



CITYWIDE TRANSIT FEASIBILITY ANALYSIS



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HDR

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Executive Summary

This study is intended to study the feasibility of a Bus Rapid Transit (BRT) system in the City of Greenville. The study will evaluate a BRT line linking Downtown Greenville with Clemson University's International Center for Automotive Research (CU-ICAR), a distance of approximately 7 miles, with 4.2 miles of the corridor within an exclusive right of way. The new line is anticipated to commence passenger operations in 2016.

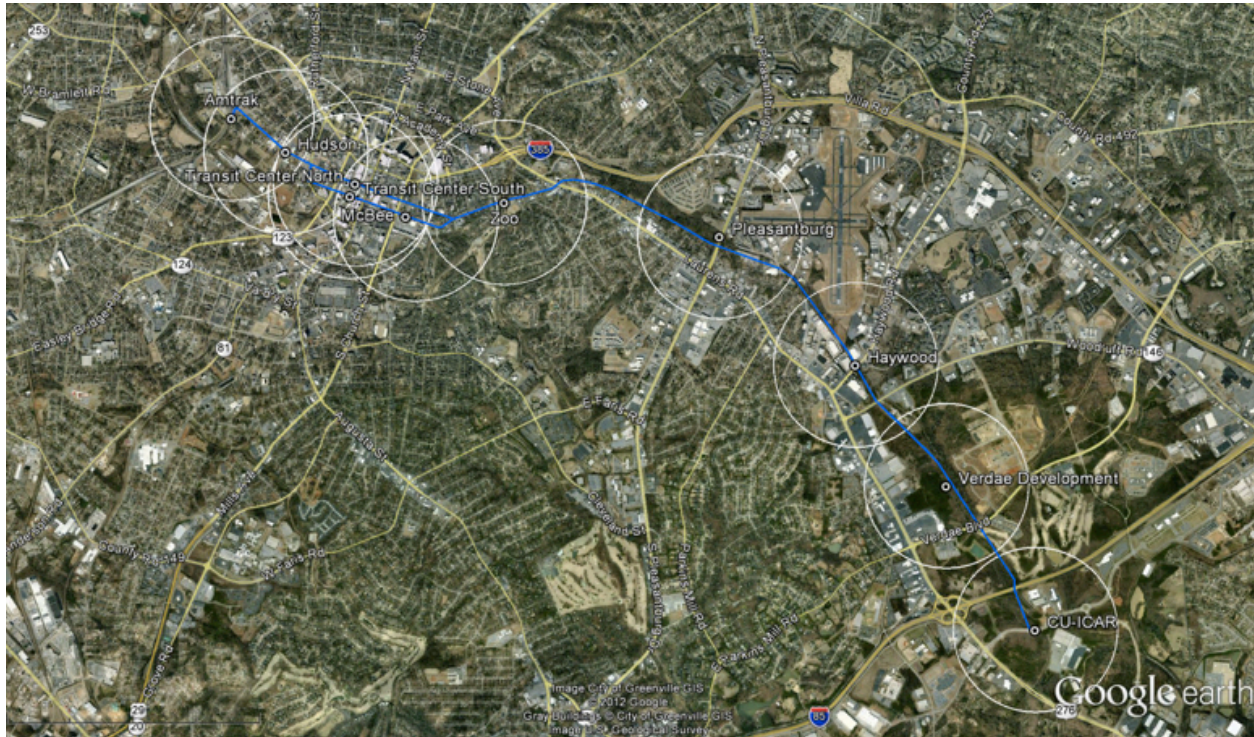


Figure 1: Project Map

Greenville Transit Authority (GTA), also known as Greenlink, serves as the local fixed route and para transit service provider for the area. The GTA service area covers approximately 148 square miles. GTA Greenlink routes are currently oriented in a hub and spoke system with the downtown transfer center serving as the nexus of the system. All Greenlink bus routes begin and end at the transfer center, with buses returning to the facility every hour.

There are currently eleven routes being offered to the Greenville community. The earliest route begins at 5:30 AM and the latest route ends at 7:30 PM. On Saturday, all routes operate 8:30 AM until 6:30 PM. Currently, all Greenlink routes operate on sixty minute headways with exception of the CU-ICAR/St. Francis shuttle, which operates in a seven mile radius every thirty minutes. Most transfers occur at the downtown intermodal center where the routes meet on an hourly basis. In addition to the fixed route CU-ICAR/St. Francis service offered by GTA, a complimentary Demand Response service is provided. This service is designed primarily for individuals with disabilities.

A BRT project in this corridor is identified in the GTA's five-year Transportation Development Plan FY 2011- 2015.

The proposed BRT has been discussed in other planning documents prepared for the City, GTA, the Metropolitan Planning Organization (MPO) and the regional economic development agency. This BRT line is planned to be a 6.73-mile project that will travel from CU-ICAR through downtown Greenville to Greenville's west side/Amtrak station. About 4.2 miles of the corridor is located within exclusive right of way, owned privately and by the Greenville County Economic Development Corporation (GCEDC).

Ten (10) BRT stations have been identified along the corridor serving varied communities/neighborhoods with potential for an increase in overall transit system ridership. These station locations are identified in Figure 1. The BRT station areas will also serve as opportunities for transit-oriented economic development (TOeD) within a ¼ mile radius of the platforms. The project will provide connections to major destinations in the Downtown core, Amtrak, CU-ICAR and future commercial and residential developments.

The BRT line is planned to operate with four (4) vehicles at 10-minute intervals during peak periods, at 15-minute intervals during off-peak hours on weekdays, and on Saturdays will operate at 30 -minute headways all day. Service headways and train lengths will be adjusted over time to accommodate growth and service patterns. The current ridership estimate is approximately 800 riders per day (opening day) and 250,000 annually. This estimate exceeds the ridership numbers for any of the routes in the current system.

The total capital cost of the BRT project is \$19.0 million in 2012 dollars and \$22.0 million in 2016 dollars. The projected O&M costs for the BRT service in opening year (2016) are expected to be approximately \$1.4 million. The projected costs for the entire Greenlink system in the opening year (2016) of the BRT line are expected to increase from \$3.6 to \$5.0 million with the BRT project.

The planned project funding would include Federal Transit Administration funding opportunities and local contribution/match/investments through funding commitments from the City of Greenville, Greenville County and private funding sources.

Section 1: Project Background

1.1 Study Purpose

The Bus Rapid Transit (BRT)/Transit Oriented-Economic Development (TOeD) Feasibility Analysis project is part of the Connections for Sustainability project which will provide a linkage between neighborhoods and jobs and open space. The overall goal of the project is to establish connections between affordable housing, transportation options, economic development opportunities, and open space in the City of Greenville, with a focus on the west side of the City. The planning efforts include a focus on housing strategy, a transit and transit oriented-economic development (TOeD) plan, zoning codes for a TOED overlay and a review of the development approval process. Ultimately, the project will focus on a plan for the west side and utilize previous studies for this effort.

The Transit Study builds on prior studies that have been conducted in the City of Greenville to evaluate the feasibility of a high capacity transit system in the City together with the associated transit oriented development projects which will also spur economic development around potential stations. All of these studies without exception identify the existing railroad corridor as the most viable option for operating a transit system in the City.

This feasibility study examined additional routes and options for running a bus rapid transit system in the City utilizing this corridor, estimates future ridership for such a system, identifies potential station areas for development focused around transit service and explores funding opportunities for implementing, operating and maintaining the transit system.



Transit services have been operated in Greenville for over a century. The Greenville Transit Authority (GTA) has been operating the service since 1974. In March 2008, the City of Greenville began operating the system under contract with GTA, and the operating name of the system was changed to Greenlink. Inclusive in the City's goal for Greenlink is to make transit improvements and provide for long-term transit planning.

One of the Greenlink Transit Vision & Master Plan (Greenlink's long range strategic vision for transit) developed in July 2010 is to "expand transit service options and connectivity." The Plan identified an initial segment of a BRT system in the short/mid-term phase connecting downtown Greenville with CU-ICAR campus. This concept was based on the Multimodal Transit Corridor Alternatives Feasibility Study completed by the Greenville County Economic Development Corporation (GCEDC) in March 2010. The Study recommended a BRT/Main Street alternative that would originate in the vicinity of Clemson University's International Center for Automotive Research (CU-ICAR), utilize the former Greenville and Northern (G&N) Rail Line (currently owned by GCEDC) and connect downtown Greenville during weekday morning and evening peak periods. Important to this concept is the City's desire to also link the City's west side with the BRT system.

1.2 Study Area

Generally, the study area extends from the City's west side/Amtrak Station through downtown Greenville to the CU-ICAR campus in the southeast, a total distance of approximately seven (7) miles. This BRT/TOeD Feasibility Analysis evaluates bus rapid transit options, which will traverse that corridor, and identifies potential TOeD sites along the preferred route (Figure 1). Approximately 4.2 miles of the corridor is located within the GCEDC right of way and privately held property northwest of Pleasantburg Drive.

Ten (10) BRT stations have been identified along the corridor serving varied communities/neighborhoods with potential for increase in overall transit system ridership. These stations are seen as catalysts for economic development opportunities as they will attract transit supportive developments that have the potential to create jobs, provide affordable housing and offer services within walking distance of other activity centers.

Plans generated from this study will be integrated by the City into the west side comprehensive plan and used as a basis to secure funding for implementing a future BRT project.

This study is divided into seven (7) Sections:

- Section 1 is the Introduction, which provides a background to the study, describes the project purpose and defines the project area.
- Section 2 discusses the project goals, guiding principles and planning process to determine the preferred BRT route.
- Section 3 is a discussion of the various planning reports and studies, which have been prepared by the City of Greenville, GTA, GCEDC and other agencies in the region, that are relevant to public transportation and land use planning.
- Section 4 is an evaluation of the different alternatives considered, a discussion of the public involvement process that resulted in the selection of a preferred BRT route, ridership and operations & maintenance analysis of the preferred route.
- Section 5 is a detailed discussion of the Transit-Oriented Economic Development analysis which examines the areas around the proposed BRT route to estimate the feasibility and market potential for transit supportive developments within a quarter-mile radius of the BRT stations.
- Section 6 is a description of the various funding mechanisms available to GTA and a potential funding plan for implementing, operating and maintaining the BRT line.
- Section 7 is a project summary, recommendations and next steps.

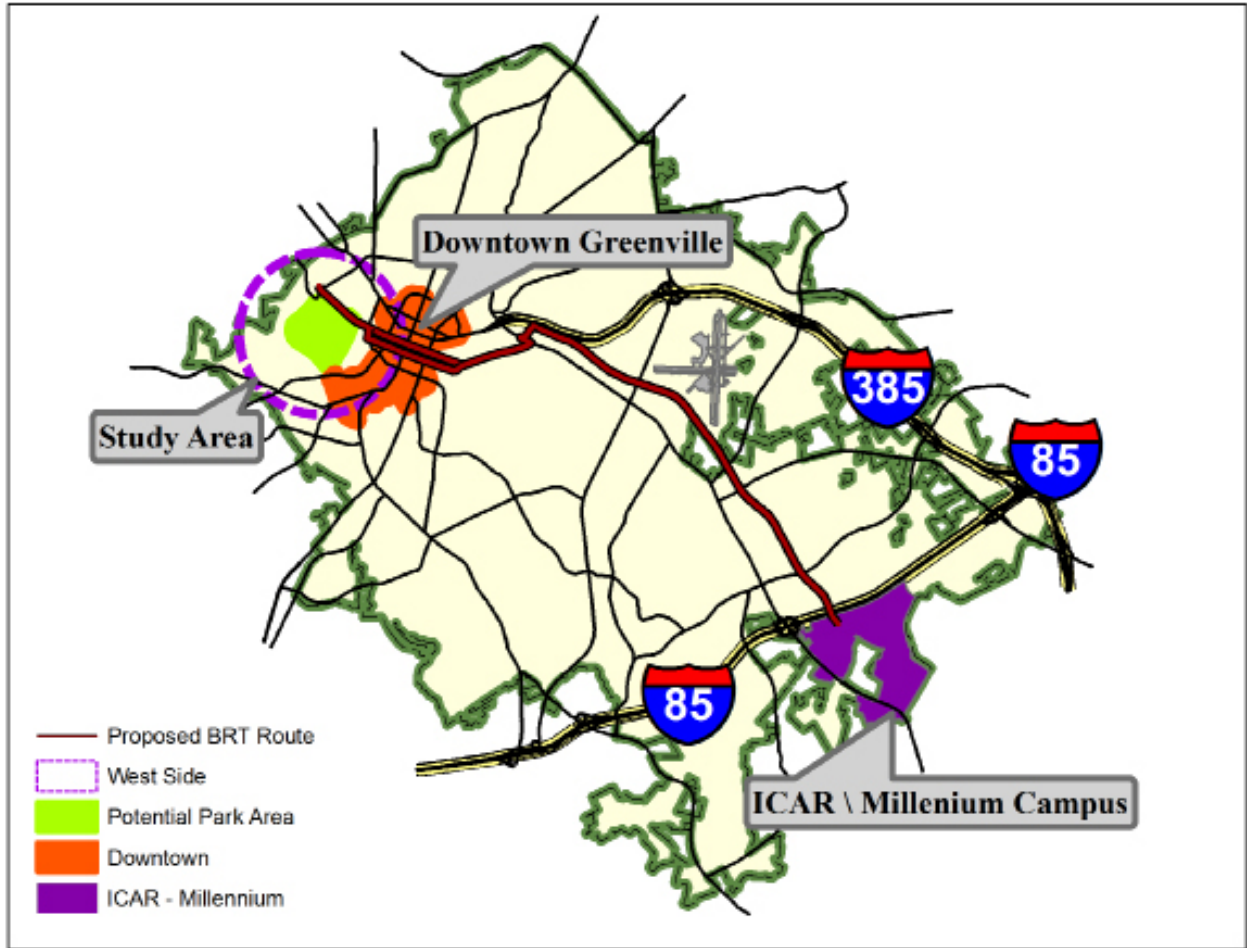


Figure 2: Study Area

Section 2: Project Goals & Guiding Principles

Generally, the purpose of the project was to connect the City’s west side/Amtrak Station area with the CU-ICAR campus through Downtown Greenville. Specifically, three key goals were identified for the project as discussed below. The HDR team developed a set of guiding principles that will help in determining the feasibility and selection of the corridor and respective TOeD stations.

2.1 Project Goals

The BRT/TOeD Feasibility Study project has three main goals:

1. Connectivity: Analyze Bus Rapid Transit (BRT) concepts along major City corridors primarily to connect CU-ICAR to West Side.

The CU-ICAR is a 250-acre automotive research campus located off Millennium Boulevard, south of interstate 85 and east of Laurens Road. The Campus is expected to have more than 20,000 jobs within 20 years of its establishment and is seen as the initial southern terminus of the BRT corridor. From this point, it provides excellent opportunity for future connections to adjoining cities such as Mauldin or Simpsonville.

The west side of Greenville is home to three special emphasis neighborhoods - Southernside, West Greenville and Payne Logan (also known as West End). The area is also home to one historic district, Hampton Pinckney, as well as the West Pendleton Art District. The City defines Special Emphasis neighborhoods as areas characterized by higher concentrations of low-to-moderate income households, with over 51% of the households earning less than 80% of the area median income. There are thirteen recognized Special Emphasis neighborhoods in the City, and efforts at community investments have been concentrated in these areas.

2. Viability: Analyze viability of Transit-Oriented Economic Development (TOeD) projects along the preferred BRT corridor. The preferred route utilizes a portion of the 13-mile corridor that was purchased by the Greenville Economic Development Corporation (GCEDC) in 1999. This portion of that corridor, known as the southern segment, is 3.42 miles in length, extending from approximately Pleasantburg Drive on the north to near Forrester Drive on the south.

Northwest of Pleasantburg Drive, the property is privately owned. Throughout most of this section, tracks have been removed and the right of way is vacant until the point where the RR ROW nears the intersection of Laurens Road/Washington Street. From that point, the corridor will travel on E Washington Street to go through downtown Greenville as it connects with the Amtrak station on the west side.

3. Accessibility: Address the need for accessibility to jobs and connectivity to key destinations in the community. According to the 2000 Census, the west side area accounts for approximately 7.4 percent of the total City population, while approximately 32 percent of west side residents live below the poverty level. Eighty (80) percent of the residents are African American, and the median household income is less than \$19,000, while the 2008 unemployment rate for the area was 22.6 percent compared with 9.5 percent for the rest of the city. Thus, there is need to provide accessibility

to employment for the residents of the area. Accessibility to the following key employment centers along the corridor is important:

- Downtown Greenville is Upstate South Carolina's largest central business district with over 3 million square feet of office space. Downtown is home to shops, restaurants, entertainment and many residents, making it a great area for economic investment.
- CU-ICAR is a 250-acre campus which has generated nearly \$250 million in investments, as of 2011, and another \$500 million in development. About 1,000,000 square feet of development has been constructed on the site, and more than 2,300 high-wage jobs have been generated.
- Verdae Development, located along a major stretch of the RR ROW, is a 1,100 acre mixed-use development with an expected population of over 10,000 residents at full build.
- St. Francis Hospital Health System, adjacent to the CU-ICAR campus, is located on 50 acres and has created 500 jobs.
- Hubbell Lighting Corporate Headquarters, also adjacent to the CU-ICAR campus, is a \$36 million investment with 350 new jobs created.

2.2 Guiding Principles

The following guiding principles were used to determine the feasibility, selection and implementation of the preferred BRT corridor and the respective TOeD stations.

- **Economic Development:** This principle considers a project's likelihood to be implemented if it meets the community's economic development goals.
- **Practicality:** This principle considers a project's effectiveness measured in terms of population and employment served and its ability to generate ridership.
- **Equity:** This principle considers a project's benefit to economically disadvantaged populations.
- **Financial:** This principle considers a project's ability to attract local and federal funding. Cost effectiveness and the ability to attract local investment are components of this principle.
- **Impact on Development:** This principle considers a project's potential ability to attract real estate development within the corridor.

2.3 Planning Process

In preparing the feasibility study and determining how viable the preferred BRT corridor is, the following process was followed:

1. **Identify:** Based on previous studies, staff, steering committee and public input, identify possible corridors for a BRT system.
2. **Evaluate:** Evaluate the conceptual corridors based on the guiding principles.
3. **Define:** Define the concept corridors based on public support and input, funding and leveraging opportunities.
4. **Analyze:** Perform operations and maintenance analysis to determine O&M costs. Perform, ridership analysis, financial and market analysis (for the TOeD concepts), and evaluate equity/ environmental justice impacts in the segment analysis.
5. **Determine:** Based on the information gained from the analysis, determine the feasibility of the BRT corridor.

2.4 Public Involvement

Engaging the community was instrumental to the success of the study. Working with the City's Planning Department and the City's Alignment Consultant (Arnett Muldrow & Associates), the HDR team established three focal points for community stakeholders involvement:

1. Community Meetings
2. Policy Steering Committee (PSC)
3. Transportation Steering Committee (TSC)

A total of eight (8) public meetings were held with the Community, PSC and TSC. One of these meetings was a TOeD workshop.



The Steering Committees included representation from the community, CU-ICAR, GCEDC, City and County agencies, citizens, transit riders and the business community.

The kick-off meeting, held on March 1, 2012, provided a project overview and opportunities for public input. Comment cards were distributed, completed and returned. The sessions provided an opportunity for the members of the community to be involved in the planning process, identifying key destinations in the metro area, possible corridors for a BRT system, potential BRT stations, TOeD areas and funding opportunities to implement the system.

Some of the key destinations identified as major activity centers in the City of Greenville include:

- CU-ICAR
- Various Downtown spots
- Greenville Technical College
- Greenville Zoo
- Haywood Mall
- Patewood Memorial Hospital
- TD Convention Center
- The Point
- Greenville Memorial Hospital
- Salvation Army Kroc Center



Comments provided at the meetings were posted on the City's website. Some of these comments (not limited to the planned BRT system) include:

- The GCEDC railroad corridor is ideal for a BRT system
- Encourage Public Private Partnership (P3) – Example: St. Francis/CU-ICAR Partnership
- It is important to branding the BRT service and differentiate it from existing transit service
- The right of way (ROW) along the GCEDC railroad varies between 60' and 200'
- Intelligent Transportation System (ITS) should be encouraged on transit vehicles (wireless, next bus, etc)

- Current bus system is cleaner but frequency needs improvements
- The proposed number of BRT stops/stations as well as the spacing between them is important
- GTA to provide information about routes and services/schedule at stops
- Improve travel speed on GTA system
- Limit number of transfers/stops on the transit service
- Provide weekend (especially Sunday) service
- Improve service frequencies (prefer 15 minutes)
- Improve span of service/24-hour operations
- Extend bus service to new areas (e.g. Airport, Duncan/Spartanburg)
- Integrate Park and Rides
- Provide more bus shelters
- Install pay stations at stops
- Encourage use of electric buses
- Service needs to be reliable and on time
- Accommodation of up to 4 bicycles
- GTA buses are new, clean, quiet and safe
- Transfer Station has been improved
- The service goes through challenging neighborhoods
- Expanded service to Mauldin and Simpsonville is important
- Transit provides an alternative to driving
- GTA provides transit service that connects to the Mall
- GTA fares are affordable



In addition to these meetings, the project team also engaged specific developers in conversations regarding transit oriented development opportunities. Meetings were held with the owners of the Verdae Development, north of CU-ICAR campus and the property northwest of Pleasantburg Drive. Further, there were coordinated field visits to the CU-ICAR campus, the Verdae Development, and the City of Mauldin's city center (south of CU-ICAR campus) to determine the feasibility of a future extension of the BRT system to the city center.

City staff provided invaluable support to the success of the study.

Section 3: Prior Studies

3.1 Introduction

The following section provides an inventory and abstracts of prior studies with relevance to the BRT and TOeD Feasibility Analysis project. These studies encompass a wide range of topic areas and subject matter, from neighborhood plans to economic development studies, as well as related transportation planning documents. The synthesis of these documents provides a solid foundation for understanding the context within which the BRT and TOeD Feasibility Analysis project is being developed, as well as a summary of the work completed to date in preparation for this project.

The following documents were reviewed and summarized below:

- GTA Transit Development Plan (2011-2016)
- Appalachian Region Comprehensive Economic Development Strategy (2007-2012)
- City of Greenville Downtown Master Plan (2008)
- Upstate Greenlink TIGER (2009)
- Greenlink Rapid Transit - TIGER II and TIGER III Applications (2010-2011)
- City of Greenville Comprehensive Plan (2009)
- Greenville County Comprehensive Plan (2009)
- Greenlink Transit Vision and Master Plan (2010)
- GCEDC Multi-modal Transit Corridor Alternatives Feasibility Study (2010)
- GPATS 2010-2015 Transportation Improvement Program (TIP)
- Greenville Forward – Vision 2025 Plan
- GPATS 2030 Long Range Transportation Plan
- Greenville Neighborhood Master Plans
 - Southernside
 - Viola Street Neighborhood Revitalization Strategy (1996)
 - West Greenville (2001-2002)
 - Haywood Road Area (2009)
- Pleasantburg Drive Corridor Master Plan (2004)
- West Washington Street Redevelopment Master Plan (2005)

3.2 Prior Studies Summaries

GTA Transportation Development Plan (2011-2016)

The GTA developed this plan to identify potential improvements to the mass transit system and to develop possible funding sources that would enable the system to both sustain its current operations and grow in the future. The six goals specifically identified in the TDP¹ are:

- Provide safe, reliable and convenient service
- Identify and establish long-term funding plan
- Expand transit service options and connectivity
- Increase community and public support through successful phased service implementation
- Tailor service to appropriately support and influence travel patterns, land use, and development
- Expand regionally

1 GTA “Transportation Development Plan 2011-2016,” p. 4.

The TDP provided an overview of existing demographics and population trends in the Greenville area, while noting the on-going and expected continued growth in Greenville County. Employment centers, transit “nodes” and existing commuting patterns within the region were also identified. Greenlink’s current system characteristics and performance measures were compared to those of “peer” area systems such as Augusta, GA; Montgomery, AL; Columbia, SC; Greensboro, NC; and Lexington, KY. These comparisons indicate that GTA/Greenlink is a much smaller system than most of its peer area systems, even though it has the second-highest service area population of the systems examined. It was determined that a more robust vehicle fleet should be acquired to offer a truly competitive transit service.

Survey data from 2010 indicated that a primary need for the transit system is to increase service and have more convenient route times and schedules. Getting current non-users to choose to use the system would also require a reduction in service headways and improved accessibility to routes. To this end, the plan considered three areas of possible expansion: downtown trolleys; a GSP/Greer express bus route; and a commuter bus route for Mauldin and Simpsonville.

The need for capital expenditures to replace the aging existing bus fleet was clearly identified, as was the need for funding sources to help cover annual operating expenses. Utilizing public/private partnerships to help fund operations was identified as a particularly viable option for meeting the financial needs of the system. The plan considered a number of federal, state and local funding options in the analysis of the system’s financial plan and potential routes for future expansion. The final recommendations of the plan included developing an aggressive approach to establishing a dedicated funding source for the Greenlink system, building upon public/private partnerships to help fund operations, and targeting more riders who choose to use the system rather than use the system out of necessity.

Appalachian Region Comprehensive Economic Development Strategy (2007-2012)

As the economic development district for the six county area of Anderson, Cherokee, Greenville, Oconee, Pickens and Spartanburg counties, the South Carolina Appalachian Council of Governments (SCACOG) was responsible for drafting a Comprehensive Economic Development Strategy (CEDS) for its respective region.

The CEDS provides a detailed description and analysis of the socioeconomic conditions in each of the six component counties, including extensive demographic data and data on employment for individual establishments with more than 500 employees. The CEDS sets forth a number of key general economic development goals and objectives, which are summarized below:

- Maintaining and improving the region’s quality of life
- Creating and fostering a skilled workforce
- Diversifying the region’s economic base
- Strengthening and enhancing government and economic development agency partnerships
- Enhancing and sustaining infrastructure
- Promoting existing commercial areas
- Ensuring that a mechanism is in place for continuing economic development planning and other regional planning efforts
- Ensuring adequate facilities for current and future economic development

- Creating an environment that promotes economic prosperity in downtown areas

The CEDS contains an extensive list of projects that are targeted to occur in the six component counties in support of these overarching regional goals and objectives.

City of Greenville Downtown Master Plan (2008)

The goals of the Downtown Master Plan include creating a framework for future development, reinforcing Downtown’s identity as the economic engine of the region, leveraging past successes in the Downtown, and creating a sustainable mixed use environment. The Plan looks beyond Main Street as the central element of Downtown and instead focuses on the “Five Corners” of Downtown as redevelopment and place-making centerpieces. These Five Corners are:

- Broad & River District: Church Street/Route 29 gateway in the southeast
- Gateway District: Interstate 385 gateway in the northeast
- Heritage Green: Rutherford/Route 276 gateway in the northwest
- County Square: the south end between Church Street and Augusta Street
- Warehouse District: between Academy Street/Route 123 and Main Street in the West End²

In addition, the Plan envisions a “Green Necklace” of parks and open space encircling the Downtown. The Plan also addresses the need for transit systems to work at the regional and local scale, specifically noting the development of the BRT system and the proposed high-speed rail connection between Raleigh, Charlotte and Atlanta. Making connections between important centers such as CU-ICAR and the Downtown on a regular basis was seen as an important element of the future plan for Downtown Greenville, as was creating an integrated system of transit options from local buses and the BRT to high-speed rail.

One of the five key planning principles identified in the Downtown Master Plan is to create a linked mass transit network that incorporates the BRT element with all other transit modes, from walking and biking to high-speed rail. As the Plan notes, “consolidating the operation of all modes of transit - trolley, GTA, and bus rapid transit - will provide the most efficient service minimizing duplications and emphasizing intermodal connections.”³

The Plan’s Implementation section contains a number of policies and initiatives to help guide the Plan’s elements from concept to reality. These include comprehensive marketing and recruitment, approval processes, housing, office uses, university presence, retail character and civic presence. The Implementation section also includes a specific transportation infrastructure initiative for bus rapid transit. The Plan recommended that the primary focus of the efforts in creating a BRT system should be on securing federal funding, acquiring any necessary land for planned rights-of-way, and making streetscaping plans that account for potential BRT use of local streets.

Upstate Greenlink TIGER (2009)

The Upstate Greenlink TIGER grant application was the first of three TIGER grant applications that ultimately resulted in a grant award and federal funding for the BRT and TOeD Feasibility Analysis Study. This grant application and associated project sought to link 18 public agencies

2 Sasaki Associates, Inc., “Downtown Greenville Master Plan,” (2009), p. 3.
 3 Sasaki Associates, Inc., “Downtown Greenville Master Plan,” (2009), p. 55.

in a coordinated approach to developing a BRT system, thereby improving air quality, promoting community walkability, creating new and diverse jobs, demonstrating a new model of development for sprawling southern cities, and promoting cleaner and more advanced transportation technologies.

The proposed BRT system would stretch from Clemson University at the western end to GSP International Airport at the eastern end, then from the City of Travelers Rest at the northern end to the City of Fountain Inn at the southern end. It was to primarily use multilane roads, but it was noted that the possibility of utilizing former rail corridors as dedicated busways. The proposed BRT was lauded as having the potential to provide a variety of environmental, economic and quality of life improvements for the region. These included improved air quality; expanded mass transit service; increased access to jobs, particular for low and moderate income people; supporting the development of new jobs in green industries; and promoting transit-oriented development.

Specific elements of the TIGER grant included:

- \$34.8 million for acquiring vehicles and infrastructure for a dedicated busway and north/south and east/west transitways
- \$42 million for buses and charging stations
- \$1 million for an alternative fueling station
- \$7 million for pedestrian and bicycle connections to public transit
- \$14 million for a LEED-certified multimodal transportation center
- \$200,000 for educating the public about transit and TOD benefits
- \$150,000 for regional development regulations to support TOD and discourage sprawl

Greenlink Rapid Transit - TIGER II and TIGER III Applications (2010-2011)

The Greenlink Rapid Transit TIGER II and TIGER III grant applications followed the original Upstate Greenlink TIGER grant application; the TIGER III application was selected for a grant award and federal funding for the BRT and TOeD Feasibility Analysis Study. These two grant applications revamped the original Greenlink BRT concept and reduced its scale and scope. In contrast to the original proposal to have BRT routes across the entire region, the TIGER II and TIGER III grant applications focused on creating a BRT route from Downtown Greenville to CU-ICAR, express service between CU-ICAR and Greenville-Spartanburg Airport, and express service between CU-ICAR and the cities of Mauldin and Simpsonville. The proposed BRT project in the final TIGER III application had a cost estimate of \$26.3 million in 2011 dollars and was expected to generate nearly \$289 million in total benefits, resulting in a benefit-cost ratio of eleven to one.

The TIGER grant applications identified several transportation challenges that the Greenville region faced, which the Greenville Transit Authority and its partner organizations wanted to address through the expenditure of TIGER funds. These challenges included Greenville's rapid rate of urban growth, contributing to significant urban sprawl; traffic congestion, which has led to significant increases in commuting times for Greenville workers; air quality and associated public health issues, which are exacerbated by urban sprawl and traffic congestion; and underfunded public transportation services.

In order to address these challenges, the grant applications proposed several project goals for the BRT and TOeD Feasibility Analysis Study. These included facilitating transit-oriented development through the creation of “transit villages” situated around eight new stops on the BRT, replicating the success that Downtown Greenville has experienced from denser development. Construction of a 3.4 mile dedicated BRT corridor, the purchase of buses and the construction of charging stations, the primary outcomes of the expenditure of TIGER grant funds, are the critical components of the BRT system and would help address several of the transportation challenges facing Greenville. New bicycle and pedestrian infrastructure, such as a multi-use trail alongside the BRT corridor, new bike storage facilities and improvements to the sidewalk network, would help encourage the use of additional alternate modes of transportation. Finally, a public education program on the benefits of transit-oriented development and new land use regulations encouraging TOeD, facilitated by Upstate Forever, would be designed to promote TOeD and the use of public transportation.

The applications also discussed how the proposed work program would meet the desired long-term outcomes of the TIGER program. The applications noted how the proposed use of TIGER funds would promote a state of good repair by reducing wear and tear on existing roadways and transportation assets through a modal shift from single-occupancy vehicles to the BRT. The economic competitiveness of the region would be enhanced through the stimulation of architectural, engineering and construction jobs in the short-term, while more high-tech jobs would be attracted to Greenville in the long-term. In addition, the proposed use of TIGER funds would help connect low and moderate income residents with some of the region’s largest employment centers. Livability would be enhanced through the reduction of commuting costs, greater convenience for commuters, improved accessibility to transportation for disadvantaged populations, improved biking and walking facilities, improved public health, and greater public safety through a reduction in vehicle miles traveled. Sustainability would be promoted in the region by encouraging a shift to more efficient development patterns, positively influencing development in economically distressed neighborhoods, concentrating housing in transit villages, and reductions in greenhouse gases due to fewer vehicle miles traveled. Finally, safety would be improved through the reduction of traffic congestion and vehicle miles traveled, which would lead to a corresponding decrease in traffic accidents.

The applications noted that the proposed program of activities would also generate significant ancillary economic activity. An estimated 3,000 acres of developable land would be accessible from the BRT, and the project itself would generate an estimated \$300 million in private investment. Innovation would also be a hallmark of the project, as signal prioritization, use of “smart cards”, and other technologies would help speed passenger service. The use of fast-charge electric buses in conjunction with CU-ICAR would also be an innovation that would provide exceptional fuel efficiency compared to other types of buses.

City of Greenville Comprehensive Plan (2009)

The “Transportation Strategies” section of the City of Greenville’s Comprehensive Plan was reviewed. This section of the plan document is organized around three primary objectives:

- Provide adequate infrastructure so that individuals have sidewalks, bike lanes, roads, etc. to navigate
- Provide adequate public transportation so that individuals do not have to rely on vehicles
- Pave the way for transit oriented developments

Under these broad objectives, specific strategies were developed from a variety of referenced source materials and publications. These strategies include the following:

- Make public transportation a planning priority, especially as part of the decision-making process when considering new public facilities and commercial projects
- Make public transportation aesthetically attractive both to improve safety and enhance community character
- Make public transportation easy for pedestrians by giving due consideration to sidewalks and routes around transit stops
- Make public transportation economically attractive by locating transit facilities near residential developments
- Understand the complexities of TOD and fully appreciate the myriad stakeholders and their needs and desires in the process
- Locate dense development near transit facilities and allow mixed use to provide increased ridership
- Consider a variety of urban design tools, such as flexible development codes, smaller urban blocks, orientation of buildings toward the street façade, provisions for bicycle parking, pedestrian infrastructure and the appropriate pricing of parking spaces to make TOD a more viable alternative to traditional development patterns

Greenville County Comprehensive Plan (2009)

The plan opens with an inventory of existing conditions, in which the following categories of data were analyzed in detail:

- Population
- Economic Development
- Natural Resources
- Cultural Resources
- Community Facilities
- Housing
- Land Use
- Transportation
- Priority Investment

The plan also included a robust citizen participation program that involved numerous community meetings, citizen committee meetings and stakeholder meetings. Civic group presentations were also held, an interactive planning exercise with local second grade students was facilitated and individual Comprehensive Plan “ambassadors” were appointed by each County Councilor to facilitate public input at the grassroots level.

As part of this process, eleven (11) issues were identified as having the greatest importance, of which “Transportation Options” was one. The Plan states that “numerous citizens commented that the County needs to have more options for travel from one place to the next. Suggestions included pedestrian facilities such as sidewalks and trails, bicycle routes, and access to mass transportation.”⁴ The Citizen Committee of the plan development process identified a number of transportation goals, including:

- “Develop an integrated transportation system that ensures accessibility, safe and efficient movement, and connectivity through all parts of the County and accommodates a range of transportation choices such as public, pedestrian, bicycle, and vehicular. This includes a “Complete Streets” initiative in the urban areas of the County.
- Implement sustainable growth and efficient use of land through coordinated, quality development, redevelopment, protection of natural and agricultural areas, and an overall more transit-oriented land use pattern in order to ensure quality of life for Greenville County’s current and future residents.”⁵

The Future Land Use map for the County plan also places an emphasis on the development of transportation corridors radiating out from the more heavily-developed central portion of the county and linking important sub-regional and employment centers together. These include interstate corridors, transit corridors, regional corridors, community corridors and neighborhood corridors. Transit corridors, such as Highway 276, are specifically identified as areas where “all development should share a common design that supports multi-modal transportation alternatives including bicycle, pedestrian, and bus rapid transit.”⁶

Greenlink Transit Vision and Master Plan (2010)

The Transit Vision and Master Plan was developed to help Greenlink establish a long-term vision for the City’s transit system, identify specific short, medium and long-term operational strategies for implementation, and establishing the policies and funding sources needed to make Greenlink a sustainable system going into the future. Phase I of the study established baseline data and produced an initial transit vision and a set of short-term service recommendation, while Phase II embellished the initial work of Phase I into long-term planning for the transit system and analyzed potential self-sustaining funding plans for the Greenlink system.

In addition, a Corridor Concept Land Use Plan was developed for the areas adjacent to primary transit routes in the City based upon the following categories:

- Regional Node – Intense mix of uses centered around a transit stop of regional road
- Central Business District – Diverse mix of uses
- Employment District – Major employment centers and facilities
- Neighborhood Node – Mixed use buildings serving the surrounding community
- Green Connections – Open space for environmental preservation or pedestrian/bicycle connections

4 “Imagine Greenville County – Tomorrow’s Vision Today,” p. 31.
5 “Imagine Greenville County – Tomorrow’s Vision Today,” p. 35.
6 “Imagine Greenville County – Tomorrow’s Vision Today,” p. 55.

Near-term improvements, those that could be implemented almost immediately, were identified and included conducting a system-wide boarding and alighting survey, modifying para transit service, making improvements and modifications to existing transit facilities, replacing aging vehicles in the bus fleet, technology improvements and gathering customer information, establishment of a Transit Demand Management program, and reviewing the governance structure of Greenlink.

The key short/mid-term improvement recommended was the establishment of a BRT line between Downtown Greenville and the CU-ICAR campus as the first phase of a larger regional BRT system. Other recommendations included implementing a revised system of fixed bus routes and circulator routes, implementing flex routes, express service and on-call service, and creating a Downtown trolley route. Long-term service improvements included implementing two regional BRT lines that would run east-west and north-south, respectively. Finally, a ½ cent county-wide sales tax was identified as a permanent funding source with the greatest potential to support Greenlink's operations.

GCEDC Multi-modal Transit Corridor Alternatives Feasibility Study (2010)

The Multi-modal Transit Corridor Alternatives Feasibility Study provided a comprehensive analysis of various transit system options for the corridor from Greenville to Fountain Inn. The study analyzed the potential costs and benefits associated with four different transit options:

- Bus Rapid Transit
- Streetcar
- Light Rail Transit
- Commuter Rail

These four transit modes were examined in terms of capital costs, operating costs, projected ridership, expected travel times, frequency and convenience of transit trips and accessibility to centers of activity. From these options, BRT was determined to be the most cost effective for the study corridor.

The study reviewed past planning initiatives and reports, examined land use and socioeconomic data for the corridor area, and existing transit usage and traffic data. The study looked closely at the existing rail corridor that could be utilized for transit, dividing the corridor into five segments for analysis. Issues such as right-of-way incursions, horizontal curves, track conditions, at-grade crossings and freight traffic were identified and discussed. Case studies were provided for applicable transit systems in other cities, and different potential alternatives for transit routes were also discussed. Finally, the potential for transit-oriented development in “transit village” nodes around route stops was analyzed from a community impact standpoint. Implementation and funding options were also discussed in detail.

GPATS 2010-2015 Transportation Improvement Program (TIP)

The Greenville-Pickens Area Transportation Study (GPATS) TIP provides a five-year blueprint for transportation spending and specific projects in the five county area. As the area's metropolitan planning organization (MPO), GPATS is required to planning for the expenditure of federal funding for transportation projects.

The following projects listed in the TIP have either direct or indirect impacts on the corridor area. They are located within the study corridor, located in areas directly adjacent to the corridor, or are of such size and scale that they will have either direct or indirect impacts on the corridor (such as the I-85/I-385 interchange upgrade project) regardless of location:

Continuing Projects

- Salters Road, Phase I – Road Widening & Sidewalks/Bike Lane

New Projects

- Salters Road, Phase II – Road Widening & Sidewalks/Bike Lane
- Woodruff Road at I-85 Interchange – Intersection Improvements

Congressional Earmarks

- CU-ICAR Roads – Complete Streets system
- Fairforest Way and ICAR Road Improvements – Widening & Reconstruction
- West Georgia Road Improvements – Left Turn Lanes & Shoulders
- Greenville Multimodal Transit Center

Exempt Projects

- I-385 at West Georgia Road Interchange – Interchange Upgrade
- I-85 Widening and Bridge Replacement
- I-385 Widening
- I-85 at I-385 Interchange Upgrade

ARRA Projects

- Fairforest Way – Road Widening
- Church Street (US29) – Road Diet Improvements

Greenville Forward – Vision 2025 Plan

Greenville Forward is an organization dedicated to facilitating the Vision 2025 Plan, a long-range comprehensive plan for Greenville that was completed in 2005. Greenville Forward oriented the Vision 2025 Plan and subsequent activities related to it around the following six “Visions”:

- Learning
- Creative
- Inclusion
- Connected
- Healthy
- Green

Each of these general “Visions” is broken down into smaller subcomponent vision items, with associated measures to determine success and specific strategies and actions to achieve success. The “Connected” vision element continues specific elements related to transportation, such as utilizing a multi-modal transportation system as the catalyst for economic growth, and utilizing a variety of transit modes such as busways and light rail to connect the region together.

Greenville Forward operates a number of programs and events aimed at advancing community dialogue about topics germane to the six visions. Research and studies conducted by Greenville Forward have included an electric vehicle survey, community health assessment, studies on education and race, community engagement and economic analysis.

GPATS 2030 Long Range Transportation Plan (LRTP)

In addition to the discussion of historical and background information on the GPATS region, the development of the LRTP included an in-depth public participation and visioning process. The goals developed as part of this process are summarized below:

- Develop a plan that maximizes benefits to the transportation system while minimizing costs involved
- Develop a smarter, sustainable transportation system
- Provide viable transportation alternatives to decrease dependence on the automobile, in turn decreasing the demand load on the existing transportation system
- Provide a safe transportation system for all users
- Recognize the effect growth patterns have on the transportation system and vice versa
- Minimize environmental impacts of the transportation system
- Encourage on-going maintenance and improvement of the existing transportation system
- Educate both GPATS area citizens and decision makers about the long range plan process and the funding sources needed to finance long range plan projects
- Develop a plan more conducive to developer-financed growth⁷

The LRTP addresses the existing highway system, identifying road classification, congested corridors and capacity issues. The plan also identifies high occurrence crash intersections in the region, three of which are located within or near the study corridor. The characteristics and impacts of the future highway system are estimated based upon the projected high priority street and highway improvement projects, and road diet and intersection improvement projects. Projecting travel conditions to the year 2030, traffic levels of service would be considerably worse without the investments prioritized in the LRTP, particularly in the area east of the City of Greenville. Additional elements examined include congestion monitoring, management and mitigation; access management, Complete Streets, and recommended typical cross-sections for different road types. The potential social and environmental impacts of the LRTP are also examined, including issues of environmental justice. Extensive analysis of existing bicycle and pedestrian facilities is also provided, along with recommendations for future actions and projects to improve safety and connectivity. The issues associated with freight movement by both ground and air were also examined.



⁷ GPATS Long Range Transportation Plan, p. 2-9

Of greatest importance to this study is the section on the transit system. This section analyzed and discussed the operational characteristics of the Greenville Transit Authority, including funding and ridership, Greenville Area Para transit service, intercity bus service and overall GTA goals for the system. A peer group comparison was completed, highlighting GTA's operations vis-à-vis other metropolitan areas in the southeastern United States. As is evident from the public comment section of the plan, many residents desire a regional transit system with greater coverage, more frequent service and greater route connections to major destinations and points of interest.



The three transit modes of bus rapid transit (BRT), light rail transit (LRT) and commuter rail were examined, with both north-south and east-west transit corridors identified as potential routes for the future. The particular flexibility of BRT service to operate on city streets in congested areas was noted, as was the high per-mile expense of LRT and commuter rail services. The study also analyzed how the implementation of a rapid transit system could induce transit oriented development along the corridor from Greenville south to Fountain Inn. A variety of conceptual options were considered for future transit and transitway routes, and additional analysis on capital costs, operational costs and potential funding options were examined.

A financial and implementation plan for the LRTP was also prepared with a priority ranking of specific transportation infrastructure projects.

Greenville Neighborhood and Corridor Master Plans

The following individual neighborhood and corridor master plans were reviewed for applicability to the BRT study.

Southernside (2011)

The impetus for the Southernside Master Plan arose from the awarding of a variety of federal and non-federal funds, including a Community Challenge Grant and a TIGER II grant, to create a master plan for the entire west side of Greenville through a three-year process called "Connections for Sustainability". As an offshoot of this effort, Southernside received funding for its own master plan. This master plan was completed in Fall 2011 and focused on the following goals:

- Increase access to commercial centers, employment, and recreational open space
- Enhance the Southernside community character
- Provide multi-modal circulation and greenway access within neighborhood
- Improve and enhance streetscape and neighborhood infrastructure
- Encourage infill and redevelopment to improve housing conditions for residents and to promote economic development

The plan encompasses a 338-acre area that borders the southern edge of Downtown Greenville. The planning process was spearheaded by Clemson University's City and Regional Planning Department, who completed an existing conditions report, a community outreach program, and a design process to meet the established goals listed above. The design process ultimately led to the development

of a general concept plan and a more detailed regulated plan for land use in the neighborhood. Finally, an illustrative master plan for the future development of the Southernside neighborhood was completed, synthesizing community needs and desires with the existing conditions previously identified. A series of recommendations and implementation strategies provided a specific guide map to reaching and achieving the revitalization of the neighborhood.

Viola Street Neighborhood Revitalization Strategy (1996)

Located along the northern edge of Downtown Greenville, the Viola Street neighborhood is a redeveloped residential section of the City. Originally a small neighborhood struggling with poverty and crime, Viola Street was redeveloped as a residential community centered around a street network of cul-de-sacs. In addition to a complete physical reconfiguration of the neighborhood, the revitalization strategy includes economic development objectives for the Greenville Urban League, including providing employment opportunities for neighborhood residents and other economic empowerment strategies.

West Greenville (2001-2002)

The West Greenville Master Plan area encompasses approximately 230 acres west of Downtown Greenville and north of the St. Francis Hospital campus. The neighborhood is further divided into five smaller sub-neighborhood areas. The future guidance for the neighborhood described in the plan includes reinforcing neighborhood commercial development along Pendleton Street, increasing development density near the West Greenville Business District, more than doubling the percentage of homeownership in the neighborhood and adding and upgrading neighborhood amenities. The plan also recommends linking West Greenville to Downtown and the surrounding neighborhoods, creating new collaborative development opportunities and improving the quality of life for neighborhood residents.

Haywood Road Area (2009)

The Haywood Road area encompasses a portion of Greenville just east of Greenville Downtown Airport and around the Exit 39 interchange on Interstate 385. This area includes a mix of uses, but has been historically a center for retail and service uses in the City for several decades centered around the Haywood Mall. However, little reinvestment has occurred in the area since the 1980s and 1990s, and the master plan process sought to identify strengths and weaknesses of the corridor, develop recommendations for public and private improvements, and produce a realistic plan for turning the Haywood Road area into a revitalized destination. The key objectives of the planning process included creating vibrant street life, managing traffic, improving connectivity and overall activity in the area, permitting a flexible development environment, and encouraging quality design.

The plan was divided into four distinct sections. First, a summary of opportunities and constraints was conducted, including a discussion of the current socioeconomic conditions in the area as well as the City and the County. The physical characteristics of the natural environment in the area were also examined, as were the existing roadway conditions. Public input was a key component of this section, and resulted in a number of recommendations for improvements to the area. These included improving the streetscape and appearance of the area; attracting high quality redevelopment; enhancing the walkability of the area; improving signage and wayfinding; and developing retail, restaurant and entertainment uses.

The second section examined the market conditions in the Haywood Road area. Existing land use was analyzed and a retail demand analysis was completed. This analysis found that the Haywood Road area is an important retail center for the City, and discussed how it both competes with and complements the Woodruff Road retail corridor. The analysis also found that the City is an importer of retail sales, and is particularly strong, in terms of market capture rate, in clothing and apparel stores. Conversely, hardware stores, nursery and garden stores and drinking establishments are underperforming in their market capture rates, and these sectors could have room for expansion. The value of retail properties in the Haywood Road area is strong compared to other areas of Greenville. An examination of the office market found that the areas adjacent to the Haywood Road area are well-positioned in terms of rents and vacancy rates, particularly when compared to other parts of the regional market area. Rents in multifamily apartments were higher than in surrounding neighborhoods, as were prices for condominiums.

The Principles and Concepts section continued with the inclusion of a visual preference survey and its results, which helped identify the types and forms of development and urban design that planning participants preferred. Development and urban design preferences were then distilled into the following set of guiding principles:

- Respecting human scale
- Sustainable patterns of development
- Multi-modal access
- People = Activity
- Balancing needs
- Site planning
- Mixed use
- Context-sensitive design and aesthetic enhancement
- Landscaping
- Attention to detail



Sample implementation examples for these guiding principles were provided, such as methods for establishing area identity, a model intersection design plan, signage recommendations, redevelopment and TOD typologies, suggestions for designing gathering places, sample road configurations, and a possible bike network. Finally, recommendations for implementation were provided in the fourth section. The plan divided the study area into five sub-areas, and provided specific recommendations for addressing unique issues in each of the sub-areas. The recommendations were also divided into immediate, mid-term and long-term categories.

Pleasantburg Drive Corridor Master Plan (2004)

Pleasantburg Drive is one of the primary north-south transportation arteries in Greenville and runs through the center of the City’s geographic area. As a result, it connects many key institutions, facilities and other assets including Bob Jones University, the Downtown Greenville Airport, Greenville Tech and the Palmetto Expo Center. The corridor bisects the potential BRT route between Downtown Greenville and the City of Mauldin. This corridor became the focal point of retail and office development in Greenville from the 1960s to the 1980s, but was then bypassed for areas further out from Downtown, leading to its decline. Revitalization of the corridor began in

the late 1990s, leading up to the drafting of the Master Plan in 2004. The planning process included stakeholder interviews and design charrettes, as well as numerous advisory group meetings.

The Master Plan began with a summary of the existing conditions, on-going initiatives and development influences in the Pleasantburg Drive corridor. This included identifying regional landmarks, examining land use and development patterns and highlighting proposed and on-going development initiatives in the corridor. A market overview was provided that examined national and regional market trends, existing market conditions and opportunities for redevelopment activity. The market overview highlighted the impacts of the growth of smaller households, the aging of “Baby Boomers” and the growth in interest in both New Urbanism and “old” urbanism. The corridor’s characteristics of proximity to Downtown, good access to interstate transportation routes and proximity to strong neighborhoods, Downtown Greenville Airport and various educational assets were identified as strengths. Conversely, outdated office space, poor relationship between corridor uses and the adjacent neighborhoods, and a highly competitive retail market were all identified as challenges for the corridor. The market overview included revitalization recommendations, including the development of a retail/restaurant center, promoting mixed use development in the corridor and revitalizing the areas around the Palmetto Expo Center and the McAlister Square site.

An urban design plan was created that provided both immediate and long-term design recommendations focused on identified key areas. The two focus areas highlighted were the Palmetto Expo Center area and the McAlister Square/Laurens Road area. For the Palmetto Expo Center area, the plan recommended road realignments; redevelopment with hotel, office and retail uses; and the creation of a unified “convention district” around the Expo Center. In the McAlister Square/Laurens Road area, the urban design plan called for road extensions and intersection reconfigurations; residential redevelopment for the Pleasantburg Shopping Center; and adding retail, office and residential uses to McAlister Square to support the educational uses already in place. Additional urban design recommendations were made for Pleasantburg Drive itself, including creating larger sidewalks, incorporating on-street parking, and streetscape improvements.

An implementation strategy encompassing a multi-level approach was developed. This strategy included a variety of urban design standards for implementation, including street design standards, site development standards, pedestrian facility standards and parking standards. The strategy also discussed various incentive tools for redevelopment in the corridor, such as property assembly and acquisition and capital improvement projects. The strategy provided a summary of potential organizational structures within which redevelopment could be fostered and funding sources that could be utilized. These structures included tax increment financing districts, municipal improvement districts, and an implementation task force.

Finally, an action plan was included that identified the steps and initiatives needed to bring the recommendations of the plan to fruition. The action plan was organized into 17 priority future actions and two on-going initiatives. Each action item was assigned a lead agency and a time frame for implementation, and had key stakeholders and potential funding sources identified.

West Washington Street Redevelopment Master Plan (2005)

The West Washington Street redevelopment area encompasses 197 acres of land located to the northwest of Downtown Greenville. This area was determined to have significant redevelopment potential but would require significant public improvements to realize its potential. Three subdistricts were identified within the redevelopment area and conceptual plans were developed for each of these subdistricts. A Project Site Inventory and Analysis was completed, which examined the issues of floodplains, topography, zoning, land use, property ownership and the quality of residential structures in the redevelopment area. Based upon an analysis of the opportunities and constraints in the area, a series of land use planning principles was developed to guide the conceptual planning process for the redevelopment area. These principles and guidelines included transitioning land uses as the distance from Downtown Greenville increases; improving the roadway system in the area; create open space within the floodplain area; promote infill housing and civic uses; improve pedestrian circulation and connectivity and promote a mixed use environment.

The analysis proceeded with an examination of a number of different potential redevelopment scenarios for the West Washington Street area. These scenarios were centered around generalized land use districts including an Urban Transition Area adjacent to Downtown, a Core Residential Area in the center of the redevelopment area, and a New Town Residential and Business Park area at the western end of the redevelopment area. The scenarios themselves included a School Option, which examined the potential impacts of developing a new elementary school in the heart of the redevelopment area; a Residential Option, which focused on the impacts of new residential neighborhoods and infill housing; a Municipal Complex Option, which examined the impacts of placing a municipal courthouse complex in the redevelopment area; and a Business Park Option, which looked at the potential for a new business park at the western end of the redevelopment area. Finally, a Consensus Plan was developed by combining elements from all four redevelopment scenarios.

Finally, the plan concluded with a detailed discussion about potential future improvements to the area. These included roadway improvements along West Washington Street, which were broken into five individual sections; streetscape improvements; and redesigning the utility infrastructure in the area. Also included were detailed cost estimates for the various proposed improvements.

Conclusion

Fifteen studies and master plans were reviewed during the preparation of the BRT and TOeD feasibility report. The studies encompass a wide range of topic areas and subject matter but all have relevance to how a BRT or TOeD project can be successfully implemented in the City. Serving the areas studied with an improved public transportation system and initiating a BRT system could help the areas thrive by allowing more end users to more easily access the focus areas. Existing development would benefit from the existence of the BRT and would likely attract additional TOeD in the form of retail, commercial and residential. These investments would help justify the initial expense of building the BRT system.

Section 4: Evaluation of Alternatives

4.1 Introduction

The BRT/TOeD Study developed and evaluated three (3) BRT alternatives to connect the City’s west side/Amtrak station area with the CU-ICAR campus. These alternatives are described below:

4.2 BRT Alternatives

Alternative #1 (Red Line): This 6-mile route proposes to connect CU-ICAR with the Kroc Center on the City’s west side through the Verdae development partially along the Railroad ROW, then onto Laurens Road to the Kroc Center traveling through Downtown along Washington and South Academy Streets.

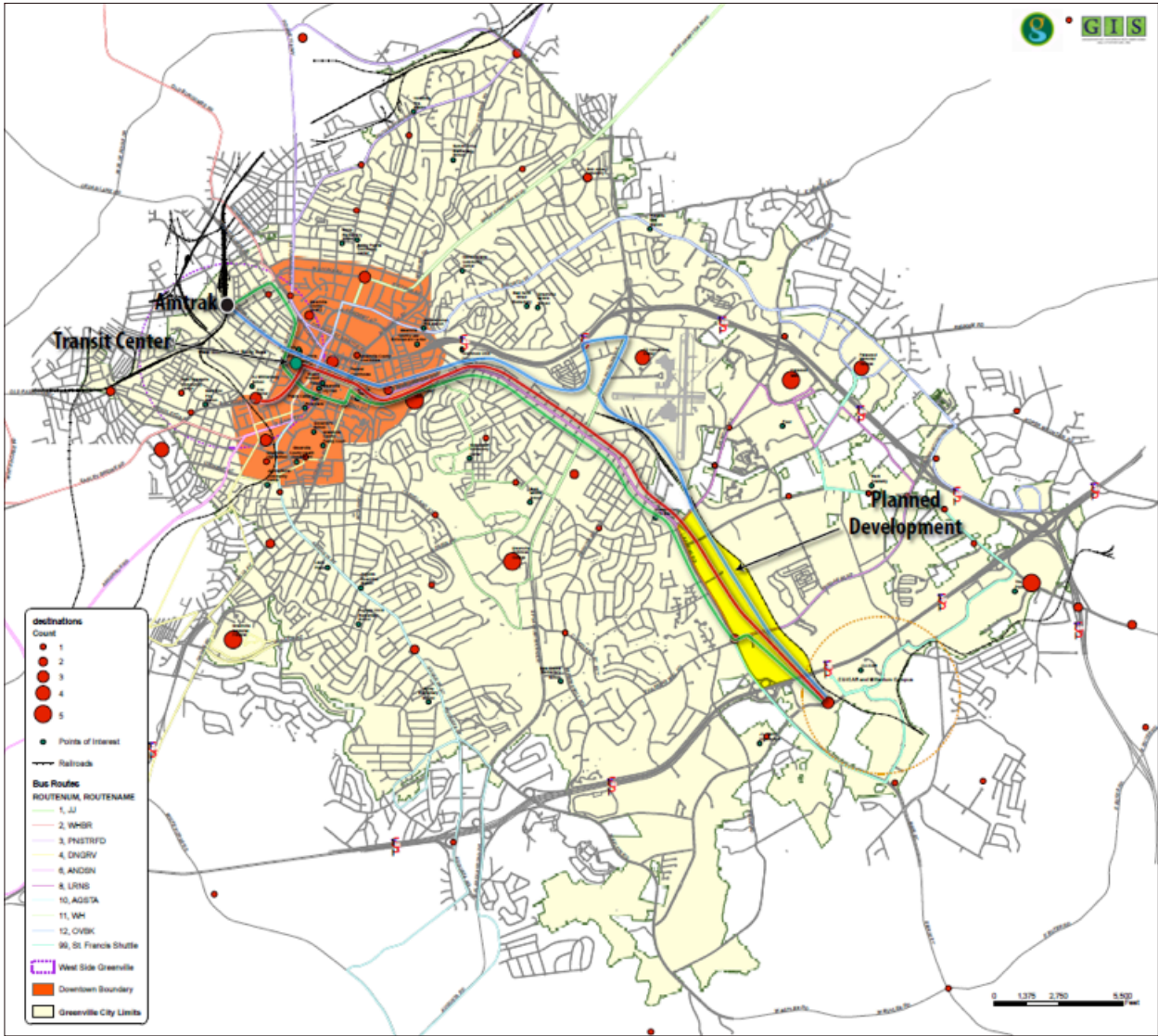


Figure 3: BRT Alternatives

Alternative #2 (Green Line): This 7-mile alternative route would connect CU-ICAR with Amtrak Station partially through the Verdae development and partially along the Railroad ROW, along Laurens, traveling through Downtown along Washington St., South Church St., East Broad St., Butler St., Buncombe St. and Mulberry St..

Alternative #3 (Blue Line): This 7.2-mile alternative route would connect CU-ICAR with Amtrak Station on the City’s west side through the Verdae development and exclusively along the Railroad ROW, connecting the airport/TD Convention Center, traveling through Downtown along Washington Street to the Amtrak Station.

4.3 Preferred Alternative

The alternatives were evaluated with input from the public and the project steering committees. The Blue Line was eventually determined as the preferred alternative, with modification. Rather than connect the TD Convention Center and Airport, the system would travel directly through the GCEDC right of way and privately-held property northwest of Pleasantburg along E. Washington Street through McBee Station to the Amtrak Station (Northbound) while traveling along W. Washington Street Southbound connecting the GTA’s Transit Center on both directions. This alternative was determined to achieve the following better:

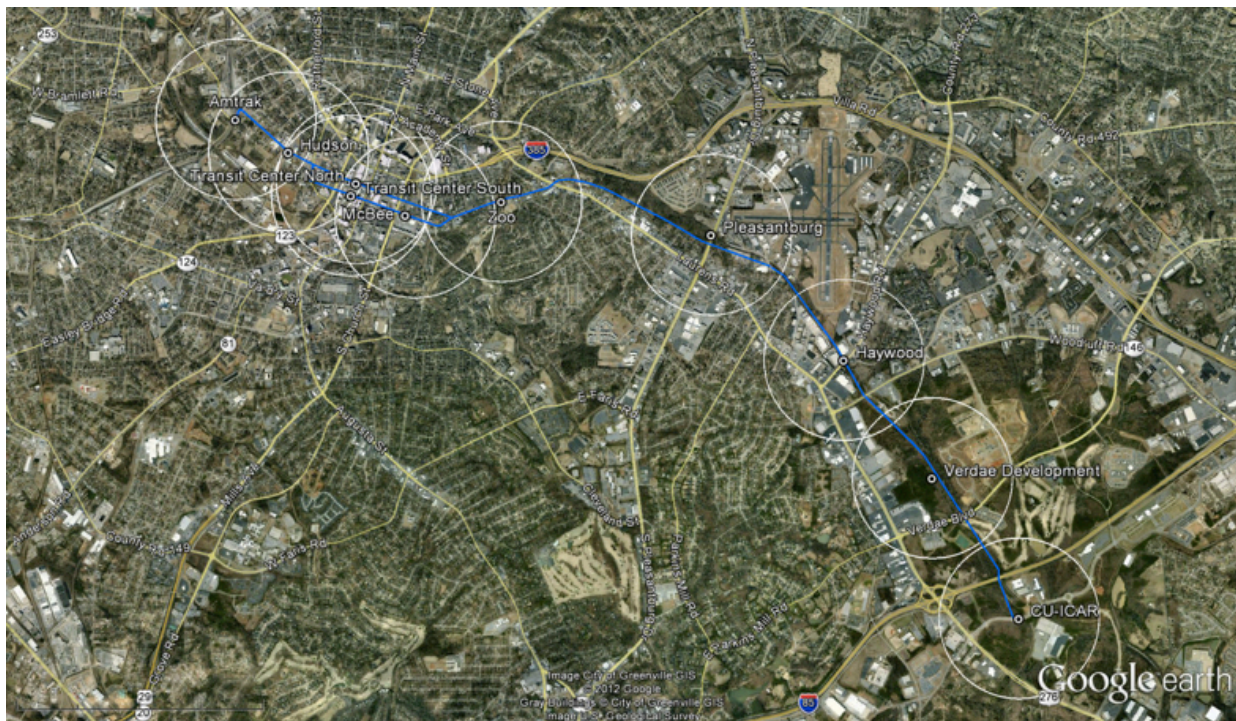


Figure 4: Preferred Alternative

- Maximizes the exclusiveness of travel offered by the railroad right of way and the private properties northwest of Pleasantburg Drive,
- Connects major activity centers downtown (hotels, court house, county and city offices, GTA transit center etc.),
- Provides links to other activity centers within ¼ mile radius (TD Convention Center, University Center, and Kroc Center),

- Maximizes ridership and optimal operational efficiency,
- Provides intermodal opportunities at the Greyhound Station downtown and Amtrak Station on the west side.

The preferred alternative also met the guiding principles as follows:

- Meets the city’s economic development goals to strengthen downtown, attract investments to the west side, and provide opportunities for infill development,
- Serves most employment centers and population,
- Benefits the economically disadvantaged populations especially in the City’s west side,
- Potential to attract local investment and real estate development along the corridor.

4.4 Bus Rapid Transit (BRT) Elements and Operating Characteristics

The FTA’s Office of Research, Demonstration and Innovation published a report titled Characteristics of Bus Rapid Transit (CBRT) for Decision Making.⁸ The CBRT report explores BRT through three different perspectives as graphically depicted below:



This structure suggests relationship between BRT elements, system performance and system benefits. The conclusion is that the choice of BRT elements, such as exclusive running ways for example, determines system performance. In turn, performance characteristics, together with individual elements, drive how benefits are generated.

A report recently released by the Government Accountability Office on “Bus Rapid Transit Projects Improve Transit Service and Can Contribute to Economic Development” reviewed 20 BRT projects performance in terms of ridership and service (July 2012).⁹ The report indicates that many U.S BRT projects incorporate at least some station amenities and most other BRT features that distinguish them from standard bus service, and improve riders’ transit experience.

8 Federal Transit Administration (US Department of Transportation) Office of Research, Demonstration and Innovation: Characteristics of Bus Rapid Transit for Decision Makers (August 2004)

9 GAO Report to the Committee on Banking, Housing, and Urban Affairs, U.S. Senate: BRT Projects Improve Transit Service and Can Contribute to Economic Development (July 2012)

One of those distinguishing features is the running way element. BRT research indicates that projects that have used dedicated running ways, such as that proposed for the Greenville BRT project, achieve significant travel time savings because of the congestion levels on city streets.



The preferred alignment will allow the BRT system to avoid conflicts with city traffic for more than 60% of the corridor while traveling exclusively within a railroad right of way and privately held properties.

However, in order for the system to operate optimally, it is important to integrate other critical BRT features such as:

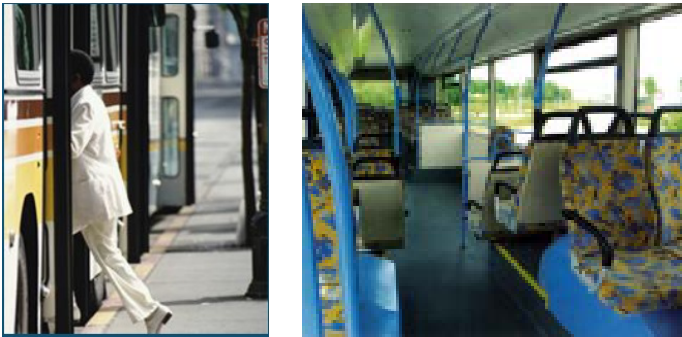
- **Stations:** uniquely branded stations with amenities such as adequate seating, weather protection, level boarding, posted route maps and schedules



- **Fare Collections:** use of off-board fare collection methods allows savings in travel time



- **Vehicles:** use of low-floor vehicles with expedited wheelchair-loading capabilities to reduce passenger-loading times



- **Branding and Marketing:** to promote the BRT service identity



- **Intelligent Transportation Systems (ITS):** installation of ITS features such as transit signal priority (TSP), vehicle tracking systems, next bus information and wireless local area network (wifi)



- **Operations and Maintenance Facility:** An operations and maintenance facility to store and maintain BRT vehicles is an important component of BRT operations, and the location and design of such a facility must enable optimal system efficiency. The facility will be required to support planned BRT operations to be used for overnight storage and vehicle maintenance that would include preventive (scheduled) maintenance, corrective (unscheduled) maintenance, routine cleaning and servicing, and major campaigns to correct component failures. Although envisioned to operate independently, the BRT system is not a rail system and therefore exists an opportunity to utilize existing GTA maintenance facilities. The analysis and locations of a BRT O&M facility is recommended to be addressed in detail in a separate analysis.

4.4 Preferred Alternative Operating & Maintenance Plan

General operating assumptions and plans for the Greenville BRT corridor assume service levels for a projected opening year of 2016. Operating assumptions include span of service, service frequency, vehicle capacity/loading standards, vehicle performance, and station dwell times.

Span of Service and Service Frequency

The span of service for the Greenville BRT corridor was developed in comparison to the current Greenville Transit Authority (GTA) weekday and Saturday schedules. As the system evolves and demand for service increases in the future, expanded hours and Sunday and holiday hours may need to be introduced. Even though other funding sources may be used, the operating plans were developed to meet FTA Very Small Starts operating requirements of offering service at least 14 hours per day and service frequency of 10 minutes during the peak period and 15 minutes during the off peak (during weekdays). Table 1 summarizes the assumed span of service and service frequency.

DAY OF WEEK	TIME PERIOD	FREQUENCY	HOURS	TOTAL HOURS
Weekdays	AM Peak Period	10 minutes	5:30 a.m. - 8:30 a.m.	14.0
	Base	15 minutes	8:30 a.m. - 3:30 p.m.	
	PM Peak Period	10 minutes	3:30 p.m. - 6:30 p.m.	
	Evening	15 minutes	6:30 p.m. - 7:30 p.m.	
Saturday	Base	30 minutes	8:30 a.m. - 6:30 p.m.	10.0
Sunday & Holidays	No Service			

Table 1: Service Hours and Frequency

Vehicle Capacity and Passenger Load Standards

Vehicle capacity and passenger loading standards have been established in order to determine the service frequency and fleet requirements for the BRT system. A 40-foot low-floor BRT vehicle that would accommodate level boarding at stations is assumed for this planning level analysis. This type of vehicle can accommodate approximately 40 seated passengers and 20 to 30 standing passengers. The passenger capacity may vary slightly if custom seating configurations are utilized. For future phases of analysis, load standards should be developed to determine the peak hour throughput required, appropriate vehicle size and level of service. During off-peak hours, the load standard for all modes should be a maximum of 100 percent (i.e. no standees).



Vehicle Performance

BRT vehicles are assumed to have a normal service maximum acceleration rate of about 2.0 miles per hour per second (mphps) from 0 and 30 miles per hour (mph), decreasing to 0.75 mphps from 0-65 mph. Normal service braking is assumed to be a constant 2.0 mphps from 65 mph to 0 mph. BRT vehicles are assumed to have a maximum speed of 65 mph. However, sections of the alignments will have speed restrictions due speed limits, operating environments and station spacing. Station-to-station BRT run time estimates have been developed based on these criteria.

Station Dwell Times

The average station dwell times factor in the time to allow passengers to board and alight the transit vehicle are assumed to be 10-20 seconds at all of the proposed stations. This average is assumed, understanding that dwell time can vary by station and time of day.

Average Intersection Delay

The average intersection delay assumes a significant level of transit signal priority (TSP) for BRT operations with the majority of the alignment at-grade. Average intersection delay for existing signalized intersections is assumed to be 10 seconds, assuming time savings with TSP at all signalized intersections.

Run Time Estimates

Table 2 provides a detailed station-to-station run time estimate for the BRT project based on operating assumptions. Station-to-station train running times were calculated and calibrated using the vehicle performance characteristics, speed restrictions for operations (mixed traffic vs. exclusive alignments), distances between stations and dwell times.

Station	Max. Speed (mph)	Distance (miles)		Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)
		Increment	Total				
CU-ICAR			0.00			00:00:00	00:00:00
	<i>Exclusive Guideway</i>	55	0.97	00:01:50	00:00:10		
Verdae			0.97			00:00:20	00:02:20
	<i>Exclusive Guideway</i>	50	0.98	00:01:48	00:00:10		
Haywood			1.95			00:00:20	00:04:38
	<i>Exclusive Guideway</i>	45	1.41	00:02:22	00:00:20		
Pleasantburg			3.36			00:00:20	00:07:40
	<i>Exclusive Guideway</i>	45	1.42	00:02:23	00:00:10		
Zoo			4.78			00:00:20	00:10:33
	<i>Mixed Traffic (Washington St.)</i>	35	0.62	00:01:23	00:00:10		
McBee			5.40			00:00:20	00:12:26
	<i>Mixed Traffic (Washington St./McBee Ave.)</i>	30	0.33	00:00:55	00:00:30		
Transit Center			5.73			00:00:20	00:14:11
	<i>Mixed Traffic (Washington St./McBee Ave.)</i>	30	0.52	00:01:17	00:00:20		
Hudson			6.25			00:00:20	00:16:08
	<i>Mixed Traffic (Washington St.)</i>	30	0.48	00:01:13	00:00:10		
Amtrak			6.73			00:00:20	00:17:51
TOTAL			6.73	00:13:11	00:02:00	00:02:40	00:17:51
						Avg. Speed =	22.6 mph
						Avg. Station Spacing =	0.8 miles

NOTES:

1. Primary Stationing based on draft - new alignment 5-30-12.
2. Assumed maximum allowable speed on exclusive ROW and grade separated = 55 mph.
3. Assumed maximum allowable speed on at-grade mixed-traffic roadways, outside of downtown = 35 mph.
4. Assumed maximum allowable speed on at-grade mixed-traffic roadways, within downtown = 30 mph.
5. Average intersection delay = 10 seconds for signalized intersections (assumes signal priority at all cross streets).
6. Number of intersections based on draft - new alignment 5-30-12.
7. Acceleration & deceleration rates based on normal BRT performance (maximum 2.0 mph/s).
8. Average dwell time = 20 seconds at surface stations.

Prepared by HDR Engineering

10-Jul-12

Table 2: Station-to-Station Run Time Estimates

End-of-Line Layovers

Transit operations plans will include time for end-of-line layovers to provide sufficient time for drivers to take breaks as required by union agreement as well as provide for schedule recovery (i.e., a late bus can “catch up” to its schedule). Operations plans will include layovers of at least 15% of the one-way run time at each end-of-line station.

Cycle Times

Cycle times are an important component used to determine operating requirements for each rail line. The cycle time consists of running time, station dwells, intersection delays, and layover time. Cycle times must be divisible by the proposed headway and used to determine vehicle requirements.

Maintenance Spare Ratio

The maintenance spare ratio (MSR) is the percentage of extra vehicles in a fleet, over and above the number actually required to provide scheduled peak period service. A 20% spare ratio is assumed for the BRT vehicle fleet, which is a commonly accepted standard in the transit industry as a goal for most new premium transit systems.

Peak and Fleet Vehicle Requirements

The BRT operating plan requires 4 vehicles for peak period operations, 3 vehicles for base period, and 2 vehicles for Saturday service with a fleet vehicle requirement is 5 vehicles (20% spares).

Summary of Operating Characteristics

Table 3 provides a summary of operating characteristics for bus routes serving the Greenville BRT corridor. FY 2010 expenses and units of service for each variable are presented in Table 4. Operating expenses assigned to each variable were summed and divided by FY 2010 units of service to derive unit costs.

The unit costs derived from the fully allocated model were applied to the projected operating statistics generated for the proposed BRT service to estimate total O&M costs. FY 2010 dollars were adjusted to opening year 2016 dollars at a 3.5% per annum for inflation.

Run Time (hr:min:sec)	Distance (miles)	---Headway---			----Annual Revenue----		Lay Over	Cycle Time	---Buses---	
		Day	Peak	Off-Peak	Veh-Miles	Veh-Hours			Peak	Off-Pk
00:18:06	6.73	Weekdays	10.0	15.0	123,100	7,620	6.9	50.0	5	
		Saturdays	30.0	n/a	109,400	6,100	4.4	45.0		3
					13,700	1,020	11.9	60.0	2	
		Sundays	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ESTIMATED TOTALS: 14,740 annual revenue vehicle-hours
246,200 annual revenue vehicle-miles
PEAK VEHICLE REQUIREMENT: 5 vehicles
FLEET VEHICLE REQUIREMENT: 6 vehicles

NOTES:

- (1) Annual revenue bus-miles and bus-hours include layover time, but do not include report and deadhead time.
- (2) Annual operating requirements based on 254 weekdays, 51 Saturdays, and no Sundays and holidays.
- (3) Operating hours are about 05:30 to 19:30 Monday - Friday, 8:30 to 18:30 Saturdays, no Sunday and holiday service.
- (4) Fleet vehicle estimate based on 20% peak-to-fleet ratio.

Table 3: BRT Operating Characteristics

EXPENSE OBJECT	FULL ALLOCATION			
	Garages	Bus-Hrs	Bus-Miles	Peak Buses
501.01 Operators Salaries/Wages	0	595,306	0	0
501.02 Other Salaries/Wages	23,251	69,754	259,490	217,674
502.00 Fringe Benefits	0	360,223	102,504	70,738
503.00 Services	39,780	0	179,776	310,018
504.01 Fuel & Lubricants	0	0	341,128	0
504.02 Tires & Tubes	0	0	50,873	0
504.03 Other Materials & Supplies	10,034	0	251,851	15,576
505.00 Utilities	42,177	0	0	0
506.00 Casualty/Liability	4,557	0	106,103	0
507.00 Taxes	0	0	0	0
508.00 Purchased Transportation	0	0	0	0
509.00 Miscellaneous Expenses	16,860	0	3,416	27,951
510.00 Expense Transfers	0	0	0	0
Total Operating Expenses:	136,659	1,025,283	1,295,141	641,957
FY2010 Units of Service	1	39,487	532,192	13
Unit Cost (operating expenses only)	\$136,659	\$25.97	\$2.43	\$49,381

SOURCE: 2010 NTD

Table 4: GTA Bus FY 2010 Expense Allocations and Unit Costs

O&M Cost Estimate Results

The estimated annual O&M costs for each of the alternatives are summarized in this section. The annual O&M cost estimates are based on opening year of 2016 operating plans and ridership projections. Table 5 provides costs for the proposed BRT service.

	Garages	Bus-Hrs	Bus-Miles	Peak Buses	Total Annual O&M Cost (2010 dollars)	Total Annual O&M Cost (2016 dollars)
FY 2010 Unit Costs	\$136,659	\$25.97	\$2.43	\$49,381		
Greenville BRT	0.5	14,740	246,200	5		
FY 2010 Cost by Variable	\$ 63,100	\$ 382,700	\$ 599,200	\$ 246,900	\$ 1,291,900	\$ 1,542,600
			<i>Cost per hour</i>		\$ 87.65	\$ 104.65

*Assumes 3% annual inflation rate

SOURCE: 2010 NTD

Table 5: Greenville BRT O&M Cost Estimates (2016 dollars)

4.5 Preferred Alternative Ridership

Ridership estimates for the Greenville BRT scenario was developed based on existing ridership and future population projections within the corridor. The population-based projection was adjusted based on elasticity factors to account for the proposed increased frequencies, as well as growth factors for a full-featured BRT system.

Methodology

First, a per-capita factor for each existing Green Link route was developed using CY 2011 ridership data and 2010 Census block-level population data. As shown in Table 6, for each route, annual ridership was divided by the population within a half-mile buffer to determine the per capita factor.

ROUTE	POPULATION	RIDERSHIP	RIDERS/CAPITA
<i>Route 1</i>	12,766	75,109	5.88
<i>Route 2</i>	23,398	110,852	4.74
<i>Route 3</i>	15,384	81,936	5.33
<i>Route 4</i>	11,950	58,643	4.91
<i>Route 6</i>	11,311	65,761	5.81
<i>Route 8</i>	11,289	81,598	7.23
<i>Route 9</i>	22,464	51,422	2.29
<i>Route 10</i>	17,886	102,874	5.75
<i>Route 11</i>	19,540	67,688	3.46
<i>Route 12</i>	15,349	64,075	4.17
<i>AVERAGE</i>	16,134	75,996	4.96
<i>MIN</i>	11,289	51,422	2.29
<i>MAX</i>	23,398	110,852	7.23

Table 6: Annual Ridership and Population by Route

The per capita factor for Route 8 – Laurens Road/Haywood Mall, which most closely follows the proposed BRT corridor, was applied to the corridors projected 2016 population (10,819). This produced a base future-year ridership of 78,201 as shown in Table 7.

In order to account for the ridership boost that would likely be realized by increasing frequencies, a range of elasticity factors, from .44 to .58, was applied to the base ridership. These factors, published in TCRP Report 118, are industry-accepted values that can be used to predict the relationship between increased frequencies and ridership.

A BRT growth factor of 25%, as recommended in TCRP Report 118, was then applied to capture the ridership benefits that may be realized by implementing a full-featured, exclusive guideway BRT system. By applying this growth factor to the high and low scenarios, the final low projection was 215,000 and the final high projection was 283,000. The mid-point of these estimates is approximately 250,000 annual riders.

	<i>2016 Projection</i>	
	Low	High
<i>Frequency Elasticity</i>	0.44	0.58
<i>Trips per Hour, AM and PM Peak Periods for Current Route 8</i>	1	1
<i>Trips per Hour, AM and PM Peak Periods for Future BRT</i>	6	6
<i>Percent Increase in Peak Period Service Frequency</i>	500%	500%
<i>Base Ridership</i>	78,201	78,201
<i>Adjusted for Increased Frequencies</i>	172,042	226,782
<i>BRT Growth Factor (25%)</i>	215,052	283,478
<i>Riders per Vehicle-Hour</i>	16.3	21.4

Table 7: Project BRT Ridership in Opening Year

Section 5: Transit Oriented Economic Development Analysis

5.1 Introduction

After developing the initial BRT concepts, the HDR team examined the areas around each proposed BRT alternative route to estimate the feasibility and market potential for transit-oriented economic development (TOeD). Developing these areas into a pedestrian-friendly mix of homes, businesses and recreational areas will increase the convenience and effectiveness of the line, allowing residents, workers and visitors to access more destinations without a car and reduce their transportation costs.



As part of the HDR project team, the Center for Neighborhood Technology (CNT) conducted the feasibility of transit supportive development uses along the corridor, within a ¼ mile radius of the proposed BRT stations.

CNT used the average household transportation costs from its Housing and Affordability Index to assess the “location efficiency” around each proposed station. The proposed station areas around the Greenlink Transit Center have the lowest average transportation costs due to Downtown Greenville’s compact, pedestrian-friendly street network and mix of residential and commercial uses.

Other areas along the proposed BRT route can improve their location efficiency by filling vacant or under utilized properties with mixed-use developments containing residential densities of at least six to eight units per acre and connecting them with “complete streets” conducive to pedestrians and bicycles. The CU-ICAR stop has lower location efficiency, but it also has a high number of jobs, and may be a strong site for future retail development and housing to serve workers looking to reduce their commute.

Areas with higher aggregate income – the number of households multiplied by average household income – generally have higher collective buying power. Denser areas, even ones with a large share of low-income households, can support new TOeD with more in-depth market analysis that evaluates the supply and demand for specific retail goods. The Haywood station area has the highest aggregate income. The Verdae station area, though it has over twice the average income of all other station areas, has the lowest aggregate income since it lacks dense housing. In general, increasing the density of housing will increase the demand for transit-oriented retail.

ESRI's Consumer Spending Potential Index was used to compare Greenville's average spending on products to the average amount spent nationally. The areas around the Verdae Development, CU-ICAR and the Greenville Zoo have the highest amount of potential spending on retail goods. Further market studies could reveal strong workforce demand for daytime amenities such as restaurants, small-format grocery stores, childcare centers, or even housing near places of work, particularly around the CU-ICAR campus.

The national real estate crisis has caused more investors and property developers to focus on compact developments and urban neighborhoods. National investors have warmed to urban infill and transit-supportive developments, and national real estate professionals expect compact housing and mixed-use neighborhoods to drive real estate investment as the economy improves.

Station areas with moderate or high transportation costs can increase the viability of TOeD by reducing the surface area of parking lots; creating on-street parking to reduce road width and slow down traffic; increasing the visibility of pedestrian and bicycle features such as bike lanes and crosswalks; and promoting vacant or under utilized "infill" properties for mixed-use development. Developing pedestrian-friendly, mixed-income housing near retail and employment centers in areas with high location efficiency, high buying power and high spending potential will ensure prosperous, convenient and sustainable development that equitably meets the needs of a diverse population.

5.2 Leveraging Transportation Assets to Foster Livable Communities

TOeDs integrate dense housing with commercial, recreational, and institutional uses, all within walking distance (less than a half-mile) of a transit station, allowing residents and workers to make many daily trips without a car. Compared to conventional car-oriented development, TOeD can substantially reduce traffic congestion, the production of greenhouse gases and other sources of air and water pollution. Implementing "location efficient" patterns of development can also reduce transportation costs for companies and households, while placing jobs in communities where they are needed, restoring prosperity to established neighborhoods, and creating a sustainable pattern of land use. Location efficient places have compact, pedestrian-friendly street networks and a mix of residential and commercial land uses, giving households the opportunity to reduce their transportation costs by eliminating car trips.

5.3 TOeD Optimizer™ Analysis

CNT created a customizable tool, the Optimizer, which uses geographic information systems (GIS) to compare multiple characteristics in existing or potential TOeD areas. The tool has been applied in a variety of transportation planning projects across the United States. The Optimizer compares existing conditions in multiple geographic areas and ranks each according to its location efficiency and market potential. Investors and public agencies may use CNT's findings to identify and prioritize sites for TOeD and to consider policies for maximizing TOeD benefits in a region. The following metrics were studied around proposed stops to assess their feasibility and potential to catalyze economic development.

1. **Density:** households per acre, as reported by the US Census
2. **Location Efficiency:** based on average household transportation costs calculated in CNT's Housing + Transportation Affordability (H+T) Index
3. **Buying Power:** calculated by multiplying the number of households by average household income, as reported by Claritas
4. **Retail Spending:** a comparison of Greenville's average retail spending with that of the nation, as reported by ESRI
5. **Demographic Market Segments:** a breakdown of each transit stations area's residents and their typical consumer behavior based on national trends, as reported by ESRI
6. **Job Access:** a breakdown of each station area's existing employment sectors, as reported by the US Census

Location Efficiency

People who live in location efficient neighborhoods tend to have lower transportation costs. Such areas are dense, mixed-use, and provide convenient walking, biking and transit access to jobs, stores, public services and other amenities. People who live in location inefficient places that require automobiles for most trips are more likely to have high transportation costs. CNT's Housing and Transportation (H+T[®]) Affordability Index shows that transportation costs vary between and within regions depending on a number of neighborhood and household characteristics.

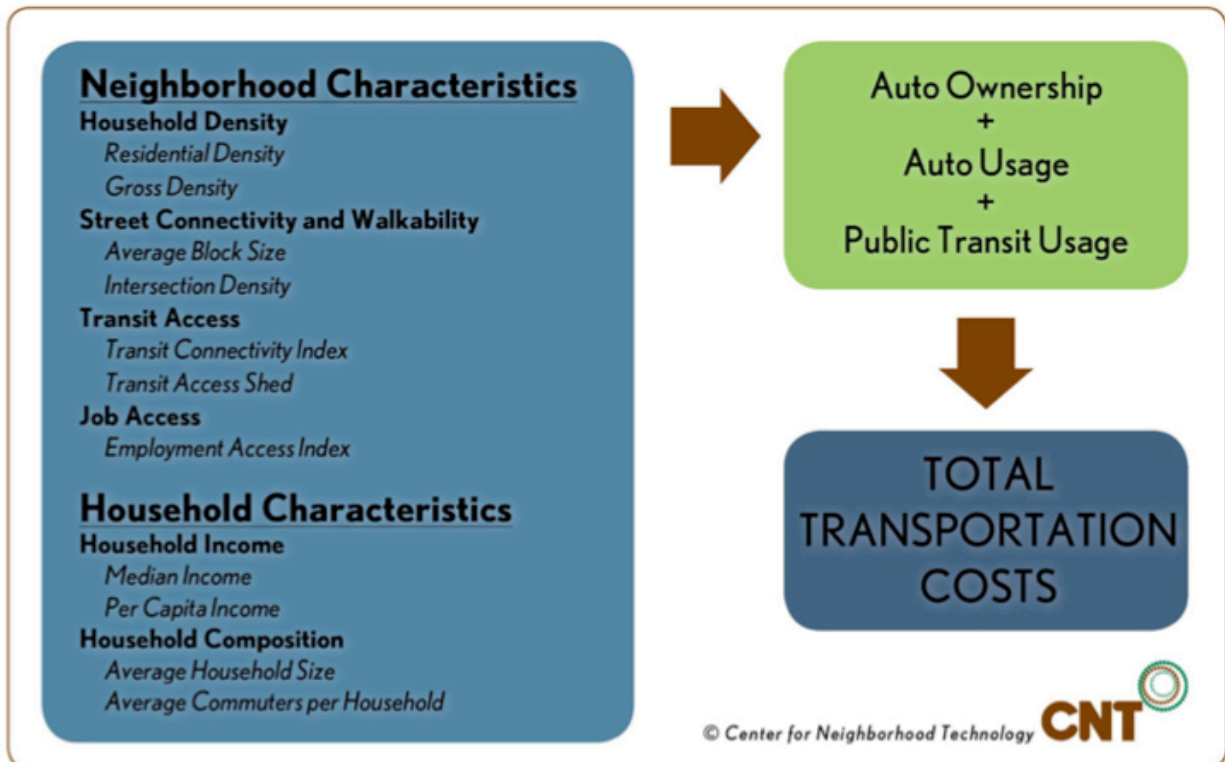


Figure 5: Housing & Affordability Index

The methods for CNT’s cost model are drawn from peer reviewed research findings on the factors that drive household transportation costs. This research has shown that transportation costs per household represent a composite of all the factors that describe location efficient conditions for an area. In other words, to the extent that an area has low transportation costs, it is likely to possess all the characteristics of high location efficiency and vice versa. Detailed methodology can be found at: htaindex.cnt.org/downloads/HTMMethods.2011.pdf

In most communities in America, the built areas around transit stations often include greater density than the surrounding community, a mix of housing and commercial development, and walkable streets. However, developments in station areas take many forms, ranging from dense, mixed-use structures in the heart of a town’s central business district to sprawling residential neighborhoods with few amenities.

Increasing the density of housing within walking distance of Greenville’s proposed BRT route is essential to its success. Promoting “infill” development on vacant or under utilized properties around proposed stations can increase the demand for transit and catalyze further TOeD. The following maps illustrate two characteristics that are highly correlated with location efficiency – density and walkability.

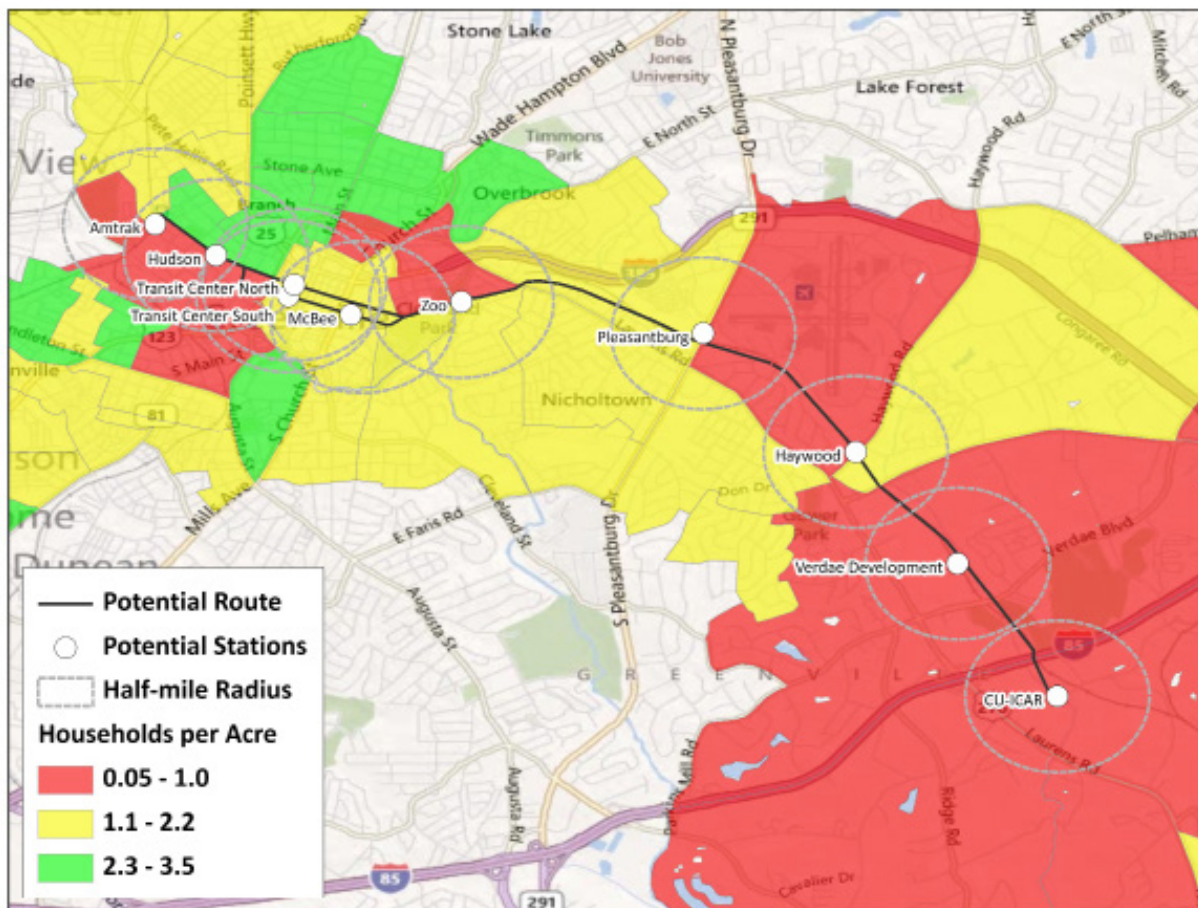


Figure 6: Residential Density along Proposed BRT Route

Residential densities are a major factor in generating transit demand and successful TOeD. Recently built multifamily residences located downtown may not be accounted for in these estimates, and planned housing developments such as those near Verdae Boulevard can significantly raise the line's viability and catalyze further TOeD.

Average street block size is a strong proxy for walkability, and one of several indicators used to calculate the overall location efficiency of areas. More location efficient areas generally have a compact, grid-like street network, which is more conducive to walking, biking and transit use.

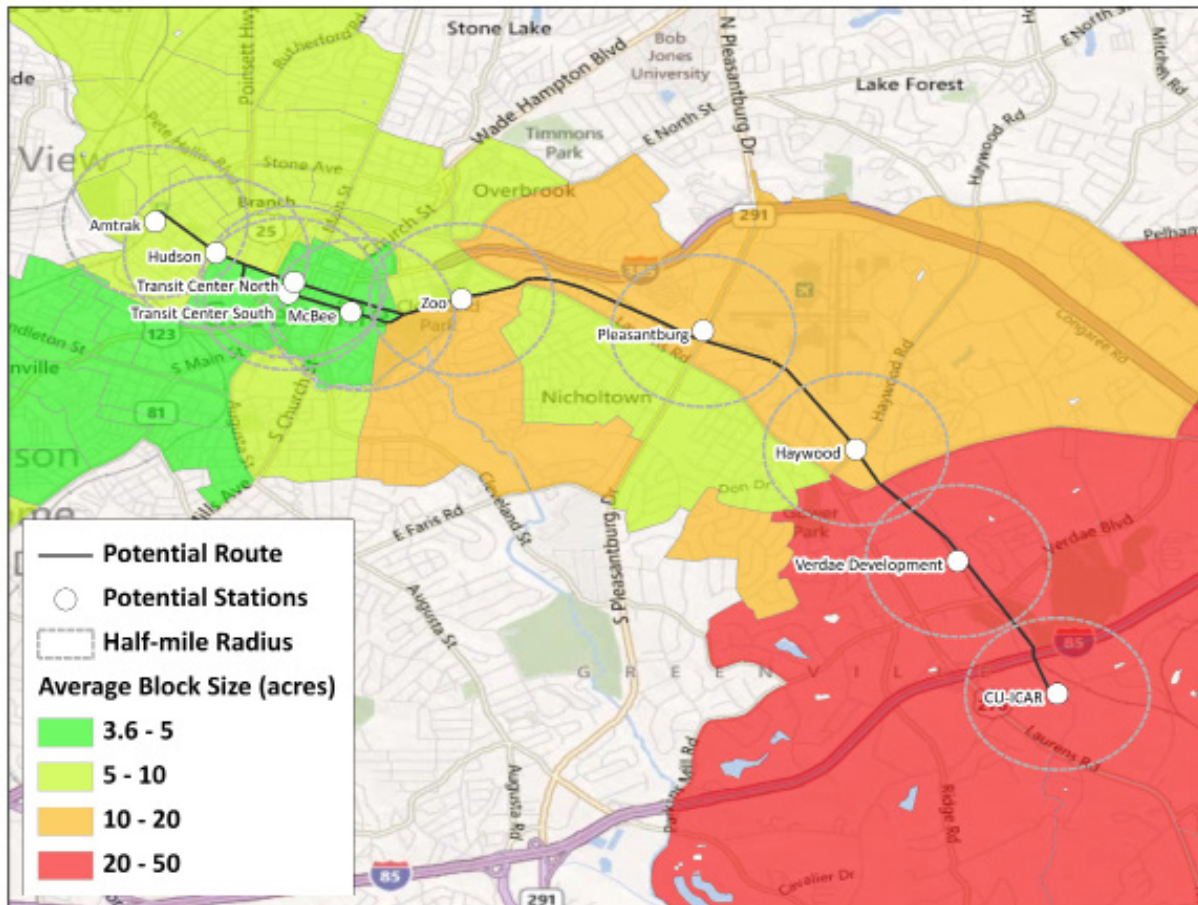


Figure 7: Walkability Along Proposed BRT Route

Density, walkability and several other factors were compiled in the H+T Index to compute average transportation costs for the areas surrounding each proposed BRT station. Station areas with lower transportation costs have higher location efficiency, and are more likely to generate high ridership and support TOeD in the near future. The areas around the Amtrak, Hudson, Transit Center and McBee have the highest location efficiency. Though the area around the Verdae Development stop is currently less location efficient, implementation of higher-density planned developments will likely shift these transportation cost estimates dramatically. The CU-ICAR area exhibits the lowest location efficiency, but it is also a rapidly growing employment hub, and therefore may provide a strong foundation for new commercial development as new employees seek opportunities to dine, shop, or even live closer to their place of work.

Average household transportation costs are calculated by combining several related neighborhood and household characteristics, including density, walkability, transit access, job access and typical household automobile use. Areas with lower transportation costs are generally more location efficient and convenient for pedestrians and bicycles, and should be prioritized for transit service.

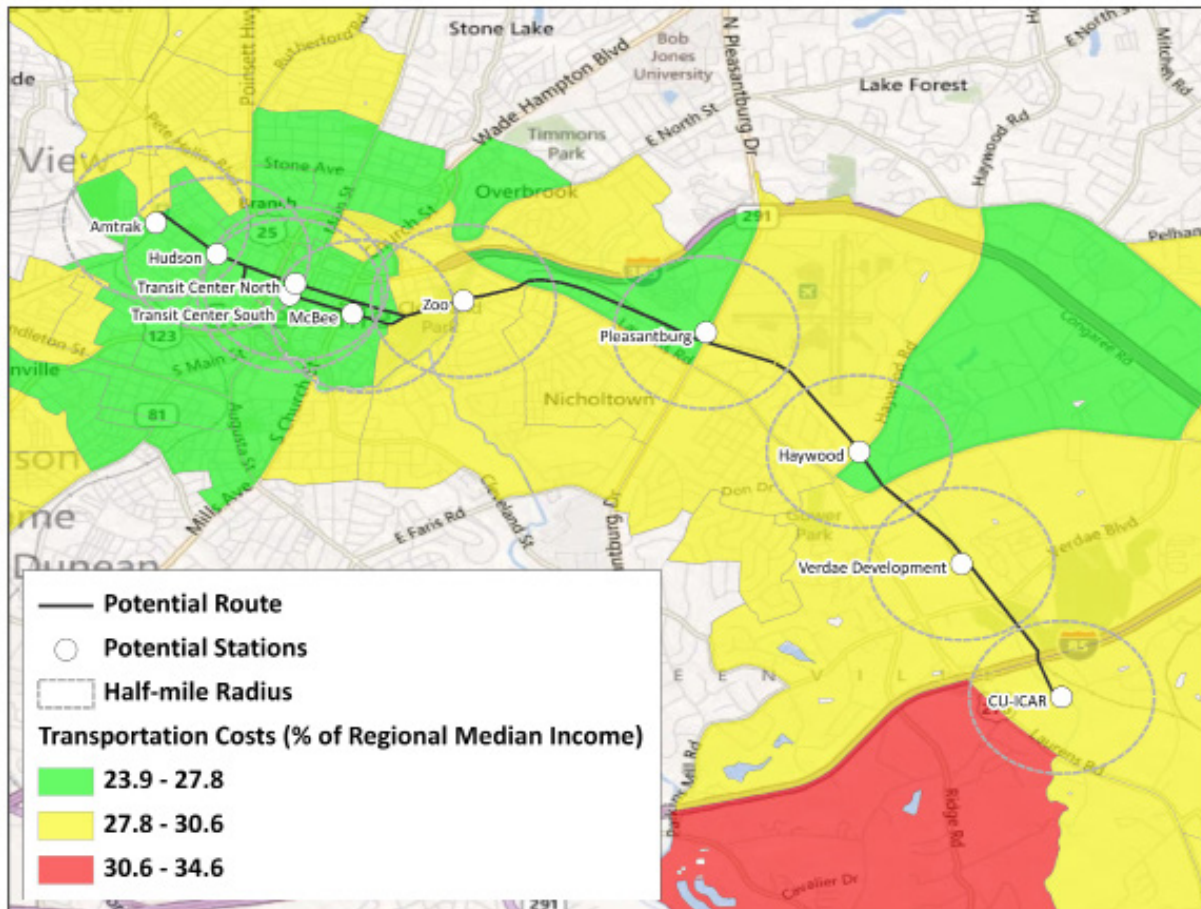


Figure 8: Location Efficiency Along Proposed BRT Route

The proposed station areas around the Greenlink Transit Center have the lowest average transportation costs due to the compact and walkable development in Greenville’s downtown. The CU-ICAR stop has lower location efficiency, but it also has a high number of jobs, and may be a strong site for future retail development and housing to serve workers looking to reduce their commute. Station areas with lower transportation costs and higher location efficiency will most likely generate the highest amount of riders in the near term since they have already established a dense, urban fabric conducive to walking. However, station areas with lower location efficiency can develop more “complete streets” that cater to pedestrians and cyclists, and prioritize compact development of retail, offices and housing on vacant or under utilized infill properties.

5.4 Buying Power

Areas with higher aggregate income – the number of households multiplied by average household income – have higher collective buying power. Combined with a number of other market factors, high aggregate income can be a significant attractor of developers, businesses, and ultimately, paying customers and residents. Dense neighborhoods, even predominantly low-income ones, can generate successful commercial developments by capitalizing on amenities such as transit access and walkable streets, and recruiting retailers for which demand can be quantified.

Areas with both high location efficiency and high buying power relative to the rest of the region warrant more fine-grained market analysis. Their pedestrian scale, density, and transit access make them strong potential areas for TOeD investment. Increasing the density of housing will increase the demand for walkable retail. Through effective public and private investments, areas can improve their location efficiency while increasing aggregate income, allowing for transportation savings, increased access to amenities and jobs, and more sustainable and healthy communities.

<i>½-mile Station Area</i>	<i>Households</i>	<i>Average Household Income</i>	<i>Aggregate Income</i>
<i>Amtrak</i>	631	\$23,599	\$14,891,001
<i>Hudson</i>	640	\$25,077	\$16,049,006
<i>Transit Center South</i>	753	\$29,342	\$22,094,207
<i>Transit Center North</i>	682	\$30,257	\$20,635,197
<i>McBee</i>	730	\$39,347	\$28,723,438
<i>Zoo</i>	618	\$42,794	\$26,446,442
<i>Pleasantburg</i>	398	\$36,468	\$14,514,427
<i>Haywood</i>	622	\$54,677	\$34,008,987
<i>Verdae Development</i>	73	\$111,364	\$8,129,563
<i>CU-ICAR</i>	NA	NA	NA
<i>Corridor Total</i>	5,147	\$43,658	\$185,492,267

Table 8: Buying Power Around BRT Station Areas

Less densely populated station areas can have low buying power despite their relatively high average household income levels. Denser areas, even lower-income ones, can support new TOeD with more in-depth market analysis. The Haywood station area's high relative density and income give it the highest aggregate income, which could be a significant magnet for developers and retailers. The Verdae station area, though it has over twice the average income of all other station areas, has the lowest aggregate income since it lacks dense housing development. Workers at employment centers are not accounted for in these estimations of buying power.

The buying power of workers should be considered in areas with established or emerging employment centers, such as CU-ICAR. Increasing amenities such as restaurants, child care, public spaces and small-format grocery stores accessible by walking or a short car trip could greatly decrease vehicle miles travelled for employees, as would mixed-income housing that meets the needs of white collar and blue collar workers. As incremental improvements are made to improve the location efficiency of areas, they may become strong candidates for expanded transit service and more intensive TOeD.

5.5 Consumer Spending Potential Index

ESRI's Consumer Spending Index allows retailers and developers to compare the average level of consumer spending in Greenville with that of the nation. The information is derived from 2006-2007 Consumer Expenditure Surveys conducted by the US Bureau of Labor Statistics.

Methodology for the Spending Potential Index can be found by visiting the following web address: esri.com/library/whitepapers/pdfs/consumer-expenditure-methodology-2011.pdf

ESRI's Consumer Spending Potential Index compares Greenville's average spending on products to the average amount spent nationally. A score of 100 average means that spending by local consumers is equal to the national average.

The area around the Verdae Development stop has the highest potential spending levels, which is to be expected considering the income levels are highest there. The areas around the proposed Haywood, Zoo and McBee stations also have high potential spending relative to the rest of the proposed station areas. Utilizing this information in conjunction with the following market segmentation analysis and property-specific market research will enable potential developments to be prioritized according to their ability to meet the needs of residents.

5.6 Demographic Market Segments

The City of Greenville can observe demographic trends to better understand demand for new businesses or housing. The corresponding map and table are derived from ESRI, a geostatistical service provider, which uses 2010 Census data and annual demographic updates to classify areas into 65 population segments characteristic of neighborhoods throughout the country. The market segments listed in each station area can help businesses, developers and planners gauge real or perceived demand for goods and services.

The City of Greenville may use this data to understand residents' typical needs, and as a marketing tool to entice residential or commercial development that existing or prospective residents might find desirable. Detailed descriptions of each market segment and their corresponding consumer preferences are available by visiting the following address: esri.com/library/brochures/pdfs/tapestry-segmentation.pdf

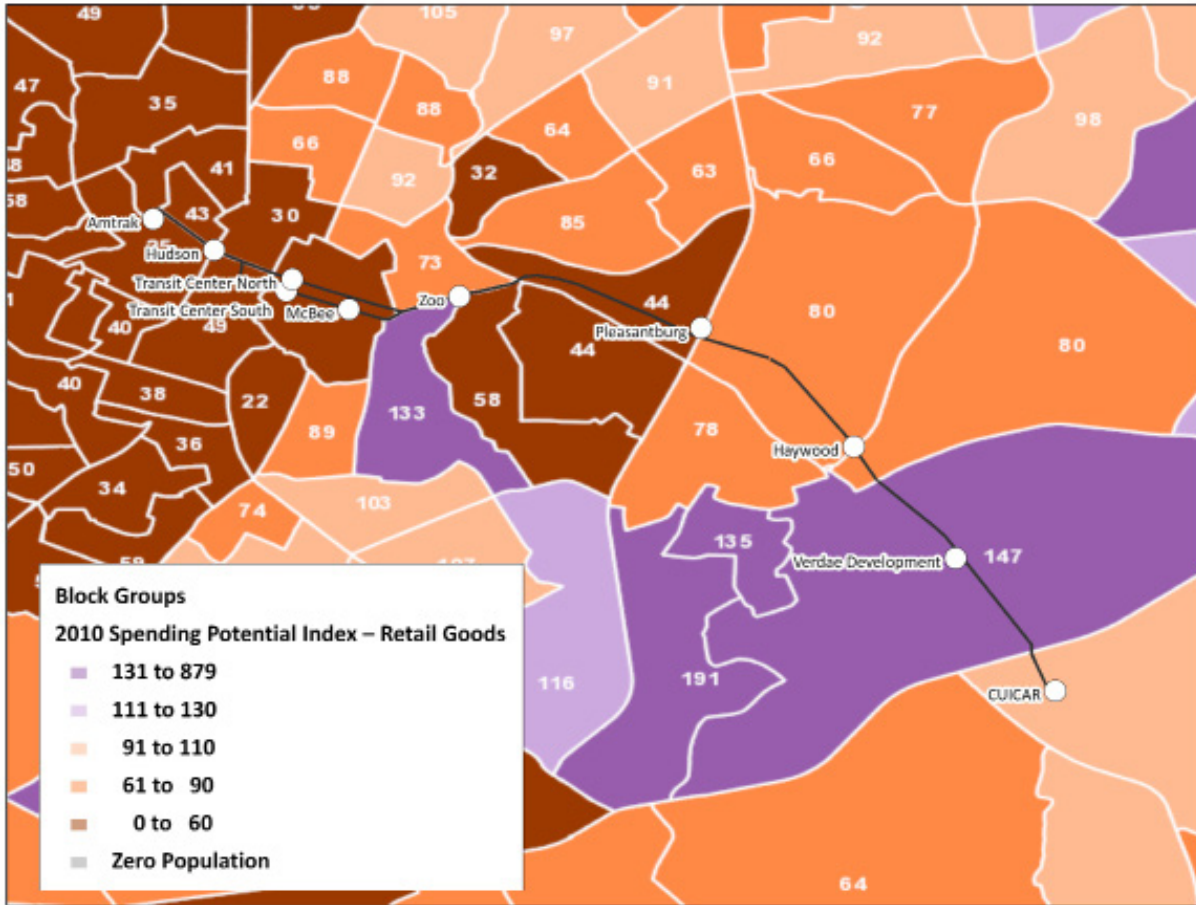


Figure 9: Consumer Spending Potential Along Proposed Route

<i>Potential ½-Mile Station Area</i>	<i>ESRI Market Segments</i>
<i>Amtrak</i>	Modest Income Homes; Home Town; Social Security Set
<i>CU-ICAR</i>	In Style; Inner City Tenants
<i>Haywood</i>	Young and Restless; In Style; Rustbelt Retirees
<i>Hudson</i>	Modest Income Homes; Social Security Set
<i>McBee</i>	Social Security Set; Great Expectations; Old and Newcomers
<i>Verdae Development</i>	In Style
<i>Pleasantburg</i>	Young and Restless; City Commons; Modest Income Homes; Rustbelt Retirees
<i>Transit Center North</i>	Social Security Set; Modest Income Homes; Great Expectations
<i>Transit Center South</i>	Social Security Set; Modest Income Homes; Great Expectations
<i>Zoo</i>	Modest Income Homes; Great Expectations; Old and Newcomers

Table 9: Market Segments Along BRT Route



Figure 10: Demographic Market Segments Along BRT Route

These market segments were created by ESRI to categorize typical consumer behavior. Monitoring trends in neighborhood demographics and buying patterns will allow the City of Greenville and prospective businesses to anticipate and fulfill the changing needs of residents and workers. Promoting properties near the proposed transit line and enticing appropriate businesses to tailor their developments to conform with TOED will enable more customers to access goods and services without an automobile.

5.7 Job Access

The number of jobs within a half-mile of each station area were added together to form a “transit shed”, and aggregated in such as way that jobs were not double-counted in overlapping station areas.. The CU-ICAR campus provides a major opportunity to connect more people to jobs via more sustainable transportation modes.

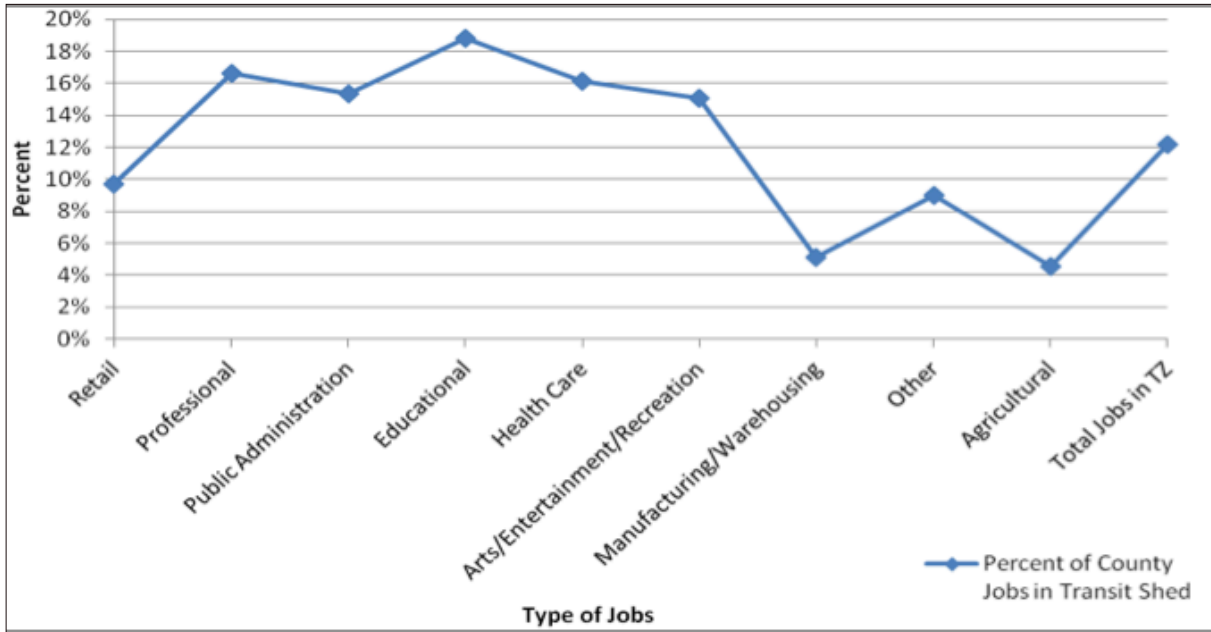


Figure 11: Percent of Jobs in Transit Shed



Figure 12: Concentration of Jobs Along BRT Route

As of 2009, there were 232,862 total jobs in Greenville County. 12% of these jobs are located within the transit shed. There is a significant mix of jobs, 19% of which are in education. The highest concentrations of jobs are located in the Transit Center and McBee station areas. Other strong job markets include Retail, Professional, Public Administration, Health Care, and Arts, Entertainment & Recreation. There is immense potential around the CU-ICAR station area, which as of 2011, has generated nearly \$250 million in investments and over 700 jobs. Hundreds more jobs are expected to be created as development, has announced more than 2,300 new high-wage jobs, and has constructed over 760,000 square feet on site, with another 75,000 square feet in process.

Potential stations located in and around downtown have the highest concentrations of jobs, according to 2009 Local Employment Dynamics estimates, and they also have the highest mix of land uses.

Stops outside of downtown have fewer jobs, but could be further developed with mixed-use development that incorporates which is expected to occur most immediately around the Verdae Development stop. Vacant shopping centers and large under utilized surface parking lots may also provide sites for long-term development opportunities along the proposed transit corridor.

<i>1/2 Mile Station Area</i>	<i>Average Vehicles per Household</i>	<i>% Journey to Work by Automobile</i>	<i>% Journey to Work Drove Alone</i>	<i>% Journey to Work by Transit</i>
<i>Amtrak</i>	0.8	79%	58%	3%
<i>Hudson</i>	1.0	83%	70%	1%
<i>Transit Center North</i>	1.1	85%	79%	0%
<i>Transit Center South</i>	1.0	83%	78%	0%
<i>McBee</i>	1.2	84%	82%	0%
<i>Zoo</i>	1.2	84%	80%	1%
<i>Pleasantburg</i>	1.2	93%	88%	1%
<i>Haywood</i>	0.9	98%	93%	1%
<i>Verdae Development</i>	1.9	99%	97%	0%
<i>CU-ICAR</i>	1.8	97%	89%	0%
<i>BRT Transit Shed</i>	1.1	89%	81%	1%

Table 10: Journey to Work

According to Census American Community Survey 2005-2009 block group averages, the greatest employment centers are currently found downtown, though CU-ICAR can be expected to substantially increase its share of jobs in the next few years.

There are lower auto ownership rates on the north end of the proposed BRT route, likely due to a combination of lower incomes households, as well as higher earners capitalizing on Greenville’s robust mix of retail and recreational uses. Auto ownership rates reach as high as 1.9 autos per household at the Verdae Development station area. Transit use is the highest at the Amtrak station – but only reaches 3% of total workers.



Figure 13: Employment Centers Along BRT Route

Driving is the primary mode of travel to work – and most of these worker trips are made alone. The households with the highest auto dependency are located outside of downtown, reaching as high as 99% around the Verdae Development stop. Employees’ auto dependency can be mitigated if planned infill development occurs with optimal pedestrian and bicycle connections, and transit service is actively promoted to businesses through pre-tax transit benefits or other transit incentives available to employees.

5.8 Capitalizing on the Growing Transit-Friendly Housing Market

Determining the market potential for new housing in infill locations will help Greenville raise the aggregate buying power of its residents, improve the market for commercial investment, and increase the demand for expanded transit service. Further analysis of specific vacant or under utilized properties and neighborhood characteristics will enable towns to prioritize housing and other types of development that best fit the needs of residents and consumers.

Areas with low and moderate transportation costs can be prioritized for housing development in order to save Greenville area residents’ money while reducing congestion. But prioritization of properties requires due diligence to prove the potential value of homes. Further analysis of comparable selling prices, assessed values, vacancy rates, school quality and crime in these areas will enable a more robust characterization of the market’s barriers and opportunities, and ensure optimal public and private investment decisions.

Land values can be expected to increase as transit and amenities are developed or made more accessible, and it is essential that residents of varying incomes reap the benefits. Gentrification (the pricing out of lower-income residents as property values increase) can be prevented by forming a land bank or land trust – a non-profit or government entity created to hold, maintain and improve vacant properties. Such an entity can attach covenants to the transfer of land that limit harmful speculation and “flipping” that does not improve the overall value of communities. The Center for Community Progress’ Land Banks and Land Banking provides a well-researched synthesis of best practices across the nation.

Mixed-use, quality rental housing and convenient, walkable neighborhoods are in demand, according to national studies referenced in subsequent sections of this report. Generation Y and baby boomers will likely reinforce this rental market upswing, and this may in turn drive up the demand for retail nearby. It is ultimately up to each town’s residents, employees and local business owners to democratically decide how their community is shaped. Housing must be sufficiently dense – around six units per acre or more – to effectively support TOeD, but the spectrum of TOeD is quite broad. One community may choose to develop one- to two-story homes that cater to families looking for a quiet yet convenient “suburban-urban” environment, while another might prefer to attract larger scale TOeD that creates a more vibrant, 24-hour “live-work-play” town center.

The national real estate crisis has caused more investors and property developers to focus on compact developments and urban neighborhoods. As the national credit bubble burst in 2007 and 2008, single-family home development crashed across the nation. According to the Joint Center for Housing Studies at Harvard University, sales of new single-family homes dropped by three-fifths between 2005 and 2008, while new single-family housing starts fell by slightly more. By contrast, multifamily starts fell far less over these years.

The Urban Land Institute (ULI) and PriceWaterhouseCoopers (PWC) report Emerging Trends in Real Estate 2012 found that developers and investors expect households to increasingly turn to rental housing as long as the single-family market remains soft. Investors see multifamily properties strongly positioned in the economic turnaround. Of these, apartment buildings within walking distance of transit are considered to offer the best return.

National investors see these urban infill and transit-supportive developments as strong bets to hold and increase their value. Infill housing is projected to attract young people striking out on their own and to retiring parents hoping to downsize from their family home. Investors also see older suburbs linked to downtowns through mass transportation as appealing opportunities. Regions that create the environments for these products will be best positioned to attract national capital.

National real estate professionals expect compact housing and mixed-use neighborhoods to drive real estate investment as the economy improves, according to a report by the ULI and PWC. The transformation of the housing market will be driven by the preferences of the aging Baby Boomer generation and the Echo Boomers who are replacing them as workers and homeowners. Many Boomers have delayed their retirement due to the bad economy, but when they leave the workforce,

they will transform the housing market. Surveys suggest that as fuel prices rises, a significant portion of aging households will want to relocate to walkable, transit-served communities, with affordable access to stores, entertainment, community centers, healthcare facilities, parks, trails, academic institutions, and other public services. As Boomers retire over the next two decades, analysts expect to see more sellers looking for small homes than buyers looking for large ones.

Meanwhile, younger households show a dwindling desire to purchase their parents' homes. With low paychecks and few entry level jobs, this generation is renting longer and delaying home ownership. Because younger households are expected to marry later and have fewer children, many will eventually look to buy a different kind of home than their parents did. National surveys sponsored by ULI suggest that Echo Boomers strongly favor urban, higher density neighborhoods to lower density ones. This highly mobile generation will shop between cities and regions that offer diverse, distinctive, and active neighborhoods before choosing where to work. Communities that offer these amenities will position themselves to attract and retain this new generation of workers.

<i>Product</i>	<i>Recent Trends (2005-2008)</i>	<i>Investor Outlook</i>
<i>Single Family Homes</i>	<ul style="list-style-type: none"> • New sales down 62.2% • New starts down 63.7% 	<ul style="list-style-type: none"> • New developments struggling with foreclosures “may have no staying power” • Prolonged 20 year “sell off” as boomers age & relocate
<i>Multifamily</i>	<ul style="list-style-type: none"> • New sales down 19.6% • Positioned for “strong rebound’ during recovery 	<ul style="list-style-type: none"> • Rental near transit is “almost can’t miss” • “Locations near transit corridors are prime”
<i>Condo & Townhomes</i>	<ul style="list-style-type: none"> • Sales down 37.2% • Owner vacancy rates “rising dramatically’ in small buildings 	<ul style="list-style-type: none"> • Demand from aging boomers will pick up as recession eases • However, “overbuilt” markets will remain weak for foreseeable future

Table 11: Trends and Investor Outlook for Housing Products

<i>Segment</i>	<i>Outlook</i>
<i>Shrinking Household Size</i>	<ul style="list-style-type: none"> • Childless and single person households fastest growing • 88% of household growth 2005-2030 will be childless
<i>Baby Boomers (1946-1964)</i>	<ul style="list-style-type: none"> • Seniors to working age ratio means more sellers than buyers • 71% of working older households want to live by transit • 75% of retiring boomers want to live in mixed-use areas • Negative home equity and good health may slow trend
<i>Echo Boomers (1982-1999)</i>	<ul style="list-style-type: none"> • 77% want to live in urban core • 1/3 will pay more to walk to shops, work, & entertainment • 50%+ will trade lot size for proximity to shop/work • Income constraints will drive demand for rental • Regions must invest in place to retain them
<i>Immigrants</i>	<ul style="list-style-type: none"> • Preference for closely connected suburbs, not “cul de sacs”

Table 12: Outlook By Demographic Segment

5.9 Adapting Assets to Create TOeD Opportunities

Prioritizing near-term development in more highly location efficient areas for which there is market demand while adapting less location efficient areas will help create a cohesive, transit-friendly transit corridor. Successful examples of urban and suburban infill development, sometimes called “adaptive reuse” or “sprawl repair”, abound:

- A pedestrian-friendly 3,500 square foot Wal-Mart on the University of Arkansas campus in Fayetteville.
- The ongoing rebirth of a walkable entertainment district by capping an expressway and nudging a grocery store in Columbus, Ohio.
- Chicago’s redevelopment of a defunct rail yard into a mixed-use, mixed-income, transit-friendly destination anchored by a two-story Target.
- Reincarnated shopping malls and parking lots in Winter Park, Florida and Cape Cod, Massachusetts;
- A frenzy of food trucks filling under utilized parking lots and “food deserts” across the nation.

5.10 Overcoming Development Barriers

Several major issues often need to be addressed in planning and implementing infill development. These activities can often be funded through a mix of public and private financing.

- **Land Acquisition:** vacant or under utilized sites might be composed of multiple parcels with numerous private owners and years of unpaid property taxes. Investigating a site’s history, clearing titles and engaging investors early on will set the stage for more effective transit.

- **Brownfield Assessment and Remediation:** sites may have contaminants on or underneath the ground, which requires costly measures to assess the property’s history and existing conditions, and, if required, remediate any harmful substances. It is often too costly for a private owner to carry out these activities on their own, so the US and state Environmental Protection Agencies provide grants and loans to assess privately or publicly held properties.
- **Local Policy:** zoning regulations, parking requirements, building materials standards, tax increment financing districts, and tax abatement programs should be made supportive of TOeD as soon as possible so developers can implement projects with full local government support.
- **Infrastructure Upgrades:** TOeDs require pedestrian-friendly infrastructure, and planning and implementing these improvements should be prioritized around high-priority development areas.

5.11 Conclusion

The ability of the Greenville region to develop in environmentally and economically sustainable ways is largely contingent upon their readiness to capitalize on development opportunities near existing or planned transportation assets. The TOeD Optimizer analysis aids Greenville in identifying those areas that have the greatest potential to yield positive economic and environmental returns. Greenville and its partners can utilize this data to enhance previously completed plans and supplement ongoing and efforts to capitalize on their strengths and improve weaknesses.

While this report can help prioritize station areas for development, there also needs to be an in-depth analysis of individual properties within these areas to attain a better understanding of the market potential for TOeD. Identifying vacant or under utilized parcels within a quarter- or half-mile of each proposed station area is a necessary next step. Analyzing parcels’ zoning, land use, assessed values, ownership and tax history will help determine whether properties are “shovel-ready” and which ones may require further pre-development activities.

Investing in TOeD will increase the stock of location efficient housing and provide greater transportation savings to residents by eliminating unnecessary car trips. Each community has competitive advantages, and coordination between communities and regional partners can allow for more cohesive transit corridor investments that improve the market for TOeD throughout the Greenville region. Prioritizing compact, mixed-use development around properties with high location efficiency and market potential, while improving pedestrian and bicycle connectivity in less location efficient areas, will set the stage for a truly effective BRT line in Greenville.

Section 6: Funding of Preferred Alternative

6.1 Introduction

The development of financial options for GTA requires an understanding of their existing funding sources and the history and future projections of those sources. Once the existing funding sources were identified, an analysis of the total revenue potential was developed. The conclusion is that in order to implement transit options beyond existing services, additional revenue sources will need to be identified.

There are many funding options that are used in other communities but not all options will work in Greenville. Each community approaches its unique situation differently, depending on various factors of which community and political support to the funding mechanism are very critical factors. The key to a successful funding package for specific projects is having the support of the public and the key decision makers in the community. Public acceptance of any package developed for funding will be critical to the success of the proposed BRT/TOeD Project.

For many projects, the most onerous project cost is not the initial capital outlay but the ongoing operating and maintenance (O&M) expenses. The funding for these O&M expenses are sometimes overlooked or not planned for over the long term. There are several sources of funding for the ongoing operating expenses. For transit projects, they include fare revenues, advertising revenues, interest, sales tax, federal funding (5307, JARC, CMAQ, STP), parking revenues and joint development funds.

Key to the successful development of any financial plan is the support of the stakeholders. The HDR team identified several options for funding; the City and GTA should work with their stakeholders to identify and refine those options that are best suited for Greenville.

The financing plan for the 6.73-mile BRT Line includes the following objectives:

- Identify the financial resources required to fund the initial capital outlay and ongoing O&M costs associated with the project.
- Identify the levels of financial commitment to be provided to fund the recommended project.
- Demonstrate to the Federal Transit Administration (FTA) and other potential funding partners the financial capacity to build, operate, and maintain the project while continuing to operate and maintain the existing transit services in Greenville.

The financial analysis has been developed based on the FTA Section 5309 Very Small Starts (VSS) Guidance (July 20, 2007). Unique to the Very Small Starts Guidance is the project evaluation based on the opening day scenario. For the BRT Line, that date is assumed to be 2016 based on programmed funds for construction and operation.

The Federal Transit Administration's VSS program requires the following:

- Enhanced transit stations
- Signal Priority/Pre-emption (for Bus/LRT)
- Low Floor/Level Boarding Vehicles
- Special Branding of Service

- Frequent Service - 10 min peak/15 min off peak
- Service offered at least 14 hours per day
- Existing corridor ridership exceeding 3,000/day
- Less than \$50 million total cost
- Less than \$3 million per mile (excl. vehicles)

The proposed BRT service meets all these criteria with the exception of the corridor ridership. Based on this analysis, the ridership for that corridor is estimated to be less than 1,000 riders/day. A 2014 update of average annual ridership for the Lauren's Road corridor shows an increase to 1,139 riders per day. The addition of three new routes (Route 14 Mauldin/Simpsonville; CUICAR/St. Francis Shuttle; and the Clemson Commuter) has provided more riders with access to the corridor.

This section discusses an overview of federal funding programs, with information regarding how the Moving Ahead for Progress in the 21st Century (MAP-21) legislation will affect evaluation and funding of future New Starts/Small Starts projects. It also discusses how the project will be funded utilizing various sources of funding.

6.2 Overview of Federal Funding Programs

Appendix B describes the various funding sources available to GTA and that the agency has been utilizing in one form or the other for its capital and operating expenses.

- Section 5303 provides funding to support comprehensive planning for making transportation investment decisions in metropolitan areas and statewide. It helps the transit agency to preserve its ability to continually provide transit services in its service area.
- Section 5307 makes federal financial resources available to urbanized areas for both capital and operating purposes.
- Section 5311 is a rural program that is formula based and supports public transportation in rural areas of less than \$50,000 population. It may be used for funding capital, operating and administrative expenses related to meeting public transportation needs for rural communities. This should be investigated for the City of Mauldin and the possibility of linking the city center up with the BRT line.
- Section 5316 is the Job Access and Reverse Program (JARC) which covers funding for capital, operating expenses to implement projects that transport low income individuals to and from employment related activities. However, this funding source is being repealed under the recently enacted MAP-21 legislation and consolidated under Sections 5307 and 5311.

6.3 Existing Operations

GTA operations are funded by contributions from FTA, Greenville County, the City of Greenville, State of South Carolina grants, fare revenues and miscellaneous revenues. Capital costs and revenues are described in detail in Section 6.4 while GTA O&M costs and revenues are discussed in Section 6.5.

Although the proposed project funding includes Federal Transit Administration VSS and local contribution/match/investments, the project does not qualify for VSS at this time largely due to projected ridership which does not meet VSS requirements. However, implementation of near term improvements to the current bus service, as recommended by this study, may result in higher ridership in the future.

Moreover, it is important to consider that the recently enacted Moving Ahead for progress in the 21st Century (MAP-21) legislation may alter the funding landscape for VSS projects and provide other funding opportunities for projects that do not meet the current VSS criteria. MAP-21 was signed into law in July 2012 and goes into effect in October 2012. It has a 2-year authorization through September 30, 2014 and maintains comparable program funding levels for New Starts and Small Starts program. The new law also changes some definitions and eligibility requirements for BRT and Corridor Bus projects. The program defines Small Starts BRT projects that operate in separated right of way dedicated to transit use during peak periods, such as this project, as transit projects that request less than \$75 million in Section 5309 funds and a total capital cost less than \$250 million.

6.4 Project Sponsor and Funding Partners

The BRT Line will be sponsored by the City of Greenville in coordination with the GTA. The Federal Transit Administration (FTA) is also assumed to be a financial participant.

Federal Funding

FTA is responsible for implementation of federal transit policy and administration of federal transit grant programs including the FTA Very Small Starts program (Title 49 United States Code (U.S.C.) Section 5309). TEA-21 and SAFETEA-LU require that proposed Very Small Starts projects be justified based on several project justification criteria, including Local Financial Commitment. SAFETEA-LU will expire on September 30, 2012. MAP-21 which expires in September 2014, also bases project ratings on project justification, land use policies and patterns, and local financial commitment. Consistent with these criteria, this financial plan report reaffirms the financial commitment of state and local agencies to the BRT Line project.

State/Local Funding

State Mass Transit Funds (SMTF) are state funds received from the South Carolina Department of Transportation (SCDOT). These are annual funds and are some of the only grant funds received by GTA that may be used to subsidize the cost of operations. Historically they have been used at a fifty percent formula level to cover a portion of the cost of Fixed Route operations.

Local revenue consists of an annual apportionment given by the City of Greenville as well as Greenville County. This amount has historically varied based on local revenue options. Another source of local revenue is the advertisement on the buses and bus shelters that are not adjacent to a state operated road. GTA is limited to restricting advertisements to shelters that are not adjacent to state operated roads due to a state policy against lobbying. Fare box revenue, though currently not the largest revenue source, is the annual revenue stream that has the most significant variance and can be manipulated to adjust the level of revenue capable of being collected.

Private investment in the project is strongly recommended based on existing partnership between GTA, CU-ICAR, and St.. Francis that provides a shuttle service to the public. Additionally, potential private/public partnerships are on-going primarily with downtown hotel owners and local universities. The proponents of the large-scaled Verdae development and other private developers have expressed interested in partnering with the City and GTA to deliver an efficient transit system for the City of Greenville.

6.5 Capital Plan

The capital plan component of the financial plan focuses on the capital costs to construct the BRT Line and the sources of funding for capital costs.

Proposed Capital Plan

Over the Fiscal Year (FY) 2012 - 2016 period, the capital cost of the BRT Line will total \$21.6 million (year of expenditure dollars, YOE). Capital costs include guideway and track, ten bus rapid transit stations, light maintenance facility, sitework, systems, right-of-way, five BRT vehicles, and professional services. Allocated contingencies are included in costs to address uncertainties in the estimated construction, right of way, and vehicle costs that typically occur as the amount of engineering and design information advances, while unallocated contingencies are typically much broader in nature and often address potential changes in the project scope and schedule. The budget includes \$363,000 for Preliminary Engineering and \$544,500 for Final Design. As noted in Section 1.0, FTA Section 5309 Very Small Starts funding will comprise 50% of total capital costs. This is a conservative but typical approach to federal funding ratio as there are other federal funding programs that allow up to 80% federal share of project funding.

Capital Costs

Table 13 summarizes the project capital cost in constant 2012 dollars. Table 14 summarizes the project capital cost in YOE dollars. The annual cash flow of capital costs in YOE dollars is presented in Table 15, based on the proposed project implementation schedule. Capital costs based on national experience from actual and designed systems and include standard allocated and 10% unallocated contingencies based on the level of engineering.

Tables 14 and 15 show the BRT Line capital costs in YOE dollars. These capital cost estimates for this purpose of this study is conceptual and further refinement of the estimates will done in future project phases such as preliminary engineering. A 3.0% annual rate of inflation for 2012 – 2016 was assumed in the analysis for all cost categories. This conservative rate of inflation is higher than the 1.3% and 2.0% rate of inflation projected by the Congressional Budget Office for the same time period.

Cost Category	Base Year \$ (2012)
10 GUIDEWAY & TRACK ELEMENTS (6.73 miles)	
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	\$840,000
20 STATIONS, STOPS, TERMINALS, INTERMODAL (10)	
20.01 At-grade station, stop, shelter, mall, terminal, platform	\$5,000,000
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	
30.02 Light Maintenance Facility	\$150,000
40 SITEWORK & SPECIAL CONDITIONS	
40.02 Site Utilities, Utility Relocation	\$600,000
50 SYSTEMS	
50.02 Traffic signals and crossing protection	\$485,250
50.05 Communications	\$500,000
50.06 Fare collection system and equipment	\$1,500,000
Construction Subtotal (10-50)	\$9,075,250
60 ROW, LAND, EXISTING IMPROVEMENTS	
60.01 Purchase or lease of real estate	\$750,000
70 VEHICLES (6)	
70.04 Bus	\$4,500,000
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	
80.01 Preliminary Engineering (4%)	\$363,000
80.02 Final Design (6%)	\$544,500
80.03 Project Management for Design and Construction (5%)	\$453,800
80.04 Construction Administration & Management (8%)	\$726,000
80.05 Professional Liability and other Non-Construction Insurance (2%)	\$181,500
80.06 Legal; Permits; Review Fees by other agencies, cities, etc. (3%)	\$272,300
80.07 Surveys, Testing, Investigation, Inspection (3%)	\$272,300
80.08 Start up (3%)	\$272,300
Subtotal (10-80)	\$17,410,950
90 UNALLOCATED CONTINGENCY (10%)	\$1,741,100
*Assumes 3% annual inflation rate	
TOTAL	\$19,152,050

Table 13: Capital Costs in Constant 2012 Dollars

Cost Category	YOE \$ (2016)
10 GUIDEWAY & TRACK ELEMENTS (6.73 miles)	
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	\$945,400
20 STATIONS, STOPS, TERMINALS, INTERMODAL (10)	
20.01 At-grade station, stop, shelter, mall, terminal, platform	\$5,627,500
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	
30.02 Light Maintenance Facility	\$168,800
40 SITEWORK & SPECIAL CONDITIONS	
40.02 Site Utilities, Utility Relocation	\$675,300
50 SYSTEMS	
50.02 Traffic signals and crossing protection	\$546,200
50.05 Communications	\$562,800
50.06 Fare collection system and equipment	\$1,688,300
Construction Subtotal (10-50)	\$10,214,300
60 ROW, LAND, EXISTING IMPROVEMENTS	
60.01 Purchase or lease of real estate	\$844,100
70 VEHICLES (6)	
70.04 Bus	\$5,064,800
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	
80.01 Preliminary Engineering (4%)	\$408,600
80.02 Final Design (6%)	\$612,800
80.03 Project Management for Design and Construction (5%)	\$510,800
80.04 Construction Administration & Management (8%)	\$817,100
80.05 Professional Liability and other Non-Construction Insurance (2%)	\$204,300
80.06 Legal; Permits; Review Fees by other agencies, cities, etc. (3%)	\$306,500
80.07 Surveys, Testing, Investigation, Inspection (3%)	\$306,500
80.08 Start up (3%)	\$306,500
Subtotal (10-80)	\$19,596,300
90 UNALLOCATED CONTINGENCY (10%)	\$1,959,600
*Assumes 3% annual inflation rate	
TOTAL	\$21,555,900

Table 14: Capital Costs in Year of Expenditure Dollars

Year of Expenditure Dollars (millions)	(2016) Dollars	2012	2013	2014	2015	2016
10 Guideway & Track Elements (6.73 miles)	\$0.95	\$0.033	\$0.162	\$0.502	\$0.247	\$0.007
20 Stations, Stops, Terminals, Intermodal (10)	\$5.63	\$ -	\$0.124	\$1.537	\$3.727	\$0.242
30 Support Facilities: Yards, Shops, Admin. Bldgs.	\$0.17	\$ -	\$0.055	\$0.081	\$0.035	\$ -
40 Sitework & Special Conditions	\$0.68	\$0.121	\$0.190	\$0.151	\$0.158	\$0.060
50 Systems	\$2.80	\$0.171	\$0.770	\$0.840	\$0.812	\$0.207
60 Row, Land, Existing Improvements	\$0.84	\$0.554	\$0.160	\$0.126	\$ -	\$ -
70 Vehicles (6)	\$5.06	\$ -	\$0.304	\$1.417	\$1.417	\$1.923
80 Professional Services	\$3.47	\$1.457	\$0.590	\$0.521	\$0.521	\$0.382
90 Unallocated Contingency	\$1.96	\$0.157	\$0.176	\$0.274	\$0.686	\$0.666
100 Finance Charges	\$0.00	\$ -	\$ -	\$ -	\$ -	\$ -
Total Project Cost (10-100)	\$21.56	\$2.494	\$2.530	\$5.448	\$7.602	\$3.487

Table 15: Capital Cost and Schedule in Year of Expenditure Dollars (Cash Flow)

Funding Sources

The second component of the capital plan identifies the proposed sources of funds for constructing the BRT Line and details the non-federal share of funds for the project. Table 16 provides a summary of the federal and non-federal sources of funding proposed for design and construction of the BRT Line in Year of Expenditure (YOE) dollars. FTA Section 5309 Very Small Starts funding will comprise 50% of total capital costs. Local funds will come from the City of Greenville.

Year of Expenditure Dollars (millions)	(2016) Dollars	2012	2013	2014	2015	2016
10 Guideway & Track Elements (6.73 miles)	\$0.95	\$0.033	\$0.162	\$0.502	\$0.247	\$0.007
20 Stations, Stops, Terminals, Intermodal (10)	\$5.63	\$ -	\$0.124	\$1.537	\$3.727	\$0.242
30 Support Facilities: Yards, Shops, Admin. Bldgs.	\$0.17	\$ -	\$0.055	\$0.081	\$0.035	\$ -
40 Sitework & Special Conditions	\$0.68	\$0.121	\$0.190	\$0.151	\$0.158	\$0.060
50 Systems	\$2.80	\$0.171	\$0.770	\$0.840	\$0.812	\$0.207
60 Row, Land, Existing Improvements	\$0.84	\$0.554	\$0.160	\$0.126	\$ -	\$ -
70 Vehicles (6)	\$5.06	\$ -	\$0.304	\$1.417	\$1.417	\$1.923
80 Professional Services	\$3.47	\$1.457	\$0.590	\$0.521	\$0.521	\$0.382
90 Unallocated Contingency	\$1.96	\$0.157	\$0.176	\$0.274	\$0.686	\$0.666
100 Finance Charges	\$0.00	\$ -	\$ -	\$ -	\$ -	\$ -
Total Project Cost (10-100)	\$21.56	\$2.494	\$2.530	\$5.448	\$7.602	\$3.487
FTA Very Small Starts	\$10.78	\$1.247	\$1.265	\$2.724	\$3.801	\$1.743
Non-FTA (Local/State)	\$10.78	\$1.247	\$1.265	\$2.724	\$3.801	\$1.743
Total Funding	\$21.56	\$2.494	\$2.530	\$5.448	\$7.602	\$3.487

Table 16: Sources of Capital Funding in Year of Expenditure Dollars

Capital Cost Estimates

The capital cost estimates were developed using the Federal Transit Administration's (FTA) Standard Cost Categories (SCC). Any project pursuing (or potentially pursuing) federal funding through FTA must organize project costs according to the SCC structure, which contains the following categories. These are defined by unit costs in Table 17 below.

SCC Category 10 – Guideway: includes all transit improvements associated with the roadway including queue jumpers and pedestrian crossings.

SCC Category 20 – Stations/Stops: includes all costs associated with at-grade stations, such as grading, structures, finishes, equipment, mechanical and electrical components, and safety systems.

SCC Category 30 – Support Facilities: Yards, Shops, Administration Buildings – includes construction costs associated with all support facilities, such as bus garages, maintenance facilities, and administration buildings. Cost elements include grading, structures, finishes, equipment, mechanical and electrical components, and safety systems.

SCC Category 40 – Sitework and Special Conditions: includes site civil elements associated with the project, including clearing and demolition, utility relocation, environmental mitigation, sidewalks, landscaping, fencing, public art, paving, and temporary construction facilities.

SCC Category 50 – Systems: includes all systems-related elements, such as traffic signal control, and communications systems.

SCC Category 60 – Right of Way, Land, Existing Improvements: includes the purchase or lease of real estate, relocation of existing households and businesses, and professional services associated with the real estate component of the project.

SCC Category 70 – Vehicles: includes the costs for limited stop bus and BRT vehicles.

SCC Category 80 – Professional Services: includes all professional, technical and management services related to the design and construction of fixed infrastructure during the preliminary engineering, final design, and construction phases of the project.

SCC Category 90 – Unallocated Contingency: includes a standard unallocated contingency to account for undefined project items in early stages of project planning and design. This contingency is in addition to specific allocated contingencies for individual line items.

The development of this initial cost estimate is based on general unit costs adopted from cost data from other similar BRT projects. The unit costs used for this study are shown in Table 17 below, organized by SCC classification:

Cost Category	Unit	Driver	Cost/Unit	Notes
10 GUIDEWAY & TRACK ELEMENTS (route miles)				
10.02 Guideway: At-grade semi-exclusive (allows cross-tra	4.2 route mile:	\$200,000	Paving and striping exclusive busway	
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)				
20.01 At-grade station, stop, shelter, mall, terminal, platfo	10 stations	\$500,000	Enhanced shelters with passenger amenities	
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS				
30.02 Light Maintenance Facility	6 vehicles	\$30,000	Minor modification and/or expansion of GTA maintenance facility	
40 SITEWORK & SPECIAL CONDITIONS				
40.02 Site Utilities, Utility Relocation	10 stations	\$60,000	Utility relocations at stations	
50 SYSTEMS				
50.02 Traffic signals and crossing protection	6.73 route mile:	\$75,000	Transit signal priority and crossings components	
50.05 Communications	10 stations	\$50,000	Station real-time messaging, public announcements and CCTV	
50.06 Fare collection system and equipment	10 stations	\$150,000	TVMs on station platforms and communication infrastructure	
60 ROW, LAND, EXISTING IMPROVEMENTS				
60.01 Purchase or lease of real estate	10 stations	\$75,000	Minor ROW acquisition or easements for stations	
70 VEHICLES (number)				
70.04 Bus	6 vehicles	\$750,000	40' Stylized BRT Vehicle	

Table 17: Greenville BRT Unit Costs (2012 dollars)

Conceptual cost estimates for the Greenville BRT project are summarized in Table 13 above. The estimate includes costs associated with transit facilities, traffic signal upgrades, the maintenance facility, and vehicle procurement. These capital cost estimates for this purpose of this study is conceptual and further refinement of the estimates will done in future project phases such as preliminary engineering. The project meets the FTA VSS criteria for project cost with less then \$50 million in total cost and \$3 million per mile (excluding vehicles). However, it does not meet the VSS criteria for ridership levels. Additionally, the operating costs for the BRT exceed 5% of the agency’s overall operating and maintenance costs.

6.6 Operations and Maintenance (O&M)

This section details the projected operating revenues and expenses for the opening year of the BRT Line. In accordance with FTA guidelines for VSS projects, this section also calculates the percentage of the operations for the BRT Line compared to the operating and maintenance costs of the existing GTA system. The existing GTA services are funded by Greenville County and the City of Greenville as well as other sources. Fare revenues are collected by GTA and used to offset the overall costs of the system.

Operating Revenues

The revenue sources to be used for the BRT Line include the South Carolina state funds, the County and City of Greenville funds and fare box revenues.

State/Local Funding

State Mass Transit Funds (SMTF) are state funds received from the South Carolina Department of Transportation (SCDOT). FTA apportions transit funding to the state for non-urbanized area (rural) transportation, Elderly Individuals and Individuals with Disabilities Program, Job Access and Reverse Commute, New Freedom, and funding for statewide planning and training assistance.

Each large urbanized and small urbanized area within the State is also apportioned formula funds for transit through FTA; and those areas apply directly to FTA for funding. These are annual funds and are some of the only grant funds received by GTA that may be used to subsidize the cost of operations. Typically, the SMTF grants range anywhere between \$290,000 and \$300,000. Historically they have been used at a fifty percent formula level to cover a portion of the cost of Fixed Route operations.

Local revenue consists of an annual apportionment given by the City of Greenville as well as Greenville County. This amount has historically varied based on annual funding needs and City and County revenue projections. Currently, GTA receives \$355,000 from each entity, for a total of \$710,000.

Another source of local revenue is advertising on buses and bus shelters that are not adjacent to a state operated road. GTA is limited to restricting advertisements to shelters that are not adjacent to state operated roads due to a state policy against lobbying. This revenue stream has not been a significant one, contributing a total of approximately \$60,000 annually.

Fare Revenue

Fare box revenue, though currently not the largest revenue source, is the annual revenue stream that has the most significant variance and can be manipulated to adjust the level of revenue capable of being collected. The average amount of annual revenue from this funding source for the GTA system is approximately \$850,000. The estimated fare box revenues for the BRT Line are approximately \$85,000 based on a fare box recovery ratio of 22.5%. The estimated fare box revenues are derived by multiplying the estimated annual ridership for the project (250,000) by the current regular base fare of \$1.50. Then using the fare box recovery ratio, the estimated fare box revenues can be derived.

Potential Future Revenue

GTA is currently exploring additional revenue streams to help fund the operational costs of the BRT Line. Potential revenue could be derived from additional City and county tax funds, parking revenue, car rental tax, hospitality tax, or tax revenues from local major events.

The City of Greenville collects a 2% hospitality tax on prepared meals and beverages in the City, which went into effect July 1, 2001. The proceeds are to be used for tourist-related activities, improvements, and facilities. The City of Greenville budgeted approximately \$6.6 million in tax revenue in 2011-2012. Assuming that the 2011-2012 hospitality tax revenue was held constant and the hospitality tax was increased by 0.5%, the City would generate approximately \$1.7 million additional revenue annually. If the City approved the additional revenue to be used for transit services related to tourism, the additional revenue could offset operating and maintenance costs or could provide GTA bonding capacity to finance the BRT project. Project financing would allow the project to be constructed faster without a substantial up front capital outlay from the City.

The purchase of service agreements that are derived from private/public partnerships is one of the newer revenue streams contributing to the GTA fiscal budget. The partnership between GTA, CU-ICAR, and St. Francis contributes \$50,000 to the agency and has become an exemplary method for

selling transit to the public as well as an added source of revenue. Additionally, potential private/public partnerships are on-going, primarily with downtown hotel owners and local universities. Through the promotion of the Commuter Benefit program, a federal tax incentive offered to corporations, the marketability of public transit continues to become a viable means of supplemental funding for future years. Identifying other areas of need within the private sector and offering businesses the opportunity to partner with GTA provides financial stability of various funding sources to operate new service.

GTA Costs

GTA costs for the opening year of the BRT Line are projected to be approximately \$5 million. This includes the operating costs of the transit services currently being provided by GTA in the region. The inflation factor used in the total GTA operating cost projections is 3%.

BRT Line O&M Costs

The O&M costs for the opening year of the BRT Line are expected to be approximately \$1.5 million. These costs were estimated in accordance with FTA planning guidelines and based on best industry practices. These costs include operators, management, administration, vehicle and facilities maintenance, fuel, energy and other expenses. The 2016 BRT Line O&M costs are inflated 3 percent annually from the 2012 operating costs and estimated to be approximately 28% of the overall costs of GTA in opening year. The calculation of these costs is included in Appendix A.

6.7 Summary of the Financial Plan

Table 18 summarizes the sources and uses of funds proposed for the BRT Line. The table includes the total capital costs and revenues for the project. Also included are the total operations and maintenance costs and revenues for the start up year for the rail extension.

Uses of Funds

As shown in Table 18, the total capital cost of the BRT Line is estimated to be about \$21.56 million. The first year operations for the BRT Line are expected to be about \$1.5 million.

Sources of Funds

The approximate total of \$23 million in projected revenues (\$21.56 million is for capital and \$1.4 for O&M) required to fund the BRT Line is expected to come from federal, state, local and other sources. The revenues used for capital are typically 50% from local sources and 50% from federal sources. State/Local sources include the City of Greenville, SCDOT and other private sources of funding needed to demonstrate local financial commitment to the project. Federal sources may include FTA Section 5309 Very Small Starts funds or other programs like TIGER or Urban Circulator, Bus and Bus Facilities Formula Grants, TOD Planning Pilot Grants under the new MAP-21 legislation. A combination of the City and County funds along with state funding would provide the O&M revenues. To implement the BRT program by 2016, the City of Greenville would need to have a referendum in 2014 to raise the millage to fund the local share of the capital outlay and the additional operating costs for the BRT Project.

	<i>Capital Costs (millions) (2016)</i>	<i>Opening Year Operating Expenses (millions)</i>
Sources		
FTA Very Small Starts	\$10.78	
Non-FTA (Local/State)	\$10.78	\$1.40
Total Sources	\$21.56	\$1.40
Uses		
Guideway and Trackwork	\$0.95	-
Stations, Stops, Terminals	\$5.63	-
Support Facilities	\$0.17	-
Sitework and Special Conditions	\$0.68	-
Systems	\$2.80	-
ROW, Land, Improvements	\$0.84	-
Vehicles	\$5.06	-
Professional Services	\$3.47	-
Contingency	\$1.96	-
Finance Charges	\$0.00	-
O&M	-	\$1.40
Total Uses	\$21.56	\$1.40

Table 18: Proposed Sources and Uses of Funds

Reliance on Existing Sources of Funding

All proposed funding sources for both the capital and operations of the BRT Line are existing sources. The City of Greenville is currently a grant recipient and will be the sponsor for the project. The state and local funding partners include the City of Greenville, Greenville County and the State of South Carolina. All sources are existing sources and formally committed. Future revenue mechanisms are also being explored to supplement O&M cost.

Summary

The basic conclusion of this financial analysis is confirmation of the ability of the parties to fund the capital and operating costs of the BRT and their existing system from the identified state and local revenue sources. The proposed BRT project does not meet the ridership levels expected for projects that qualify for FTA's VSS program. While this plan bases its funding analysis on the VSS Program, the project will pursue other sources of FTA funding, such as TIGER grants and the Urban Circulator program.

6.8 Findings

The key findings of the financial analysis and financial plan for the BRT project are as follows:

- The total \$23 million (capital and first year operations) in revenues required to fund the BRT Line is expected to come from federal, state, local and other sources. Of the available funding, approximately \$21.56 million is for capital and approximately \$1.5 for O&M.
- The projected costs for the GTA system in the opening year of the BRT Line are expected to be approximately \$3.6 and \$5.0 million including the BRT project.
- GTA is seeking additional local revenue sources to accommodate the construction and implementation of the BRT Line, while continuing to operate existing services.

6.9 Other Funding Opportunities

In addition to the potential sources of funding already identified, other ways of financing transit improvement projects include:

- Public/private partnerships (P3);
- Bonding;
- State Infrastructure Banks;
- Loans and commercial paper program;
- Expanding the transit authority's service activities for example managing taxicab services and parking services in the service area or restrictively in the city's core;
- Congestion Mitigation & Air Quality Improvement Program (CMAQ) which could be used to fund a vanpooling program that could run prior to the implementation of the BRT system. This source of funding is only available if Greenville is determined to be a non-attainment area. It provides flexible funding source for State and local governments to support transportation projects and programs that help improve air quality and reduce traffic congestion in regions designated as non-attainment areas. The funds can be used to purchase vans while the operations of the vans can be paid for by passenger fares supplemented by up to 30% state operating funds. Under MAP-21, this funds source is now administered by Federal Highway Administration (FHWA);
- Establishing partnerships with institutions and major employers while providing transit services at discounted rates;
- MAP-21 legislation includes \$10,000,000 for a Transit-Oriented Development (TOD) Pilot Program associated with fixed guideway projects. The funds can be used for comprehensive planning purposes for projects that seek to:
 - Enhance economic development, ridership and other goals established during project development and engineering process;
 - Facilitate multi-modal connectivity and accessibility;
 - Increase access to transit hubs for pedestrian and bicycle traffic;
 - Enable mixed use development;
 - Identify infrastructure need associated with the eligible project; and
 - Include private sector participation.

These are just few examples. Appendices B and C include both funding and financing options for both the capital and operating components of a project. The tables are meant to be inclusive of funding and financing mechanisms that have been or are being contemplated to be implemented to fund similar-type projects.

Section 7: Findings and Recommendations

7.1 Introduction

This study concluded, as other studies have concluded, that utilizing the existing GCEDC right of way corridor to implement a high capacity transit system such as a Bus Rapid Transit system in Greenville is recommended. From this point of view, a BRT system and its associated TOeD projects is feasible. However, implementing this proposed BRT system will depend on other critical factors such as ridership and funding.

More over, utilizing this right of way will require a combination of various funding options, to implement such a system, and the identification of a local dedicated funding source to operate it.

As stated earlier in Section 6, the Federal Transit Administration's Very Small Starts program requires the following:

- Enhanced transit stations
- Signal Priority/Pre-emption (for Bus/LRT)
- Low Floor/Level Boarding Vehicles
- Special Branding of Service
- Frequent Service - 10 min peak/15 min off peak
- Service offered at least 14 hours per day
- Existing corridor ridership exceeding 3,000/day
- Less than \$50 million total cost
- Less than \$3 million per mile (excl. vehicles)

The proposed BRT service meets all these criteria with the exception of the corridor ridership. Based on this analysis, the ridership for that corridor is estimated to be less than 1,000 riders per day. A 2014 update of average annual ridership for the Lauren's Road corridor shows an increase to 1,139 riders per day. The addition of three new routes (Route 14 Mauldin/Simpsonville; CUICAR/St. Francis Shuttle; and the Clemson Commuter) has provided more riders with access to the corridor.

7.2 Findings

Overall study findings include the following:

- The exclusive ROW makes BRT system more efficient and effective
- A BRT system along corridor is highly likely to attract additional riders
- Although system ridership with BRT is higher than any other route in the GTA system, it does not meet FTA Very Smarts criteria (3,000 average daily ridership)
- There is no dedicated source of funding identified to fund a BRT system in Greenville
- Station areas offer opportunities for transit supportive development
- Potential for mixed-use developments in large, under utilized surface parking lots throughout the corridor is great.

7.3 Recommendations

Overall study recommendations are as follows:

- ***Recommendation: Implement a BRT system in phases.***

Although the implementation of a high capacity transit system, such as a BRT, along the preferred corridor, is not feasible at this time because of the low ridership numbers and lack of operating funds, a phased implementation of such a system is recommended.

Route 8 (Laurens Road to Haywood Road) is the existing bus route that runs most closely and parallel to the proposed preferred BRT alternative. This route currently runs every 30 minutes, from 5:30 am to 7:20 pm, Monday to Friday, connecting Downtown Transit Center to Haywood and Greenville malls and on Saturdays from 8:30 am to 6:20pm.

This study recommends that near-term improvements be implemented to Route 8 between Downtown Transit Center, along Laurens Road, up to Verdae Boulevard as follows:

- Improve route frequency on Monday to Friday to 15 minutes at peak and 30 minutes off peak
- Expand route span of service from 5:30am to 10:30pm
- Utilize a 40-foot, low floor vehicle
- Install intelligent transportation system such as wi-fi on the vehicles
- Create a different brand for major bus shelters along the route

A phased implementation of an improved bus route along Laurens Road could help build ridership for a future BRT system while, creating an awareness in the minds of the community on the operations of such a system in the future.

- ***Recommendation: Utilize the exclusive GCEDC railroad right of way for a high-capacity transit service.***

The GCEDC corridor has been identified as a potential BRT corridor in multiples studies prepared for the City of Greenville, the GTA, and GCEDC. The Economic Development Corporation owns the railroad track which runs from near the intersection of Laurens Road and Pleasantburg Drive in Greenville County down to property now or formerly owned by Hollingsworth on Wheels.

The GCEDC is not opposed to GTA running a BRT service within the proposed ROW adjacent to the railroad corridor. A formal agreement is anticipated, pending specificity of use. This will result in maximum operational efficiency for the service and create opportunities for transit supportive development along the corridor.

- ***Recommendation: Envision the BRT system as a starter line for regional transit connectivity.***

This BRT line, if implemented, provides a first step opportunity for Greenville to have a high capacity transit corridor that can be extended to adjoining cities in the future. For example, the City of Mauldin, just south of the initial termini at CU-ICAR, has expressed an interest in a similar high capacity transit service that links Greenville to its city center.

Mauldin is currently creating a master plan for the redevelopment of a 12-city block area immediately to the north of the city's municipal complex. The plan includes a transportation plan and, potentially, a desire to have a multi-modal facility as part of the plan.

Currently, GTA is implementing an extension of its fixed route service to Mauldin in October 2012. The Mauldin/Simpsonville route will provide service from Downtown Greenville to the University Center located off Pleasantburg and Antrim Drive, through Mauldin and to the Wal-Mart on Grandview Road in Simpsonville on an hourly basis. This extended route will provide an opportunity for the City of Greenville and GTA to assess ridership along that route and how a BRT system extending from CU-ICAR to City of Mauldin, in the future, could provide more frequent, faster service linking the two cities together.

- ***Recommendation: Implement the project as a multi-use system.***

Project success increases with the creation of a multi-use system of transit, trails and parks/open space. Although the corridor is envisioned for a high capacity transit system, largely running on an exclusive portion of the corridor connecting downtown Greenville with CU-ICAR, it provides a rare opportunity for a multi-use system of transit, trails and parks.

On January 28, 2008, the Greenville City Council adopted the Trails and Greenway's Master Plan which recognizes the importance of connecting residents and visitors alike to popular destinations throughout the City. The Master Plan promotes safe and sustainable transportation, stimulates economic growth and helps to protect the environmental quality of open spaces and river corridors.

The Greenville Hospital System Swamp Rabbit Trail, a 17.5 mile multi-use trail system that runs along the Reedy River connecting the city with Travelers Rest, is an example of a trail that could be bundled with the transit project.

Further, a Bicycle Master Plan was completed and adopted by City Council in September of 2011. The Plan presents a framework to help strategize the expansion of the existing bikeway network, complete network gaps, and provide greater transportation connectivity while educating and encouraging bicycling throughout the City of Greenville.

By utilizing the corridor for transit, trails and parks/open spaces, the value of the corridor increases, ridership potential increases and so is the ability of the project to attract funding for implementation.

- ***Recommendation: Collaboration between the City of Greenville, Greenlink, GCEDC, and private developers and institutions is critical in order to be able to implement the TOeD around the ten (10) BRT stations.***

Public Private Partnership activities already exist within the City of Greenville. For example, the partnership between GTA, CU-ICAR, and St.. Francis contributes is an exemplary method for selling transit to the public as well as an added source of revenue to GTA.

There are potential private/public partnerships on-going primarily with downtown hotel owners and local universities. Key BRT station areas such as at Verdae, CU-ICAR, Pleasantburg and Amtrak could provide opportunities for collaboration between public and private entities to engage in joint development efforts at implementing transit supportive land uses around the stations creating destinations for work, live, shop or play.

This study recommends the establishment of a regional TOeD Collaborative consisting of representations from various public and private entities, boards and councils, developers and business owners, transit users and transit providers, among others. This group will primarily exist to strengthen the existing public private partnership efforts ongoing in the region, particularly within proximity of the preferred BRT corridor and be a platform to promote economic development associated with a high capacity transit corridor.

- **Recommendation: Identify a dedicated funding source.**

Investments in public transportation have clear, tangible benefits which generate economic activity and create much-needed jobs as well as result in federal, state and local tax revenues. This is why it is important to identify a dedicated source of funding to operate the system before implementing it.

Providing dedicated funding, means providing a reliable source of annual revenues that supports transit operations’ capital costs. Although it does not necessarily mean “new” or “increased” funding, the expansion of existing transit service will necessitate new revenue and thus identification of a funding source that will be dedicated towards providing that service.

This dedicated funding can be secured in a variety of ways, either, by a legislative body or by the voters and it should be dedicated for transit without being subject to the same kind of discretion associated with general fund revenues. This approach reduces the annual burden placed on local governments to find funding for public transportation and minimizes the uncertainty for public transit customers, operators, and the business community looking to invest along fixed transit routes.

GTA currently has no dedicated funding source identified to operate a high capacity transit service such as a BRT in its service area. The City of Greenville working with the GTA Board should seek input from the public regarding a referendum to secure funding for operating a BRT system in the near future.

Appendix A: Calculation of Operating and Maintenance (O&M) Costs

Operations and Maintenance Cost Estimates

Operations and maintenance O&M estimates were developed based on the GTA's financial and operating data for fiscal year 2010 using the following cost model structure and required inputs.

Model Structure and Inputs

Operating costs were derived from FY 2010 National Database (NTD) reports and were allocated to four variables: garages, annual revenue bus-hours, annual revenue bus-miles, and peak buses. The following equation summarizes the fully-allocated cost model used to estimate annual O&M costs for the study alternatives:

		Garages		Bus-Hours		Bus-Miles		Peak Bus
Estimated		Unit Cost		Unit Cost		Unit Cost		Unit Cost
Annual	=	x	+	x	+	x	+	x
O&M Cost		Projected		Projected		Projected		Projected
		Garages		Bus-Hours		Bus-Miles		Peak Buses

Where:

- Garages: number of bus storage and maintenance garages.
- Annual Revenue Bus-Hours: Total hours of revenue service operated by all trains in one year.
- Annual Revenue Bus-Miles: Total miles of revenue service operated by all trains in one year.
- Peak Buses: The maximum number of passenger vehicles scheduled in service at the same time.

FY 2010 expenses and units of service for each variable are presented in Table 4. Operating expenses assigned to each variable were summed and divided by FY 2010 units of service to derive unit costs. The unit costs derived from the fully allocated model were applied to the projected operating statistics generated for the proposed BRT service to estimate total O&M costs. FY 2010 dollars were adjusted to current year 2012 dollars at a 3.5% per annum for inflation.

Appendix B: Overview of Federal Funding

Program	Description	Eligible Recipient	Eligible Activities
Section 5303	To provide funding to support cooperative, continuous, and comprehensive planning for making transportation investment decisions in metropolitan areas and statewide	State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs). Federal planning funds are first apportioned to State DOTs. State DOTs then allocate planning funding to MPOs.	<p>(A) to support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;</p> <p>(B) to increase the safety of the transportation system for motorized and nonmotorized users;</p> <p>(C) to increase the security of the transportation system for motorized and nonmotorized users;</p> <p>(D) to increase the accessibility and mobility of people and for freight;</p> <p>(E) to protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;</p> <p>(F) to enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;</p> <p>(G) to promote efficient system management and operation; and</p> <p>(H) to emphasize the preservation of the existing transportation system.</p> <p>Major new fixed guideway projects, or extension to existing systems financed with New Starts funds, typically receive these funds through a full funding grant agreement that defines the scope of the project and specifies the total multi-year Federal commitment to the project.</p>

Program	Description	Eligible Recipient	Eligible Activities
Section 5307	<p>Makes Federal resources available to urbanized areas and to Governors for transit capital and operating assistance in urbanized areas and for transportation related planning. An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the U.S. Department of Commerce, Bureau of the Census.</p>	<p>Funding is made available to designated recipients that must be public bodies with the legal authority to receive and dispense Federal funds. Governors, responsible local officials and publicly owned operators of transit services are to designate a recipient to apply for, receive, and dispense funds for transportation management areas. Generally, a transportation management area is an urbanized area with a population of 200,000 or over. The Governor or Governor's designee is the designated recipient for urbanized areas between 50,000 and 200,000.</p>	<p>Eligible activities include planning, engineering design and evaluation of transit projects and other technical transportation-related studies; capital investments in bus and bus-related activities such as replacement of buses, overhaul of buses, rebuilding of buses, crime prevention and security equipment and construction of maintenance and passenger facilities; and capital investments in new and existing fixed guideway systems including rolling stock, overhaul and rebuilding of vehicles, track, signals, communications, and computer hardware and software. All preventive maintenance and some Americans with Disabilities Act complementary para transit service costs are considered capital costs.</p> <p>For urbanized areas with populations less than 200,000, operating assistance is an eligible expense. In these areas, at least one percent of the funding apportioned to each area must be used for transit enhancement activities such as historic preservation, landscaping, public art, pedestrian access, bicycle access, and enhanced access for persons with disabilities.</p> <p>For urbanized areas with 200,000 in population and over, funds are apportioned and flow directly to a designated recipient selected locally to apply for and receive Federal funds. For urbanized areas under 200,000 in population, the funds are apportioned to the Governor of each state for distribution. A few areas under 200,000 in population have been designated as transportation management areas and receive apportionments directly.</p>

Program	Description	Eligible Recipient	Eligible Activities
Section 5311	<p>This is a rural program that is formula based and provides funding to states for the purpose of supporting public transportation in rural areas, with population of less than 50,000. The goal of the program is to provide the following services to communities with population less than 50,000:</p> <p>Enhance the access of people in nonurbanized areas to health care, shopping, education, employment, public services, and recreation; Assist in the maintenance, development, improvement, and use of public transportation systems in nonurbanized areas; Encourage and facilitate the most efficient use of all transportation funds used to provide passenger transportation in nonurbanized areas through the coordination of programs and services; Assist in the development and support of intercity bus transportation; Provide for the participation of private transportation providers in nonurbanized transportation.</p>	<p>A subrecipient of the program includes a State or local governmental authority, a nonprofit organization, or an operator of public transportation or intercity bus service that receives federal transit program grant funds indirectly through a recipient.</p>	<p>An eligible recipient may use the funding for capital, operating, and administrative expenses for public transportation projects that meet the needs of rural communities. Examples of eligible activities include: capital projects; operating costs of equipment and facilities for use in public transportation; and the acquisition of public transportation services, including service agreements with private providers of public transportation services.</p> <p>The state must use 15 percent of its annual apportionment to support intercity bus service, unless the Governor certifies, after consultation with affected intercity bus providers that the needs of the state are adequately met.</p>
Section 5316	<p>The Job Access and Reverse Commute (JARC) program was established to address the unique transportation challenges faced by welfare recipients and low-income persons seeking to obtain and maintain employment. Many new entry-level jobs are located in suburban areas, and low-income individuals have difficulty accessing these jobs from their inner city, urban, or rural neighborhoods. In addition, many entry level-jobs require working late at night or on weekends when conventional transit services are either reduced or non-existent. Finally, many employment related-trips are complex and involve multiple destinations including reaching childcare facilities or other services.</p>	<p>States and public bodies are eligible designated recipients. Eligible subrecipients are private non-profit organizations, State or local governments, and operators of public transportation services including private operators of public transportation services. However, this funding source is being repealed under the recently enacted MAP-21 legislation and consolidated under Sections 5307 and 5311.</p>	<p>Capital, planning and operating expenses for projects that transport low income individuals to and from jobs and activities related to employment, and for reverse commute projects.</p>

Appendix C: Summary of Funding Mechanisms

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Development Impact Fees/ Benefit Assessment Districts	Fee collected on new development that occurs within project area; Fee assessment of existing property owners to pay for specific infrastructure that benefits area.	Primarily used on capital projects to service debt but could be used on operating.	Those that directly benefit from project pay for a portion or all of the project.	If development fees are already being collected in area, could make total fees too high and development might not be feasible.	Can be set up in one time payments or annual assessments.
Tax Increment Financing (TIFs)/TIRZs	Using a portion of increased taxes due to increased property values due to a specific transit/road project to pay for the project.	Primarily used on capital projects.	The project that causes the increase in the value receives the benefit of the increased value.	Typically cities and counties interpret this financing mechanism as though funding is being taken away from them.	Many requirements related to TIF/TIRZ financing.
Federal discretionary funds	Federal Transit Administration funds that are earmarked by Congress.	Primarily used on capital projects.	Provides additional capital funding.	Competitive process; Requires strong local support and effective lobbying; Depending on type of funds could require additional work for application and could make process longer.	
FTA New Starts Funding	Federal Transit Administration funds earmarked by Congress for rail and BRT projects.	Primarily used on capital projects.	Potential new funding for project for up to 50% of the total project cost.	Competitive process Increases timeline for project; Increases cost of project due to additional time needed to follow FTA guidelines.	

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Transportation Enhancements Program	10 percent of the Surface Transportation Program funds used on projects that expand travel choices and enhance the transportation experience; FHWA grant program.	Primarily used on capital projects.	Additional funding source.	Competitive Process administered through State.	12 eligible activities: Pedestrian & Bicycle Facilities; Pedestrian & Bicycle Safety & Educational Activities; Acquisition of scenic or historic easements and sites; Landscaping & scenic beautification; Historic preservation; Rehab & operation of historic transportation buildings; Conversion of abandoned railway corridors to trails; Removal, control of outdoor advertising Archaeological planning & research; Environmental mitigation; Establishment of transportation museums.
Public Private Partnerships	Comes in many forms including: private funding of infrastructure based on benefits, Design Build Operate Maintain Finance (DBOMF) of infrastructure, or any combination.	Primarily used on capital projects.	Additional funding source and potential financing mechanism that does not impact bonding capacity; Allows cost to be spread out over time; Potentially decrease cost of project due to inflation; Portion of risk assumed by private organization; Allows projects to be started and completed sooner.	Potentially higher costs due to financing by private entity; Potentially higher costs due to risk assumed by private entity; Need identified revenue source to repay investment.	

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Bonding	Can include issuing bonds using fare revenues, sales tax revenues, grant revenues, toll revenues from the state or any other revenue source.	Typically used on capital projects.	Financing mechanism that can allow projects to happen sooner than with pay as you go; Potentially decrease cost of project due to inflation; Allows cost to be spread out over time.	Costs associated with issuance of bonds; Election required to issue bonds; Need identified revenue source to repay bonds.	
Grant Anticipation Notes	Notes payable issued to be paid from grant proceeds.	Typically used on capital projects.	Financing mechanism based on anticipated grants; Can be used to implement projects sooner.	Can only be issued to mature within three years of issuance; Need identified revenue source to repay notes.	
TIFIA Loans	Federal credit program for eligible transportation projects; Three types of credit assistance: secured (direct) loans, loan guarantees and standby lines of credit.	Used on capital projects.	Financing mechanism that allows projects to be completed sooner; Low interest loans; Easier than bonds to implement.	Need identified revenue source to repay loans.	
State Infrastructure Banks (SIB)	Allows certain states to use regular Federal-aid highway apportionments to capitalize state-administered revolving funds.	Used on capital projects.	Financing mechanism that allows projects to be completed sooner; Low interest loans; Easier than bonds to implement.	Need identified revenue source to repay loans.	
Fares	Cost to customer for use of transit system; Plan for regular increases in fares tied to Cost of Inflation.	Primarily used for operating.	Can plan for additional revenue; Allows customers to plan to pay a larger fare; Fare keeps up with inflation; Potential less ridership loss due to smaller increases.	Public hearings required to raise fares.	Important to communicate need for increases to customers.

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Federal Funding for Operating	Use of 5307, JARC on operating expenses. See Table 1 for details.	Primarily used for operating.	Additional source of revenue for operating expenses.	5307 can only be applied to preventive maintenance. Shift of funds that could be used on capital JARC funds are typically programmed for only a few years – would require source for continued funding.	
Parking Revenues from City and Park and Ride lots	City to increase parking fees and give all or a portion of the fees to the selected project; Charge a parking fee at Park & Ride locations for either all parking or premium parking.	Primarily used for operating.	Additional source of funding Increase in city parking fees could encourage increased use of transit.	Parking fees at Park and Ride locations could discourage transit use.	Politics of increasing city parking fees.
Fees on tickets sold at Entertainment Venues	Charge a fee on tickets sold at entertainment venues to pay for transit services that serve the location.	Typically used for operating expenses.	Provides another source of revenue; Allows customers of venues to pay for transit services that serve the entertainment venues.	Ticket promoters or owners of the venues may not want to include fee because they might be concerned that people won't attend events because of fees.	Can be set up as a percentage or fixed fee on each ticket sold.
Private Donations	Donation from a private foundation; Can be trust fund or endowment.	Can be used for operating or capital.	Provides another source of revenue.	May include specific stipulations that don't fit the overall goal of project.	
Leasing of ROW	Lease Railroad ROW to utilities for cables and other utilities.	Can be used for operating or capital.	Additional source of revenue; Allows utilities to provide services where they are required; Allows use of cables or utilities by system.	Need to get utilities to agree to payment structure; Could be complicated structure.	
Partnerships	Develop additional partnerships where private companies pay for all or a portion of transit services or capital projects.	Can be used for operating or capital.	Facilitate the implementation of new services and capital programs sooner.	Need to get partners to understand the value of the partnership.	Identify local partners, employers and educational institutions, who are supportive of GTA.

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Dedicated Sales Tax	A percentage tax on all items sold in service area.	Can be used for operating or capital.	Additional dedicated source of funding.	Election required; Citizens would need to see the value in the project; Little control over amount received each year – dependent on economy.	
Hotel/Motel Tax	Percentage tax on hotel/motel fees.	Can be used for operating or capital.	Additional source of funding; Diversification of funding sources.	Tourism industry may believe that the additional tax will cause certain groups not to plan a trip to Greenville; Already a funding mechanism in place for several other projects.	
Car Rental Tax	Percentage tax on car rentals.	Can be used for operating or capital.	Additional source of funding; Diversification of funding sources.	Car rental businesses may believe that the additional tax will cause a decrease in the car rental business.	
Vehicle Registration Fee	Increase the vehicle registration fee and allocate additional revenues to transportation.	Can be used for operating or capital.	Additional source of funding.	Difficulty in getting appropriate agency to agree to increasing fees.	
Advertising Revenue (buses, benches, shelters)/ Sponsorships	Allow for advertising on buses, benches, shelters and other amenities for a fee; Can be a long term contract for advertising on a shelter or other amenity in exchange for the construction costs; Naming rights could be sold for park and ride facilities or other infrastructure.	Can be used for operating or capital .	Additional source of funding; Depending on contract structure, could be a fixed revenue source each year.	Administration costs for program can offset some of the additional revenue.	Program can be set up to have advertising company be responsible for maintenance of shelters or benches in exchange for advertising fees; Need strong marketing component.

Funding/ Financing Mechanism	Description	Used for Operating or Capital	Pros	Cons	Potential Issues / Comments
Joint Development on Existing and Planned Facilities	Private funds are used to develop property resulting in profit for the private developer and a developed asset.	Typically used for capital projects; Ongoing revenues could be used to offset operating expenses.	Increase revenue; Potential increase in ridership on transit; Enhances facilities; Sharing of risk on project.	Creation of joint development structure can be complicated; Ensuring fair distribution of revenues and risk can take time; Process to choose developer within required procurement guidelines can be a challenge; Potential that costs to implement are more than revenues from project.	Need for knowledgeable staff in evaluation of different proposals.
Tolls	Fees charged on highway system.	Could be used on operating or capital.	Additional revenue source.	Would require partnership with State Need for an understanding by the State on the benefits of sharing toll revenues for projects that aren't road related.	
Congestion Pricing	Work with state to implement congestion pricing on toll roads and allocate a portion of toll revenues to transit; Congestion pricing is pricing based on demand. When the demand is higher, the tolls are higher; Peak period pricing on bus system; Peak period parking fees by the City and allocate a portion of those fees to transit.	Could be used on operating or capital.	Additional revenue source.	Would require partnership with State and/or City for increasing tolls or parking revenues; Need for an understanding by State and City on the benefits of sharing toll and parking revenues on projects that aren't road related; Peak period pricing could be considered a fare increase; Would require commitment by transit operators to charge correct fare.	
Safety Inspection Fee	Charge a fee when cars are inspected.	Could be used on operating or capital.	New source of revenue with little fluctuation because it is based on number of vehicles.	Implementation of new fee could draw criticism; Need legislator support for implementation.	

