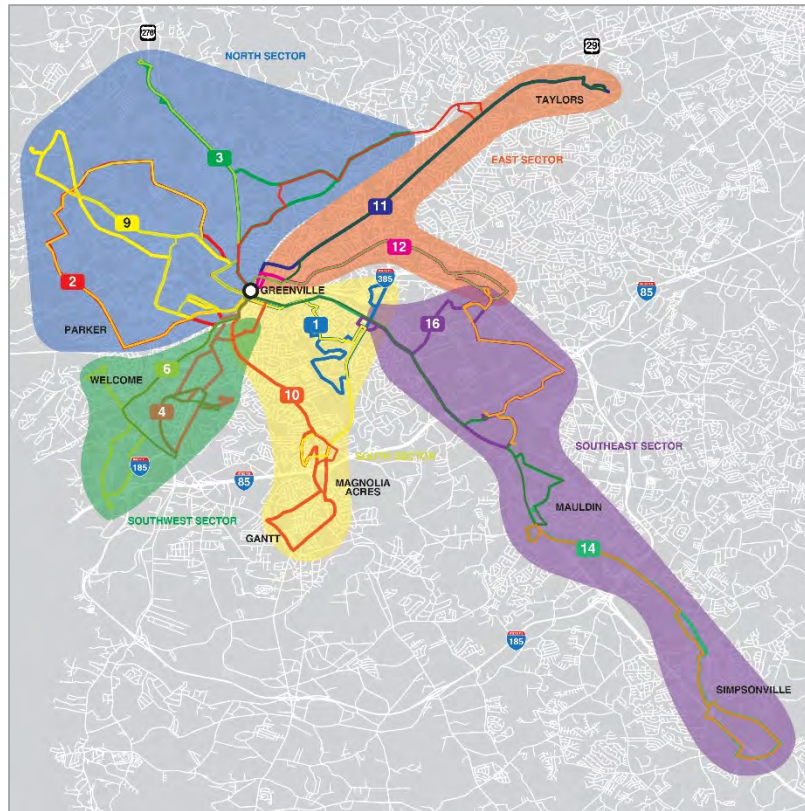
North Sector (Routes 2,3, and 9)
Figure 5-5 shows the existing and proposed routes for the North sector.

Route 2 –this route is converted into a bi-directional route, using the same alignment along Academy Street, Washington Avenue, and White Horse Road. This route is proposed to turn around at Farrs Bridge Road and Eunice Drive and return to downtown Greenville via the same alignment.

Route 3 – this route is proposed to be split into two new routes. Route 3 would operate on Poinsett Highway to Furman University. Route 5 would operate primarily on Rutherford Road, ending at the Wade Hampton Boulevard Walmart. Splitting this route would accomplish two things. First, it would improve on-time performance issues. Second, it would convert both corridors to bi-directional service.

Route 9 – this route would be reconstituted to include parts of the existing route 9 (along Pendleton Street, Woodside Avenue, and Cedar Lane Road) with part of route 2 (along Old Buncombe Road). Part of this route would operate bi-directional, but a one-way loop is also employed at the outer edge of the route.

Eliminated would be service on Parker Road, along with service to the Greenville Tech North Campus. Riders along Parker will be able to walk to Cedar Lane Road for the revised route 9. There are very few riders at Greenville Tech North (2 daily boardings during the ride check), and elimination will enable resources to be reassigned to places in the core with more potential riders.

<u>East Sector (Routes 11 and 12)</u>
The existing and proposed routes for the East sector is shown in Figure 5-6.

Route 11 – most of route 11 is proposed to remain the same as existing. It already operates bi-directionally on Wade Hampton Boulevard and is productive, ranked fifth in the existing system. The one change to this route is to use Academy Street to/from the transit center in downtown Greenville. This small change should help with the overall on-time performance of the route by keeping it on the periphery of downtown.

Route 12 – this route is also proposed to retain the same alignment as existing because it already operates bi-directionally, the alignment was updated by Greenlink in 2016, and is ranked fourth in the existing system. Like route 11, route 12 is proposed to use Academy Street to/from the transit center in downtown Greenville.

<u>Southeast Sector (Routes 14 and 16)</u>
The existing and proposed routes for the Southeast Sector is shown in Figure 5-7.

Route 14 – this route is proposed to be divided into two. Route 8 would operate on Laurens between downtown Greenville and downtown Mauldin. Route 14 would operate between downtown Mauldin and Simpsonville. The alignment for each route would stay the same as the existing route 14, except for a small modification in Mauldin to serve the new Social Security Administration office. Breaking the route up into two will provide an inconvenience for some riders traveling the entire distance from Greenville to Simpsonville. The benefit is that it sets Greenlink up for more flexibility in the future. Routes 8 and 14 could be realigned or extended as new development comes online in the Mauldin and Simpsonville area. These ideas were not explored in this study.

Route 16 – this route is proposed to maintain the eastern part of its alignment along Carolina Point Parkway, Woodruff Road, Mall Connector Road, and Patewood Drive. It would become bi-directional along this alignment. Eliminated would be the segment on Laurens Road to McAlister Square, which was deemed redundant with route 8. The route 16 would become significantly more useful by operating bi-directionally. A comment heard several times was that students living in the Waterside Apartments on Woodruff Road desired a direct connection to CU-ICAR. Operating this route bi-directionally will provide that fast, direct connection desired.

Figure 5-5: North Sector Existing and Proposed Routes
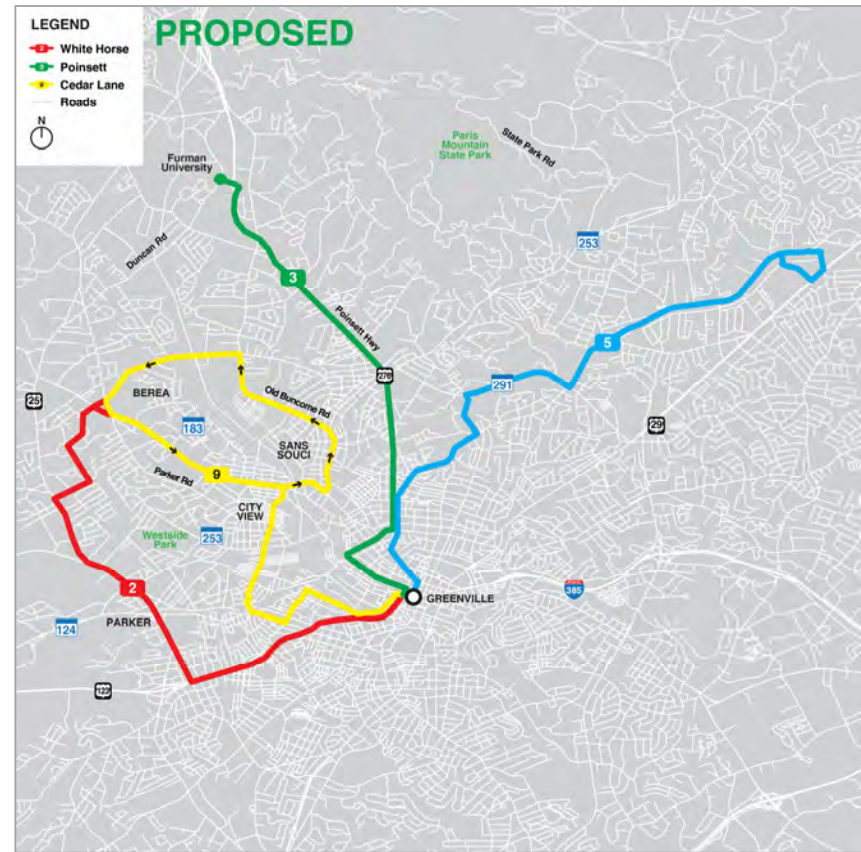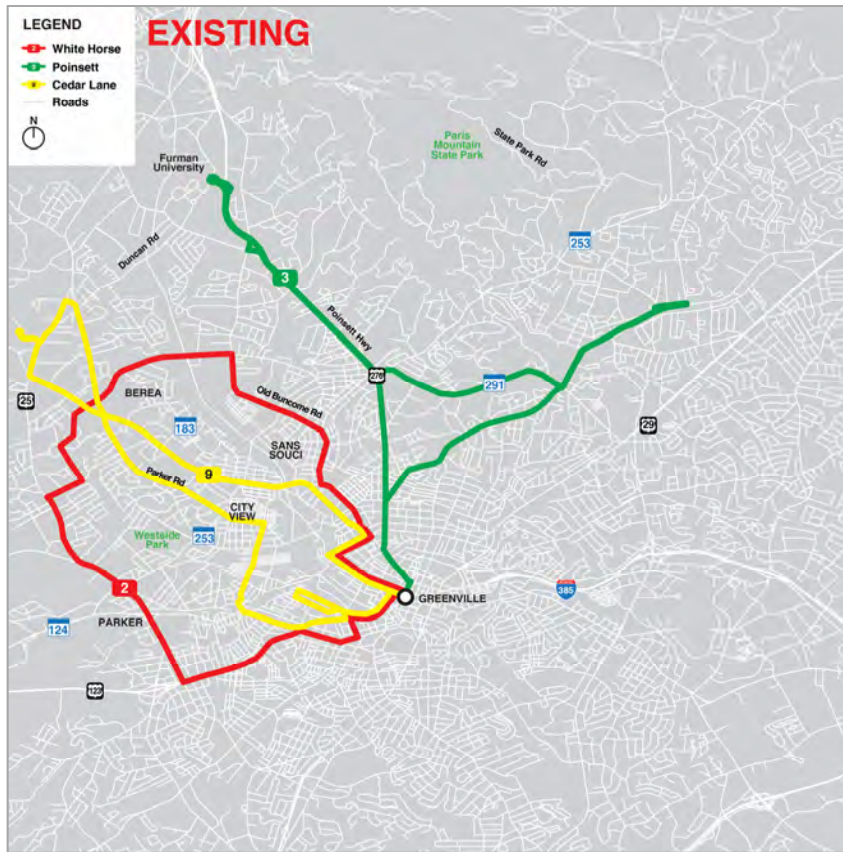
Figure 5-6: East Sector Existing and Proposed Routes
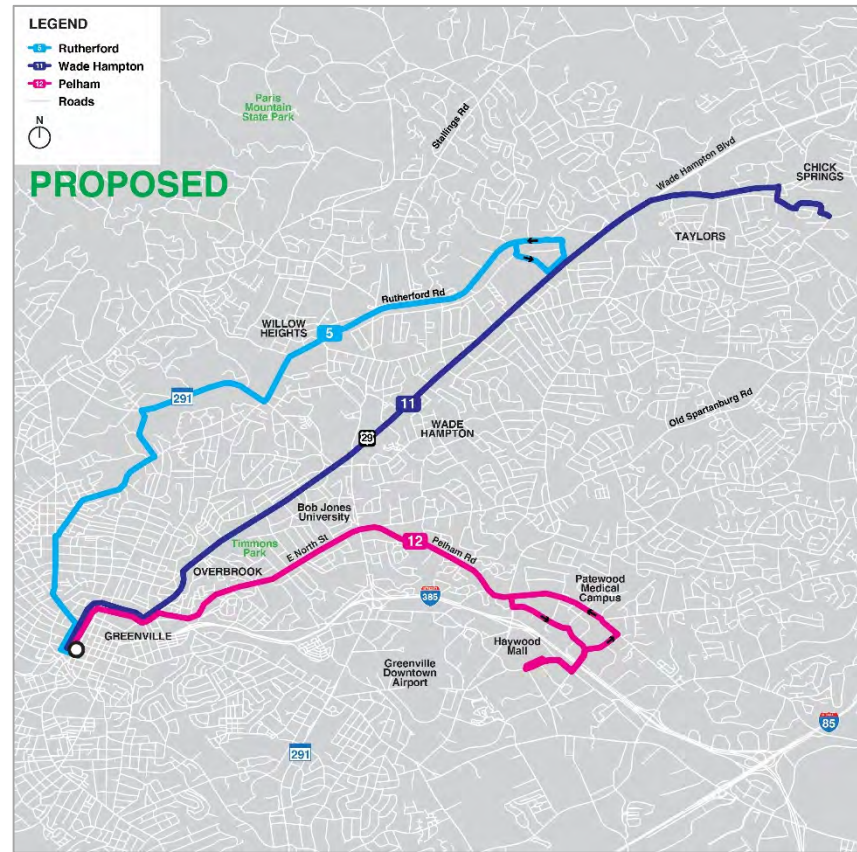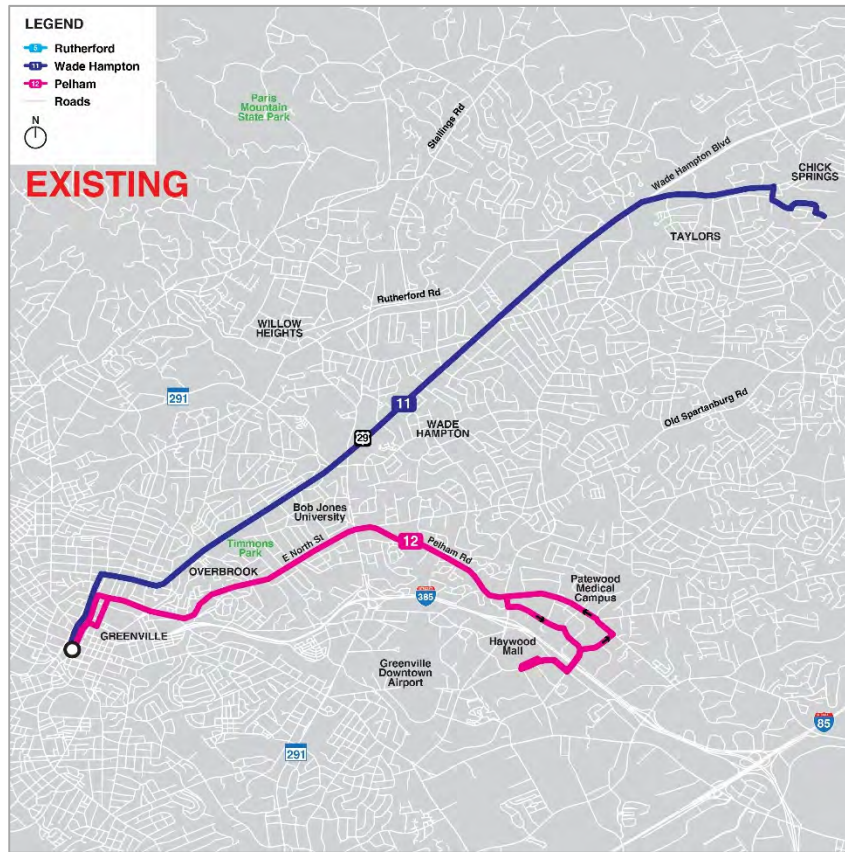
Figure 5-7: Southeast Sector Existing and Proposed Routes
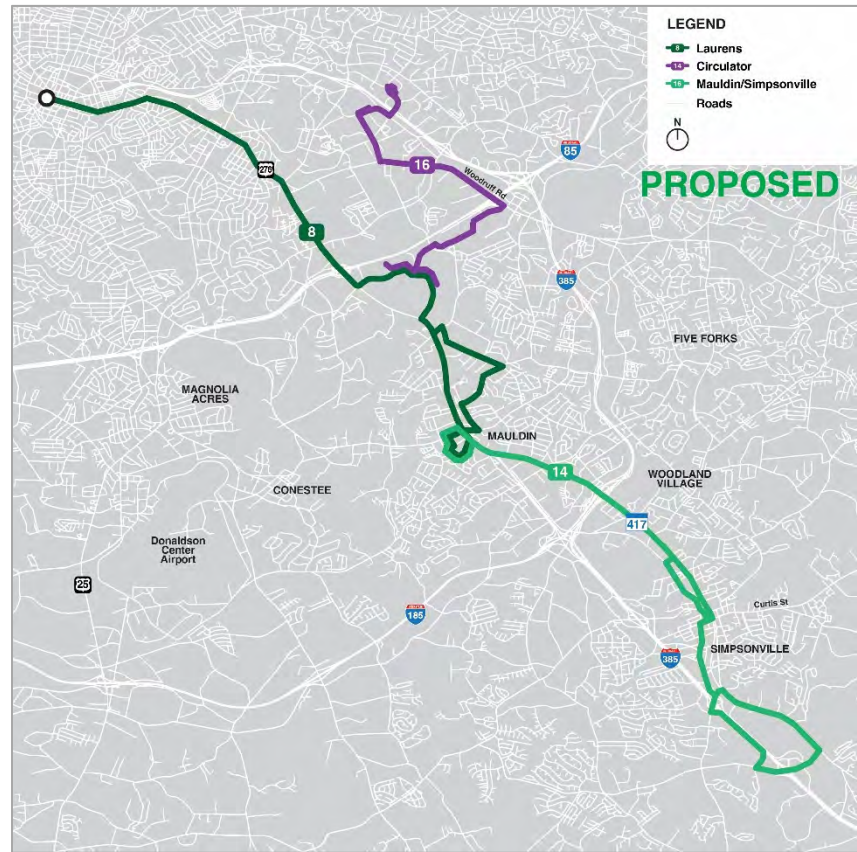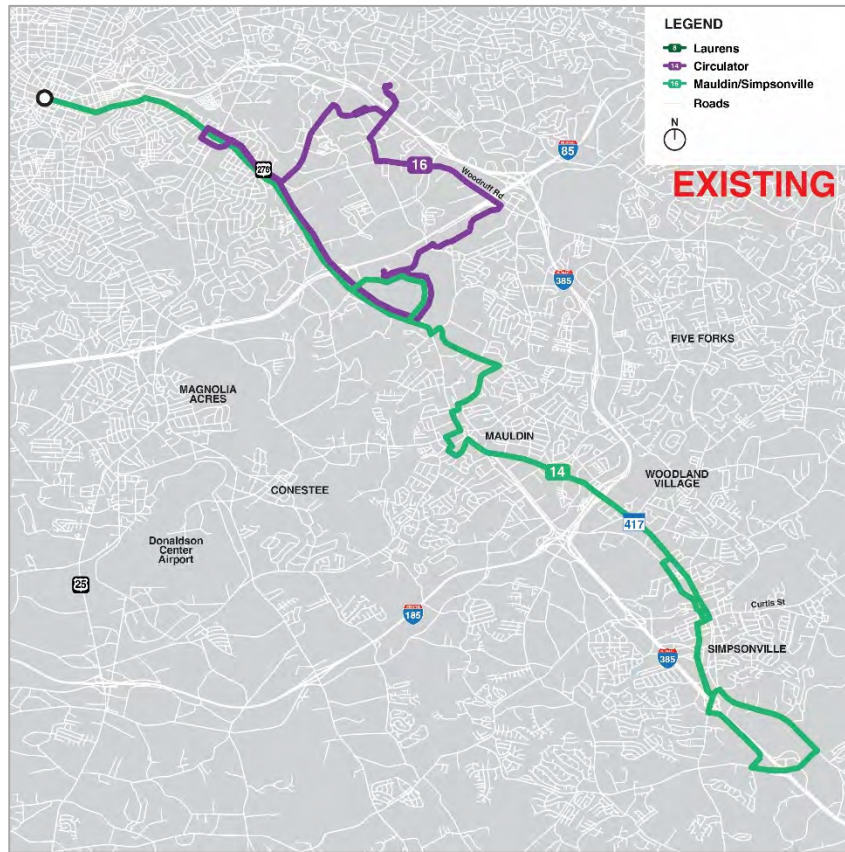
South Sector (Routes 1 and 10)
The existing and proposed routes for the south sector is shown in Figure 5-8.

Route 1 – this route will follow its existing alignment through Nicholtown to Pleasantburg Drive. At that point, instead of turning north to end at Lowndes Hill Road, the proposed route would turn south, ending at the intersection of Pleasantburg Drive and Mauldin Road. The proposed change will result in most of this route operating bi-directionally. Further, it provides two new connections. One is that Nicholtown residents will be able to take this route to shopping in the Pleasantburg/Mauldin/Augusta intersections.

The other connection is that residents along Old Augusta Road can connect to Greenville Tech. This neighborhood has a high unemployment rate, and the connection to Greenville Tech could help some residents improve their economic situation through education.

Route 10 – this route will mostly follow its existing alignment. It operates bi-directionally along Augusta Street, and is ranked as the second most productive in the existing Greenlink network. One proposed change would be to remove the route from Old Augusta Road, as this will be taken over by route 1. The removal should streamline the trip for other customers.

Southwest Sector (Routes 4 and 6)
The existing and proposed routes for the southwest sector is shown in Figure 5-9.

Route 4 – this route is proposed to be eliminated, with parts of this alignment covered by route 6. The analysis showed that much of route 4's existing alignment is within a 0.5 mile walk of proposed services (route 6 along Anderson and Old Piedmont Highway and route 10 along Augusta). While elimination of this (or any route) is undesired, it was determined through extensive analysis to be in the best interest of the overall Greenlink network.

Route 6 – this route is proposed to keep its existing alignment on Anderson Road (which is bi-directional service), then turn and use White Horse Road and Old Piedmont Highway to reach Greenville Memorial Hospital. This proposal would combine the most productive parts of routes 4 and 6. Eliminated would be segments on White Horse Road north of Anderson, Staunton Bridge Road, and Frontage Road.

The Grove Station Apartments would also lose service. While this is a cut to a stop that sees significant activity (12 average daily boardings), the apartments are 6.6 miles from downtown Greenville. Thus, they are beyond the area that can be served effectively within existing Greenlink resources.

Figure 5-8: South Sector Existing and Proposed Routes
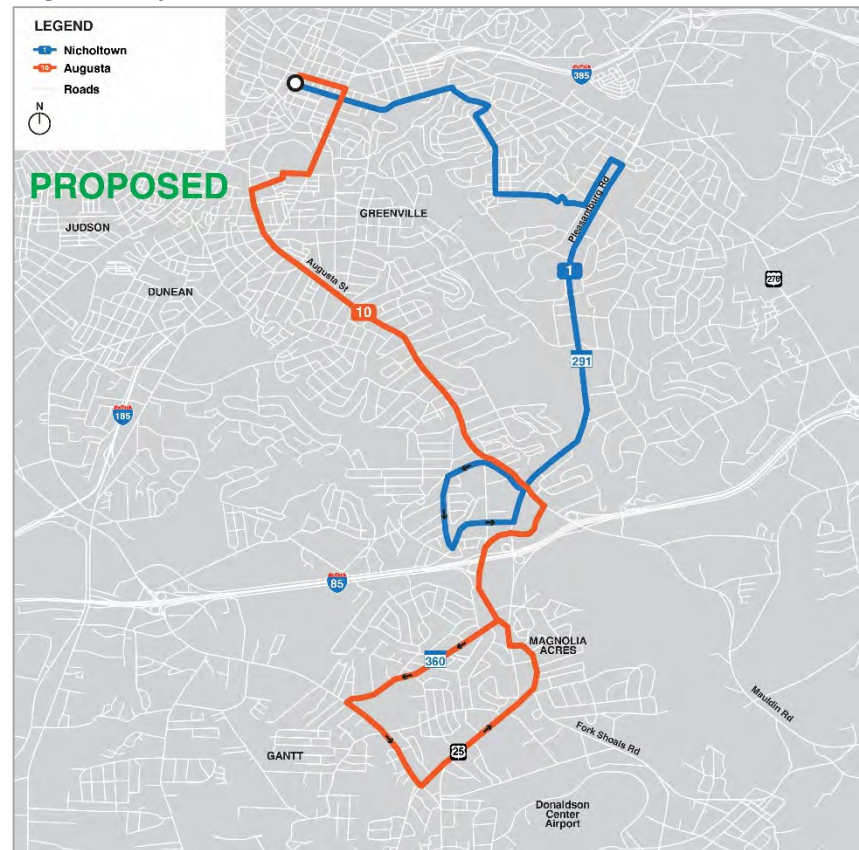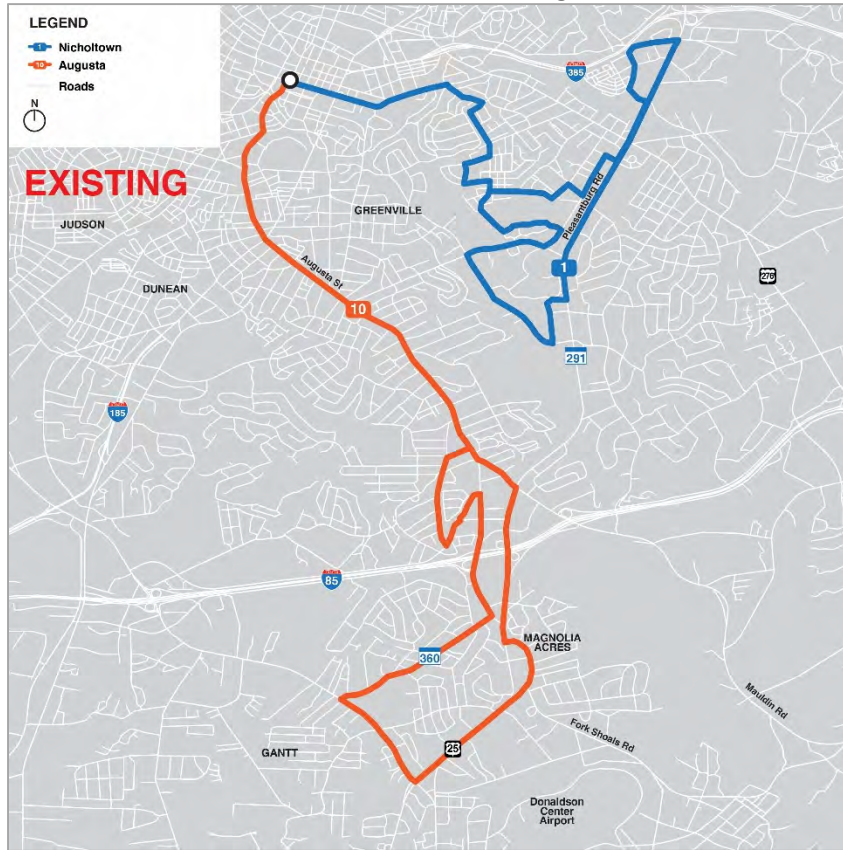
Figure 5-9: Southwest Sector Existing and Proposed Routes

Comprehensive Operations Analysis
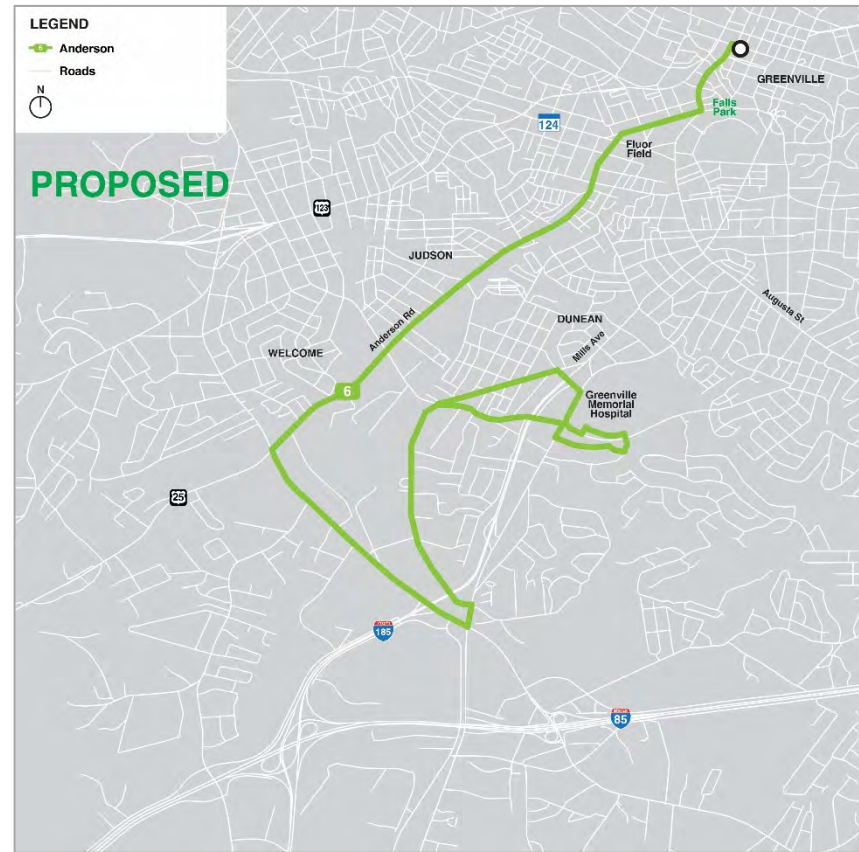
Evaluation of Draft System

The final part of the COA is to take the proposed network and measure the differences between the existing and proposed. The goal for this process is to ensure that the proposed network is an improvement for the clear majority of riders in the system.

Bi-Directional Service

As noted earlier in this chapter, a large emphasis of the draft route recommendations has been on bi-directional service for the routes. Table 5-3 shows the number of bi-directional miles for the existing and proposed system. A 63% increase in bi-directional route miles will occur if the proposed network is implemented. This change will drastically improve travel times for a large majority of the Greenlink customer base.

Table 5-3: Existing and Proposed Bi-Directional Miles

	Bi-directional [mi]
Existing	48.7
Proposed	79.3
Percent Change	**62.9%**

Service Footprint

Table 5-4 shows the service area in square miles for the existing and proposed networks. The service area was measured by drawing a 0.5-mile buffer around both networks. As the table shows, there is a 7% decrease in service area. The conversion of many routes from one-way loops to bi-directional routes had the effect of shrinking the service area by 5.4 square miles.

Table 5-4: Service Area for Existing and Proposed Network

	Service Area [mi^2]
Existing	77.8
Proposed	72.4
Percent Change	**-6.9%**

Stop Activity

The change in service footprint must also be considered with stop activity. Table 5-5 shows all stop activity within 0.5 miles of the existing and proposed networks. While it is true that service footprint is shrinking by 7%, stop activity only drops by 2%. To put it another way, Greenlink is shrinking the service footprint while keeping 98% of its customer base. This indicates that the proposed network is efficient, putting resources in the core where ridership is strongest.

Table 5-5: Stop Activity within 0.5 miles of Existing and Proposed Network

	Within New Service Area	Outside New Service Area	Total Existing Activity
Boardings	1,680	33	1,713
Alightings	1,773	53	1,826
Total Stop Activity	3,453	86	3,539
Total Percentage	**97.6%**	**2.4%**	**100.0%**

New route connections

While the transfer analysis shows that 83% of riders are likely to connect through downtown Greenville, there is still a need for connections outside of downtown. The number of connections outside of downtown Greenville would increase from four to six under the proposed network, as shown in Figure 5-10. The two new connections would be between routes 5 and 11 at the Wade Hampton Walmart, and between routes 1 and 10 at the Pleasantburg Drive/Mauldin Road intersection. All other connections already exist within the network.

On-time performance

Greenlink currently operates a pulse and that is recommended to continue with the proposed network. As such, improvements to run times are an important part of this evaluation. A pulse only works if all routes can reach the transit center consistently within the allotted time.

The major change expected to help on-time performance is the conversion of existing route 3 into two routes. Currently route 3 is the worst performer in the network (late 91% of the time during the ride check in February 2017). Operating two distinctive routes – route 3 on Poinsett and route 5 on Rutherford – will ensure both corridors are served effectively and the pulse operates on-time.

Another smaller change is how routes 11 and 12 enter and leave downtown Greenville. Currently those routes use Richardson Street (route 11) or Park Avenue (route 12). Both routes are recommended to use Academy into and out of downtown. While a small change, it is projected to provide a 1-minute travel time savings and add reliability to both routes, which will in turn help on-time performance of the entire system.

Figure 5-10: Proposed Network Connections Outside of Downtown
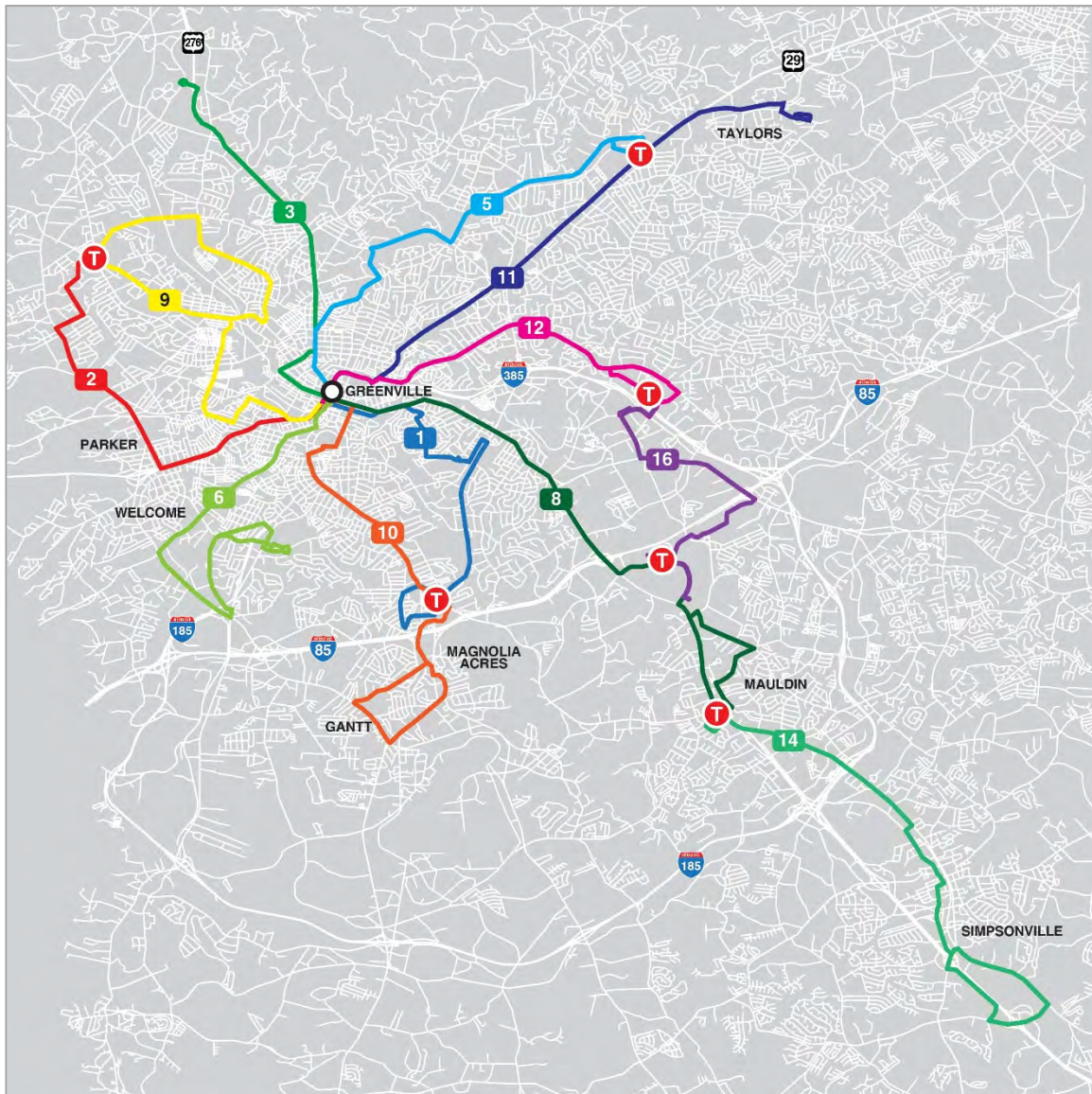
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APPENDIX 1A PUBLIC OPEN HOUSE COMMENTS

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Sign-In Sheet
Comprehensive Operations Analysis
Public Open House
April 27, 2017
3:00 – 6:00 p.m.

Name	Organization	Email Address or Phone Number
Kim Calhoun		Kaeee4@gmail.com
Sam Zimmerman	GTA Board	revz three@aol.com
Jeff Church		JFFR CHURCH@gmail.com
Alice Booth		NiCeman@ATT.Net
Mike Nix		LindaWButz990@outlook.com
Linda Butler	Retired	MaryMcGowan@gmail.com
Mary McGowan		864 519-7227
Stephanie Young		

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Sign-In Sheet
Comprehensive Operations Analysis
Public Open House
April 27, 2017
3:00 – 6:00 p.m.

Name	Organization	Email Address or Phone Number
(illegible)	CLEMSON SC	MKAYLC@CLEMSON.EDU
Derrick Blondino	Clemson, SC	dblond@g.clemson.edu
Jalen Elrod	GYD	864-915-7080

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![greenlink Connecting Greenville]

Sign-In Sheet
Comprehensive Operations Analysis
Public Open House
April 27, 2017
3:00 – 6:00 p.m.

Name	Organization	Email Address or Phone Number
Priscella Lee-Bridges	UTC PIC GvilleDrawl	plccbridgesmdellsouth.net
LAWRENCE PARKS	SC WORKS	lparks@dew.sc.gov
Connie Terrell		cterrell@aol.com
Anthony Smith		
Victoria Wornom	Furman	victoria.wornom@furman.edu
Hannah Wheeler	Furman	hannah.wheeler@furman.edu
Charles Salm	eDR Solutions	info@edrsolutions.co
LAURA BELL		belltate@gmail.com
ARON TANNENBAUM	CLEMSON UNIV	ATANNEN@CLEMSON.EDU
Tina Dent	D.S.S.	tina.dent@dss.sc.gov
Sam Janosik	UTC/GCAW TOUCH THE FUTURE	admin@touchthefuture.us
Sarah Franco	Velo Wheels Gives Back	sarahfranco@veloxwheels.com
TED FRANK		GICTED FRANK@GMAIL.COM
Hillary Halpern		hillary@houseofmerdes.com
Mary McGowan		marymcgowan@gmail.com
Susan McLarty (Ellis McLarty)	Westminster Pres	smclarty@wpc-online.org
Brennan Hansley	GPATS	bhansle@greenvillecounty.org

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Comprehensive Operations Analysis

Public Open House

Good morning!

I was sorry to miss the gathering - I work Thursday evenings. The traffic on Woodruff Road (as everyone knows) can be awful at times. There is a new library opening soon at Five Forks - there are shopping malls - a movie theater - all these things are not available to someone like my husband who can not drive. So when I am at work - he can only get to places that are within walking distance.He would love to be able to get downtown, to museum, etc.

We used to live in Fairfax City - there was a bus that went round the city and he could go to library, movie, museum, -- he really misses that. So, I thought I would give you our thoughts on the subject - thanks for all your good work.

Kathy O'Hare

oharekpe@gmail.com

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COMPREHENSIVE OPERATIONS ANALYSIS
Comment Form – Public Open House

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Name (optional):	Mary Barr
Email Address or Phone Number (optional):	
Comment:	

The city + county need to pour way more $ into Greenlink, which, I think, does A great job considering the little $ that they get. I would love to see service expanded (For me personally) (time + place). My only concern is that the #14 not Arrive early to i-car, so that people (like me) →

Please turn in your comment form at the sign-in table before you leave. Comments will also be accepted through May 6, 2017 via email or regular mail to:

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Connetics Transportation Group
570 Colonial Park Drive, Suite 302
Roswell, GA 30075
mheard@ctgconsult.com

who Are trying to connect
from the clemson VAN don't
Miss it. I Also want
to give A MAjor shoutout
to the bus drivers
(greenlink) who Are hands
down the kindest people,
Always helping pAsSAngers
with directions etc.....

Also, FYI, every bus
rider I know At clemson
really misses Greenlink.
You guys did A greAt job when

you were in charse!

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Name (optional): Susan McLarty	
Email Address or Phone Number (optional):	
Comment:	

Thank you for working to improve our transportation in Greenville. We look forward to positive change for all of out citizens in our community.

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Name (optional):	Derrick Blending
Email Address or Phone Number (optional):	ddblend@g.clemson.edu
Comment:	I really enjoy looking at public transit as I love to advocate for it. Greenlink has a great system with great buses, great facilities, and professional staff. It is difficult to navigate the web page in learning how to ride and find stops. Having a GPS app, free, like Clemson Area Transit would be amazing. Greenlink has a new marketing coordinator, but I have not seen anything new or different. There is no social media presence. I do believe that if the local universities sat down together, we could see a strong increase in ridership, free or reduced fares, and increased service. (More frequent + longer hours) I believe the focus shouldn't be obtaining electric buses at this time. The roads of Greenville cannot accommodate EVs. Greenlink must continue to serve all and be a solution to the problem.

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Name (optional):	Jalen Elrod
Email Address or Phone Number (optional):	seal0602@gmail.com
Comment:	

- Lobbying elected officials at the state level to push for increased funding to Greenlink

- 24/7 public transportation

- Greenlink Smartphone apps

- Wifi on buses

- 30 min stop rotations

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Name (optional):	Mary McGowan
Email Address or Phone Number (optional):	
Comment:	

Thank you for doing this study! I work for Greenville County Schools and choose not to drive. Transit options are such an important part of Greenville's development and future!

I think it would be great to partner with organizations like Bike Walk Greenville and Greenville County Schools for PR + promotions – not only to encourage ridership, but to get the word out about the benefits to everyone (riders + non) of public transit! I think if we can influence attitudes + perceptions, it will go a long way in advocating for gaining funding that is so needed.

Thanks!

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Name (optional):	Stephanie .
Email Address or Phone Number (optional):	(864)517-2271
Comment:	

I ♥ Gtac Greenlink.

I hope and pray that you guys will extend funding for better buses, handicapped Accessible, Sunday hours As Well As extended hours and cheaper (Affordable bus fere.

Please turn in your comment form at the sign-in table before you leave. Comments will also be accepted through May 6, 2017 via email or regular mail to:

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Comprehensive Operations Analysis

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Name (optional):	LINDA BUTLER
Email Address or Phone Number (optional):	LINDAWBUT2990 OUTLOOK COM
Comment:	* BUS SCHEDULES POSTED AT BUS STOPS * BETTER BUS CONNECTIONS * PARK AND RIDE AT CERTAIN LOCATIONS * BUSES PLACED IN GROWING AREAS * MORE BUSES DURING RUSH HOURS * BUS APPS.

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Name (optional):	Hillary
Email Address or Phone Number (optional):	hillary@houseofmendes.com
Comment:	Some thoughts I had would be to increase frequency of service every 30 mins vs hour. In addition to running the bus in both directions. In particular Rute 3 has a certain hours where more crowded during shift changes & maybe have additional service during that time. Additional transfer spots between lines would be great too. In addition having more pedestrian friendly areas where buses run with sidewalks & save crossways. In addition being able to load refillable transit cards that can be purchased my mail or online would be great.

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Name (optional):	Alicia Book
Email Address or Phone Number (optional):	
Comment:	

Really to get straight to the point, I think that the handicap people that are in wheel chairs should be treated a little better, and the Mentally Handicapped people should have, maybe a separate Bus for them so they can feel equal, because sometimes they get upset over, the bus drivers that are in a hurry to go own them. routes. plus, the buses dont go as Far out to different areas, That people need to go. And Areas like The Historical area, The Cripple Creek realy need a Bus stop near Besides Washington, St. I think, that if some of the Bus drivers, didnt take everything So serious, And get to the bottom of why a person is Lashing out, its obvious, a mind thing going on. Also, think they should change the bathroom to (Seperate the men From the Women   1 male / 1 female restrooms.

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(It will be more sanitary, And also if you could lord willing, can plz try to put a water machine in for the people. Water is very important And Some, sugar Free items in the venting machines! Oh yeah in the restroom they need hand soap. Thank you.

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Name (optional):	Sarah Franco
Email Address or Phone Number (optional):	Sarahfranco@velovalels.com
Comment:	

It seems well established that the wheel + spoke configuration and underfunding hurts the most vulnerable people in Greenville. It must have been *more than* a year ago that the Greenville News had an article discussing how difficult it is for people without cars to get to 3rd shift jobs or out th the fringes of Greenville. This is even more true for single mothers. It's time for Greenville to stop paying lip service to caring about people. Let's actually work to lift everybody. A better system with better funding will help us all.

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Name (optional):	Hannah Wheeler + Victoria Worman
Email Address or Phone Number (optional):	hannah.wheeler@furman.edu
Comment:	

Would like to have a full informational session for Furman students to educate them on Greenlink. We want to get our students excited about using the bus! We know they'd like an app to track the bus, and later hours so they can enjoy downtown's night life.

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Name (optional):	AR oN TANNENBAVM
Email Address or Phone Number (optional):	864-616-6780
Comment:	

I FIND THE PO-J BUS TO BE VERY USEFUL FUL ME.

Please turn in your comment form at the sign-in table before you leave. Comments will also be accepted through May 6, 2017 via email or regular mail to:

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APPENDIX 1B STAKEHOLDER MEETING SUMMARIES

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Greenville Health System
Date: Thursday, April 27, 2017

1. **What does Greenlink do well?**
   Group was mostly quiet about the things Greenlink does well. Almost all in the group stated that they drive to work and have not taken Greenlink.

2. **What are some of the transit/transportation issues in the Greenville region?**
   The most important transit issue identified by the group service span. The network barely operates early enough for employees to arrive for a 7am shift. The larger issue is at night. The last inbound trip occurs at 7:00p. Many cafeteria employees end their shift at 7p or later, and this is not enough time to clock out and walk to the bus stop. At least one more trip in the evening is necessary.

   The group brought up the need for Sunday service. They pointed out the hospital operates 24/7, and therefore there is a constant need to employee travel at night and on weekends.

3. **What specific suggestions would you make to improve Greenlink service?**
   As noted above, service span was identified as the primary improvement requested by GHS. We also discussed stop location. The GHS main campus is large and it is difficult to serve all locations. The group thought it might be a good idea to revise the stop locations to better serve the campus.

   Finally, the group thought educating people on how to ride was also important. They noted many patients come to the hospital without transportation options. They would be good candidates to ride Greenlink (home from hospital, back for appointments), but they do not understand the system and therefore do not seriously consider it.

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Lengthen service span, first on weekdays, then on weekends. Then add Sunday service.

Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Greenville Health System
April 27, 2017
9:00 – 10:00 a.m.

Name	Organization	Email Address or Phone Number
Jason Taylor	GHS	LTaylor5 or GHS.org / 455-3023
Karen Clisham	GHS	KClisham@ghs.org / 455 7104
Barb Dendy	GHS	bdendy @ ghs.org / 5224D3
Pat Leach	GHS	PLEACH @ GHS. ORG
Anne Marie Maertens	GHS/Access Health	amaertens@ghs.org
Lane Chapman	GHS	LChapman4@ghs.org
Tabatha Darby	GHS/GCEMS	tdarby@ghs.org
Rut Rivera	GHS/PASos	rsoto@ghs.org
Angela Lake	GHS (mobile Heath)	ALake@GHS.org
Candice Hipp	GHS	chipp@ghs.org
Darin Thomas	GHS	DTThomas @ ghs.org

Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Greenville County Council
Date: Thursday, April 27, 2017

What does Greenlink do well?
Attendees noted that Greenlink is a vital community service and they support some sort of transit in Greenville. They also liked the arrangement where the county pays in to the system but that Greenville city handles the day to day operation of the system.

1. **What are some of the transit/transportation issues in the Greenville region?**
Funding for transit is a major issue. Sid noted that the county is contributing the same amount for the past eight years. He also stated the Upstate is an anti-tax area (a 1 cent transportation sales tax in 2012 failed).

   Another issue brought up is the perception of empty buses (i.e., people wondering what they are paying for). The group also wondered if it was a PR issue – that people do not think of Greenlink as useful.

   Finally, the group noted the buses were purchased in 2008 and are not at the end of their useful life. They see the maintenance issue and the need for new buses as a ticking time bomb.

2. **What specific suggestions would you make to improve Greenlink service?**
Fred noted he would like to see improvements in first mile/last mile connections (specifically through an automated vehicle).

3. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
Specific priorities were not discussed.

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: County Council
April 27, 2017
10:30 – 11:30 a.m.

Name	Email Address or Phone Number
SID CATES	SCATES@greenvillecounty.org
Xanthene S. Norris	XNorris@greenvillecounty.org
LYNN W BALLARD	lynn1466@bellsouth.net
Fred Payne	FPayne@greenvillecounty.org

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Human Services
Date: Thursday, April 27, 2017

1. **What does Greenlink do well?**
   Table 1
   - People are using the system
   - Basics – cleanliness
   - No safety concerns expressed

   Table 2
   - Covers city
   - Consistent
   - Trolley is nice and expanding, choice riders

   Table 3
   - Trying to cover large area
   - Trolley service
   - Bike racks
   - Capacity is good
   - Customer service and drivers - good

   Table 4
   - Only public transportation provider
   - ADA accessible and bike racks
   - Presence in community is improving
   - Agencies can buy passes in bulk. Customer discounts

   Table 5
   - Has done a better job conveying services
   - Buses stop when they see people standing
   - Feel buses are more visible to community

2. **What are some of the transit/transportation issues in the Greenville region?**
   Table 1
   - Communication of special passes to drivers
   - Last mile and first mile
   - Limited coverage in Greer, Slater, Southern, Simpsonville, County
   - Potential passengers don't understand routes/system

   Table 2
   - Limits on times (hours of operation)
   - Hourly frequency (headways)
   - Geographic limitations – the outskirts are not served
   - What does the trolley do?
   - Routing might mean long ride to cover short distance
   - Partners and connections – ex. Donaldson Center
   - Safety of stops – lack of sidewalks
   - Signage attached to poles
   - May have to pay for transfers when route is poorly designed
   - Payment form – quarters and exact change is a hassle
   - Serving people in need outside of area

   Table 3
   - Coverage area isn't good
   - Internet service is not user friendly
   - On time service
   - Safety at stops – personal and walking at sidewalks
   - ADA compliance
   - paratransit

   Table 4
   - Communication on fare structure
   - Limited service hours
   - More options to attract those who are not currently riding

   Table 5
   - Meeting the needs of entire county
   - Website not user friendly
   - Need ride to bus stop to use service
   - Does not go to people who need it
   - Bus stop safety: train tracks, traffic (incidents), lighting, weather protection
   - Demographic that doesn't have access to online schedule, no computer
   - Can't buy discount pass anymore
   - Not walkable

3. **What specific suggestions would you make to improve Greenlink service?**
   Table 1
   - Improving frequency – shorter than 1 hour
   - look at express routes
   - Wifi/technology at stops
   - Add service to Greer and BMW, Travelers Rest/Slater
   - Educating when and where bus runs and how to access this information
   - Adding more shelters
   - Evaluate current stops
   - Proterra

   Table 2
   - Shelters
   - 24/7 service
   - Alignment with shift schedules
   - Multiple transfer sites/sub hubs
   - Intersecting routes so hubs not needed (ex. Haywood)
   - Multiple buses along route
   - Add modes – rail
   - Take transit as far as feasible
   - Look at zoning and growth

   Table 3
   - More civic leader involvement in transportation decisions
   - Evening service
   - Monthly discounted tickets for daily riders
   - Increase outreach to groups about how to use the service (train volunteers to do this)
   - Discounted tickets for students and users of service organizations
   - Trunk line service
   - Feedback survey on busses for customer to fill out at anytime

   Table 4
   - Pilots/trials for later hours
   - Use data for decisions and communicate with partners
   - Collaborate with bike share
   - Park and rides for events
   - Sunday service
   - Extend student discounts
   - Eliminate transfers

   Table 5
   - Expand routes
   - Monthly passes
   - Unlimited passes for tourists
   - Non-profit passes

- Bus ride field trips
- Ease and accessibility of schedule
- Use positive trolley perception as marketing tool
- Trolley is being used to run errands: publix, CVS

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Table 1
   - Educating when and where bus runs and how to access this information
   - Improve frequency to shorter than 1 hour
   - Add service to Greer, BMW, Travelers Rest/Slater

   Table 2
   - Routes where most feasible and needed
   - Frequency where populated, less where less populated
   - Priority
     - Frequency on select routes
     - Length of service – at least shift changes
     - Partnerships with employers – shuttles, shift alignment, identify incentives
   - Money needs to increase
   - Volunteers to train riders and community

   Table 3

   Table 4

   Table 5
   - Offer unlimited passes
   - Take care of current system before expanding
   - Dangerous intersections
   - User friendly website
   - Get transfer passes from initial bus ride
   - Print maps and schedules
   - Education, like driving courses are taught in school, but for transit at schools, churches, non-profits
   - People conflate trolleys and fixed routes, which is a good thing
   - Trolley tracker inaccurate
   - Park and ride that pushes parking away from downtown. Ex: park at Bi-Lo then ride bus into downtown
   - Color code routes on specific bus route map and schedule
   - Have businesses sell unlimited bus passes

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Health and Human Services
April 27, 2017
9:30 – 10:30 a.m.

Name	Organization	Email Address or Phone Number
Sally Green	Project Host	sallyg@Project host.org
Caroline Robertson	Greer Relief	caroline.robertson@greerrelief.org
Tony McDade	United Ministries	TMcDade@united-Ministries.org
Karen Salerno	Taylors Free Medical Clinic	Ksnsalerno@taylorsfmc.org
Paulette Dunn	Loaves & Fishes	Paulette@loaves and fishes greenville.org

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Health and Human Services
April 27, 2017
9:30 – 10:30 a.m.

Name	Organization	Email Address or Phone Number
NICOLE WILLIAMSON	PENDLETON PLACE	NWILLIAMSON@PENDLETONPLACE.ORG
Jose Zurita	Gateway House	JZurita@gateway-SC.org
Lisa Green	Cancer Survivors of Greenville	lisa@cancersurvivorsofsc.org
Jocelyn Slaughter	Greenville Literacy Assoc.	Slaughter@greenvilleliteracy.org

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Health and Human Services
April 27, 2017
9:30 – 10:30 a.m.

Name	Organization	Email Address or Phone Number
Nicole McAden	Greenlink	Nmcaden@greenvillesc.gov
John Cocciolone	Thrive UPSTATE	John.Cocciolone@Thrive UPSTATE.org
Dick ONeill	OCCI-SLG	dick.pat 430@gmail.com
Mandy Black	Little Steps	Mandy@LittleStepsSC.org
Catriona Carlisle	Meals on Wheels	Ccarlisle@mowgvl.org
Denice Harris	Homes of Hope	dharris@homesofhope.org
Alesia Love	A Child's Haven	alesia@achildshaven.org
TANYA MORGAN	GOODWILL	tmorgan@goodwillsc.org
Brett Fuller	Gateway Inc.	864-242-9193
Julie Meredith	Safe Harbor	julie.meredith@safeharborsc.org
Asha Mayfield	Goodwill	amayfield@goodwillsc.org
Taiva Smith	New Horizon Family Health Services	tsmith@newhorizonfhs.org
Jimmy Wooten		jwooten@newhorizonfhs.org
Catie Buckingham	Center for Community Services	catie@centercs.com
Beth Padgett	Compass of Carolina	Padgett@compassofcarolina.org

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Comprehensive Operations Analysis

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Education
Date: Thursday, April 27, 2017

1. **What does Greenlink do well?**
   - Coverage with limited resources
   - Good stewards
   - Engaging community about what works
   - Gary is very visionary – improvements, leadership
   - Adjusting to needs (e.g., CU-ICAR)
   - Better buses – nicer and less polluting
   - Improved bus stops
   - Forward thinking on partnerships and flexible
   - CU-ICAR students without cars- willing to meet their needs
   - Bike racks
   - Maintenance much better

2. **What are some of the transit/transportation issues in the Greenville region?**
   - ADA compliance at stops
   - Bringing all people to same table
   - Still room for improvement on maintenance
   - Frequencies
   - Hub and spoke – takes too long
   - LEP – website, signage
   - Deaf, blind, limited vision students– bus annunciation becoming more critical
   - Cherrydale to Travelers Rest
   - Students with infants needing daycare / school Travelers Rest High School
   - Service improvements needed to Donelson Center, west side of Greenville, SCTAC, Southchase
   - Greenville Tech – main campus to Greer and Simpsonville
   - More direct service to and between hospitals
   - Manufacturing and hospitals and restaurants hours are too limited to serve employees
   - East-west service into Easley, Pickens, Spartanburg, and Anderson
   - Passes – discount fares Not adequate service to manufacturing hubs
   - Short span
   - No Sunday service
   - Students in alternative HS program who live outside Greenlink service area can't get to school

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3. What specific suggestions would you make to improve Greenlink service?
   - Expand to more parts of county
   - LRT – North south and east west
   - Get rid of folks on I-85 complete loop
   - Expand hours and days
   - Connector routes from rural communities
   - Trunk routes with feeder service
   - Intentional and incremental expansion of service
   - Work with businesses to get them to take on part of costs
   - Make service more attractive than driving
   - Sliding payment scale for fares
   - Pass programs
   - Student fares
   - Bus-only lanes on interstates with park and ride service
   - HOV
   - Arterial rapid transit
   - Modify Circulator route to reduce travel time from Waterside Greene Apartments to CU-ICAR

4. Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Hospitality
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**
   Meeting attendees noted that Greenlink does a good job of serving the downtown core, where numerous hotels and restaurants are located. This is especially helpful for hotel workers like housekeepers who work a typical day shift, as they can use the system.

2. **What are some of the transit/transportation issues in the Greenville region?**
   Meeting attendees said the single largest issue with Greenlink is service span. Hospitality workers cannot use the system since many of them work late into the evenings, long after service has stopped running. The group also wanted to discuss parking policy and where hospitality workers might park in downtown Greenville. They did not think transit service was a viable option for workers after midnight (who are tired and would not want to wait for a bus).

   Another issue is stop location and maintenance. Attendees noted that some of stops were out of the way, and that shelters were limited to just a few locations. They also expressed concern with the maintenance of some stops.

3. **What specific suggestions would you make to improve Greenlink service?**
   The conversation about improvements was mostly about service span.

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Increasing service span is essential. Because Saturdays are important for hospitality industry, the group thought later Saturday hours were just as important as weekday service span.

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Bon Secours/St Francis Hospital
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**
   Meeting attendees admitted they do not know the Greenlink system well, but that St Francis patients and free clinic users do use the system.

2. **What are some of the transit/transportation issues in the Greenville region?**
   Similar to conversations with Greenville Health, meeting attendees said their biggest transit issue is with service span. Employees cannot use the system because it simply does not operate late enough on weekdays/Saturdays. They would also like to see Sunday service.

3. **What specific suggestions would you make to improve Greenlink service?**
   Alex stated that increased housing in the downtown core means more need for transit. He thought a short run bus operating between City View, Downtown, and Nicholtown may be helpful.

   The group also noted an issue with the stop at Pelham and Patewood, and requested that Greenlink consider moving this stop.

   Another issue is that the route 6 serves the St Francis Downtown campus, but riders must walk to the Spinx gas station (located at Pendleton/Academy) to access the bus. They suggested routing the bus into the campus.

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Increasing service span for hospital workers is essential.

Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Bon Secours/St. Francis
April 28, 2017
9:00 – 10:00 a.m.

Name	Organization	Email Address or Phone Number
Emily Wood	BSHSI – St. Francis	emily.wood@bshsi.org
Heather Henson	BSHSI – St. Francis	heather_henson2@bshsi.org
Waller Smith	" "	Waller-smith@bshsi.org
Nick Bruter	BSMG	johnnick_Brater@bshsi.org
Bonnie Acosta	BSHSI	bonnie_acosta@bshsi.org
Alex Garvey	BSHSI	alex_garvey @ BSHSI.org
Sarah Lewis	BSHSI-St.Francis	Sarah_lewis@bshsi.org
Jenny Gonzalez	Bon Secours St Francis	jenny_gonzalez@bshsi.org
Keith Newnam	Bon Secour St. Francis	keith_newnam@bshsi.org
Teri Ficicchy	BSHSI	TeresA_ficicchy2@bshsi.org
Carol Alcorn	BSHSI	carol-alcorn@bshsi.org

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Greenville Chamber of Commerce
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**
   Meeting attendees did not offer an opinion of the existing Greenlink system. They noted for many of them that Greenlink is an afterthought.

2. **What are some of the transit/transportation issues in the Greenville region?**
   This conversation was wide ranging, and included discussion of the current Greenville economic climate, parking availability, and other various economic issues.

   Attendees discussed the fact unemployment in the region is very low, and that some people who want to participate in the job market cannot due to transportation issues. So they would like to see Greenlink become more useful to the unemployed. One area with transit need is Butler Road, which has call centers. Another area is manufacturing, with Fountain Inn and the Donaldson Center named as important destinations.

   Attendees noted that downtown parking is almost 85% full. Most businesses in the downtown provide parking for their employees, but as parking costs go up, this perk may be revised (or eliminated). One bank located downtown is discussing a pilot program to provide a park and ride at McAlister Square, with free shuttle service into downtown.

   Another park and ride issue is the SCDOT reconstruction of the I-85/385 interchange. The group thought there may be an opportunity to provide park and ride pilot program as part of this highway project.

   Finally, attendees thought Greenlink should sell monthly passes. They felt this might compel some businesses to purchase the passes for their employees.

3. **What specific suggestions would you make to improve Greenlink service?**
   The group wanted to see commuter service into downtown Greenville and extensions into manufacturing areas to better connect workers with jobs.

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   The group understood that service expansion was a long-term priority. They would like to see more dedicated funding for transit, and in the short term they want to see the existing system become more useful.

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Chamber of Commerce
April 28, 2017
1:30 – 2:30 p.m.

Name	Organization	Email Address or Phone Number
Katie Busbee	Greenville Chamber	kbusbee@greenvillechamber.org
BRENDA LAAKSO	NEXT, GREENVILLE Chamber	blaakso@NEXTSC.ORG
Kim Williams	GADC	KiWilliams@greenvillecounty.org
Tevis Geddy	GADC	TGeddy@grccavillccounty.org
Mark Farry	GADC	MFarry@greenvillecounty.org
Hank Hyatt	Greenville Chamber	hhyatt@greenvillechamber.org
Mike Panasko	City of GVL	mpanasko@greenvillesc.gov
Emily Hutchings	City of Greenville	ehutchings@greenvillesc.gov
Mary Douglas Hirsch	City of Greenville	mdhirsch@greenvillesc.gov

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: City of Greenville Mayor and Council Members
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**
   Greenlink is doing much better since the City took it over and is fundamentally sound. The transit coverage within the City is good. Bike racks on the buses are great, especially given the number of cyclists. True bus stops instead of flag stops was a big improvement.

2. **What are some of the transit/transportation issues in the Greenville region?**
   The system is underfunded. There is a lack of equity between what the City and County are paying. Mauldin and Simpsonville should also be contributing for the service they get. A source of dedicated funding is needed, but need to have some early successes with improving system before pursuing. Also need to figure out how to be more competitive for FTA grant programs (e.g., TIGER).

   Need to better connect where people live and work. Hourly service is not attractive, the buses don't go all the places they need to go, and service ends too early at night for people to get home. It takes too long to get where you need to go with the current hub and spoke system. Multi-modal improvements are needed for first mile/last mile connections.

3. **What specific suggestions would you make to improve Greenlink service?**
   - Implement 30-minute service
   - Extend the span of service to provide evening service
   - Expand service to reach more employment destinations (e.g., Woodruff Road, SCTAC)
   - Improve/expand service to better transportation disadvantaged neighborhoods
   - Reinstate service on Verdae Blvd. (medical offices)
   - Revisit the TIGER grant application system of trunk routes, circulators and transfer centers
   - Empower bus operators to bring suggestions to the attention of staff
   - Place bus shelters at more locations
   - Consider Sunday service
   - Educate the public on the benefits of transit (better marketing)
   - Modify Mauldin and Simpsonville service to make it more useful
   - Implement a guaranteed ride home program

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   - Purchase electric buses (e.g., Proterra) if awarded Low or No Emission Vehicle grant
   - Start to implement 30-minute service incrementally
   - Use existing resources as effectively as possible, even if that means cutting some things
   - Implement pilot project routes to show early successes (e.g., Laurens Rd)

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Manufacturing
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**
   Meeting attendees admitted they do not know the Greenlink system well, but that some manufacturing firm employees do use the system. David Clayton (Greenville Tech, Center for Manufacturing Innovation) said people are excited about the trolley and like the new branding and image.

2. **What are some of the transit/transportation issues in the Greenville region?**
   Transit can be a challenge for the sub-set of people seeking or holding lower-paying manufacturing jobs who don't have personal vehicles, due to the dispersed and distant location of most manufacturing jobs (beyond Greenlink's current service area). Locations of these jobs include Fountain Inn, Pelham Road area, Augusta Grove, SCTAC, Taylors, and Greer. Current service is not attractive to choice riders.

3. **What specific suggestions would you make to improve Greenlink service?**
   - Extend the routes to connect to any clusters of manufacturers with lower-paying jobs
   - Make transit more convenient and attractive to those who have their own cars (e.g., Proterra buses, express routes from Park and Ride lots)
   - Do a better job of raising awareness of the transit system and educate people on how to ride
   - Partner with SC Works

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Specific priorities were not discussed.

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Comprehensive Operations Analysis (COA)
Focus Group Meeting

Meeting: Other Cities
Date: Friday, April 28, 2017

1. **What does Greenlink do well?**

2. **What are some of the transit/transportation issues in the Greenville region?**
   Greer used to have service and it was supposed to be restored. The City has a sizable transportation disadvantaged community living near downtown that would benefit from access to service jobs. Not sure there's enough demand for express service from Park and Ride lots in Greer.

   Fountain Inn is a net importer of jobs and is trying to reduce transportation costs. Manufacturing employment locations include Southchase and Woodville. There is not much affordable housing in Fountain Inn, so workers are coming from outside the city.

   Simpsonville is a low density area, so they are not sure where service should go. When Route 14 was being designed, looked at either serving the mill village or apartments (chose the mill village). Need to continue to serve the Walmart and there is also a trailer park.

3. **What specific suggestions would you make to improve Greenlink service?**
   Greer would like service for those who need it, a mini-transfer center near the police station downtown, service to Target and Trade Street. Greer might be willing to fund capital, but probably not operations. Fountain Inn thinks a circulator in Fountain Inn connected to a Greenlink route might make sense. Mauldin is interested in a circulator, service to Woodruff Rd. All shopping needs can be met at the Shops at Greenridge on Woodruff Rd, so maybe Route 14 should end there instead of going all the way downtown. Liked the TIGER route idea of trunk service with circulators in Mauldin, Simpsonville, Fountain Inn and Greer.

4. **Given that Greenlink's financial resources are limited, what improvements do you think should be the highest priorities?**
   Greer would like service restored for those who need it, even if it's just one trip in each peak period. Mauldin needs service to the new federal court building on Main St under construction now. Need to make Route 14 as efficient as possible by targeting resources to where they are most needed.

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Sign-In Sheet
Comprehensive Operations Analysis
Stakeholder Focus Group: Other Cities
April 28, 2017
1:30 – 2:30 p.m.

Name	Organization	Email Address or Phone Number
Dennis Raines	City of Mauldin	draines@mauldincitysc.com
David Dyrhaug	Mauldin	DDYRHAUG@MAULDINCITYSC.com
Jason Knudsen	Simpsonville	jknudsen@simpsonville.com
Andrew Roth Ford	Greenville Cnty/Fountain Inn	a.roth.ford@greenvillecounty.org
Kelli McCormick	City of Greer	Kmccormick@cityofgreer.org

APPENDIX 2A FLEET AND FACILITIES PICTURES

*Eastern bay looking toward
one of the north doors*
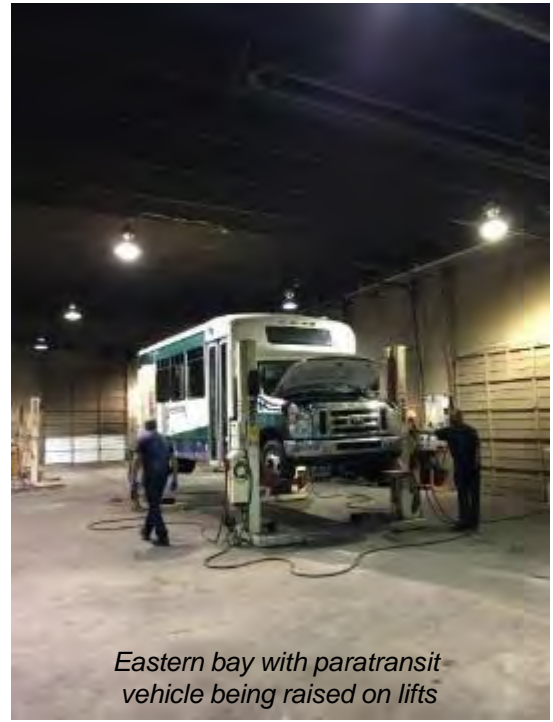
*Eastern bay with paratransit
vehicle being raised on lifts*

*Vehicle path from the eastern
bay to the western bay*
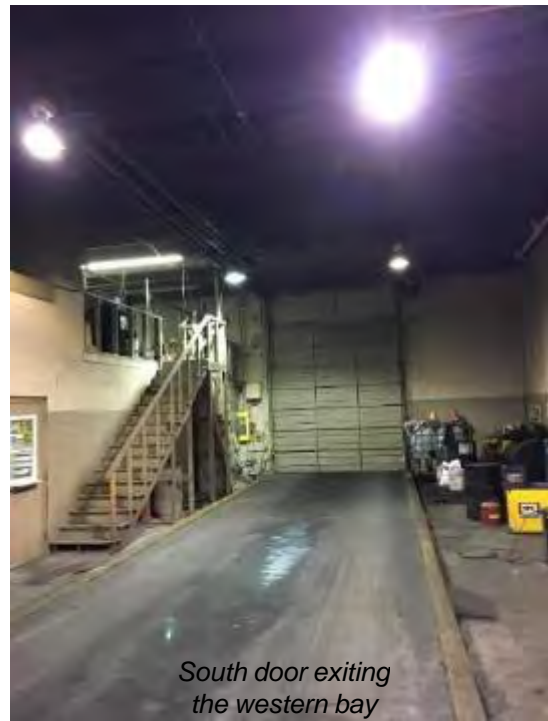
*South door exiting
the western bay*

South end of the western bay
(south door to the L of picture)

View from eastern bay toward office space

View from eastern bay toward western bay
(trolleys had just been washed)

Stairs leading to storage space above offices

DEF Tank (275 gallon)
Waste Oil Tank (275 gallon)

ATF Tank (275 gallon)
Engine Oil Tank (275 gallon)
Engine Coolant Tank (275 gallon)

Diesel UST (20,000 gallon) fill port and manhole

Gasoline UST (10,000 gallon) fill port

Gasoline dispenser
Fuel management system Diesel dispenser

View of fueling canopy
from street

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APPENDIX 2B SAMPLE PREVENTIVE MAINTENANCE GOALS AND OBJECTIVES

GTA may want to consider adding some or all of the following goals and objectives.[9]

Create a Safety Culture – Reduce Injuries and Accidents

- Responsible for personal safety, and accountable for agency employee safety and safety performance by providing a safe, clean and organized work environment.
- Goal is to reduce employee injuries by xx percent.

Quality and Reliability of Service – Improve MBRC (Miles Between Road Calls)

- Responsible to provide safe, clean and reliable equipment for our customers and buses that go out on time and remain in service.
- Goal is to achieve xx miles between road calls.

Quality and Reliability of Service – Improve Bus Cleanliness

- Responsible for providing a clean bus for our operators and customers.
- Goal is to achieve a rating of xx or better (rating scale of 1 to 10, with 10 being the best) by –date-.

Quality and Reliability of Service – On-Time Performance and Reduce Out-Lates

- Responsible to provide safe, clean and reliable equipment for our customers and buses that go out on time and remain in service.
- Goal is xx percent roll-out completed on time.

Operations Budget Efficiencies and Effectiveness

- Responsible for safeguarding and wisely spending taxpayer dollars.
- Goals are to reduce absenteeism by xx percent and remain at or below allocated operating and overtime budget.

Quality and Reliability of Service – Minimize Repair Time

- Responsible for supporting bus operations by minimizing the amount of out-of-service time for buses.
- Goal is to complete repairs at xx percent on time of the target date.

Quality and Reliability of Service – Improve Fleet Cleanliness and Reliability

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[9] In the items below, fields containing "xx" require completion by GTA staff dependent on current situations and recognized capacity for improvement. Goal numbers should be set at values that can feasibly be met given factors such as current fleet condition, facility capacity, parts availability, and manpower availability and quality.

- Responsible for providing a safe, clean and reliable bus for our operators and customers.

- Goal is to develop a grading system for interior/exterior condition/cleanliness for the agencies bus fleet.

Quality and Reliability of Service – Improve Agencies Facility Equipment Reliability

- Responsible for the maintenance and reliability of the agencies equipment

- Facility Maintenance goal is to ensure that the agencies equipment and grounds are fully functional as designed.

Preventive Maintenance Inspection (PMI) On-Time Performance

- The agency's goal is xx percent.

APPENDIX 2C SAMPLE TABLE OF CONTENTS FOR STANDARD OPERATING PROCEDURES

GENERAL

1 Maintenance and Management

2 Emergency Contact and Facility Directory

3 Distribution of Common Communication

4 Facility Schematics

5 SOP Posting and Availability

SAFETY AND SECURITY

6 Rules and Regulations

7 Security Protocols

8 Access Control

9 Key Distribution, Security and Control

10 Safety Procedures

11 Safety Equipment

12 Injury on the Job

13 On-Site Accident/Incident Reporting

14 Accident/incident Notification Process

15 On-Site Vehicle Management

16 Security Systems

17 CCTV Monitoring and Usage

18 Alarm Systems

19 Physical Access Control Systems

20 Intercom System

21 Personal Storage Units/ Storage of Hazardous equipment on facility grounds

22 Lost and Found Policy

23 Personal Protective Equipment

24 Building and Grounds Lighting

25 Fire Detection, Suppression and Inspection

26 Facility Accessibility

27 Use of PA System

28 First Aid and Medical Station locations

29 Responsibility

30 Building Entrances and Exits

31 Reporting Suspicious Activity

32 Employee Identification

33 MSDS Update procedures and book locations

34 Pedestrian Walkways (interior and exterior)

35 Fall Protection

36 Building Entrances and Exits

37 Visitors to the Facility

EMERGENCY

38 Emergency Contacts and Facility Directory

39 Who to contact on specific events, 24/7

40 Emergency Operating Plans

41 Severe Weather Planning

42 Power Outage

43 Emergency Drills and Exercises

44 Contagious Disease Outbreak Protocol

SERVICE COORDINATION

45 Policy and Procedure Approval Process

46 Monthly Coordination Meeting (General Staff)

47 Contract, Facility Maintenance

48 Contract, Janitorial/Custodial Services

PROGRAM EQUIPMENT

49 Contract, Bus Wash

50 Contract, Bulk Trash Disposal

51 Contract, Hazardous Waste

52 Contract, Oil/Water Separator

53 Fuel and Fuel System Management

INFORMATION TECHNOLOGY – ELECTRICAL SYSTEMS

54 Information Technology (IT) and Other Technology Systems at Facility

55 General Requirements

56 Server Room

57 Technician Kiosks

58 Fax/Printer/Copy/Shredder

59 Fuel Management System

60 Other Technology Management System

61 Other Technology System

INFORMATION TECHNOLOGY – TELECOMMUNICATION SYSTEMS

62 Intercom

63 Telephones

64 Network Cabling & Jack

65 Facility Voice and Data Communications

ENVIRONMENTAL MANAGEMENT

66 Waste Management Plan

67 Storm Water Management

68 Fluids and Spill Management

69 Air Quality

70 Ventilation and Air Monitoring

71 Paint booth, materials and product handling

72 Cleaning Equipment, Materials and Agents

73 Sustainability Stewardship

74 Environmental Hazard and Waste

FACILITY GROUNDS

75 Maintenance and Bus Yard Traffic Flows

76 Speed Limits

77 Parking

78 Vehicle Idling Policy

79 Pedestrian Areas

80 Maintenance of Fencing and Gates

81 Snow Management and Surface Conditioning

82 Landscaping and Grounds Maintenance

ADMINISTRATION/OPERATIONS BUILDING

83 Scheduled Maintenance Program for Administration / Operations Building

84 Conventional Postal Delivery Mail Management

85 Conference & Training Room Reservation and Usage

86 Bus Simulator Usage

MAINTENANCE BUILDING

87 Scheduled Maintenance Program for Maintenance Building

88 General Housekeeping

89 Space Allocation

90 Cleaning of Work Areas

91 Tool Box Storage

92 Furniture Responsibilities and Control

93 Store Room Management

94 Signage Service and Maintenance

TOOLS AND EQUIPMENT

95 Tool and Equipment Management

FLUIDS MANAGEMENT

96 Fuel Management

97 Non-Fuel Fluids Management

98 Waste Liquid

APPENDIX 2D PRELIMINARY MAINTENANCE FACILITY DETAILED SPACE PROGRAM

Operations Space Requirements

	Description	Space Standard			Qty	Area	Remarks
		30' to 35' Buses			19		
	Fleet	Paratransit			8		
		Total			27		
16	**Operations**						
17	Lobby / Waiting Area	20	x	20	400	1	400	
18	Conference Room	12	x	20	240	1	240	10 to 12 people
19	Copy / Workroom	10	x	15	150	1	150	
20	File / Storage Room (Admin)	10	x	15	150	1	150	
21	Coffee / Break Area	10	x	15	150	1	150	
22	Operations							
23	Operations Superintendent	12	x	12	144	1	144	
24	Field Supervisor	10	x	12	120	1	120	Shared office
25	Dispatch	15	x	20	300	1	300	
26	Check-in Area	15	x	20	300	1	300	
27	Conference Room	15	x	24	360	1	360	14 to 16 people
28	Copy / Workroom	10	x	15	150	1	150	
29	File / Storage Room	10	x	15	150	1	150	
30	Driver Room	25	x	30	750	1	750	30 people
31	Vending / Kitchenette	10	x	15	150	1	150	
32	Driver Locker Area	20	x	25	500	1	500	50 half lockers
33	Men's Restroom	10	x	20	200	1	200	1 WC + 2 U + 2 Lav
34	Women's Restroom	10	x	20	200	1	200	2 WC + 2 Lav
35	Custodial Room	8	x	10	80	1	80	
36	Training							
37	Training Office	10	x	12	120	1	120	
38	Training Room	25	x	30	750	1	750	25 people
39	Training Storage	8	x	10	80	1	80	
40	Support Space							
41	IT / Server Room	10	x	10	100	1	100	Size to be verified during design
42	Mechanical	20	x	40	800	1	800	Size to be verified during design
43	Electrical	10	x	15	150	1	150	Size to be verified during design
44	Telephone Equipment Room	8	x	10	80	1	80	Size to be verified during design
45	Subtotal						6,574	
46	Circulation Factor				30%		1,972	
47	**Total Operations**						**8,546**	

Maintenance Space Requirements

	Description	Space Standard			Qty	Area	Remarks
		30' to 35' Buses			19		
	Fleet	Paratransit			8		
		Total			27		

	Description					Qty	Area	Remarks
48	**Maintenance**							
49	Fleet Services Manager	12	x	12	144	1	144	
50	Maintenance Office	15	x	20	300	1	300	Incl. Garage Superintendent
51	Copy / Workroom	10	x	10	100	1	100	Including office storage
52	Men's Restroom / Locker / Shower	10	x	20	200	1	200	1 WC + 1 U + 2 Lav + 1 shower
53	Women's Restroom / Locker / Shower	10	x	15	150	1	150	1 WC + 1 Lav + 1 shower
54	Custodial Room	8	x	10	80	1	80	
55	Mechanic Breakroom	15	x	25	375	1	375	Up to 10 people + vending
56	Parts Storage							
57	Parts Office	10	x	12	120	1	120	
58	Shipping & Receiving	20	x	20	400	1	400	
59	Parts Storeroom	40	x	30	1,200	1	1,200	40 square feet per bus
60	Tool Crib	10	x	15	150	1	150	
61	Preventive Maintenance Bays	20	x	50	1,000	1	1,000	1 per 50 buses
62	Running Repair Bays	20	x	50	1,000	2	2,000	1 per 20 buses
63	Common Work Area	20	x	50	1,000	1	1,000	
64	Portable Equipment Storage	20	x	50	1,000	1	1,000	
65	Tool Box Storage							Tool boxes to be in repair bays
66	Body Repair							Contracted
67	Building Maintenance	20	x	50	1,000	1	1,000	Includes Route Maintenance
68	Lube / Compressor Room	15	x	20	300	1	300	

69	Subtotal			9,519
70	Circulation Factor	20%		1,904
71	**Total Maintenance**			**11,423**

Fuel and Wash, Parking and Other Space Requirements

Description	Space Standard			Qty	Area	Remarks

	Fleet	30' to 35' Buses	19	
		Paratransit	8	
		Total	27	

	Description	Space Standard			Qty	Area	Remarks
72	**Fuel and Wash**						
73	Fuel Positions	20	x	50	1,000	1	1,000	
74	Control Room	10	x	12	120	1	120	
75	Vault / Money Counting Room	15	x	25	375	1	375	
76	Vacuum Equipment Room	10	x	15	150	1	150	
77	Cleaning Equipment Room	10	x	15	150	1	150	
78	Bus Washer	20	x	60	1,200	1	1,200	
79	Water Reclaim / Wash Equipment Room	10	x	60	600	1	600	
80	Chassis Wash	20	x	60	1,200	1	1,200	with vehicle lift
81	Subtotal						4,795	
82	Circulation Factor				10%		480	
83	**Total Fuel and Wash**						**5,275**	

		Space Standard			Qty	Area	Remarks
84	**Agency Vehicle Parking**							
85	Fixed Route Bus Parking	14	x	40	560	19	10,640	Allows wheelchair lift / ramp to be
86	Handivan Parking	14	x	30	420	19	7,980	extended during pre-trip inspection
87	Non-Revenue Vehicle Parking	10	x	20	200	9	1,800	
88	Subtotal						20,420	
89	Circulation Factor				100%		20,420	Assumes access to every vehicle
90	**Total Bus Parking**						**40,840**	

		Space Standard			Qty	Area	Remarks
91	**Employee / Visitor Parking**							
92	Employee Parking	10	x	20	200	55	11,000	
93	Visitor Parking	10	x	20	200	5	1,000	
94	Subtotal						12,000	
95	Circulation Factor				100%		12,000	
96	**Total Employee / Visitor Parking**						**24,000**	

		Space Standard			Qty	Area	Remarks
97	**Other**							
98	Emergency Generator	15	x	20	300	1	300	
99	Subtotal						300	
100	Circulation Factor				10%		30	
101	**Total Other**						**330**	

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APPENDIX 4A ROUTE PROFILES

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 1 — Pleasantburg Dr / Cleveland Park

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	177.5	126.8

On-Time Performance	Early	On-Time	Late
Weekday AM	100.0%	0.0%	0.0%
Weekday Midday	66.7%	33.3%	0.0%
Weekday PM	0.0%	100.0%	0.0%
Weekday All Day	61.5%	38.5%	0.0%
Saturday	60.0%	40.0%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	227		118	
Riders/Revenue Hour	16.2	(6 of 11)	11.8	(9 of 11)
Riders/Revenue-Mile	1.3	(4 of 11)	0.9	(6 of 11)
Riders/One-Way Trip	16.2	(7 of 11)	11.8	(10 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$764		$546	
Cost/Rider	$3.37	(5 of 11)	$4.61	(7 of 11)
Farebox Recovery Ratio	26.48%	(6 of 11)	19.32%	(7 of 11)
Subsidy/Rider	$2.48	(5 of 11)	$3.72	(7 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$202		$105	
Revenue/Revenue-Hour	$14.46	(6 of 11)	$10.55	(8 of 11)
Revenue/Revenue-Mile	$1.14	(4 of 11)	$0.83	(7 of 11)
Revenue/One-Way Trip	$14.46	(7 of 11)	$10.55	(9 of 11)

Ridership By Ticket Type

- Normal Fare — 44%
- Transfer — 32%
- Day Pass
- City/County — 1%
- Elderly/ADA — 4%
- Other — 19%

Households & Employment within 1/4-Mile

Route 1
Other Greenlink Routes

Households & Employment within 1/4-mile

Greenlink COA: Route Profile Analysis

1

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Greenlink COA: Route Profile Analysis   2

Comprehensive Operations Analysis

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 1 Weekday
Outbound Ridership

Route 1 Weekday
Inbound Ridership

Route 1 Outbound Timepoints
A Transit Center Bay A
B E Washington St & Cleveirvine Ave
C Roosevelt Ave & Sumlar Hall Dr
D Rebecca St & Hall St
E Cleveland St & E Faris Rd
F Cleveland St & Cleveland Ln
G S Pleasantburg Dr & Robin Hood Rd
H University Center
I Lowndes Hill Rd & N Pleasantburg Dr

Route 1 Inbound Timepoints
I Lowndes Hill Rd & N Pleasantburg Dr
J Greenacre Rd & Clark St
K Clark St & Mims Ave
L E Washington St & Cleveirvine Ave
M Transit Center Bay A

Stop Activity
25 Boardings
25 Alightings
Route 1
Other Greenlink Routes

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 1 Saturday Outbound Ridership

Route 1 Saturday Inbound Ridership

Route 1 Outbound Timepoints

A Transit Center Bay A
B E Washington St & Cleveirvine Ave
C Roosevelt Ave & Sumlar Hall Dr
D Rebecca St & Hall St
E Cleveland St & E Faris Rd
F Cleveland St & Cleveland Ln
G S Pleasantburg Dr & Robin Hood Rd
H University Center
I Lowndes Hill Rd & N Pleasantburg Dr

Route 1 Inbound Timepoints

I Lowndes Hill Rd & N Pleasantburg Dr
J Greenacre Rd & Clark St
K Clark St & Mims Ave
L E Washington St & Cleveirvine Ave
M Transit Center Bay A

Stop Activity

25 Boardings
25 Alightings

Route 1

Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Route 2   White Horse Road

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	186.2	133.0

On-Time Performance	Early	On-Time	Late
Weekday AM	66.7%	33.3%	0.0%
Weekday Midday	60.0%	40.0%	0.0%
Weekday PM	25.0%	50.0%	25.0%
Weekday All Day	50.0%	41.7%	8.3%
Saturday	25.0%	62.5%	12.5%

Service Productivity	Weekday		Saturday	
Average Daily Riders	402		266	
Riders/Revenue Hour	28.7	(1 of 11)	26.6	(1 of 11)
Riders/Revenue-Mile	2.2	(1 of 11)	2.0	(1 of 11)
Riders/One-Way Trip	28.7	(1 of 11)	26.6	(1 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$779		$557	
Cost/Rider	$1.94	(1 of 11)	$2.09	(1 of 11)
Farebox Recovery Ratio	47.70%	(1 of 11)	44.21%	(1 of 11)
Subsidy/Rider	$1.01	(1 of 11)	$1.17	(1 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$372		$246	
Revenue/Revenue-Hour	$26.55	(1 of 11)	$24.60	(1 of 11)
Revenue/Revenue-Mile	$2.00	(1 of 11)	$1.85	(1 of 11)
Revenue/One-Way Trip	$26.55	(1 of 11)	$24.60	(1 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

39%, 32%, 4%, 0%, 9%, 16%

Households & Employment within 1/4-Mile

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday

Ridership by Trip - Saturday

Weekday Ridership by Segment

Greenlink COA: Route Profile Analysis

2

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 2 Weekday Ridership

Route 2 Saturday Ridership

Route 2 Timepoints

A   Transit Center Bay B
B   Pendleton St & N Leach St
C   Easley Bridge Rd & N Florida Ave
D   White Horse Rd & W Marion Rd
E   Berea High School
F   Sulphur Springs Rd & Old Buncombe Rd
G   Old Buncombe Rd & Blease St
H   Transit Center Bay B

Route 2 Timepoints

A   Transit Center Bay B
B   Pendleton St & N Leach St
C   Easley Bridge Rd & N Florida Ave
D   White Horse Rd & W Marion Rd
E   Berea High School
F   Sulphur Springs Rd & Old Buncombe Rd
G   Old Buncombe Rd & Blease St
H   Transit Center Bay B

Stop Activity

25 Boardings
25 Alightings

Route 2

Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3
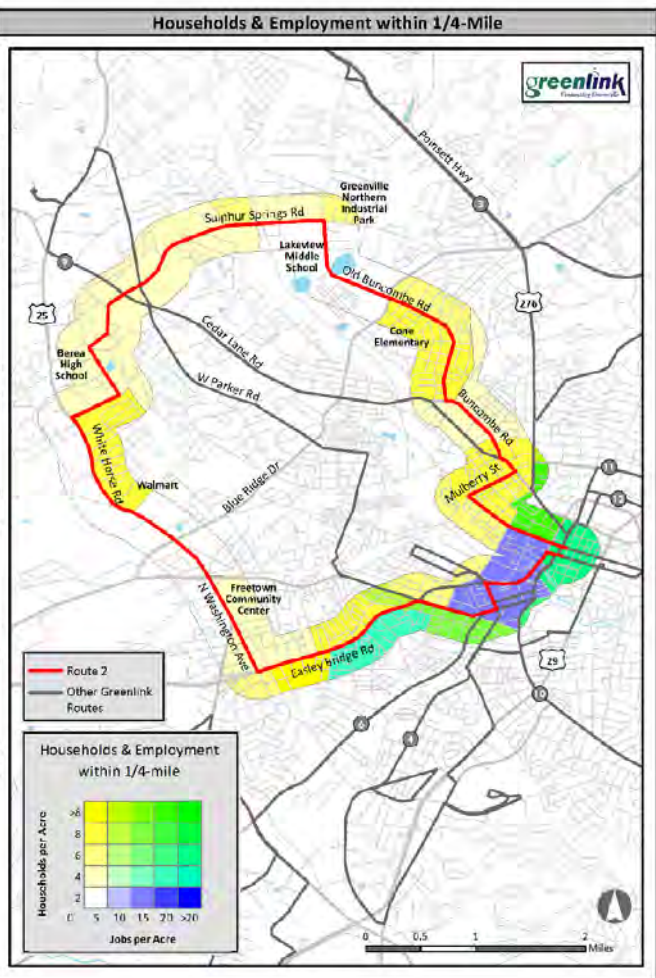
Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 3   Poinsett Hwy / Rutherford Rd

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	259.7	185.5

On-Time Performance	Early	On-Time	Late
Weekday AM	0.0%	0.0%	100.0%
Weekday Midday	0.0%	20.0%	80.0%
Weekday PM	0.0%	0.0%	100.0%
Weekday All Day	0.0%	9.1%	90.9%
Saturday	30.0%	60.0%	10.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	310		202	
Riders/Revenue Hour	22.2	(3 of 11)	20.2	(3 of 11)
Riders/Revenue-Mile	1.2	(5 of 11)	1.1	(4 of 11)
Riders/One-Way Trip	22.2	(3 of 11)	20.2	(3 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$906		$647	
Cost/Rider	$2.92	(3 of 11)	$3.21	(3 of 11)
Farebox Recovery Ratio	31.31%	(3 of 11)	28.53%	(3 of 11)
Subsidy/Rider	$2.01	(3 of 11)	$2.29	(3 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$284		$185	
Revenue/Revenue-Hour	$20.26	(3 of 11)	$18.46	(3 of 11)
Revenue/Revenue-Mile	$1.09	(5 of 11)	$1.00	(4 of 11)
Revenue/One-Way Trip	$20.26	(3 of 11)	$18.46	(3 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

40% / 34% / 14% / 8% / 0% / 4%

Households & Employment within 1/4-Mile

Households & Employment within 1/4-mile

Households per Acre / Jobs per Acre

- Route 3
- Other Greenlink Routes

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Greenlink COA: Route Profile Analysis

Comprehensive Operations Analysis

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 3 Weekday Outbound Ridership

Route 3 Weekday Inbound Ridership

Route 3 Outbound Timepoints
A Transit Center Bay C
B Rutherford St & Harvley St
C Poinsett Hwy & Cherrydale Pt
D Furman University Main Entrance

Route 3 Inbound Timepoints
D Furman University Main Entrance
E Rutherford Rd & Hillrose Ave
F Rutherford St & Echols St
G Transit Center Bay C

Stop Activity
25 Boardings
25 Alightings
Route 3
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 3 Saturday
Outbound Ridership

Route 3 Saturday
Inbound Ridership

Route 3 Outbound Timepoints
A   Transit Center Bay C
B   Rutherford St & Harvley St
C   Poinsett Hwy & Cherrydale Pt
D   Furman University Main Entrance

Route 3 Inbound Timepoints
D   Furman University Main Entrance
E   Rutherford Rd & Hillrose Ave
F   Rutherford St & Echols St
G   Transit Center Bay C

Stop Activity
25 Boardings
25 Alightings
Route 3
Other Greenlink
Routes

Greenlink COA: Route Profile Analysis

4

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 4   Dunean / Grove Rd

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	176.4	126.0

On-Time Performance	Early	On-Time	Late
Weekday AM	50.0%	50.0%	0.0%
Weekday Midday	20.0%	80.0%	0.0%
Weekday PM	75.0%	25.0%	0.0%
Weekday All Day	46.2%	53.8%	0.0%
Saturday	77.8%	22.2%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	190		123	
Riders/Revenue Hour	13.6	(9 of 11)	12.3	(6 of 11)
Riders/Revenue-Mile	1.1	(6 of 11)	1.0	(5 of 11)
Riders/One-Way Trip	13.6	(10 of 11)	12.3	(7 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$762		$544	
Cost/Rider	$4.01	(7 of 11)	$4.43	(6 of 11)
Farebox Recovery Ratio	21.37%	(9 of 11)	19.35%	(6 of 11)
Subsidy/Rider	$3.15	(8 of 11)	$3.57	(6 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$163		$105	
Revenue/Revenue-Hour	$11.63	(9 of 11)	$10.54	(9 of 11)
Revenue/Revenue-Mile	$0.92	(7 of 11)	$0.84	(6 of 11)
Revenue/One-Way Trip	$11.63	(10 of 11)	$10.54	(10 of 11)

Ridership By Ticket Type

- Normal Fare 33%
- Transfer 35%
- Day Pass 4%
- City/County 1%
- Elderly/ADA 11%
- Other 16%

Households & Employment within 1/4-Mile

Greenlink COA: Route Profile Analysis

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Greenlink COA: Route Profile Analysis

2

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 4 Weekday Outbound Ridership

Route 4 Outbound Timepoints
A Transit Center Bay D
B Rhett St & N Markley St
C Guess St & Seth St
D Greenville Hospital System (Roger C. Peace Rehab)
E Greenville Hospital System (ER Entrance)
F Old Piedmont Highway & Grove Rd

Route 4 Weekday Inbound Ridership

Route 4 Inbound Timepoints
F Old Piedmont Highway & Grove Rd
G Marue Dr & K-Mart Plz
H Green Ave & Guess St
I University Ridge & County Square
J Transit Center Bay D

Stop Activity
25 Boardings
25 Alightings
Route 4
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 4 Saturday Outbound Ridership

Route 4 Saturday Inbound Ridership

Route 4 Outbound Timepoints
A Transit Center Bay D
B Rhett St & N Markley St
C Guess St & Seth St
D Greenville Hospital System (Roger C. Peace Rehab)
E Greenville Hospital System (ER Entrance)
F Old Piedmont Highway & Grove Rd

Route 4 Inbound Timepoints
F Old Piedmont Highway & Grove Rd
G Marue Dr & K-Mart Plz
H Green Ave & Guess St
I University Ridge & County Square
J Transit Center Bay D

Stop Activity
25 Boardings
25 Alightings
Route 4
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Comprehensive Operations Analysis

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 6   Anderson Rd

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	210.0	150.0

On-Time Performance	Early	On-Time	Late
Weekday AM	25.0%	50.0%	25.0%
Weekday Midday	40.0%	60.0%	0.0%
Weekday PM	Insufficient data during this time period		
Weekday All Day	33.3%	55.6%	11.1%
Saturday	30.0%	70.0%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	198		120	
Riders/Revenue Hour	14.1	(8 of 11)	12.0	(7 of 11)
Riders/Revenue-Mile	0.9	(9 of 11)	0.8	(8 of 11)
Riders/One-Way Trip	14.1	(9 of 11)	12.0	(8 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$820		$586	
Cost/Rider	$4.15	(9 of 11)	$4.89	(8 of 11)
Farebox Recovery Ratio	22.59%	(7 of 11)	19.14%	(8 of 11)
Subsidy/Rider	$3.21	(9 of 11)	$3.96	(8 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$185		$112	
Revenue/Revenue-Hour	$13.24	(7 of 11)	$11.21	(6 of 11)
Revenue/Revenue-Mile	$0.88	(8 of 11)	$0.75	(8 of 11)
Revenue/One-Way Trip	$13.24	(8 of 11)	$11.21	(7 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

40%
29%
19%
4%
1%

Households & Employment within 1/4-Mile

Households & Employment within 1/4-mile

Route 6
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

1

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Greenlink COA: Route Profile Analysis

2

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 6 Weekday Outbound Ridership

Route 6 Weekday Inbound Ridership

Route 6 Outbound Timepoints
A   Transit Center Bay F
B   Anderson Rd & S Washington Ave
C   White Horse Rd & Anderson Rd
D   Old Easley Bridge Rd & Margal St
E   White Horse Rd & Anderson Rd

Route 6 Inbound Timepoints
E   White Horse Rd & Anderson Rd
F   Grove Station Apartments
G   White Horse Rd & Anderson Rd
H   Anderson Rd & S Washington Ave
I   Transit Center Bay F

Stop Activity
25 Boardings
25 Alightings
Route 6
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 6 Saturday Outbound Ridership

Route 6 Saturday Inbound Ridership

Route 6 Outbound Timepoints

A   Transit Center Bay F
B   Anderson Rd & S Washington Ave
C   White Horse Rd & Anderson Rd
D   Old Easley Bridge Rd & Margal St
E   White Horse Rd & Anderson Rd

Route 6 Inbound Timepoints

E   White Horse Rd & Anderson Rd
F   Grove Station Apartments
G   White Horse Rd & Anderson Rd
H   Anderson Rd & S Washington Ave
I   Transit Center Bay F

Stop Activity

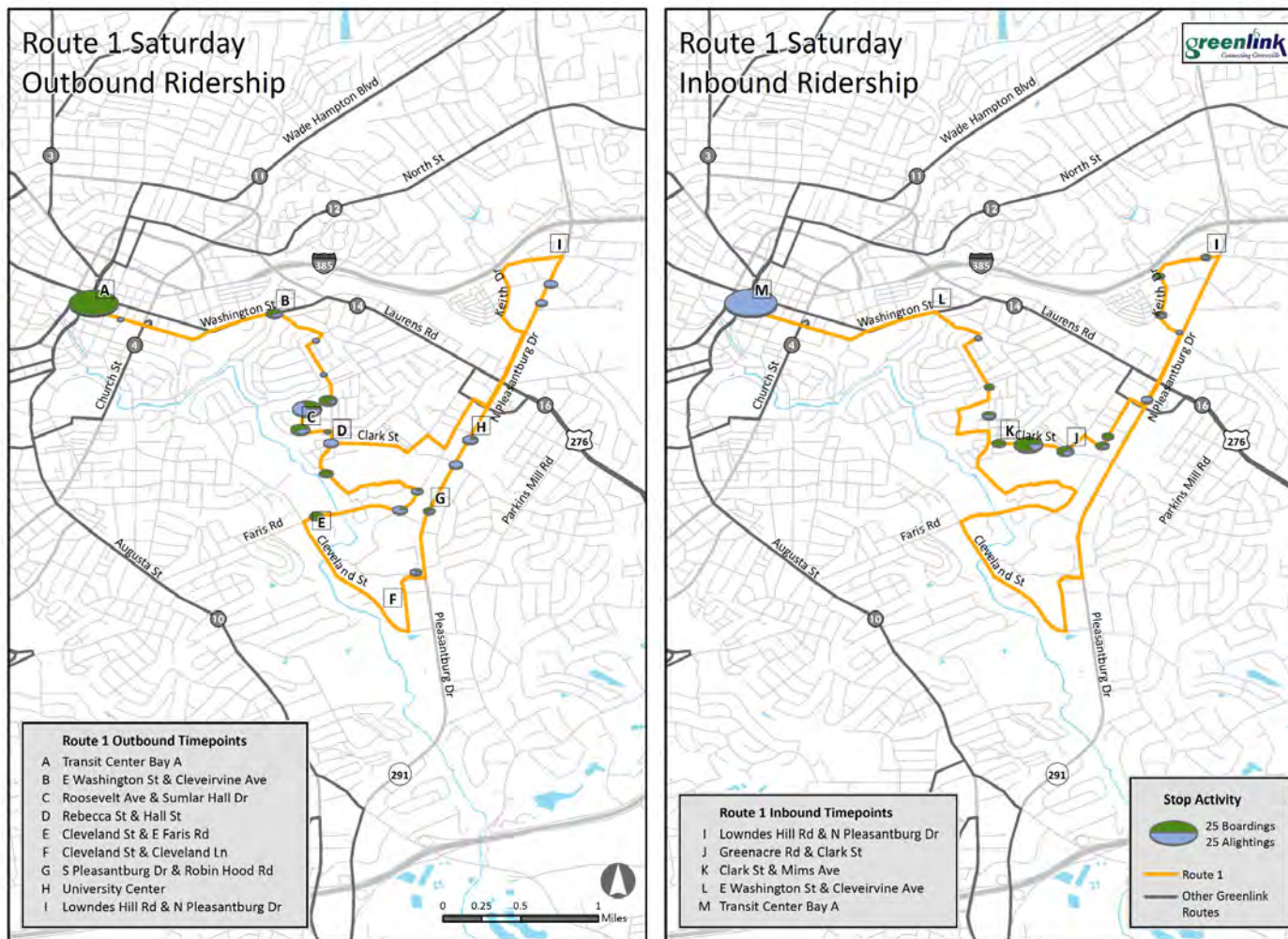25 Boardings
25 Alightings

Route 6

Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

greenlink
Connecting Greenville

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 9   West Parker / Berea / Woodside

Characteristics	Weekday	Saturday	
Span of Service	5:30 am – 7:30 pm	8:30 am – 6:30 pm	
Frequency	60	60	
Peak Buses	1	1	

Operatng Statistics	Weekday	Saturday	
One-Way Trips	14	10	
Revenue-Hours	14.0	10.0	
Revenue-Miles	215.6	154.0	

On-Time Performance	Early	On-Time	Late
Weekday AM	0.0%	66.7%	33.3%
Weekday Midday	16.7%	83.3%	0.0%
Weekday PM	0.0%	50.0%	50.0%
Weekday All Day	7.7%	69.2%	23.1%
Saturday	20.0%	60.0%	20.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	205		119	
Riders/Revenue Hour	14.7	(7 of 11)	11.9	(8 of 11)
Riders/Revenue-Mile	1.0	(8 of 11)	0.8	(9 of 11)
Riders/One-Way Trip	14.7	(8 of 11)	11.9	(9 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$830		$593	
Cost/Rider	$4.04	(8 of 11)	$4.99	(9 of 11)
Farebox Recovery Ratio	22.25%	(8 of 11)	18.02%	(9 of 11)
Subsidy/Rider	$3.14	(7 of 11)	$4.09	(9 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$185		$107	
Revenue/Revenue-Hour	$13.19	(8 of 11)	$10.68	(7 of 11)
Revenue/Revenue-Mile	$0.86	(9 of 11)	$0.69	(9 of 11)
Revenue/One-Way Trip	$13.19	(9 of 11)	$10.68	(8 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

22%
33%
11%
1%
3%
31%

Households & Employment within 1/4-Mile

Route 9
Other Greenlink Routes

Households & Employment within 1/4-mile
Households per Acre
Jobs per Acre

Greenlink COA: Route Profile Analysis

1

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group
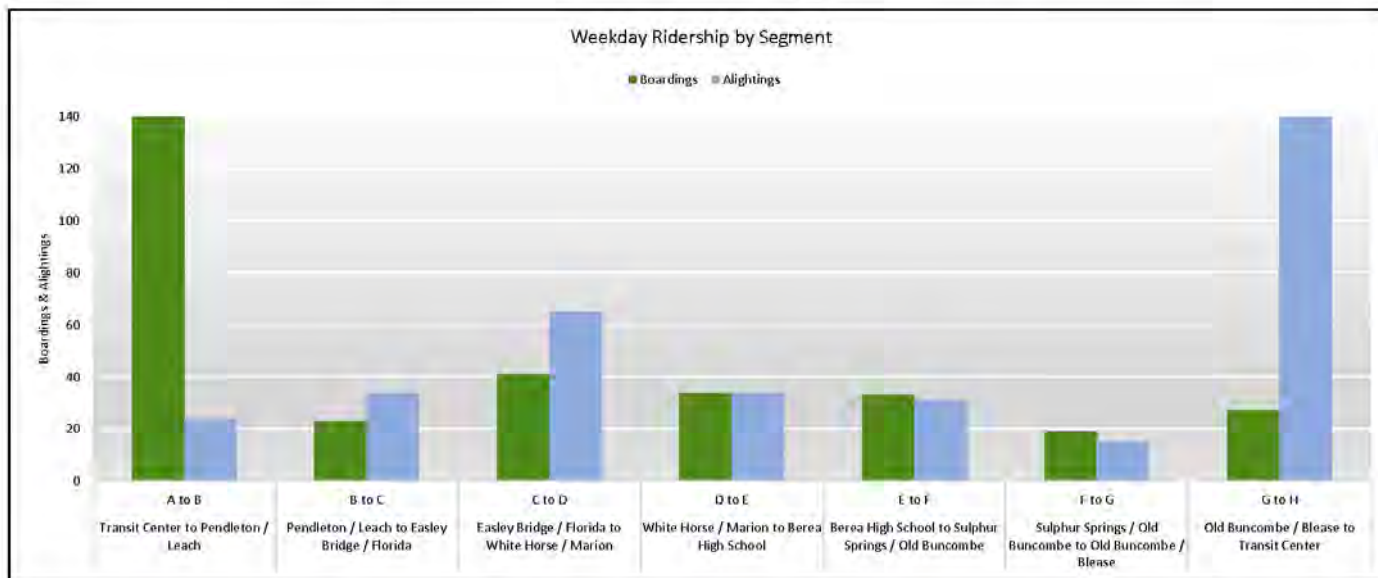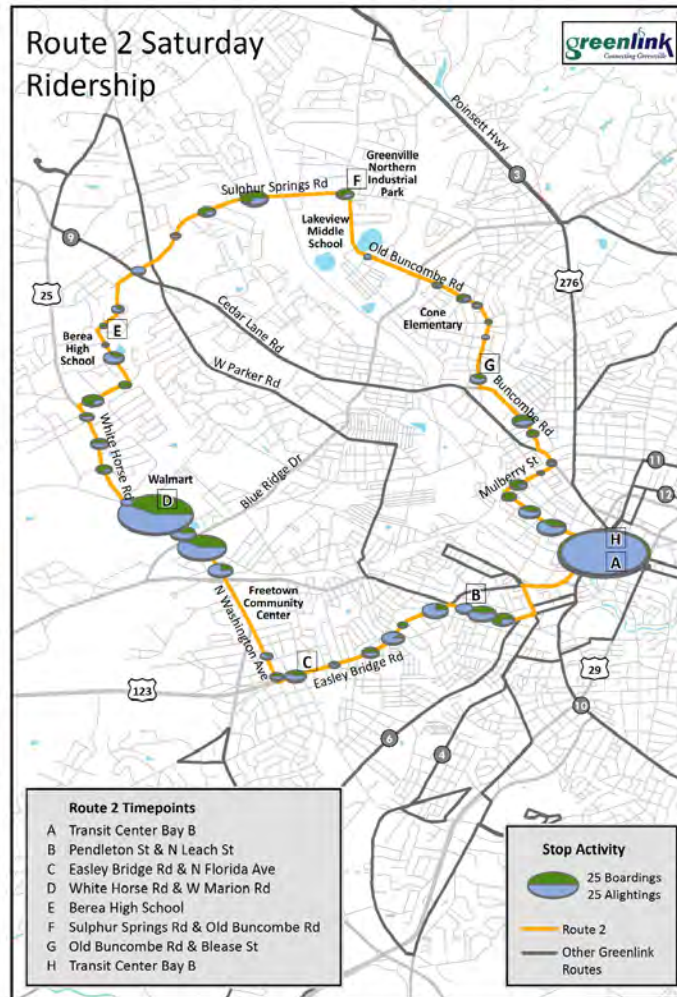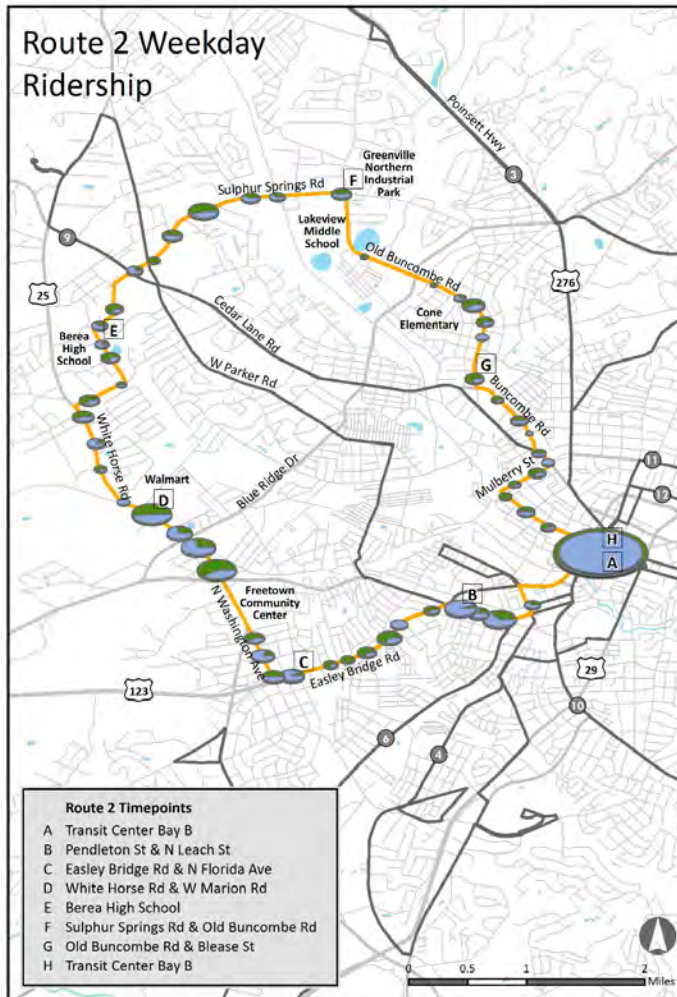

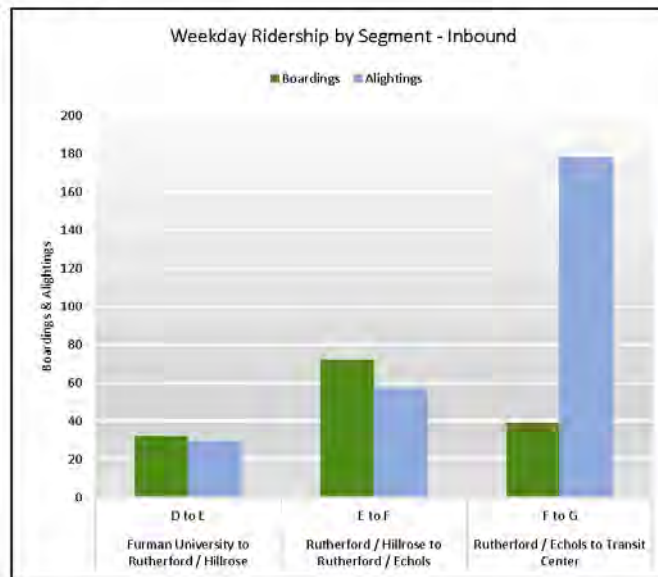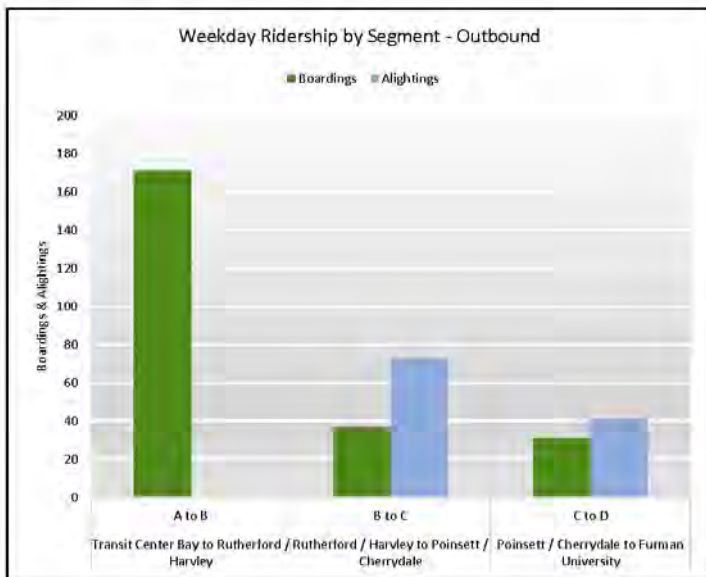Greenlink COA: Route Profile Analysis

2

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 9 Weekday Outbound Ridership

Route 9 Weekday Inbound Ridership

Route 9 Outbound Timepoints
A   Transit Center Bay I
B   Pete Hollis Blvd & Metropolitan Dr
C   Cedar Lane Rd & Old Bleachery Rd
D   Greenville Tech NW Campus

Route 9 Inbound Timepoints
D   Greenville Tech NW Campus
E   W Parker Rd & Farrs Bridge Rd
F   Woodside Ave & W Bramlett Rd
G   S Academy St & Perry Ave
H   Birnie St & S Hudson St
I   Transit Center Bay I

Stop Activity
25 Boardings
25 Alightings

Route 9
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 9 Saturday Outbound Ridership

Route 9 Outbound Timepoints
A Transit Center Bay I
B Pete Hollis Blvd & Metropolitan Dr
C Cedar Lane Rd & Old Bleachery Rd
D Greenville Tech NW Campus

Route 9 Saturday Inbound Ridership

Route 9 Inbound Timepoints
D Greenville Tech NW Campus
E W Parker Rd & Farrs Bridge Rd
F Woodside Ave & W Bramlett Rd
G S Academy St & Perry Ave
H Birnie St & S Hudson St
I Transit Center Bay I

Stop Activity
25 Boardings
25 Alightings
Route 9
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 10   Augusta Rd

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	206.5	155.0

On-Time Performance	Early	On-Time	Late
Weekday AM	0.0%	75.0%	25.0%
Weekday Midday	0.0%	75.0%	25.0%
Weekday PM	25.0%	50.0%	25.0%
Weekday All Day	8.3%	66.7%	25.0%
Saturday	40.0%	60.0%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	374		234	
Riders/Revenue Hour	26.7	(2 of 11)	23.4	(2 of 11)
Riders/Revenue-Mile	1.8	(2 of 11)	1.5	(2 of 11)
Riders/One-Way Trip	26.7	(2 of 11)	23.4	(2 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$814		$594	
Cost/Rider	$2.18	(2 of 11)	$2.54	(2 of 11)
Farebox Recovery Ratio	44.46%	(2 of 11)	38.10%	(2 of 11)
Subsidy/Rider	$1.21	(2 of 11)	$1.57	(2 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$362		$227	
Revenue/Revenue-Hour	$25.85	(2 of 11)	$22.65	(2 of 11)
Revenue/Revenue-Mile	$1.75	(2 of 11)	$1.46	(2 of 11)
Revenue/One-Way Trip	$25.85	(2 of 11)	$22.65	(2 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

14%, 8%, 1%, 2%, 44%, 30%

Households & Employment within 1/4-Mile

Route 10
Other Greenlink Routes

Households & Employment within 1/4-mile
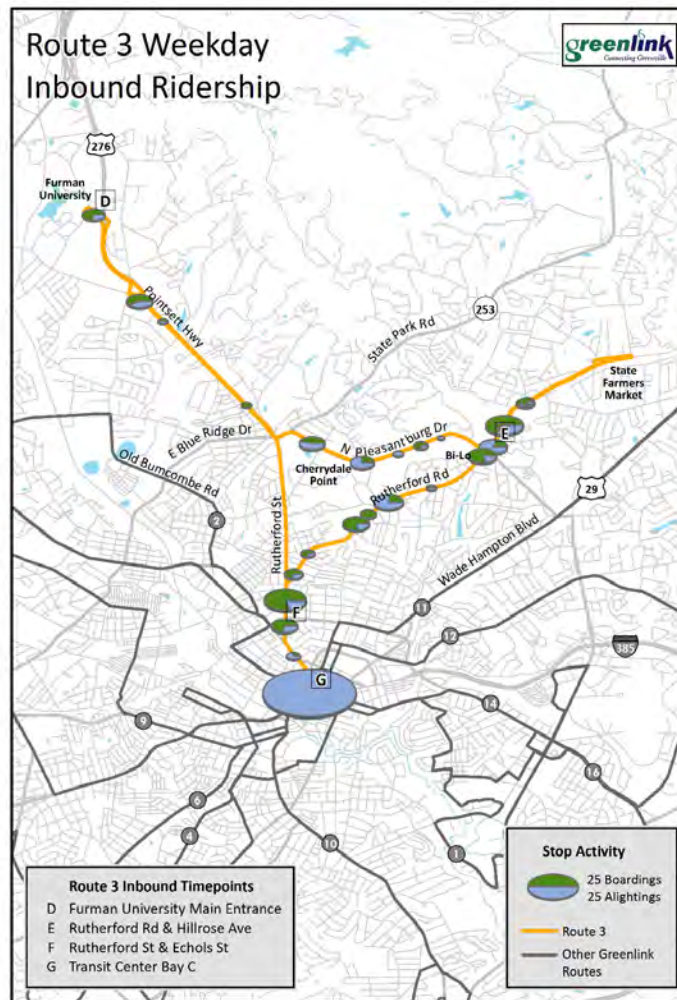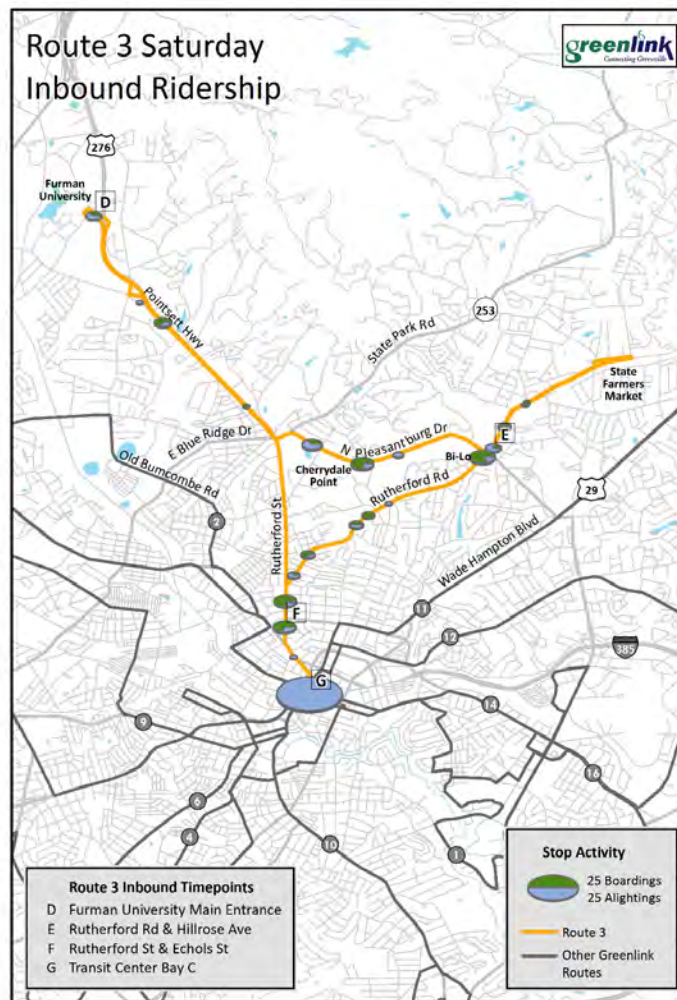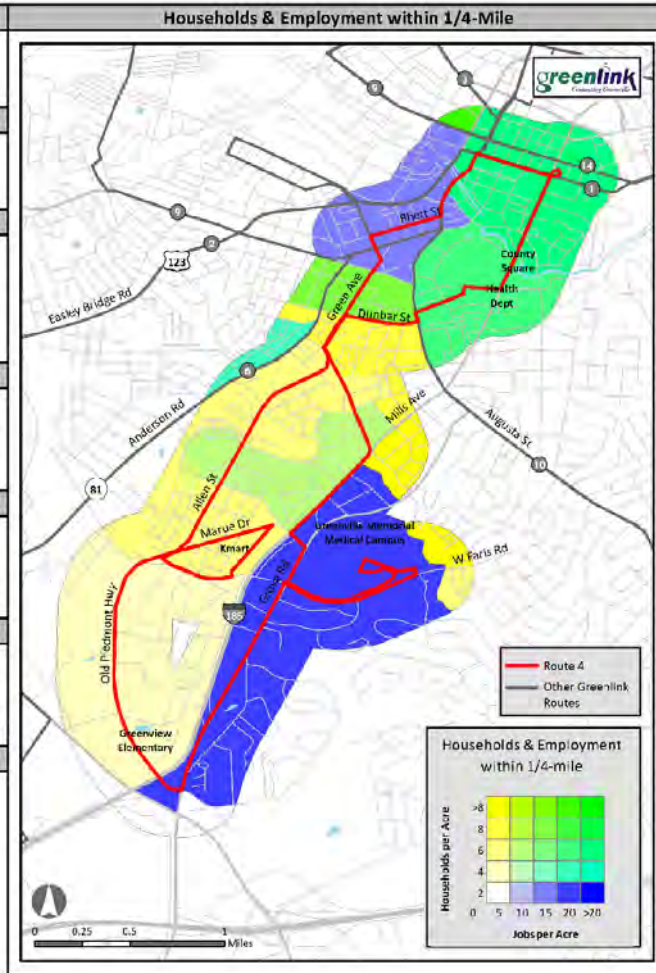
Greenlink COA: Route Profile Analysis

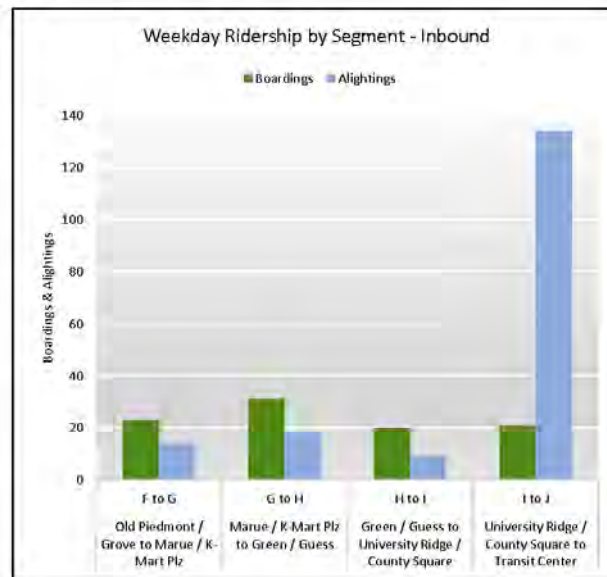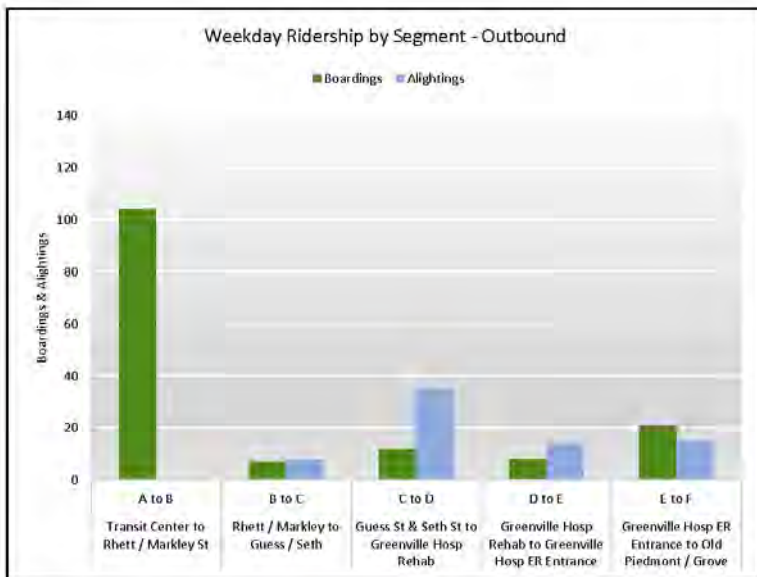Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday

Ridership by Trip - Saturday

Weekday Ridership by Segment - Outbound

Weekday Ridership by Segment - Inbound

Greenlink COA: Route Profile Analysis

2

Route 10 Outbound Timepoints
A Transit Center Bay J
B Augusta St & Dunbar St
C Augusta St & Augusta Dr
D Old Augusta Rd & Potomac Ave
E Frontage Rd & Augusta Rd
F Crestfield Rd & White Horse Rd

Route 10 Inbound Timepoints
F Crestfield Rd & White Horse Rd
G S Pleasantburg Dr & Mauldin Rd
H Augusta St & Oregon St
I Augusta St & Thruston St
J Transit Center Bay J

Stop Activity
25 Boardings
25 Alightings
Route 10
Other Greenlink Routes

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 10 Saturday Outbound Ridership

Route 10 Outbound Timepoints
A Transit Center Bay J
B Augusta St & Dunbar St
C Augusta St & Augusta Dr
D Old Augusta Rd & Potomac Ave
E Frontage Rd & Augusta Rd
F Crestfield Rd & White Horse Rd

Route 10 Saturday Inbound Ridership

Route 10 Inbound Timepoints
F Crestfield Rd & White Horse Rd
G S Pleasantburg Dr & Mauldin Rd
H Augusta St & Oregon St
I Augusta St & Thruston St
J Transit Center Bay J

Stop Activity
25 Boardings
25 Alightings
Route 10
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Route 11 Wade Hampton / Taylors

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	250.6	179.0

On-Time Performance	Early	On-Time	Late
Weekday AM	25.0%	50.0%	25.0%
Weekday Midday	0.0%	50.0%	50.0%
Weekday PM	25.0%	50.0%	25.0%
Weekday All Day	14.3%	50.0%	35.7%
Saturday	11.1%	44.4%	44.4%

Service Productivity	Weekday		Saturday	
Average Daily Riders	254		158	
Riders/Revenue Hour	18.1	(4 of 11)	15.8	(4 of 11)
Riders/Revenue-Mile	1.0	(7 of 11)	0.9	(7 of 11)
Riders/One-Way Trip	18.1	(5 of 11)	15.8	(4 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$890		$636	
Cost/Rider	$3.51	(6 of 11)	$4.02	(5 of 11)
Farebox Recovery Ratio	28.20%	(5 of 11)	24.65%	(4 of 11)
Subsidy/Rider	$2.52	(6 of 11)	$3.03	(5 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$251		$157	
Revenue/Revenue-Hour	$17.93	(4 of 11)	$15.67	(4 of 11)
Revenue/Revenue-Mile	$1.00	(6 of 11)	$0.88	(5 of 11)
Revenue/One-Way Trip	$17.93	(4 of 11)	$15.67	(4 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

46%, 28%, 4%, 1%, 6%, 15%

Households & Employment within 1/4-Mile

Households & Employment within 1/4-mile

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday

Ridership by Trip - Saturday

Weekday Ridership by Segment - Outbound
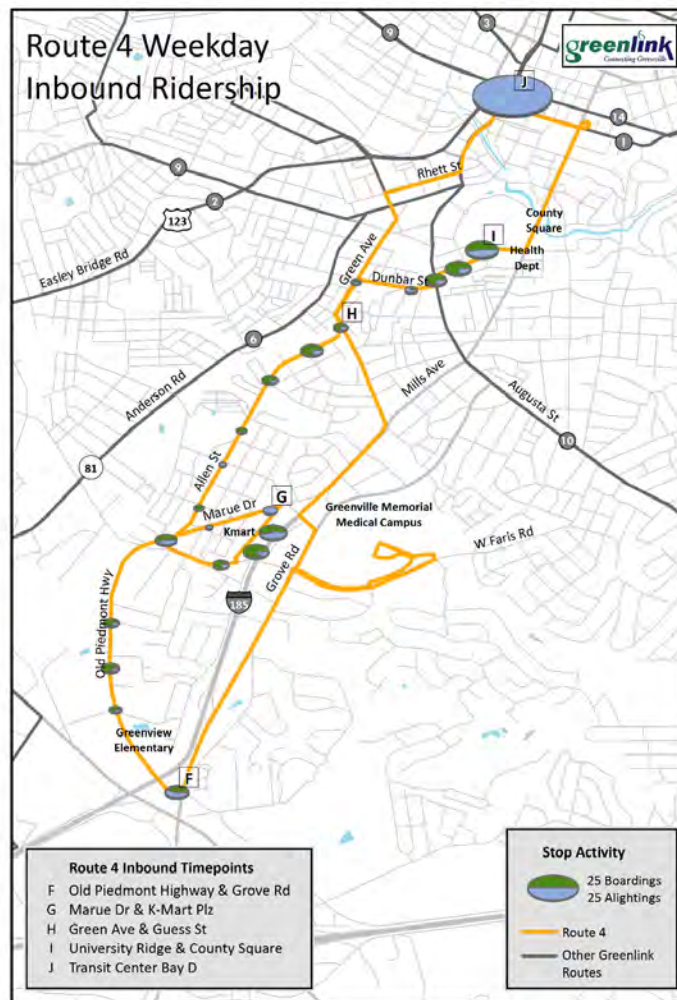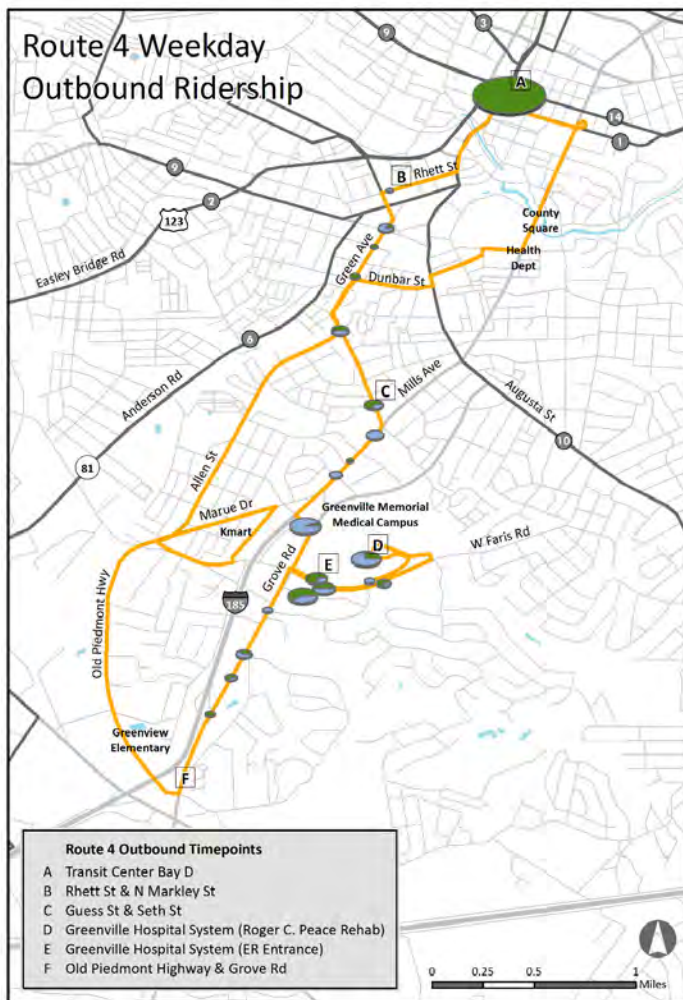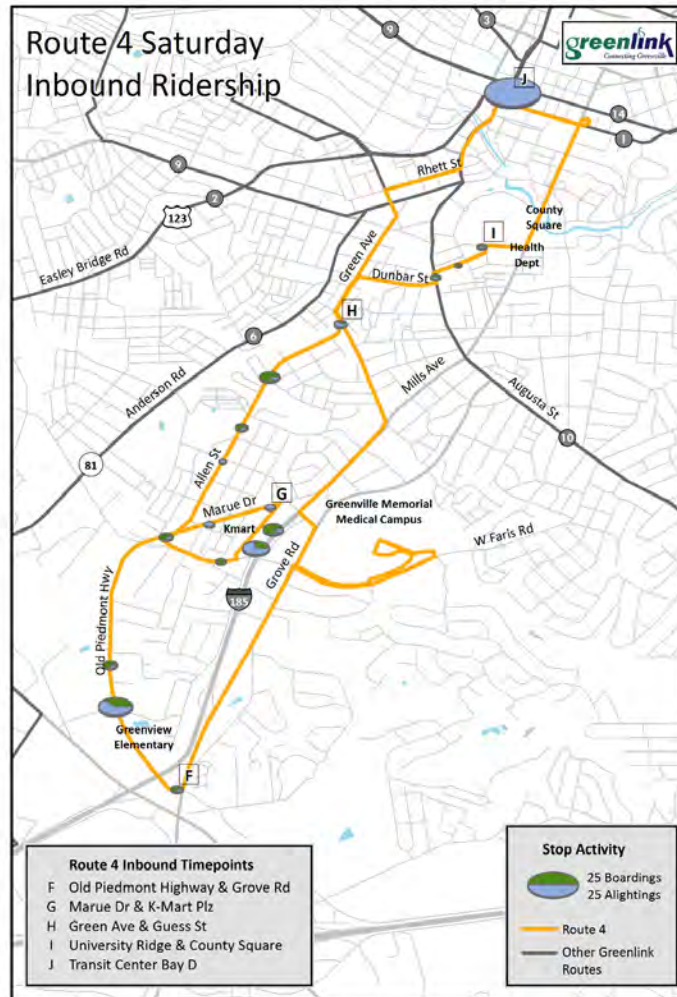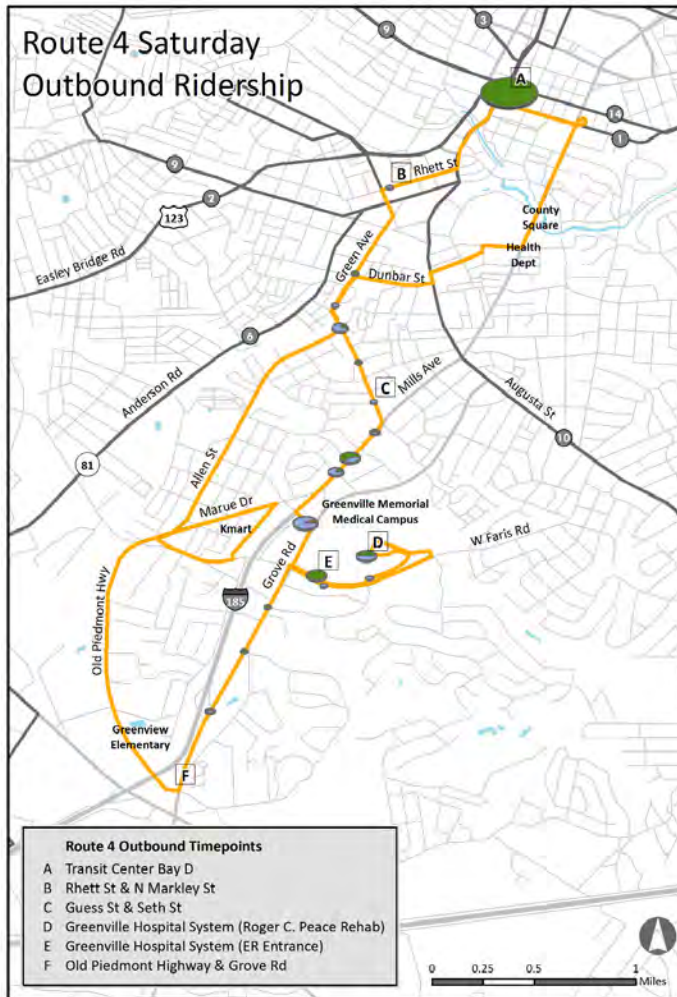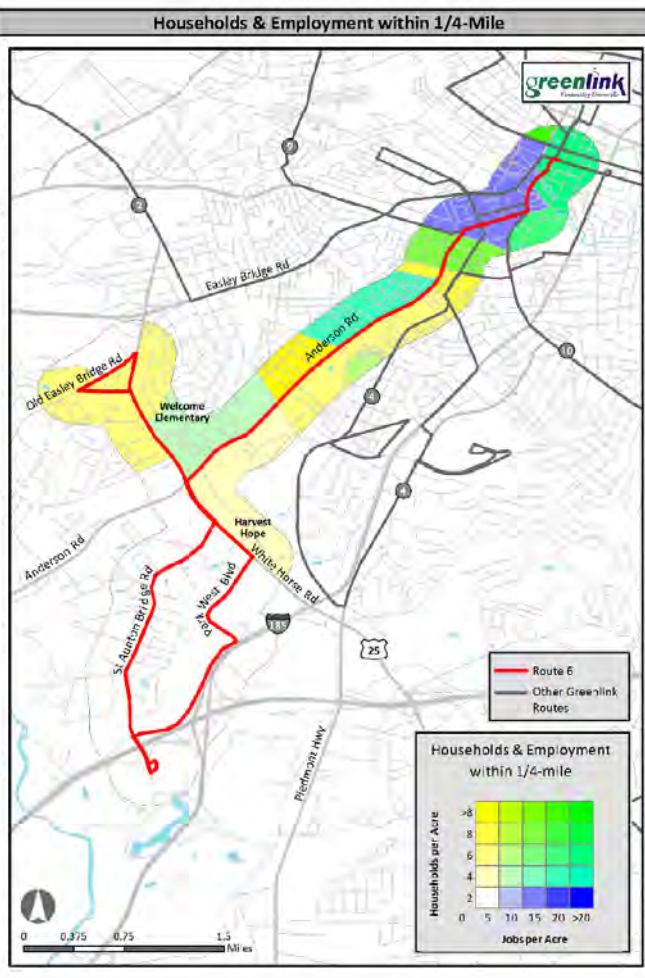
Weekday Ridership by Segment - Inbound
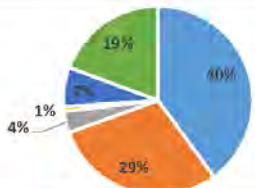
Greenlink COA: Route Profile Analysis

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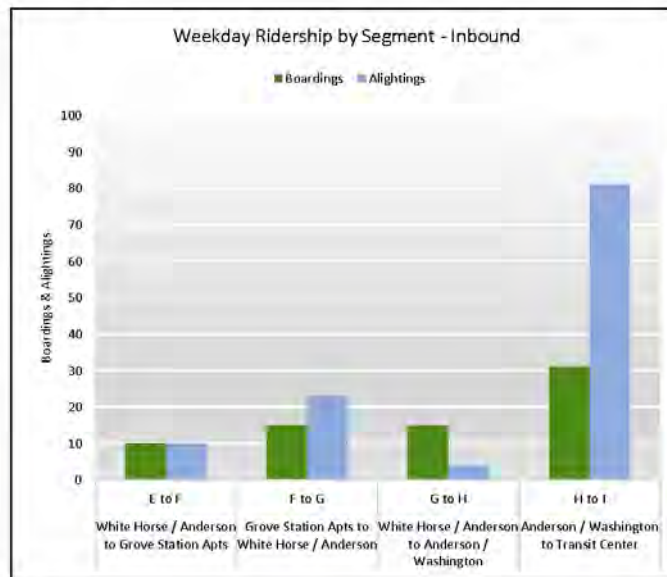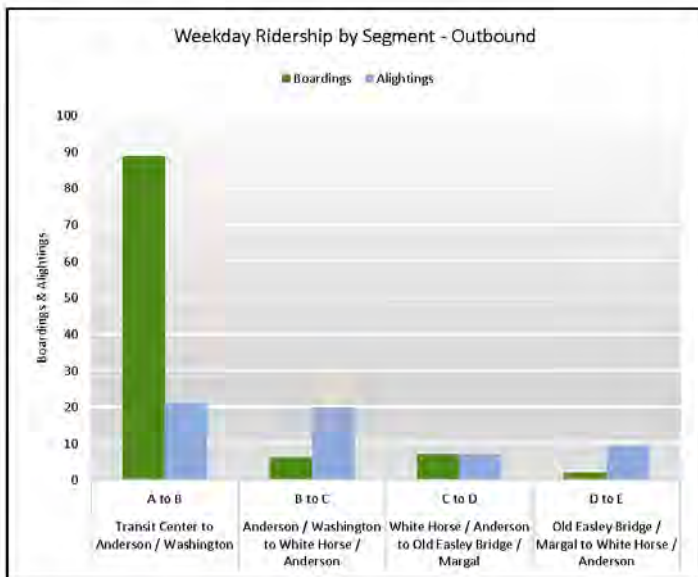Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 11 Weekday Outbound Ridership

Route 11 Weekday Inbound Ridership

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Route 11 Outbound Timepoints

A Transit Center Bay K
B Wade Hampton Blvd & Column St
C Wade Hampton Blvd & Pine Knoll Dr
D 3000 Block Wade Hampton Blvd
E Wade Hampton Blvd & W Main St
F Boling Rd & Gavin Pl

Route 11 Inbound Timepoints

F Boling Rd & Gavin Pl
G Wade Hampton Blvd & Edwards Mill Rd
H Wade Hampton Blvd & Tappan Dr
I Wade Hampton Blvd & N Pleasantburg Dr
J Wade Hampton Blvd & E Earle St
J Transit Center Bay K

Stop Activity

25 Boardings
25 Alightings

━━━ Route 11
━━━ Other Greenlink Routes

Greenlink COA: Route Profile Analysis

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Route 11 Saturday Outbound Ridership

Route 11 Saturday Inbound Ridership

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Route 11 Outbound Timepoints

A   Transit Center Bay K
B   Wade Hampton Blvd & Column St
C   Wade Hampton Blvd & Pine Knoll Dr
D   3000 Block Wade Hampton Blvd
E   Wade Hampton Blvd & W Main St
F   Boling Rd & Gavin Pl

Route 11 Inbound Timepoints

F   Boling Rd & Gavin Pl
G   Wade Hampton Blvd & Edwards Mill Rd
H   Wade Hampton Blvd & Tappan Dr
I   Wade Hampton Blvd & N Pleasantburg Dr
J   Wade Hampton Blvd & E Earle St
J   Transit Center Bay K

Stop Activity

25 Boardings
25 Alightings

Route 11

Other Greenlink Routes

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 12   Overbrook / Pelham Rd

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	1	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	14.0	10.0
Revenue-Miles	175.0	125.0

On-Time Performance	Early	On-Time	Late
Weekday AM	0.0%	100.0%	0.0%
Weekday Midday	0.0%	66.7%	33.3%
Weekday PM	0.0%	66.7%	33.3%
Weekday All Day	0.0%	75.0%	25.0%
Saturday	28.6%	71.4%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	249		145	
Riders/Revenue Hour	17.8	(5 of 11)	14.5	(5 of 11)
Riders/Revenue-Mile	1.4	(3 of 11)	1.2	(3 of 11)
Riders/One-Way Trip	17.8	(6 of 11)	14.5	(5 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$760		$543	
Cost/Rider	$3.05	(4 of 11)	$3.75	(4 of 11)
Farebox Recovery Ratio	28.46%	(4 of 11)	23.19%	(5 of 11)
Subsidy/Rider	$2.18	(4 of 11)	$2.88	(4 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$216		$126	
Revenue/Revenue-Hour	$15.44	(5 of 11)	$12.59	(5 of 11)
Revenue/Revenue-Mile	$1.24	(3 of 11)	$1.01	(3 of 11)
Revenue/One-Way Trip	$15.44	(6 of 11)	$12.59	(6 of 11)

Ridership By Ticket Type

- Normal Fare
- Transfer
- Day Pass
- City/County
- Elderly/ADA
- Other

13%, 33%, 10%, 1%, 4%, 34%

Households & Employment within 1/4-Mile
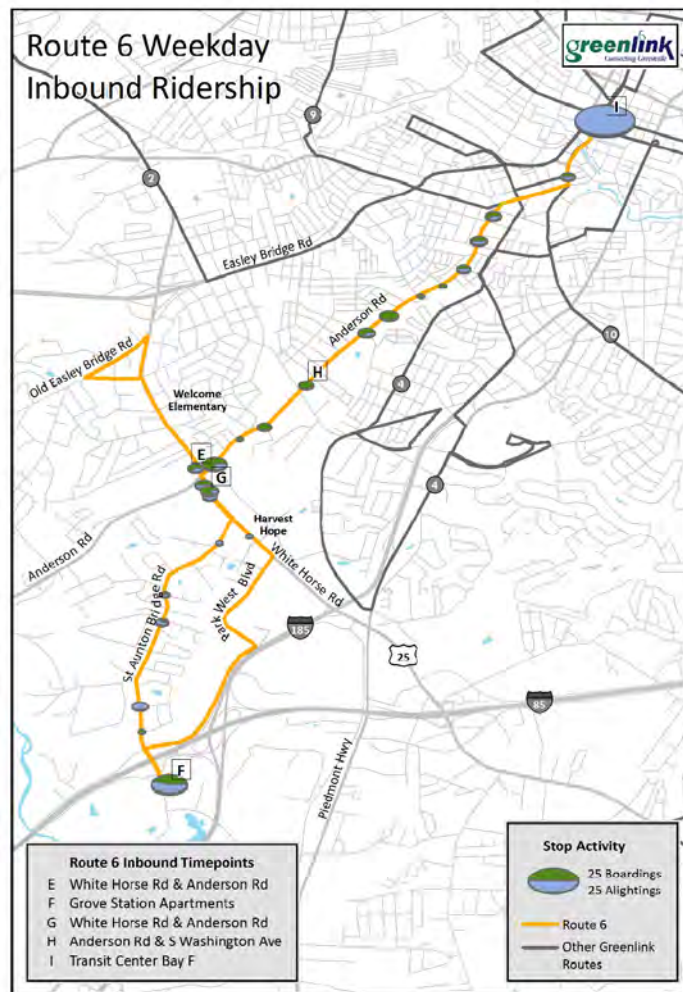
Route 12
Other Greenlink Routes

Households & Employment within 1/4-mile

Greenlink COA: Route Profile Analysis   1

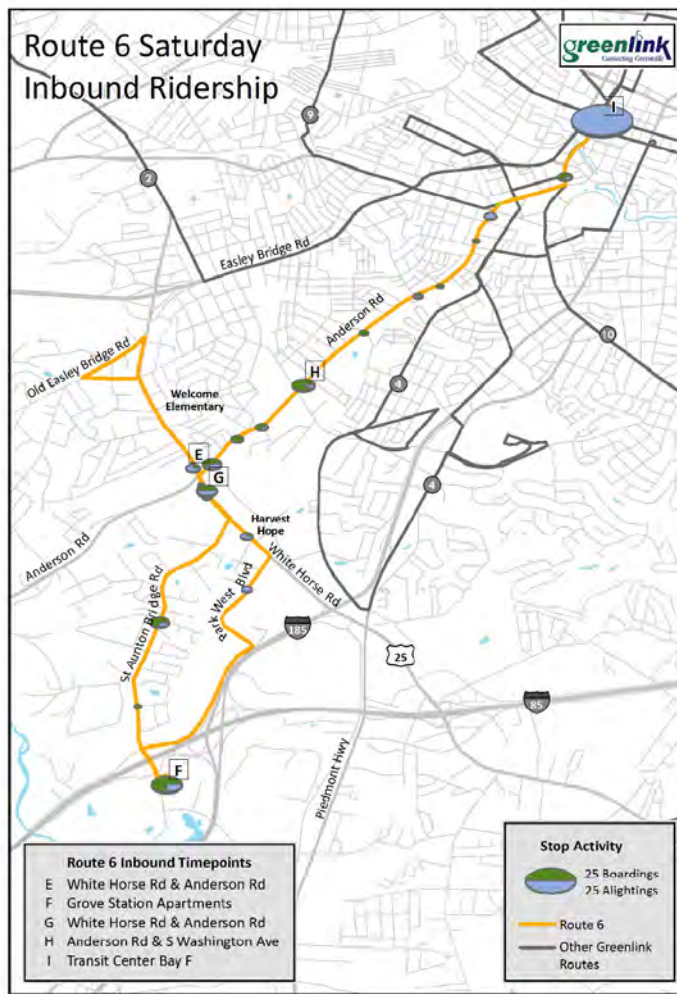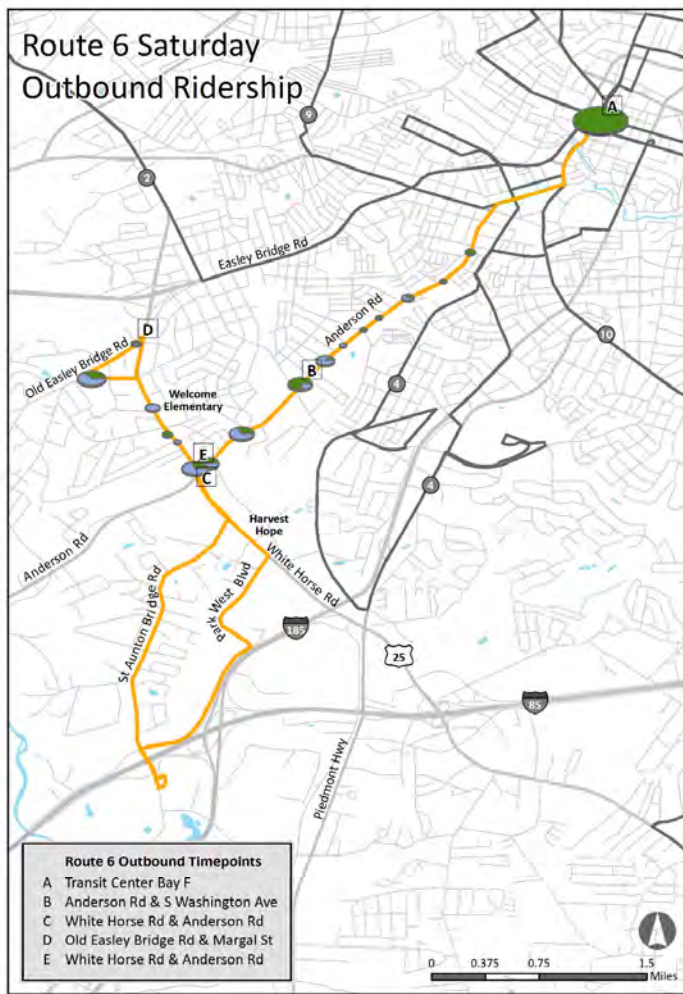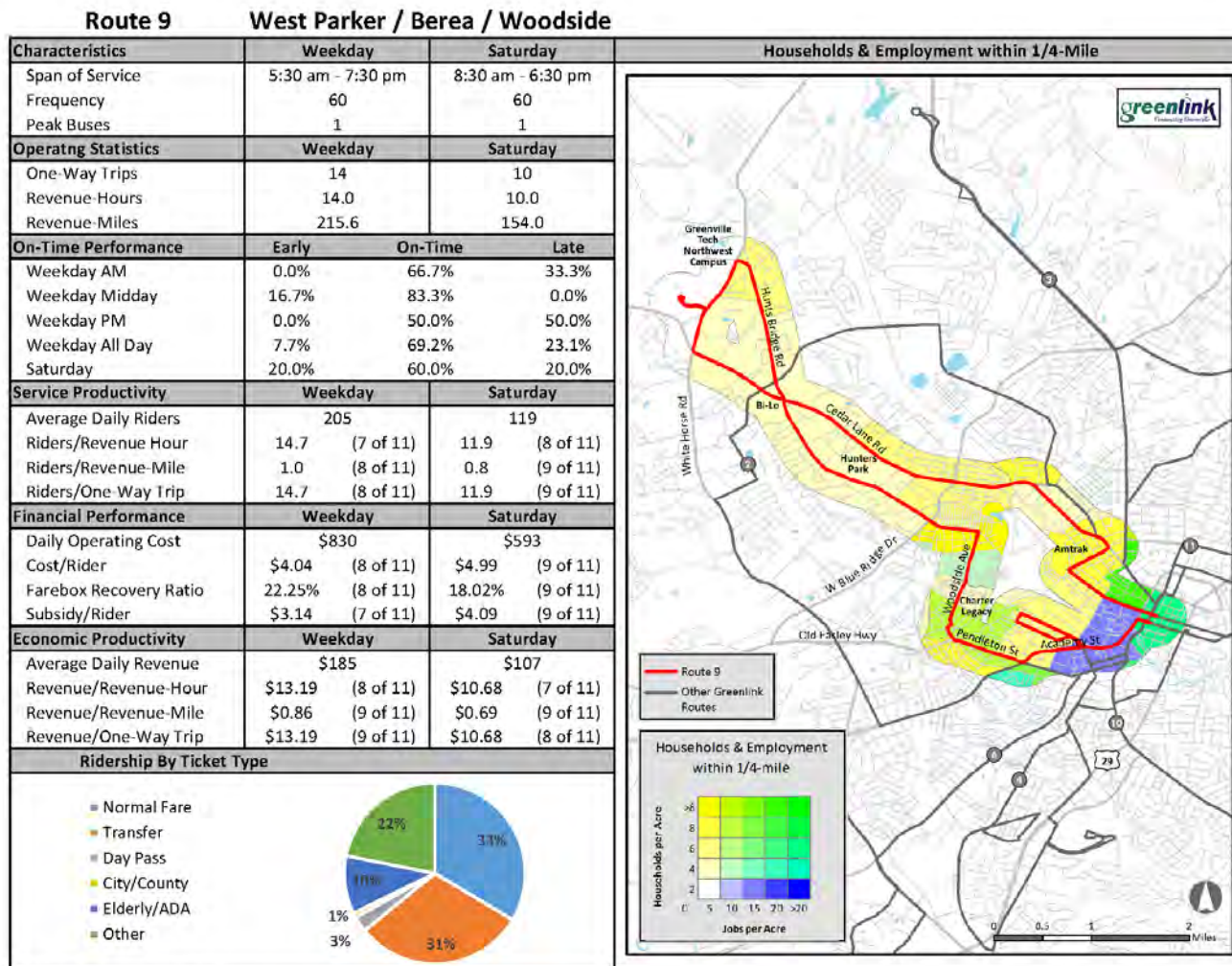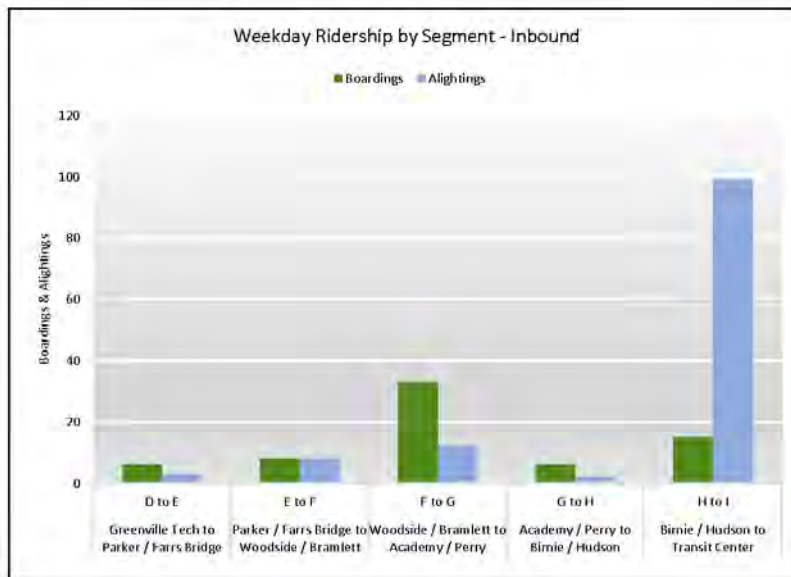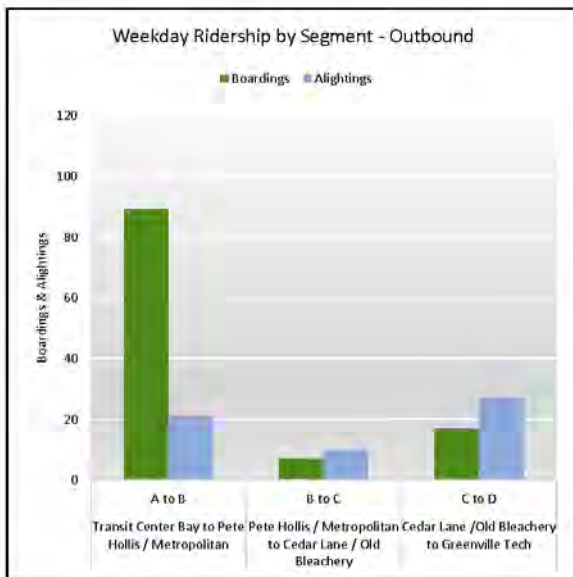Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday

Ridership by Trip - Saturday

Weekday Ridership by Segment - Outbound
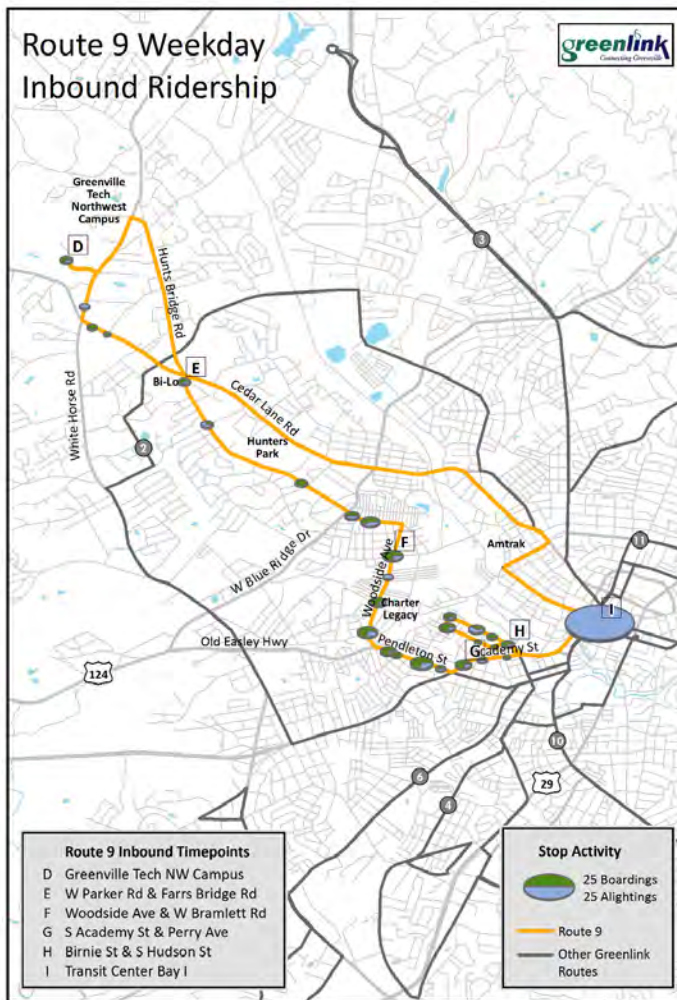

Weekday Ridership by Segment - Inbound
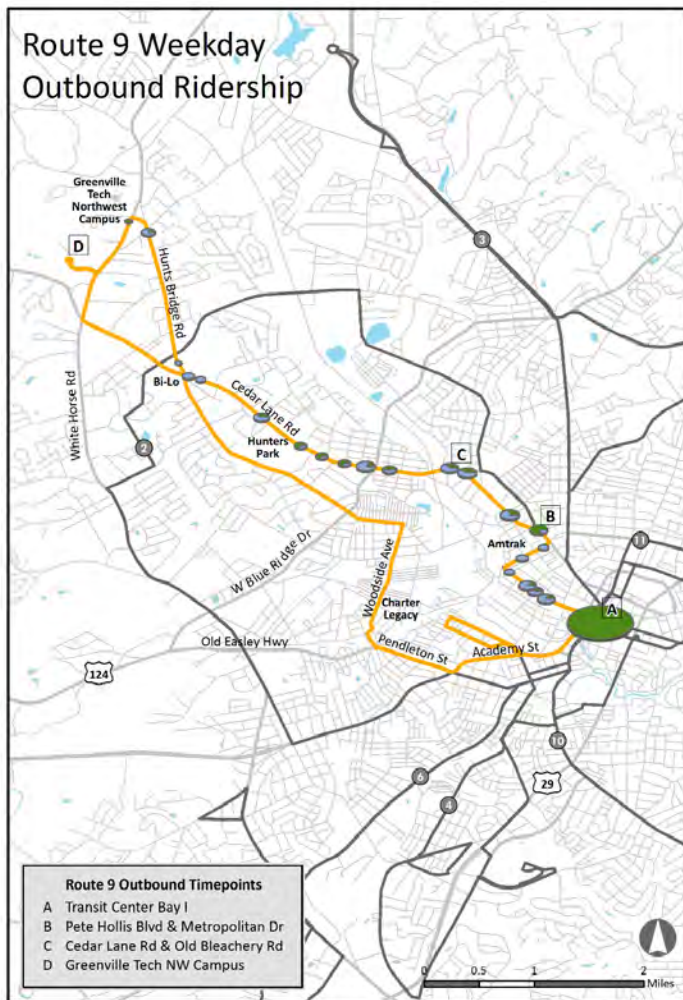
Greenlink COA: Route Profile Analysis

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Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 12 Weekday Outbound Ridership

Route 12 Weekday Inbound Ridership

Route 12 Outbound Timepoints
A   Transit Center Bay L
B   E North St & Pelham Rd
C   Roper Mountain Rd Ext & Pelham Rd
D   Haywood Mall

Route 12 Inbound Timepoints
D   Haywood Mall
E   Orchard Park Dr & Haywood Rd
F   E North St & N Pleasantburg Dr
G   Transit Center Bay L

Stop Activity
25 Boardings
25 Alightings
Route 12
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

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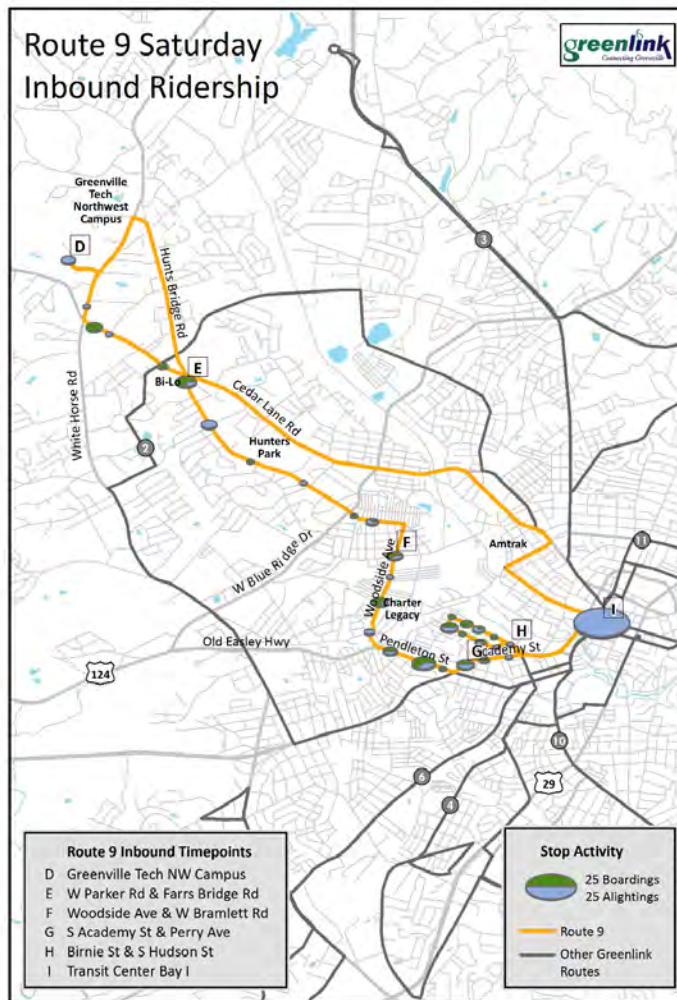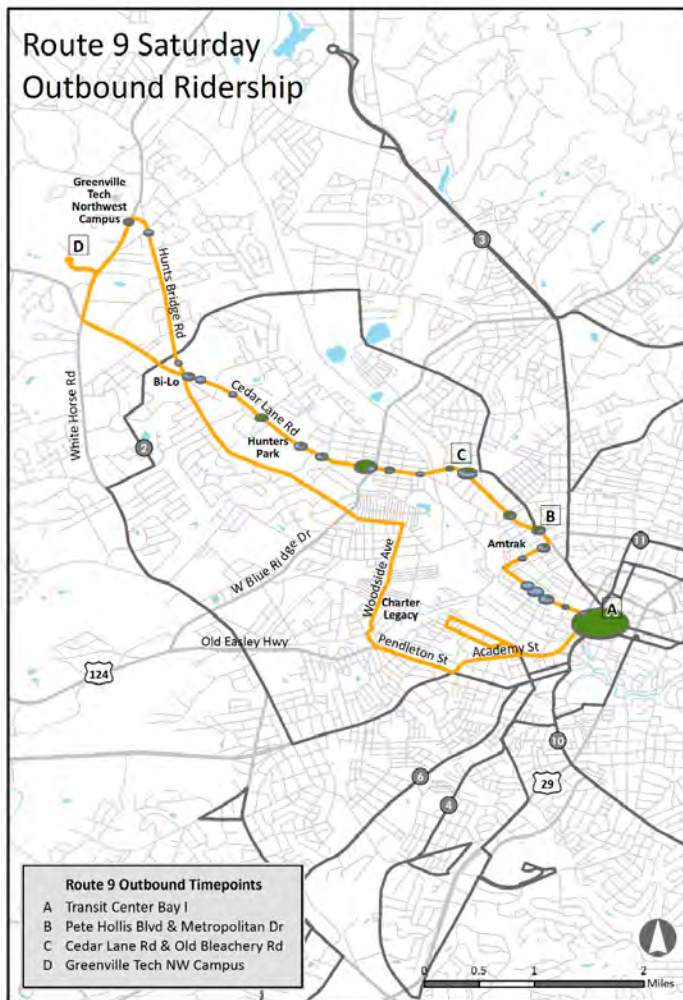Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 12 Saturday
Outbound Ridership

Route 12 Outbound Timepoints
A   Transit Center Bay L
B   E North St & Pelham Rd
C   Roper Mountain Rd Ext & Pelham Rd
D   Haywood Mall

Route 12 Saturday
Inbound Ridership

Route 12 Inbound Timepoints
D   Haywood Mall
E   Orchard Park Dr & Haywood Rd
F   E North St & N Pleasantburg Dr
G   Transit Center Bay L

Stop Activity
25 Boardings
25 Alightings
Route 12
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

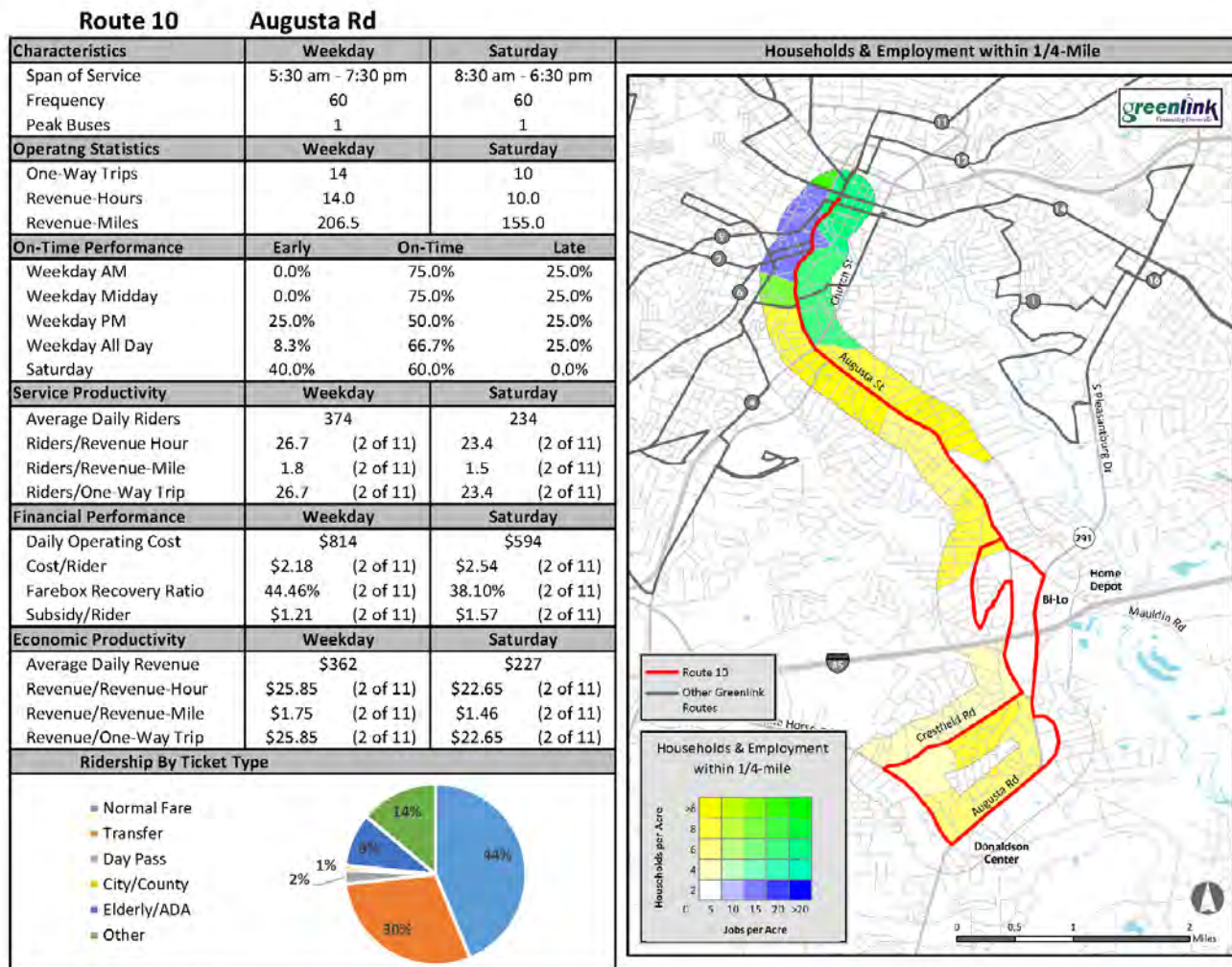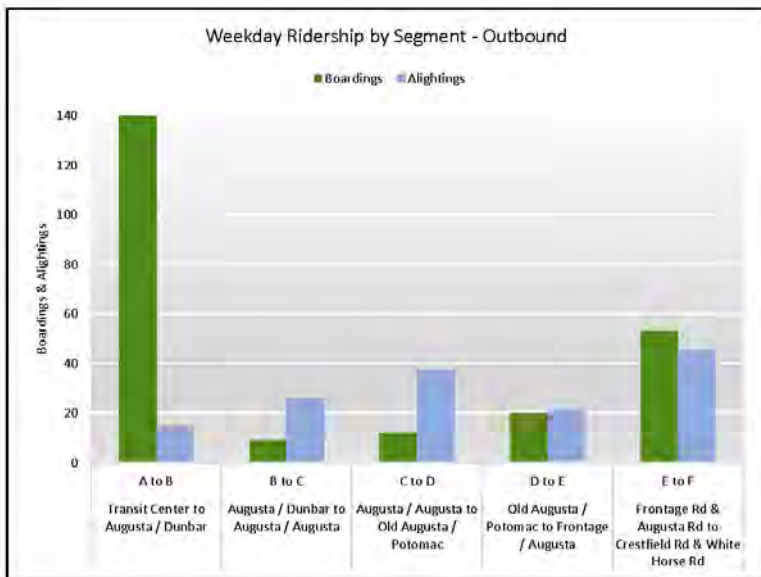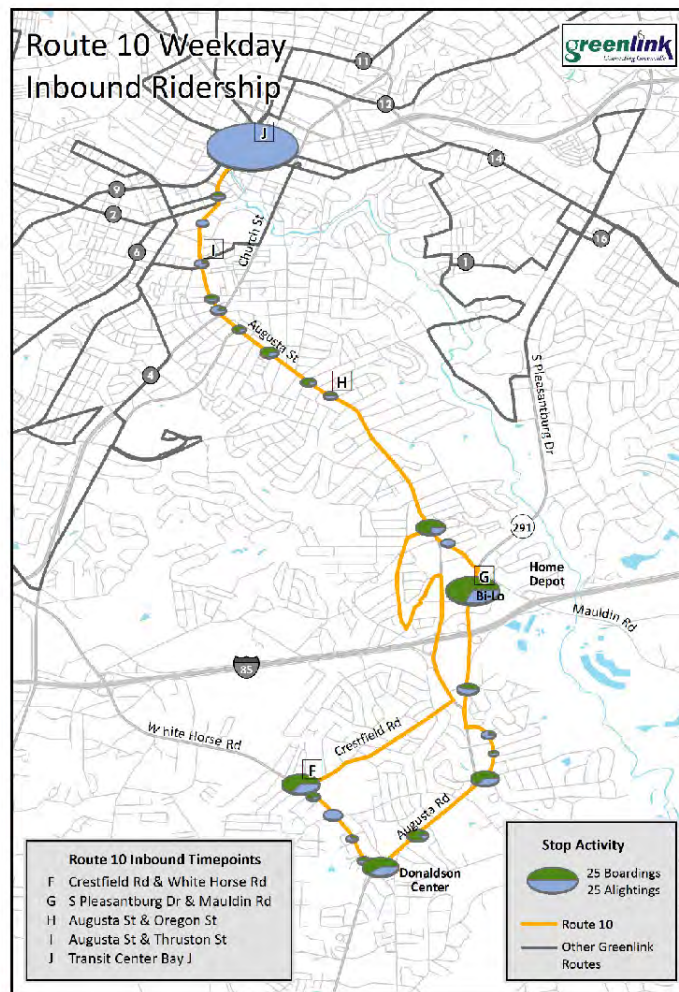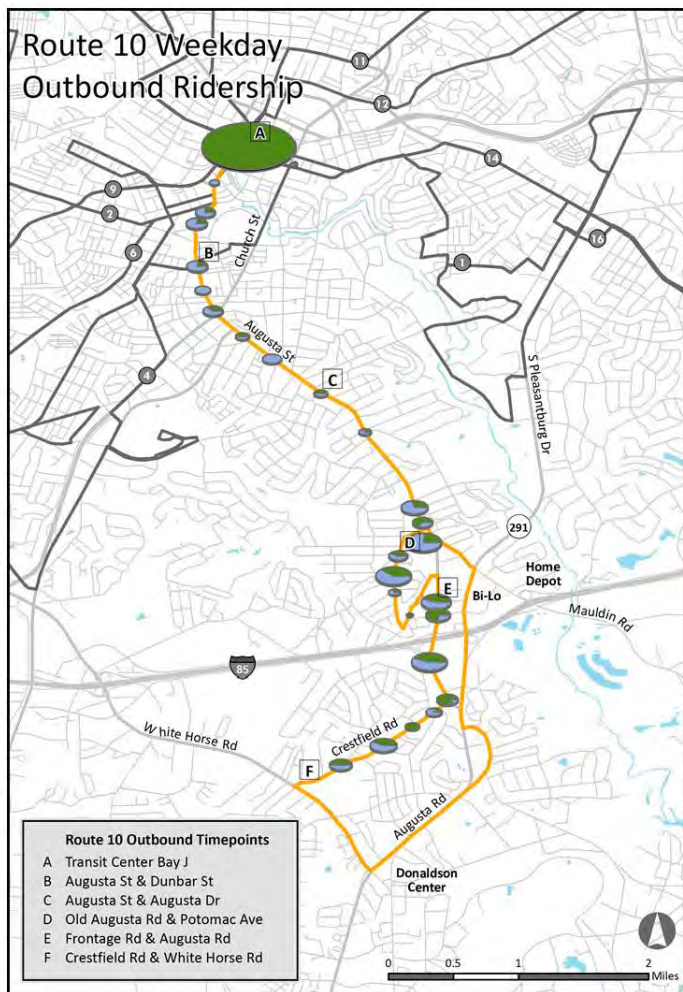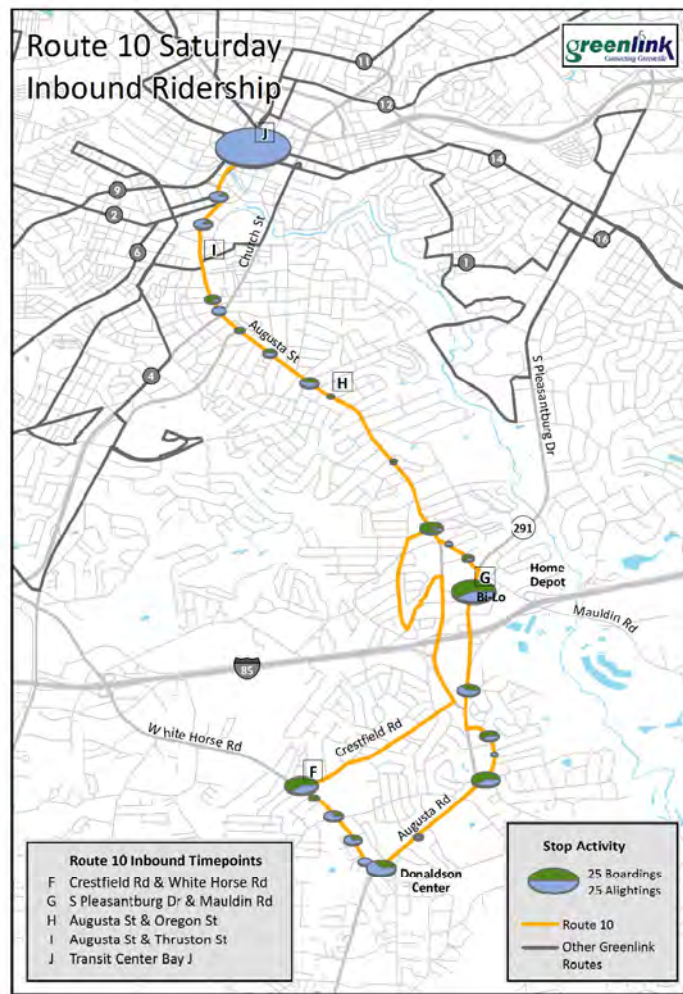## Route 14 — Mauldin / Simpsonville

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 7:30 pm	8:30 am - 6:30 pm
Frequency	60	60
Peak Buses	2	2

Operatng Statistics	Weekday	Saturday
One-Way Trips	14	10
Revenue-Hours	28.0	20.0
Revenue-Miles	501.2	358.0

On-Time Performance	Early	On-Time	Late
Weekday AM	75.0%	25.0%	0.0%
Weekday Midday	83.3%	16.7%	0.0%
Weekday PM	66.7%	33.3%	0.0%
Weekday All Day	76.9%	23.1%	0.0%
Saturday	55.6%	44.4%	0.0%

Service Productivity	Weekday		Saturday	
Average Daily Riders	267		139	
Riders/Revenue Hour	9.5	(10 of 11)	6.9	(10 of 11)
Riders/Revenue-Mile	0.5	(10 of 11)	0.4	(10 of 11)
Riders/One-Way Trip	19.1	(4 of 11)	13.9	(6 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$1,780		$1,272	
Cost/Rider	$6.67	(10 of 11)	$9.16	(10 of 11)
Farebox Recovery Ratio	13.73%	(10 of 11)	10.00%	(10 of 11)
Subsidy/Rider	$5.76	(10 of 11)	$8.25	(10 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$244		$127	
Revenue/Revenue-Hour	$8.73	(10 of 11)	$6.36	(10 of 11)
Revenue/Revenue-Mile	$0.49	(10 of 11)	$0.36	(10 of 11)
Revenue/One-Way Trip	$17.46	(5 of 11)	$12.72	(5 of 11)

Ridership By Ticket Type
Normal Fare, Transfer, Day Pass, City/County, Elderly/ADA, Other — 38%, 36%, 16%, 3%, 1%

Households & Employment within 1/4-Mile

Greenlink COA: Route Profile Analysis   1

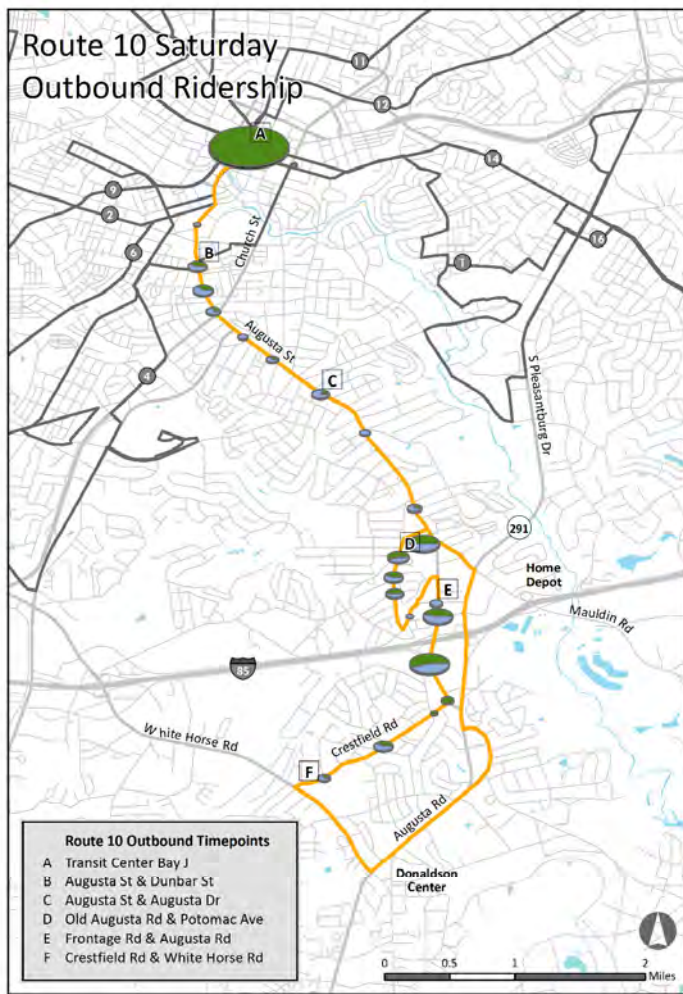Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday
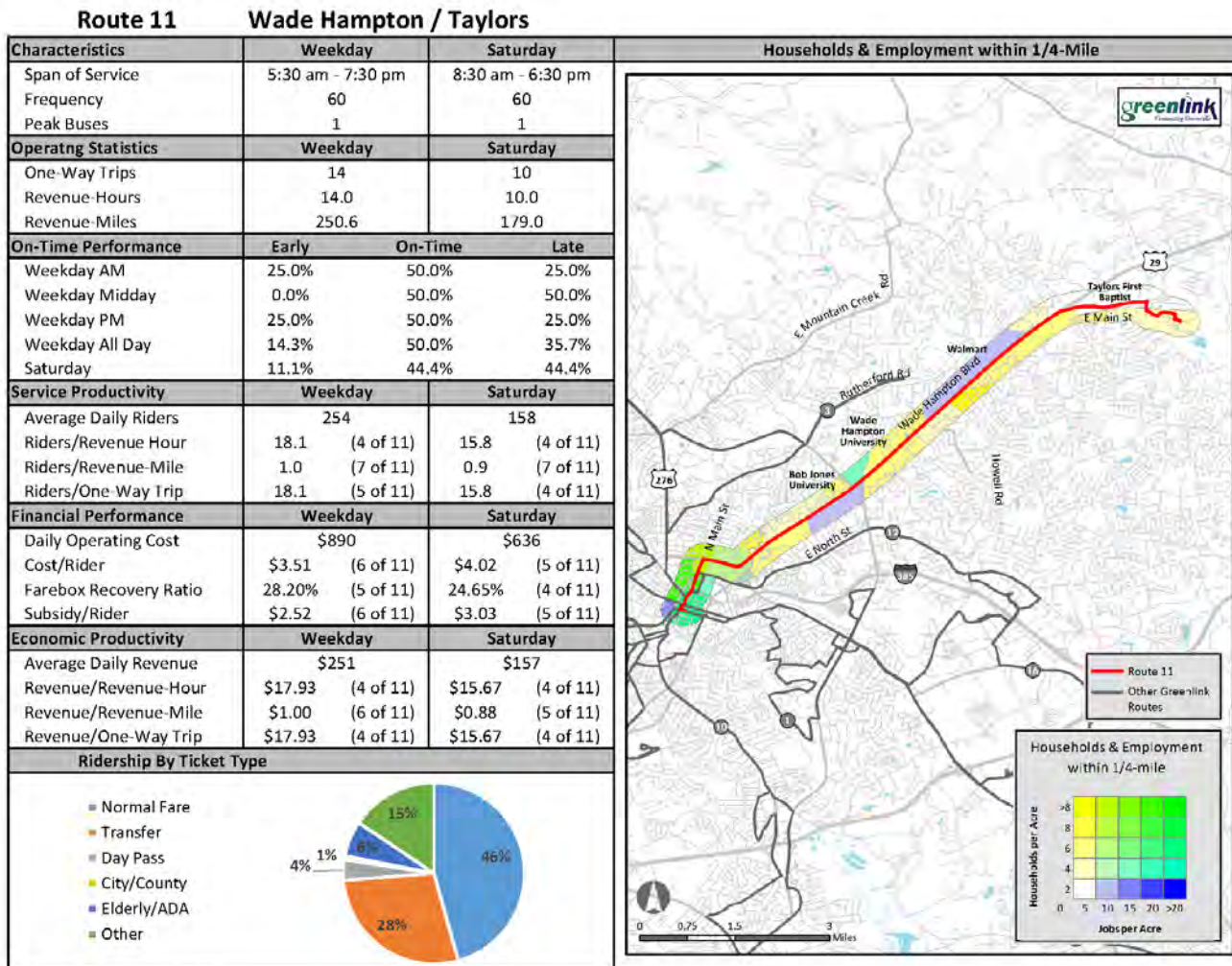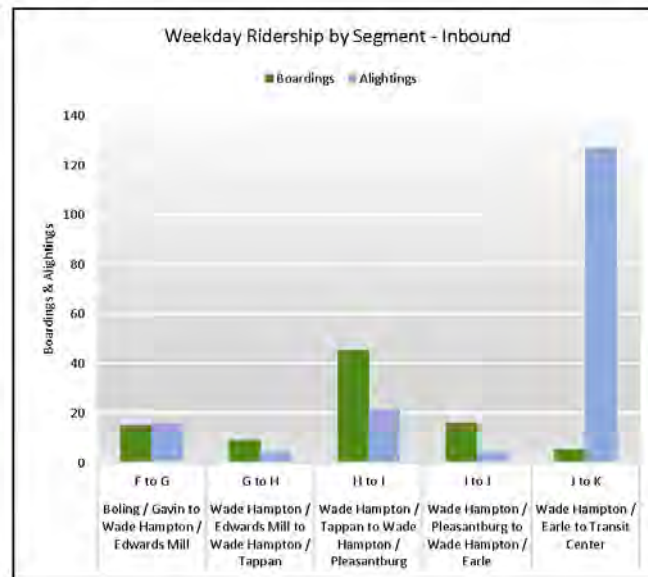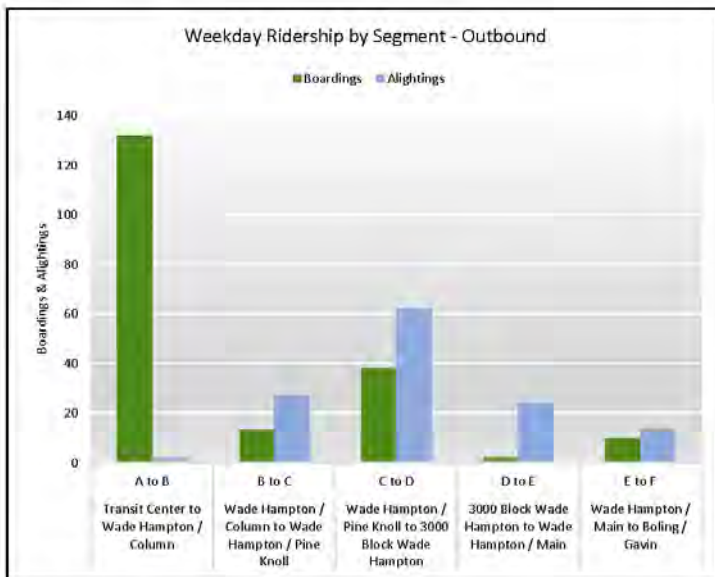
Ridership by Trip - Saturday

Weekday Ridership by Segment - Outbound

Weekday Ridership by Segment - Inbound

Greenlink COA: Route Profile Analysis

2

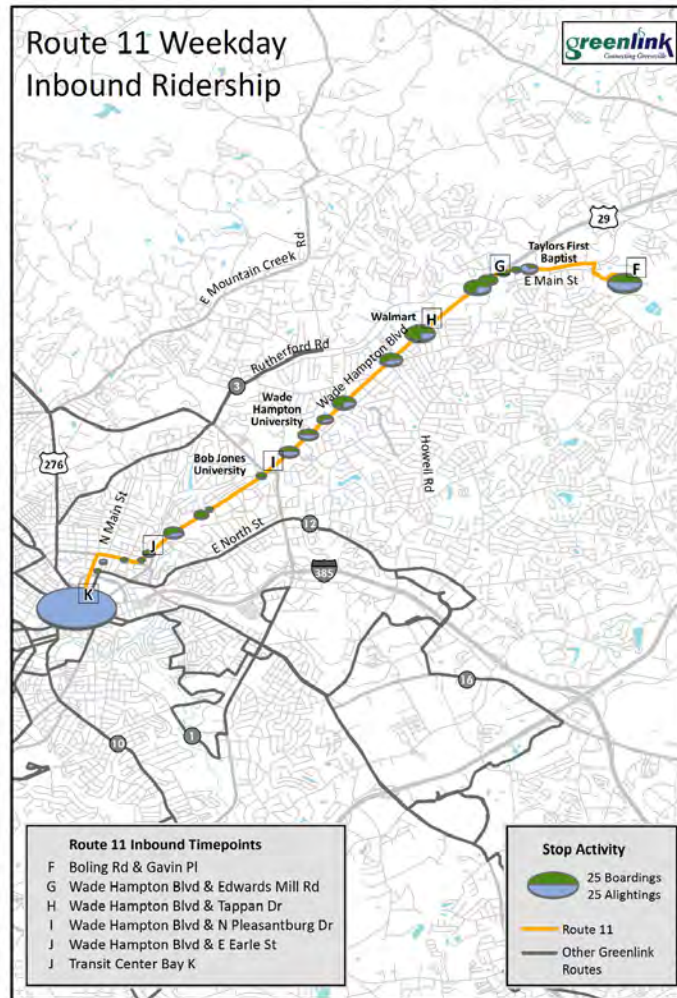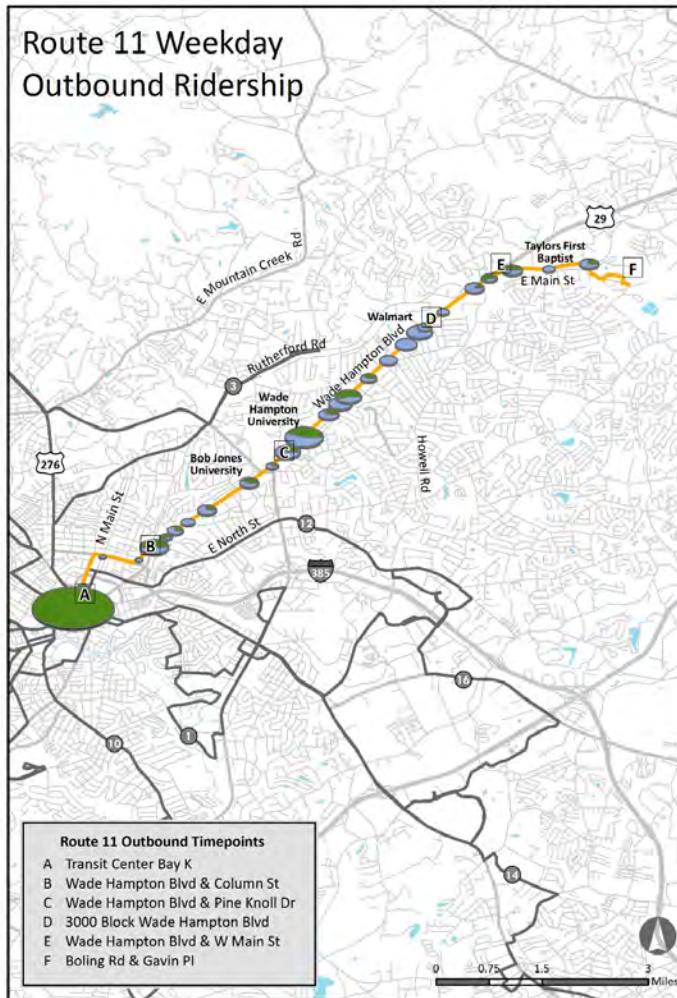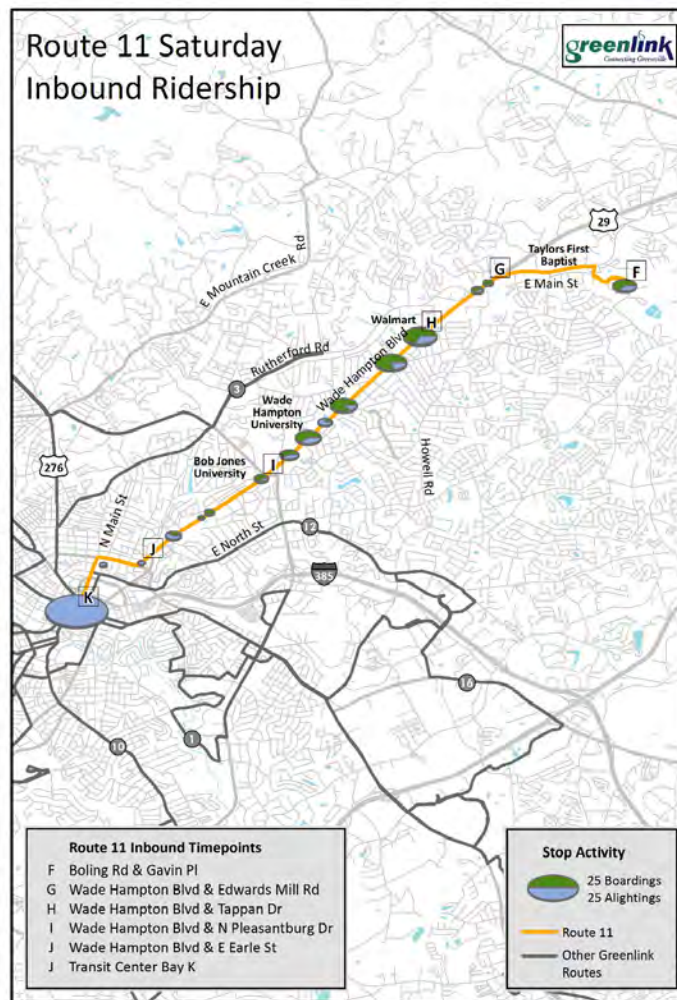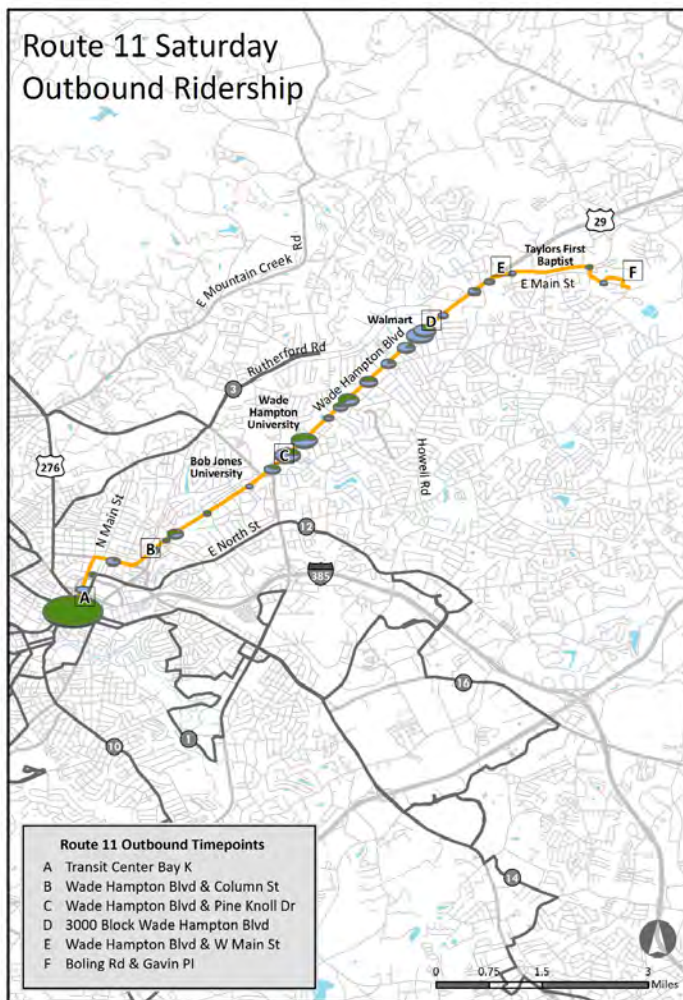Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 14 Weekday Outbound Ridership

Route 14 Outbound Timepoints
A Transit Center Bay N
B St. Francis Millenium (On Innovation)
C CU-ICAR
D Miller Rd & Old Mill Rd
E Cary St & W Butler Rd
F Owens Ln & New Neely Ferry Rd
G NE Main St & Pelham Rd
H South St & N Industrial Dr
I 3900 Block Grandview Dr

Route 14 Weekday Inbound Ridership

Route 14 Inbound Timepoints
I 3900 Block Grandview Dr
J South St & Fairview Pointe Dr
K NE Main St & Hwy 14
L Owens Ln & S Main St
M Cary St & W Butler Rd
N Miller Rd & Old Mill Rd
O St. Francis Millenium (On Innovation)
P CU-ICAR
Q Transit Center Bay N

Stop Activity
25 Boardings
25 Alightings
Route 14
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Comprehensive Operations Analysis

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Connecting Greenville

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 14 Saturday Outbound Ridership

Route 14 Outbound Timepoints
A Transit Center Bay N
B St. Francis Millenium (On Innovation)
C CU-ICAR
D Miller Rd & Old Mill Rd
E Cary St & W Butler Rd
F Owens Ln & New Neely Ferry Rd
G NE Main St & Pelham Rd
H South St & N Industrial Dr
I 3900 Block Grandview Dr

Route 14 Saturday Inbound Ridership

greenlink
Connecting Greenville

Route 14 Inbound Timepoints
I 3900 Block Grandview Dr
J South St & Fairview Pointe Dr
K NE Main St & Hwy 14
L Owens Ln & S Main St
M Cary St & W Butler Rd
N Miller Rd & Old Mill Rd
O St. Francis Millenium (On Innovation)
P CU-ICAR
Q Transit Center Bay N

Stop Activity

25 Boardings
25 Alightings

Route 14

Other Greenlink Routes

Greenlink COA: Route Profile Analysis

4

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

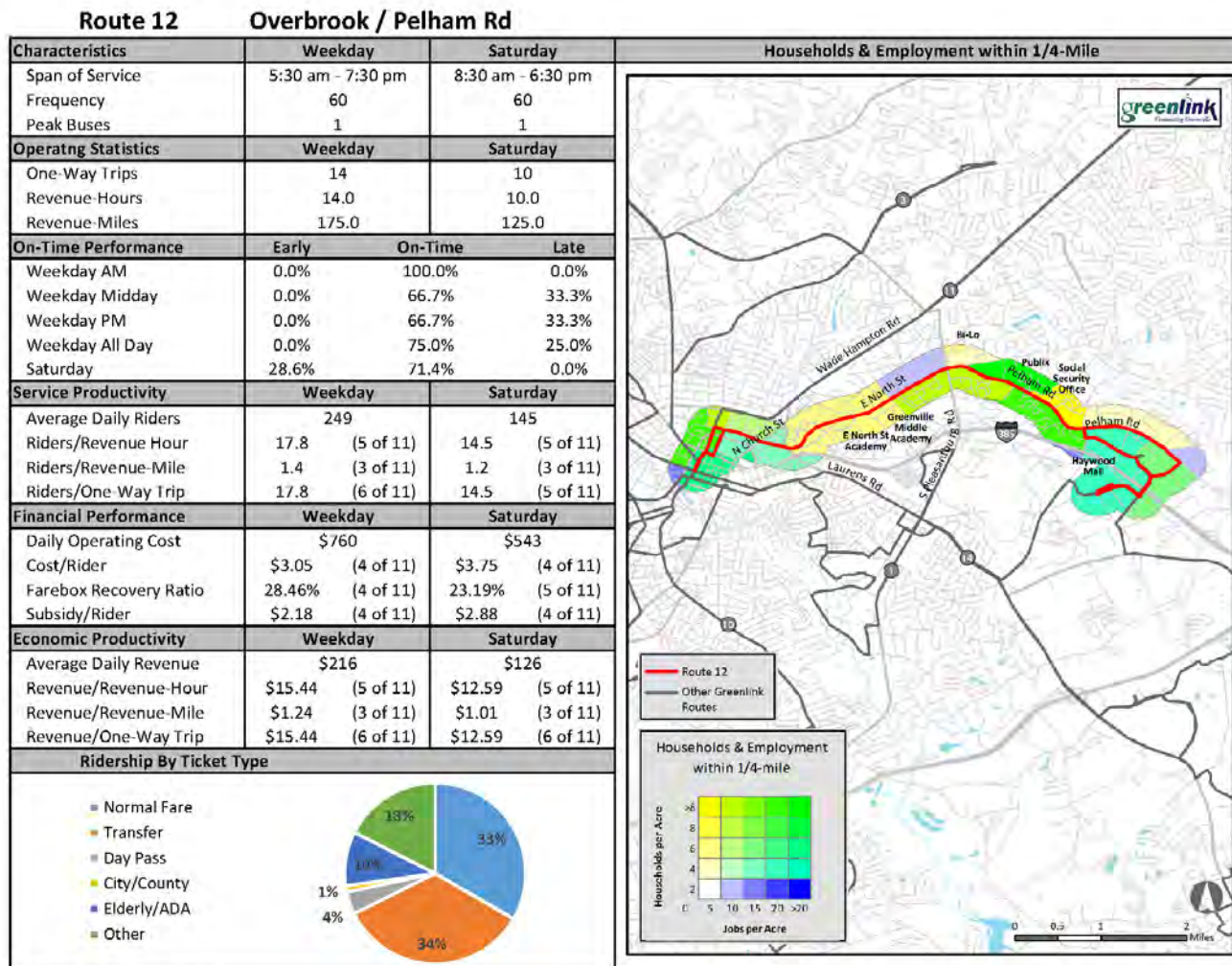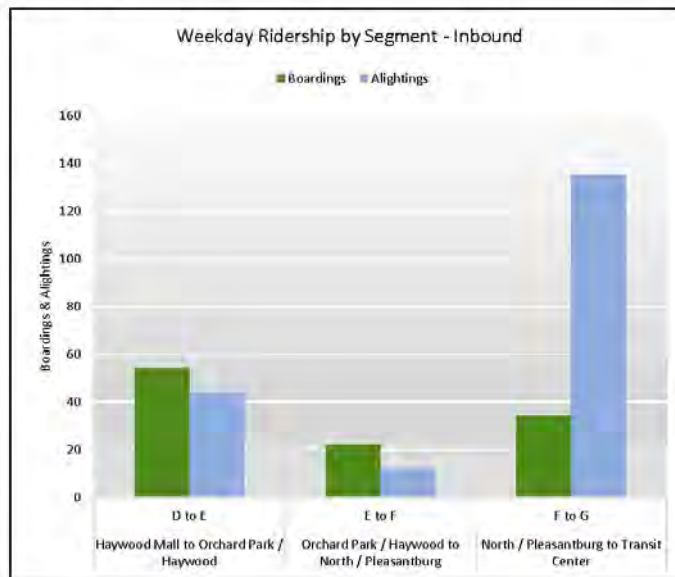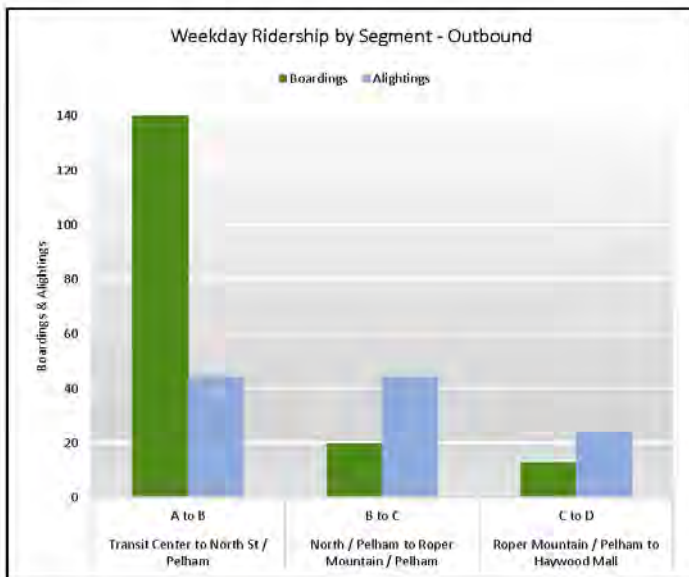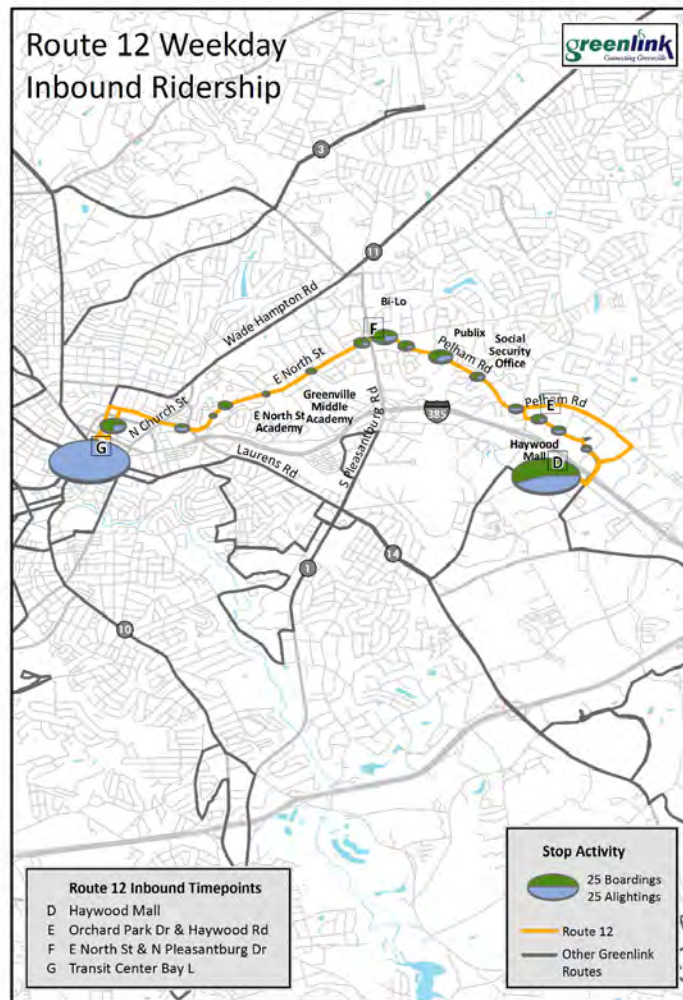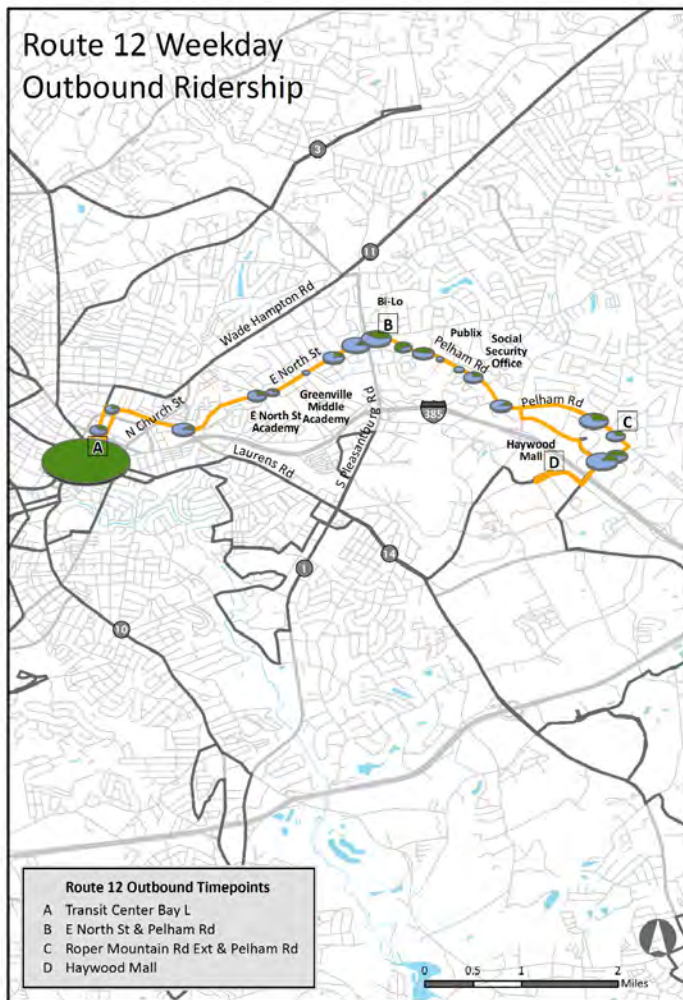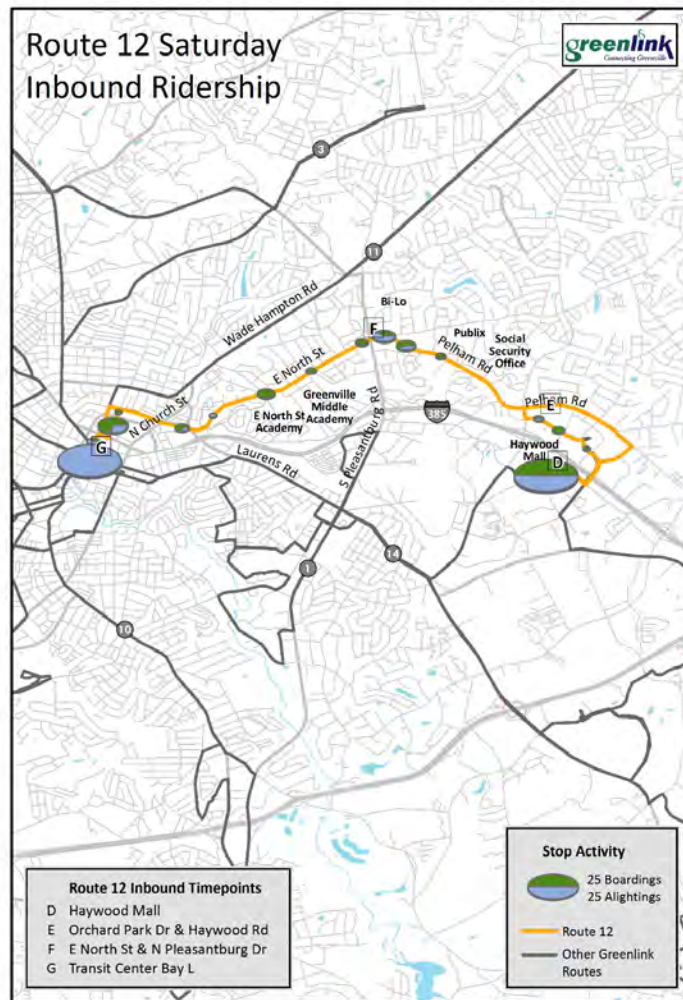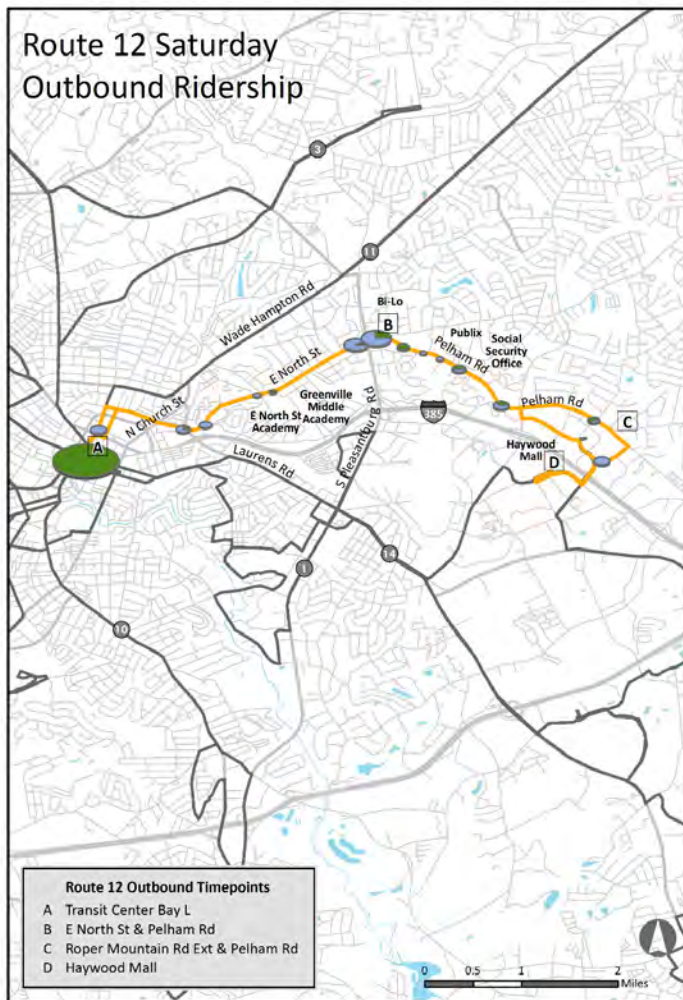### Route 16 — Circulator: CU-ICAR / University Center / Haywood Mall

Characteristics	Weekday	Saturday
Span of Service	5:30 am - 9:30 pm	8:30 am - 6:30 pm
Frequency	30	60
Peak Buses	2	1

Operatng Statistics	Weekday	Saturday
One-Way Trips	29	19
Revenue-Hours	29.0	10.0
Revenue-Miles	441.1	289.0

On-Time Performance	Early	On-Time	Late
Weekday AM	37.5%	62.5%	0.0%
Weekday Midday	0.0%	60.0%	40.0%
Weekday PM	25.0%	50.0%	25.0%
Weekday All Day	19.2%	57.7%	23.1%
Saturday	22.2%	44.4%	33.3%

Service Productivity	Weekday		Saturday	
Average Daily Riders	134		50	
Riders/Revenue Hour	4.6	(11 of 11)	5.0	(11 of 11)
Riders/Revenue-Mile	0.3	(11 of 11)	0.2	(11 of 11)
Riders/One-Way Trip	4.6	(11 of 11)	2.6	(11 of 11)

Financial Performance	Weekday		Saturday	
Daily Operating Cost	$1,709		$825	
Cost/Rider	$12.78	(11 of 11)	$16.43	(11 of 11)
Farebox Recovery Ratio	3.54%	(11 of 11)	2.75%	(11 of 11)
Subsidy/Rider	$12.32	(11 of 11)	$15.98	(11 of 11)

Economic Productivity	Weekday		Saturday	
Average Daily Revenue	$61		$23	
Revenue/Revenue-Hour	$2.09	(11 of 11)	$2.27	(11 of 11)
Revenue/Revenue-Mile	$0.14	(11 of 11)	$0.08	(11 of 11)
Revenue/One-Way Trip	$2.09	(11 of 11)	$1.20	(11 of 11)

Ridership By Ticket Type

- Normal Fare — 50%
- Transfer — 2%
- Day Pass — 0%
- City/County — 2%
- Elderly/ADA — 29%
- Other — 17%

Households & Employment within 1/4-Mile

Route 15
Other Greenlink Routes

Households & Employment within 1/4-mile

Households per Acre / Jobs per Acre

Greenlink COA: Route Profile Analysis

1

Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Ridership by Trip - Weekday
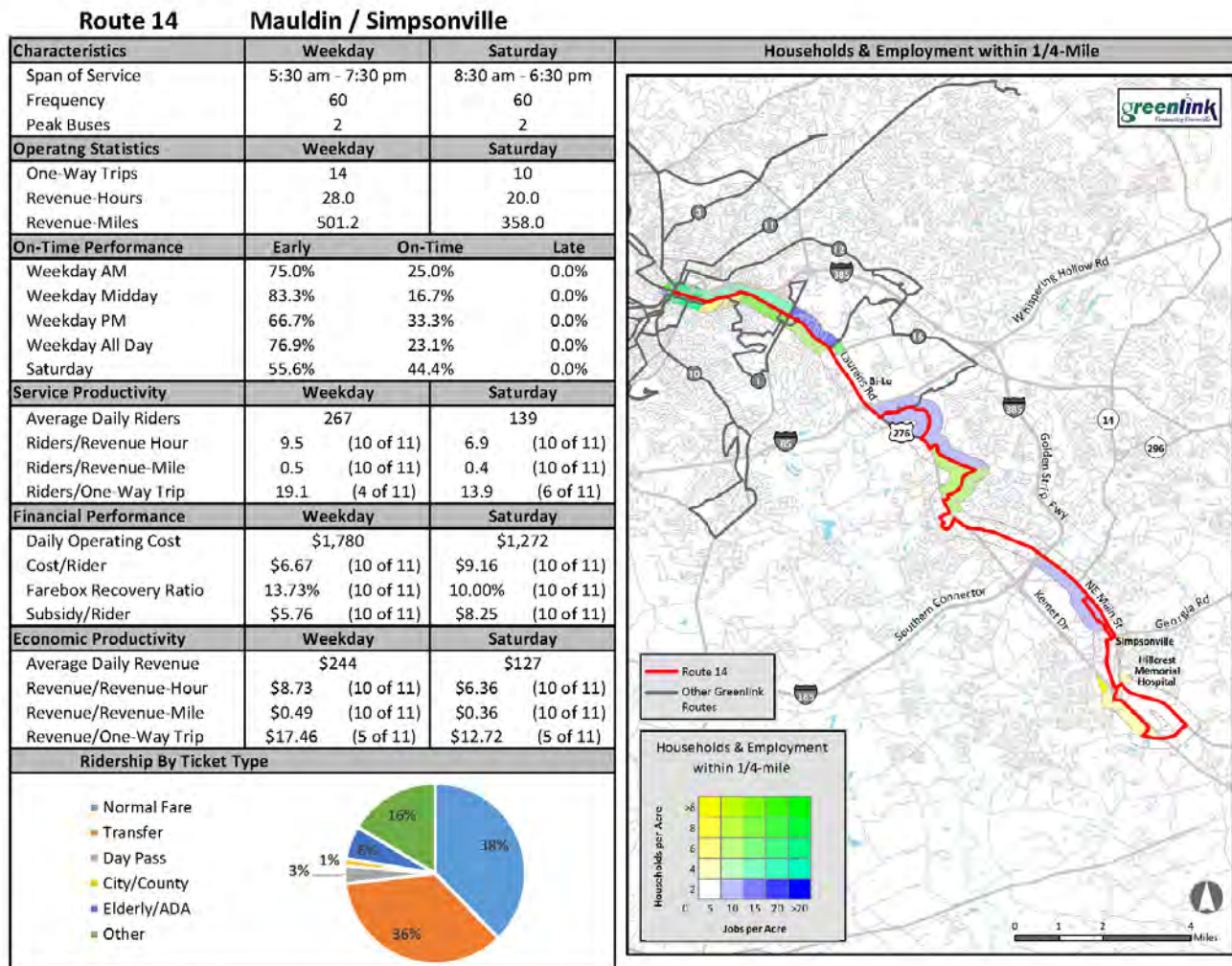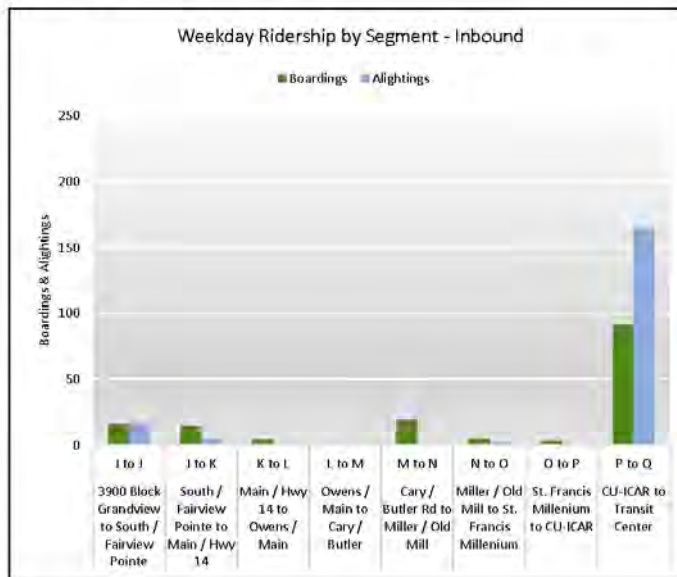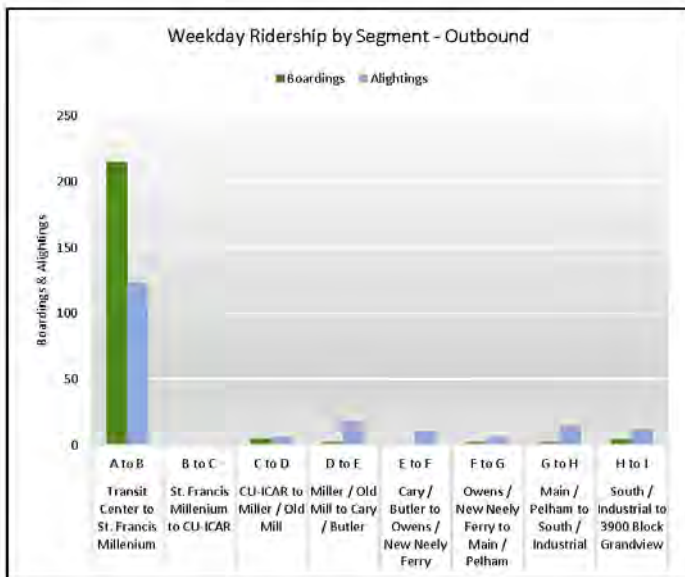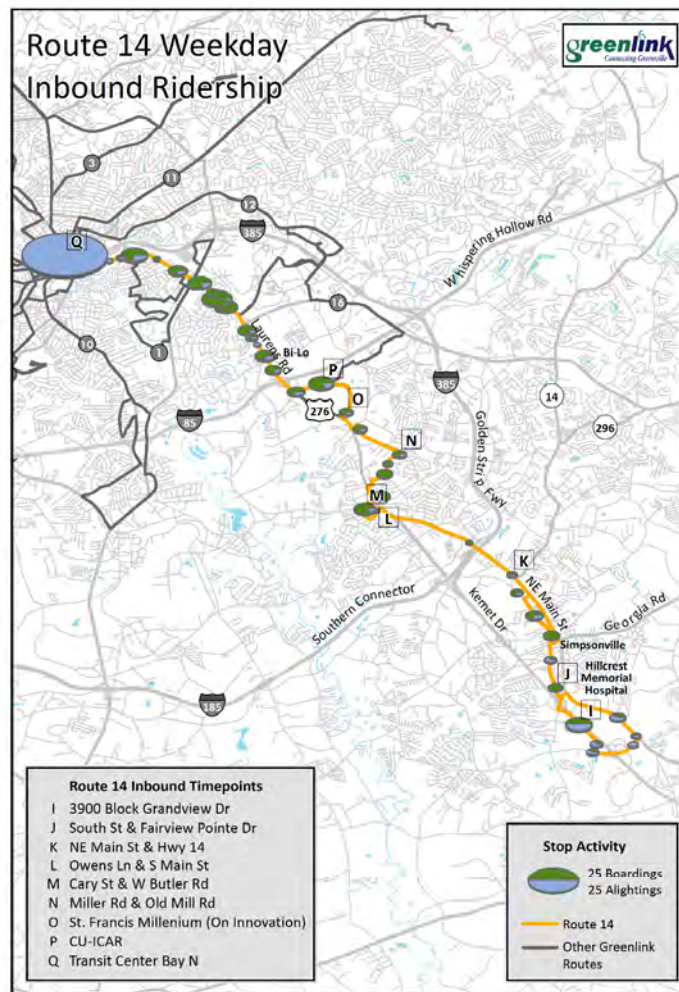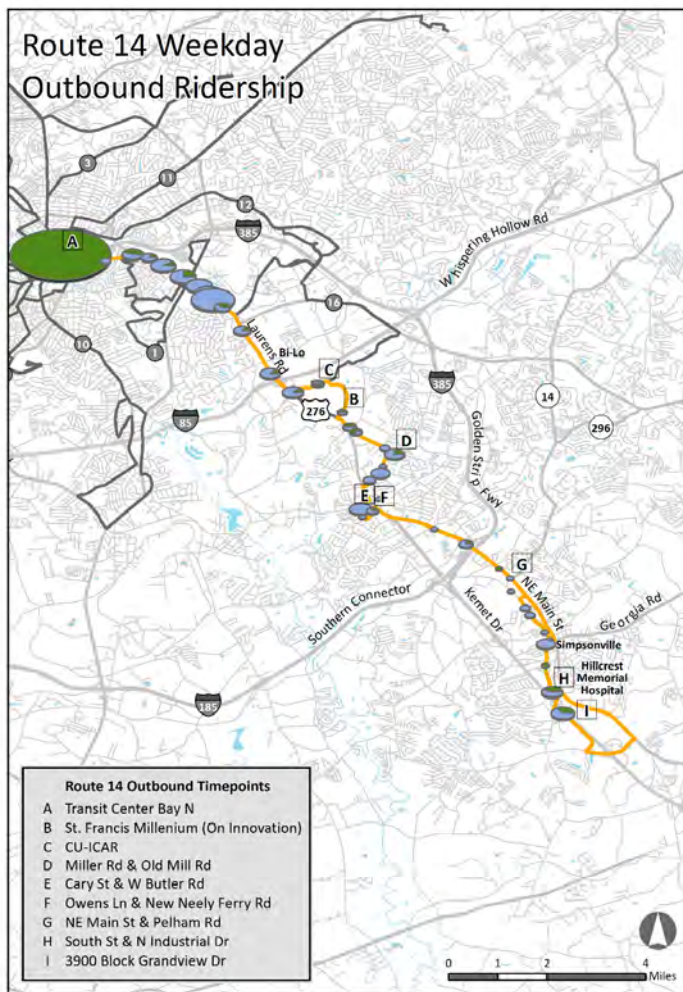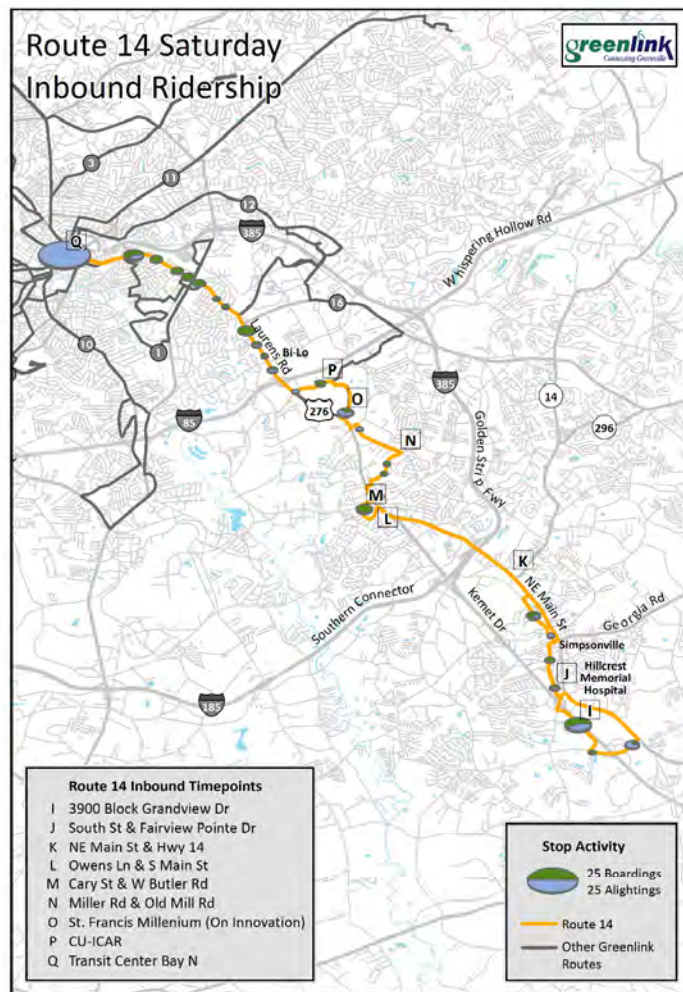
Ridership by Trip - Saturday

Weekday Ridership by Segment

Greenlink COA: Route Profile Analysis

2

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Greenlink Comprehensive Operations Analysis by Connetics Transportation Group

Route 16 Weekday Ridership

Route 16 Timepoints
A CU-ICAR
B St. Francis Millenium (On Innovation)
C E Antrim Dr & S Pleasantburg Dr
D Haywood Mall
E St. Francis Eastside
F Patewood @ Orchard Park Dr
G Waterside Greene
H CU-ICAR

Route 16 Saturday Ridership

Route 16 Timepoints
A CU-ICAR
B St. Francis Millenium (On Innovation)
C E Antrim Dr & S Pleasantburg Dr
D Haywood Mall
E St. Francis Eastside
F Patewood @ Orchard Park Dr
G Waterside Greene
H CU-ICAR

Stop Activity
25 Boardings
25 Alightings
Route 16
Other Greenlink Routes

Greenlink COA: Route Profile Analysis

3

Comprehensive Operations Analysis

APPENDIX 5A OPERATING STATISTICS MODEL

Existing Greenlink operating statistics model

Route	Day of week	Direction	SERVICE SPAN					FREQUENCY					TRAVEL TIME							DAILY STATS		ANNUAL STATS		AM Peak Vehicle	PM Peak Vehicle
			EARLY	AM PK	MID	PM PK	EVE	EARLY	AM PK	MID	PM PK	EVE	One-way Trips	One-way trip length	Trip Length	Est. speed	Lay-over	Run Time	Cycle Time	Rev Hrs	Rev Miles	Rev Hrs	Rev Miles		
WEEKDAY STATISTICS																									
1 Pleasantburg Dr / Cleveland Park	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	12.7	12.7	15.2	15%	50	60	14	178	3,570	45,268	1.0	1.0
2 White Horse Road	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	13.3	13.3	16.0	15%	50	60	14	186	3,570	47,481	1.0	1.0
3 Poinsett Hwy / Rutherford Rd	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	18.6	18.6	22.3	15%	50	60	14	260	3,570	66,224	1.0	1.0
4 Dunean / Grove Rd	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	12.6	12.6	15.1	15%	50	60	14	176	3,570	44,982	1.0	1.0
6 Anderson Rd	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	15.0	15.0	18.0	15%	50	60	14	210	3,570	53,550	1.0	1.0
9 West Parker / Berea / Woodside	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	15.4	15.4	18.5	15%	50	60	14	216	3,570	54,978	1.0	1.0
10 Augusta Rd	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	14.8	14.8	17.7	15%	50	60	14	207	3,570	52,658	1.0	1.0
11 Wade Hampton / Taylors	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	17.9	17.9	21.5	15%	50	60	14	251	3,570	63,903	1.0	1.0
12 Overbrook / Pelham Rd	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	12.5	12.5	15.0	15%	50	60	14	175	3,570	44,625	1.0	1.0
14 Mauldin / Simpsonville	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	35.8	35.8	21.5	15%	100	120	28	501	7,140	127,806	2.0	2.0
16 Circulator	Weekday	1	1.0	3.0	7.0	3.0	2.0	30	30	30	30	60	30.0	15.2	15.2	18.3	15%	50	60	30	456	7,650	116,349	2.0	2.0
SATURDAY STATISTICS																									
1 Pleasantburg Dr / Cleveland Park	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	12.7	12.7	15.2	15%	50	60	10	127	510	6,467		
2 White Horse Road	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	13.3	13.3	16.0	15%	50	60	10	133	510	6,783		
3 Poinsett Hwy / Rutherford Rd	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	18.6	18.6	22.3	15%	50	60	10	186	510	9,461		
4 Dunean / Grove Rd	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	12.6	12.6	15.1	15%	50	60	10	126	510	6,426		
6 Anderson Rd	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.0	15.0	18.0	15%	50	60	10	150	510	7,650		
9 West Parker / Berea / Woodside	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.4	15.4	18.5	15%	50	60	10	154	510	7,854		
10 Augusta Rd	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	14.8	14.8	17.7	15%	50	60	10	148	510	7,523		
11 Wade Hampton / Taylors	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	17.9	17.9	21.5	15%	50	60	10	179	510	9,129		
12 Overbrook / Pelham Rd	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	12.5	12.5	15.0	15%	50	60	10	125	510	6,375		
14 Mauldin / Simpsonville	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	35.8	35.8	21.5	15%	100	120	20	358	1,020	18,258		
16 Circulator	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.2	15.2	18.3	15%	50	60	10	152	510	7,757		

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Comprehensive Operations Analysis

Proposed Greenlink operating statistics model

Route	Based on	Route	Day of week	Direction	SERVICE SPAN					FREQUENCY					TRAVEL TIME							DAILY STATS		ANNUAL STATS		AM Peak Vehicle	PM Peak Vehicle
					EARLY	AM PK	MID	PM PK	EVE	EARLY	AM PK	MID	PM PK	EVE	One-way Trips	One-way trip length	Trip Length	Est. speed	Lay-over	Run Time	Cycle Time	Rev Hrs	Rev Miles	Rev Hrs	Rev Miles		
WEEKDAY STATISTICS																											
A	2	#2 - White Horse	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	13.8	13.8	16.0	15%	52	60	14	193	3,570	49,266	1.0	1.0
B	9	#9 - Cedar Lane	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	14.7	14.7	18.5	15%	48	60	14	206	3,570	52,408	1.0	1.0
C	3	#3 - Poinsett	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	13.5	13.5	18.0	15%	45	60	14	189	3,570	48,266	1.0	1.0
D	3	#5 - Rutherford	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	15.7	15.7	18.1	15%	52	60	14	220	3,570	56,120	1.0	1.0
E	11	#11 - Wade Hampton	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	18.2	18.2	21.5	15%	51	60	14	255	3,570	65,045	1.0	1.0
F	12	#12 - Pelham	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	12.5	12.5	15.0	15%	50	60	14	175	3,570	44,625	1.0	1.0
G	1	#1 - Nicholtown	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	13.8	13.8	16.0	15%	50	60	14	193	3,570	49,266	1.0	1.0
H	10	#10 - Augusta	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	15.1	15.1	17.7	15%	51	60	14	211	3,570	53,836	1.0	1.0
I	6	#6 - Anderson	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	15.4	15.4	18.0	15%	51	60	14	216	3,570	54,978	1.0	1.0
J	14_in	#8 - Laurens	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	18.9	18.9	22.0	15%	52	60	14	265	3,570	67,544	1.0	1.0
K	14_out	#14 - Mauldin/Simpsonville	Weekday	1	1.0	3.0	7.0	3.0		60	60	60	60		14.0	21.2	21.2	24.5	15%	52	60	14	297	3,570	75,684	1.0	1.0
L	16	#16 - Circulator	Weekday	1	1.0	3.0	7.0	3.0	2.0	30	30	30	30	60	30.0	16.3	16.3	19.0	15%	51	60	30	489	7,650	124,695	2.0	2.0
SATURDAY STATISTICS																											
A	2	#2 - White Horse	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	13.8	13.8	16.0	15%	52	60	10	138	510	7,038	1.0	1.0
B	9	#9 - Cedar Lane	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	14.7	14.7	18.5	15%	48	60	10	147	510	7,487	1.0	1.0
C	3	#3 - Poinsett	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	13.5	13.5	18.0	15%	45	60	10	135	510	6,895	1.0	1.0
D	3	#5 - Rutherford	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.7	15.7	18.1	15%	52	60	10	157	510	8,017	1.0	1.0
E	11	#11 - Wade Hampton	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	18.2	18.2	21.5	15%	51	60	10	182	510	9,292	1.0	1.0
F	12	#12 - Pelham	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	12.5	12.5	15.0	15%	50	60	10	125	510	6,375	1.0	1.0
G	1	#1 - Nicholtown	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	13.8	13.8	16.6	15%	50	60	10	138	510	7,038	1.0	1.0
H	10	#10 - Augusta	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.1	15.1	17.7	15%	51	60	10	151	510	7,691	1.0	1.0
I	6	#6 - Anderson	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	15.4	15.4	18.0	15%	52	60	10	154	510	7,854	1.0	1.0
J	14_in	#8 - Laurens	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	18.9	18.9	22.0	15%	52	60	10	189	510	9,649	1.0	1.0
K	14_out	#14 - Mauldin/Simpsonville	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	21.2	21.2	24.5	15%	52	60	10	212	510	10,812	1.0	1.0
L	16	#16 - Circulator	Saturday	1		1.0	7.0	2.0		60	60	60	60		10.0	16.3	16.3	19.0	15%	51	60	10	163	510	8,313	1.0	1.0