Introduction

Public transportation has played a minor and declining role in most American cities since the middle of the 20th century, and the Greenville metropolitan area is no exception. Nevertheless, mass transit is a key element of an effective regional transportation system. Many people rely on public transportation to provide access to employment, medical care, education, and shopping.

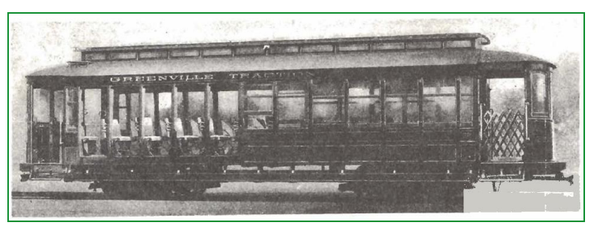
As the region continues to urbanize, transit will become increasingly important to ensure mobility for senior citizens, youth, persons with disabilities, and those with limited income. Good public transit services enable full participation in society by everyone, regardless of age, ability, or income.

In the GPATS region, fixed-route public transit service currently exists only within and immediately adjacent to the City of Greenville. Eight of the nine municipalities in the region are not served by public transit. In public meetings, residents from across the region consistently have pointed to the lack of effective transit service as a critical long-term issue.

The City of Greenville contains the most densely-developed part of the region, where few opportunities remain to widen major roads. If the recent resurgence of development in the downtown Greenville area continues, parking and traffic problems will continue to worsen. An effective regional transit network will become as important to sustaining downtown Greenville as it has been to Atlanta and Charlotte, where major investments in regional transit continue to be made.

Transit is essential to maintain viable downtown centers and to ensure mobility for those who are unable to drive. It also helps relieve traffic congestion, reduce air pollution, and reduce energy consumption and costs. Public transit can play an important role in the region by providing another alternative to the single-occupant automobile traveler. Increasing the level of public transit service in the region also can increase regional connectivity and access to employment as well as enhance regional security and evacuation procedures by fostering an integrated, multimodal system.

This chapter will provide a brief historical background on transit in the region, examine current services, and present a financially feasible concept plan to develop an effective regional transit system.



Source: Palmetto Traction: Electric Railways of South Carolina

Public Transit in the Upstate: A Brief History

Street Railways

Textile manufacturing in South Carolina's Upstate spurred a migration from farms and foothills to the region's growing cities and towns, and the cotton that blossomed from red clay hills put money in the pockets of the region's mill owners, mill workers, and merchants. As the urban population grew, the first street railways appeared in Anderson, Greenville, and Spartanburg.

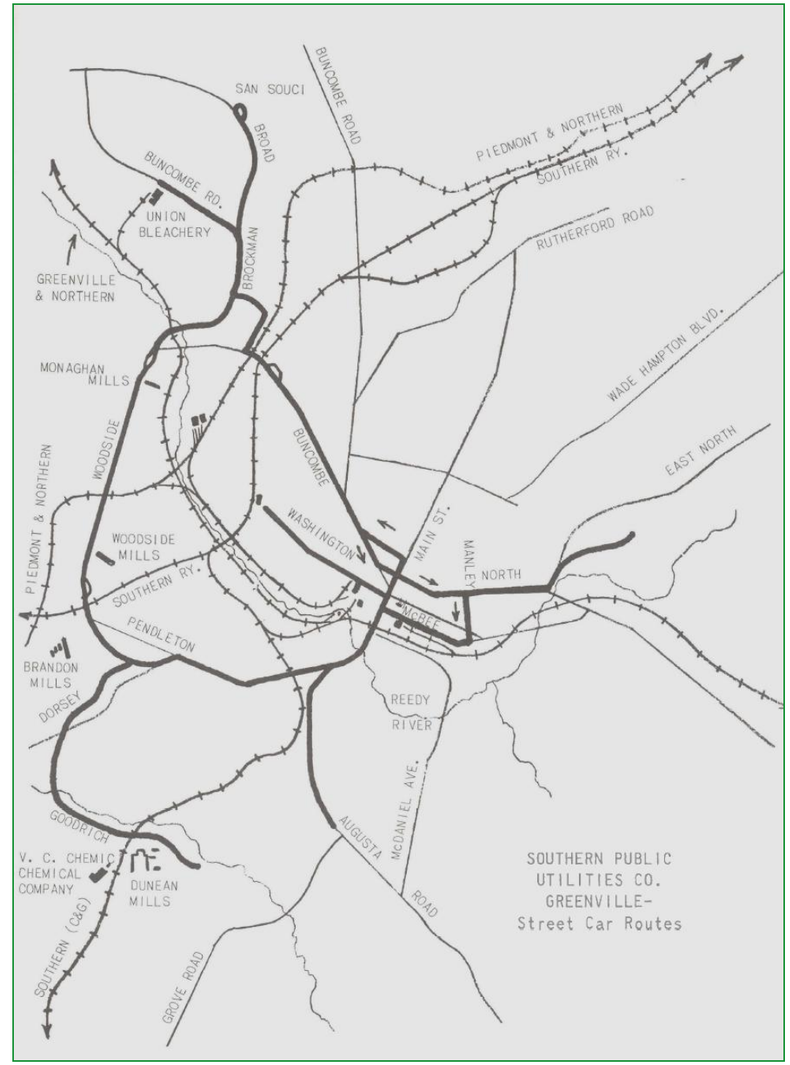
Greenville's first streetcars were small horse-drawn vehicles. Built in the late 1800s, the horse railways connected the central business district of Greenville with the rail stations of the Atlanta & Richmond Air Line and the Greenville & Columbia Railway.

Horsecars proved slow and uneconomical to operate, and in 1899 the Greenville Traction Company was chartered to build and operate an electric street railway for freight and passenger service. By 1910, when Greenville Traction Company was sold to the Southern Power Company, Greenville was served by more than 14 miles of streetcar lines and the standard fare was 5 cents. In 1913, the Southern Public Utilities Company acquired the city's streetcar franchise and continued to improve and expand the system. Southern operated the network as the Greenville City Lines, and electric streetcars served Greenville until the late 1930s. **Figure 7.1** represents the extent of the streetcar lines in the 1930s, when the system reached its zenith.

In the late 1930s, Greenville City Council encouraged Duke Power, which had acquired Southern Power Company and its street railway division in 1925, to abandon streetcars in favor of electric trolleybus service.

Trolleybuses offered several advantages over streetcars. With rubber tires, the vehicles could maneuver in the increasingly congested downtown area, and could move around illegally parked vehicles. The electric buses were less expensive than streetcars to purchase, and service could be expanded more readily, as the trolleybuses required only the overhead electric lines and eliminated the construction of a

Figure 7.1 – Greenville Streetcar Lines, 1930s



railroad in the middle of a city street. Because street railways typically ran down the middle of city streets, the new system meant that passenger boarding could occur at the sidewalk rather than in the middle of the street. Maintenance was a final key advantage: street railway companies were required to construct and maintain the pavement (typically bricks) above their rail lines between the rails and for a few feet on each side of the rails, and trolleybuses shifted street maintenance to public works agencies.

Greenville's trolley buses served 4,770,300 rides in 1941, and more than 10 million passengers boarded in 1945. Transit ridership in Greenville — and nationwide — peaked during World War II, when tires and gasoline were rationed and automobile manufacturing ceased as the nation focused its industrial capacity on military machines. After the war, ridership quickly dropped to prewar levels, and continued to decline as automobiles became increasingly affordable to more people.

Southern Public Utilities Trolleybus, Circa 1946

Industrialization in the early 1900s created more demand for interurban travel. In response to the growing demand for intercity passenger and goods movement, James B. Duke bankrolled a relatively unusual electric passenger and freight railroad that linked the cities, towns, and villages of the Upstate. The Piedmont and Northern, or "P&N", ran from Greenwood, Belton, and Anderson to Greenville, Taylors, Greer, Duncan, Lyman, and Spartanburg. As a division of Duke Power Company, the trains on the P&N ran on clean electric power while competing steam locomotives on the parallel Southern Railway belched smoke and soot. Although often maligned as "that damned trolley line" by the steam railroaders, the P&N defied regional convention and operated electric locomotives until the mid-1950s, when diesel locomotives became the industry standard.

Although some are in a state of decay, several passenger and freight stations on the P&N remain intact in the Upstate. One of the railroad's few two-story stations has been restored in Downtown Greer, preserving the distinctive blond brick and terra cotta tile roof common to all of the P&N stations.

The regional, interurban passenger service provided by the Piedmont & Northern Railroad lasted until 1951. By that time, passenger traffic had declined significantly due to the rising affordability and availability of automobiles. Freight business allowed the company to continue operation until 1969, when the railroad was merged into the Seaboard Coast Line (now part of the CSXT system). The main line of the P&N is now owned by CSX Transportation and portions between Greenville and Spartanburg see limited use.

Bus Lines

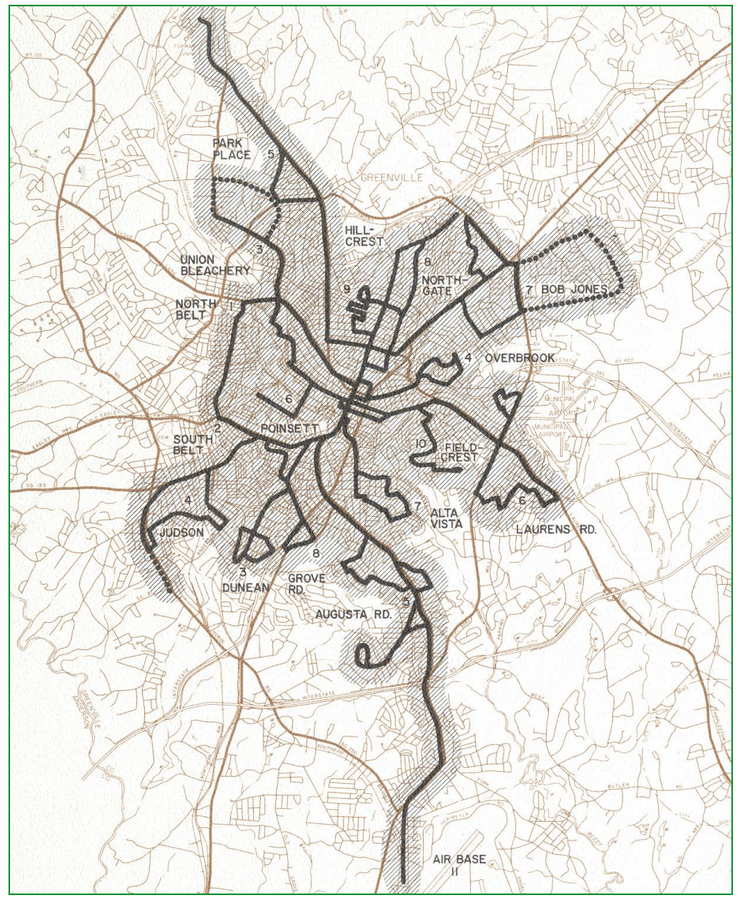
In 1955, trolleybus service was replaced with diesel bus service when Duke Power sold its interests in the company to City Coach Lines. By the 1950s, the diesel powered bus had become a more reliable, comfortable, and less-capital intensive mode of transit, making it especially attractive to smaller urban areas such as Greenville. Greenville City Coach Lines operated bus service in the Greenville urbanized area from 1955 to 1975. In 1965, this service consisted of 30 buses operating in maximum service on 11 routes, providing transit service within ¼ mile to 83 percent of the urbanized area (**Figure 7.2**). Ten of the routes operated with headways of 30 minutes or less. The standard adult fare was 20 cents per boarding.

Greenville City Coach Lines stopped operation in 1975 after years of declining revenue, ridership, and subsequent reductions in service, despite modest subsidies from the City of Greenville and Greenville County to maintain service.

The Greenville Transit Authority (GTA) was established in 1975, taking over an improvised emergency transit service, which operated during peak hours using second-hand school buses in the months following City Coach Lines' demise. The GTA was created with independent operating responsibility supported by funding from the City of Greenville, Greenville County, and fare revenue. By 1976, GTA had acquired 17 new buses, resumed day long service, and extended routes to gain new ridership within the area (Greenville Area Transportation Study, 1995 Recommended Transportation Plan). However, transit's share of overall trips made in the region continued to decline.

Over the next two decades, GTA continued operations until service was again halted during GTA's financial crisis in May 1996, caused in part by the loss of Federal Transit Administration (FTA) operating subsidies. Changes in federal law in the 1990s eliminated operating subsidies for transit systems in urbanized areas with more than 200,000 population. With inadequate local funding to cover operations, service was suspended. The City of Greenville and Greenville County recognized the need to maintain a public transit system within the region and came to an agreement on funding operations that allowed GTA to resume operations.

Figure 7.2 – Greenville City Coach Lines, 1965



Source: Greenville Area Transportation Study: Harland Bartholomew and Associates, 1968

Transit Services in 2006

The Greenville Transit Authority

Currently, the Greenville Transit Authority provides the only fixed route public transit service in the GPATS region. GTA's service area of 148 square miles is focused on the City of Greenville and adjacent areas of Greenville County. The other municipalities in the region, including Pickens, Easley, Liberty, Mauldin, Simpsonville, Fountain Inn, and Greer, remain without any fixed-route public transit service. A study was conducted in 2005 to explore potential transit extensions to the cities of Mauldin and Simpsonville, but the recommendations were not implemented due to a lack of local funding commitment from either municipality.

Operating Characteristics of the GTA

GTA's current route network is best characterized as a hub and spoke layout, with the hub located at the intermodal bus transit center in downtown Greenville.

GTA operates 12 spoke routes and recently added 1 cross-town route. All routes operate on 60-minute headways, except for the #1 which operates on 30-minute headways during the AM peak period. Service is generally provided between 5:30 a.m. and 7:30 p.m., with some routes operating on Saturdays and none on Sundays (**Table 7.1**).

Table 7.1 – GTA Fixed Route Operations, 2006

#	Route Name	Operating Hours	Frequency	Saturday Service
1	Jesse Jackson Townhomes	5:00 A.M. - 7:00 P.M.	60 minutes	Yes
2	White Horse Rd. / Pendleton	5:30 A.M. - 7:30 P.M.	60 minutes	No
3	Poinsett-Rutherford	5:30 A.M. - 7:30 P.M.	60 minutes	Yes
4	Dunean-Grove	5:30 A.M. - 7:30 P.M.	60 minutes	Yes
5/7	Birnie / Gower & County Square	5:00 A.M. - 6:30 P.M.	60 minutes	Yes
6	Anderson Rd.	5:30 A.M. - 7:30 P.M.	60 minutes	Yes
8	Laurens Rd.	6:30 A.M. - 8:30 P.M.	60 minutes	Yes
9	White Horse Rd. / Pendleton	6:30 A.M. - 6:30 P.M.	60 minutes	No
10	Augusta Rd.	5:30 A.M. - 8:30 P.M.	60 minutes	Yes
11	Wade Hampton-Taylors	5:30 A.M. - 7:30 P.M.	60 minutes	No
12	Overbrook	6:30 A.M. - 7:30 P.M.	60 minutes	No
13	Parker-Woodside	6:00 A.M. - 7:30 P.M.	60 minutes	Yes
51	Pleasantburg Rd.	5:00 A.M. - 6:30 P.M.	60 minutes	No
52	Donaldson Center	5:30 A.M. - 7:00 P.M.	60 minutes	No

Source: Greenville Area Transportation Study: Harland Bartholomew and Associates, 1968

Most of the fixed routes originate and terminate at the downtown intermodal terminal and operate along hour-long routes in different corridors of the City and County of Greenville. This type of layout places a heavy emphasis on trips going to and from the downtown business district, and is similar to the route layout operated in the 1960s. **Figures 7.3**, **7.4**, and **7.5** illustrate the current routes and characteristics of the populations they serve. This analysis focuses on "Environmental Justice" considerations, which evaluate how minority and low-income groups are affected by transportation investments.

Current transit coverage and frequency of service, however, is below the level of service offered in 1965. In addition, some of the spoke routes are actually long, hour-long loops through a large area — an approach used to cover a large area with one bus. These long loop routes sacrifice service quality by creating very long travel times for residents on the early portion of the loop who must travel far out of their way to arrive at the transfer center. Ideally, as GTA's Transit Development Plan states, "bi-directional service should be favored over loops" wherever possible.

Ridership

When GTA resumed operation after the financial crisis in 1996, fixed-route bus service was resumed, but with a reduction in route coverage. **Figure 7.6** shows that the system quickly regained ridership, and in early 2005, GTA expanded service to its current operating level. In fiscal year 2006, total ridership was 896,315 passengers. For a historical comparison, Greenville City Coach Lines carried 3,510,756 revenue passengers on a similar route network with more frequent service in 1965, when automobile ownership in the region was much lower than it is today.

Figure 7.6 – Annual Ridership, 1997 - 2006

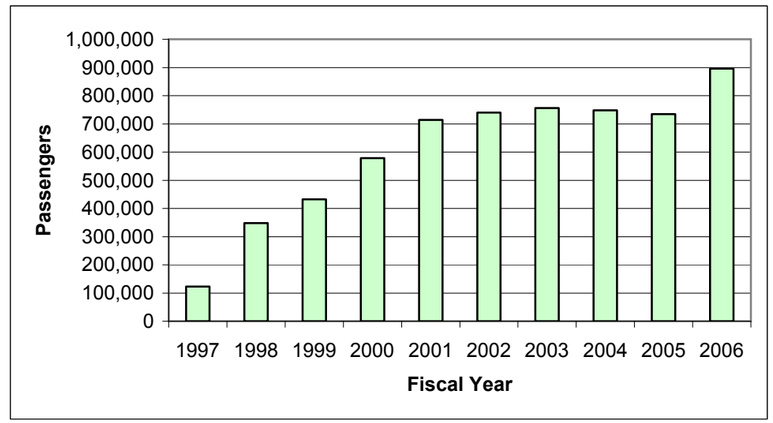


Figure 7.3 – Existing Transit Routes and Regional Population Density

Figure 7.4 – Existing Transit Routes and Environmental Justice

Figure 7.5 – Regional Environmental Justice and Population Density

GTA Funding

In transit operations, capital and operating expenses are often funded through separate programs. The Greenville Transit Authority currently obtains funding through a number of sources, including fare revenue, local government contributions, and State and Federal grants.

Capital expenses, such as the purchase of new buses, are generally covered by the 5307 Urban Area Formula program, administered by the Federal Transit Administration. This program provides funding for capital costs, preventative maintenance costs, and a small portion of paratransit operating expenses based on population, population density, and transit agency performance data. The 5307 program provides an 80 percent Federal share for most capital expenses, and increases to 90 percent of vehicle costs needed to comply with the Clean Air Act Amendments and the Americans with Disabilities Act (ADA). This program also has become an important source of funding for maintenance since the Federal Transit Administration changed the definition of capital expenses to include preventive maintenance expenses. The estimated 5307 funding available for the Greenville Urbanized Area over the 2004-2006 period is displayed in **Table 7.2**. Historically, the Greenville Urbanized Area has had to decline the opportunity to maximize Federal funding assistance for capital expenses due to a lack of local funds to match the Federal share.

Table 7.2 – 5307 Greenville Urbanized Area Allocation

Year	Allocation
2004	$ 1,680,497
2005	$ 1,668,097
2006	$ 1,822,293

Because of the restrictions on federal funds, operating expenses are covered by a combination of state grants, local government contributions, fare revenue, and other operating funding such as the sale of advertising. As shown in **Table 7.3**, fare revenues cover approximately 23 percent of operating expenses, a percentage comparable to many other transit agencies in the Southeast. The local operating funding required to sustain GTA transit operations originates from the City of Greenville and Greenville County's General Expense Funds, a situation that can lead to unpredictable year-to-year operating predictions as the local contributions fluctuate according to the overall health of the local budgets. State grants also contribute significant funding for operations.

Table 7.3 – GTA's Sources of Operating Funding in 2004

Source	Funding	Percent
Fare Revenues	$529,971	23%
Local Funds	$562,312	25%
State Funds	$479,472	21%
Federal Assistance	$624,151	28%
Other Funds	$67,033	3%
Total Operating Funds	$2,262,939	100%

Greenville Area Paratransit (GAP)

The Americans with Disabilities Act requires a transit agency to provide paratransit service to ADA eligible persons that is comparable to the fixed route service. GTA provides Greenville Area Paratransit (GAP) service within ¾ mile of the fixed route service during regular operating hours. GAP is operated with smaller, wheelchair accessible vehicles. Trips can be scheduled up to 14 days in advance, and are otherwise served on a first come, first served basis.

Demand response is the most costly form of public transit due to the low number of passengers served per vehicle hour. GAP service averages 1.9 passengers per vehicle-hour. GAP is an essential public service, but the expense must be taken into account when planning transit route expansion. For comparable systems in the southeastern U.S., paratransit operations add 14 percent to the cost of fixed route bus service. While the costs are high, ADA paratransit ensures that persons with disabilities have access to transportation services for work, shopping, medical care, and personal activity. Without it, some people would not be able to remain productive members of society.

Intercity Transit Services

Intercity public transit service is provided by Amtrak and Greyhound. Amtrak provides a stop in the City of Greenville along the Crescent Line operating between New Orleans and Washington, D.C. One southbound train and one northbound train serve Greenville daily. The City of Greenville also is the only area in the GPATS region served by Greyhound, which stops at the intermodal terminal in downtown Greenville ten times daily with service along the I-85 corridor.

GTA Goals

The Greenville Transit Authority developed a set of four core goals with corresponding objectives during the creation of their 2006 Transit Development Plan. The goals originated from a number of sources, including previous plans, stakeholder interviews, a rider survey, bus operators' focus groups, public forums, and additional meetings with key agencies. The four goals were:

- A public transportation system that improves the mobility and accessibility for existing transit riders by providing transportation to jobs, educational and cultural facilities, medical services, shopping, and other community centers
- A public transportation system that improves the mobility and accessibility for senior citizens and the disabled community by providing viable cost-efficient specialized transportation options to improve their quality of life
- A public transportation system that increases transit ridership through providing transportation to regional centers by expanding mode choices to attract new transit riders
- A public transportation system that is efficient and effective in providing transit services that continues to improve overall system performance

Peer Comparison

Public transit in the GPATS region was compared to selected regions in the Southeastern United States with similar urban area characteristics.

One way to assess relative transit service is to compare the number of vehicles operated in maximum service to the urbanized area population. In terms of transit service per capita, the Greenville Urbanized Area ranks lowest among peer transit systems. In 2004, Greenville Transit Authority operated less than half as many vehicles per capita as the next lowest transit system, Augusta-Richmond County, and provided less than one quarter of the vehicles per capita as the median transit agency in the group (**Table 7.4**). As might be expected from low transit service availability, GTA also ranks lowest in unlinked passenger trips, with 754,800 trips in 2004.

Despite such relatively low transit quality indicators, the GTA is performing above average in terms of cost effectiveness. GTA's operating expense per vehicle revenue hour and per unlinked passenger trip is well above the average of peer cities in the Southeast.

This peer comparison may suggest that GTA has adjusted to providing an efficient, minimal level of service with the limited funding provided. However, in terms of funding public transit and service availability, the GPATS region lags far behind that of similar urban areas in the Southeast.

Table 7.4 – Peer Groups Comparisons

		Transit Quality		Performance Indicators				
Agency	Urbanized Area Population	Vehicles Operated in Maximum Service	Vehicles/ 100,000 population	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trips/ Vehicle Revenue Mile	Unlinked Passenger Trips/ Vehicle Revenue Hour
Greenville Transit Authority	380,025	9	2.4	$50.8	$0.6	$2.6	1.3	19.3
Augusta Richmond County Transit Department	335,630	22	6.6	$53.9	$0.6	$3.1	1.4	17.5
Greensboro Transit Authority	267,884	22	8.2	$66.7	$1.0	$3.0	1.8	22.4
Capital Area Transit (Raleigh, NC)	541,527	46	8.5	$64.0	$0.9	$2.8	1.8	22.9
Asheville Transit System	221,570	19	8.6	$54.6	$1.3	$3.0	1.2	18.1
Charleston Area Regional Transportation Authority	423,410	43	10.2	$75.1	$0.4	$3.0	1.9	24.8
Birmingham-Jefferson County Transit Authority	663,615	72	10.8	$56.0	$0.7	$3.2	1.3	17.6
Winston-Salem Transit Authority	299,290	33	11.0	$59.6	$1.3	$2.6	1.9	22.9
Central Midlands Regional Transit Authority	420,537	49	11.7	$70.5	$0.7	$4.1	1.4	17.4
Durham Area Transit Authority	287,796	35	12.2	$51.8	$0.7	$2.1	1.7	24.5
Chattanooga Area Regional Transportation Authority	343,509	49	14.3	$77.0	$0.9	$5.2	1.0	14.9
Knoxville Area Transit	419,830	71	16.9	$51.0	$1.5	$3.4	1.2	15.1
Corpus Christi Regional Transportation Authority	293,925	65	22.1	$68.2	$0.7	$2.7	1.8	25.6
City of Tallahassee	204,260	49	24.0	$73.4	$0.9	$2.1	2.6	34.6
Chapel Hill Transit	287,796	70	24.3	$63.0	$0.8	$1.7	2.9	37.6
Charlotte Area Transit	758,927	243	32.0	$75.2	$0.7	$3.0	1.8	25.5
		Average:	**14.0**	**$63.2**	**$0.9**	**$3.0**	**1.7**	**22.5**
		Median:	**11.3**	**$63.5**	**$0.7**	**$3.0**	**1.7**	**22.6**

Source: 2004 National Transit Database. Federal Transit Administration

Public Desires for Public Transit

During the development of the *2030 Long Range Transportation Plan* for GPATS, public workshops were held in order to gather input on desired transportation improvements within the area. The workshop attendees were separated into small groups and presented with a series of maps separated by mode (vehicle, transit, pedestrian/bicycling) on which they could illustrate and discuss their issues and desires for the region. A two-page survey also was distributed.

Results from the survey show a great dissatisfaction with current transit services in the region and a preference for greater funding of public transit. Sixty-one percent of survey respondents ranked transit services in the region as poor. Furthermore, only 7 percent of respondents had used public transit within the region. When asked to allocate funding among eight transportation improvements, "maintaining adequate public transit" was allocated only one percent less funding than "widening and building highways," with 17 and 18 percent of the total allocation, respectively. This funding allocation preference is significantly counter to current transportation funding trends in the region, where road construction receives far more funding than public transit.

During the small group activities, when asked about what improvements they would like to see of public transit in the region, participants expressed a desire for expanded coverage, more frequent service, and routes connecting major activity centers. In general, the participants were expressing dissatisfaction with the region's lack of regional service and the Greenville Transit Authority's simple radial route design. Participants also expressed the desire for a higher quality transit service that might attract traditional automobile commuters. The abandoned rail corridors in the region were mentioned as a potential asset to provide high frequency, high-speed service on dedicated right-of-way to avoid road congestion.

A ridership survey conducted by GTA in November, 2005 also gives insight as to desired improvements and weaknesses of the system as perceived by current transit users. Only 45 percent of riders indicated they were using transit for work purposes. GTA is serving more transportation needs than the traditional work commute trip. Also, 78 percent of riders said they required a transfer to another bus to complete their trip, indicating that most riders' destinations were somewhere other than downtown.

A Concept Plan for the GPATS Region

Based on input from public workshops, Greenville Transit Authority goals, and the public transit needs in the region, GPATS staff developed a financially-constrained public transit concept plan. This concept plan, if implemented, would bring public transit service in the region to the average level of service that currently exists in comparable urban areas within the Southeast.

The overall concept builds upon the existing route network of GTA by connecting activity centers throughout the GPATS region. The existing fixed route bus service operated by GTA would be improved, and new transitways would be implemented to provide regional connections in the US 123/I-85 corridor and in the US 276 corridor.

This report does not address the organizational arrangements that would be needed to operate the regional routes identified in this report. Regional routes could be operated by a regional transit authority, which would have to be created by the jurisdictions served, or could be operated through an interlocal agreement among the local governments in the region. Several workable models for developing a regional transit system exist, and the details of the organizational arrangements for regional transit are not addressed here.

Upgrading the Existing Service – A Timed Transfer System

The first step to improving transit in the region should be to ensure that the current fixed-route bus system, the backbone of almost all transit networks, meets the needs of current transit riders as efficiently as possible.

The existing single hub and spoke system of GTA works well for a region with highly centralized employment and retail growth in downtown areas. However, employment and retail activity has dispersed dramatically in the Greenville area since the 1950s, and changing development patterns and lifestyles have resulted in an increasingly decentralized region with greater cross-town and suburban travel needs.

A timed-transfer system design is one way of addressing the need for greater travel across the region. A timed-transfer system works by identifying a number of transfer points throughout the service area instead of just in one central location. These transfer points are located at major activity centers and destinations. By designing the system so that buses traveling toward different locations meet or "pulse" at these transfer points at certain time intervals (such as every 30 minutes), customers are able more efficiently to travel between any two major activity centers in the region, usually with only one timed transfer. The routes would be interlinked to further reduce transfer requirements; for example, the suburban hubs would all be served by a single circumferential route.

The timed-transfer system with cross-town routes would reduce the number of transfers required while significantly reducing travel time for riders traveling between suburban locations. Riders traveling to or from downtown also would benefit from the system because the radial spoke routes would still operate but riders would be offered transfer points off of the radial spokes at the transfer centers. In addition, the large loops of the current system are greatly reduced in favor of bi-directional routes.

Transfer stations would be placed in locations that are known to have high attraction for transit riders, such as Greenville Technical College, the Cherrydale shopping complex, and Haywood Mall.

Regional Connectors

Three different types of regional transit service are considered in this plan: bus rapid transit (BRT), light rail transit (LRT), and commuter rail.

Bus Rapid Transit

BRT is a strategy for providing the quality and speeds of rail transit at lower cost. It has been implemented in various forms in several large cities, including Seattle, Boston, Los Angeles, and Pittsburgh. A simple definition of BRT is captured by the phrase "think rail, use buses." Capital costs for Bus Rapid Transit vary widely.

In its least capital intensive form, BRT would consist of buses operating at relatively high frequency along a route with widely spaced stops, generally not more than two or three stops per mile in densely populated areas and one or fewer stops per mile in suburban areas. Improved passenger amenities — including shelters, seating, and system maps — are provided at all stops, and a consistent and attractive image is created. While the buses would operate in mixed traffic with cars, less frequent stops allow buses to operate at higher speeds. Other technology may also be used to improve bus operating speeds, as will be discussed later. Generally, capital costs for this type of BRT are about $200,000 per mile.

A more capital-intensive version of BRT provides an exclusive transitway — essentially a two-lane bus-only roadway. A key advantage of BRT over rail options is that transitways can be provided in the most congested areas, with buses operating on streets and freeways along other portions of their routes. Vehicles may operate on electricity or use internal combustion engines. Several U.S. cities, including San Francisco, Boston, and Seattle, operate electric trolley buses on some routes. Capital costs for BRT on exclusive transitway are generally in the $15 to $25 million per mile range.

Light Rail Transit

LRT is essentially a modern version of the streetcars that served Greenville in the early 1900s. One key advantage of LRT is that it can operate in mixed traffic on city streets, as was the common practice in the early 1900s. Electric power is drawn from overhead electric lines, allowing pedestrians and automobiles to cross the rails. An important limitation of LRT is that it cannot share tracks with freight rail service. Limited freight service can be provided during hours that LRT service does not operate, generally between midnight and 5 a.m. Where any significant volume of freight service is operated, LRT will require separate tracks.

Capital costs for LRT are unavoidably high, ranging from $25 to $50 million per mile. The first LRT line in the Carolinas will open in Charlotte in 2007, at a cost of $50 million per mile.

Commuter Rail

Commuter rail can be operated using locomotive-hauled trains, such as those currently operated by Amtrak in the region, or with smaller, self-powered railcars called diesel multiple units (DMUs). Widely used in the U.S. on interurban passenger rail lines through the 1950s, and still used in Europe, a new generation of DMUs has been developed for use in the U.S., and is being considered by several existing and proposed commuter rail operations. A key advantage of DMUs over light rail vehicles is that they can share tracks with freight railroads.

Capital cost for commuter rail service is typically between $5 and $10 million per mile. The trains operate in mixed traffic with freight service, and typically require improved signal systems and train control systems as well as some additional track and switches. Commuter rail service cannot be implemented by simply putting a few passenger trains on a freight rail line. For this plan, an average cost of $7 million per mile is assumed for commuter rail service between Greer and Clemson.

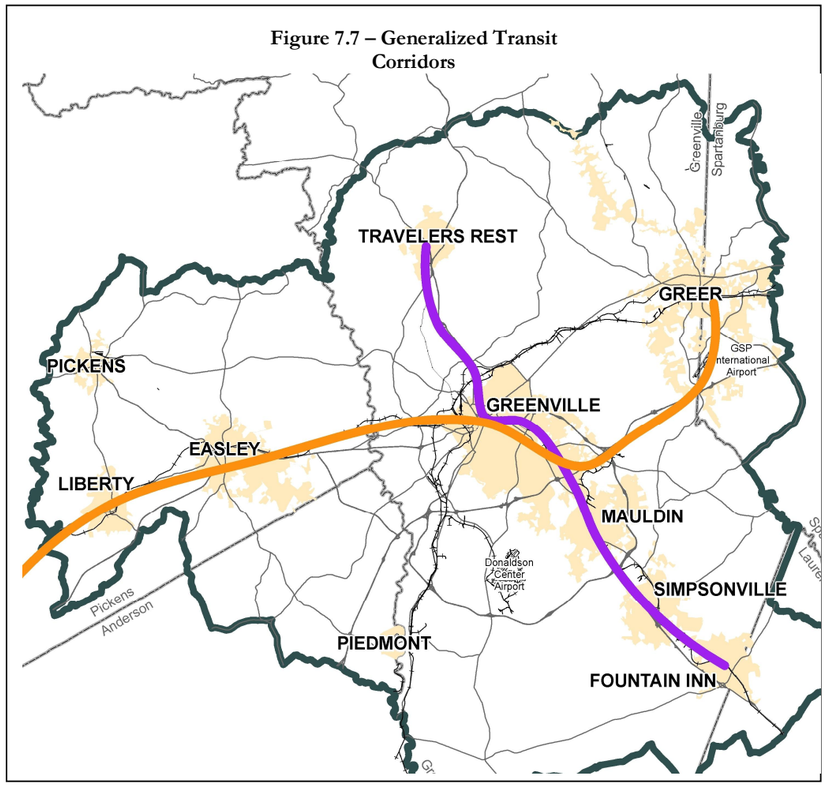
Proposed Regional Transit Corridors

A recurring theme during the public input process for this plan was the need for better regional transit connectivity. Participants expressed a desire for higher-quality express transit service that could connect the municipalities and employers of the region and provide an alternative to automobile commuting. Two corridors (**Figure 7.7**) were identified as the most promising based on existing development patterns and anticipated growth:

- The U.S. Highway 123/ Interstate 85 corridor, running between Clemson University, Easley, Greenville, the emerging ICAR and Verdae development complex, and Greenville-Spartanburg Regional Airport
- The US 276 corridor, connecting Fountain Inn, Simpsonville, Mauldin, ICAR and Verdae, Greenville, Furman University, and Travelers Rest

These two transit corridors would directly connect seven of the municipalities within the region and serve common commuting patterns, providing many residents with a previously unavailable public transit option for regional travel. These regional connectors would connect with the local bus routes and additional feeder shuttles to provide more localized service.

Figure 7.7 – Generalized Transit Corridors



Transit-Oriented Development

Among the most important benefits of investment in high-quality transitways is the opportunity they create for redevelopment. Transit-oriented development is characterized by higher-density, walkable, mixed-use development focused upon a transit service.

In order to support higher ridership within the region and on the transitways in particular, land use controls should encourage higher-density, mixed-use development within proximity to the transitways. Higher-density development will support a higher-level of transit service, which will in turn encourage increased development adjacent to the transitway. This cycle is beneficial to the support of transit, the efficient use of land, and would be a tool for economic development within the region.

To illustrate the opportunity offered by transit oriented development, an older commercial and residential area in Mauldin was selected as an example of how transit-oriented redevelopment could work. The Carolina Piedmont line is still an active freight line through Mauldin, but transit service could be provided in the corridor through agreements for joint use of the right-of-way.

Mauldin is the only city in the GPATS region that does not have a traditional downtown. The city failed to attract a major industry in the early 1900s, and as a result did not begin to experience significant economic growth until the 1950s. All of the city's commercial development followed the sprawling, automobile-oriented shopping center pattern; a traditional central business district never developed. There is no downtown street network, and no clear center of town.

Simply for illustrative purposes, a transit oriented redevelopment is assumed to occur at the intersection of Miller Road and Murray Avenue, a location close to the historic center of Mauldin, which was a railroad depot near the city's current public works department (see **Figure 7.8**).

A transit-oriented development — in this case, a downtown Mauldin — could convert a portion of Murray Avenue, from Miller Road to Butler Road, to a traditional downtown street.

Existing single-family houses that have been converted to small business use, auto repair shops, and one-story commercial buildings would be replaced by two- and three-story traditional downtown buildings, with retail and commercial offices at ground level and residential uses in the upper floors. The street would be reconstructed with wide sidewalks, parallel parking, and street trees, with new buildings located immediately behind the sidewalks. Mauldin's new cultural and recreational complex — located at Murray Avenue and East Butler Road at the old Mauldin Elementary School — would be a five-minute walk away.

A high-quality, high-frequency transit service — either light rail transit or bus rapid transit — would connect the new downtown Mauldin with downtown Simpsonville, Fountain Inn, Greenville, Travelers Rest, Furman University, ICAR, and Verdae. A single transfer at a transit station on the ICAR campus would provide rapid access to Greenville Spartanburg Airport, Easley, Liberty, or Clemson University. Feeder routes would radiate from the downtown Mauldin station to provide commuters across the city with good access to a high-quality regional transit service, and to downtown retail businesses. **Figure 7.8** illustrates the current configuration of the "downtown Mauldin" site, and **Figure 7.9** transposes a downtown pattern from another part of the region on the area to illustrate the potential for redevelopment.

Rail corridor, downtown Mauldin

Figure 7.8 – Existing Development, "Downtown" Mauldin

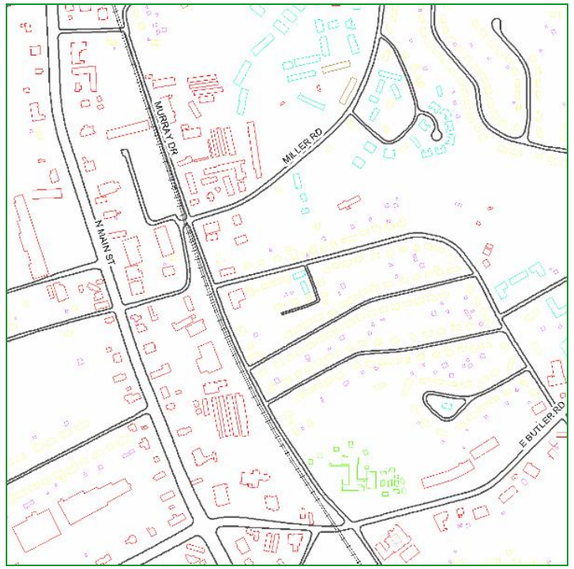


Figure 7.9 – Conceptual TOD Development, Downtown Mauldin

Transit Innovations

Transitway Development

In order to attract ridership in corridors that have traditionally been served solely by automobile travel, the regional transit routes proposed in this plan will require innovations to reduce transit travel time and induce people to shift from congested highways to an alternative mode of travel.

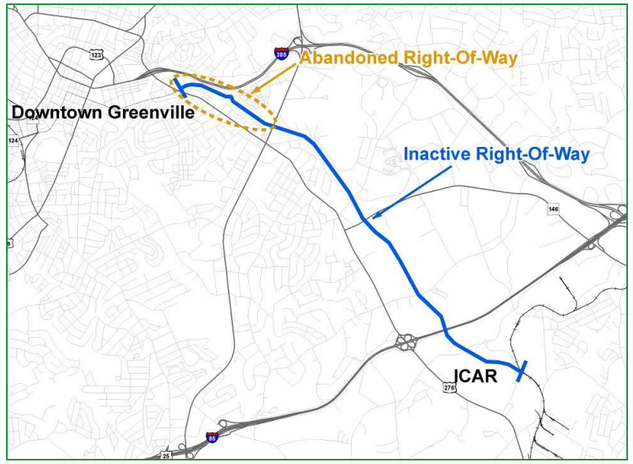
Greenville and Northern Rail Line near ICAR

Several types of improvements would be used to improve transit performance. Dedicated rights-of-way are an attractive option in congested corridors, allowing an otherwise road-going vehicle the opportunity to bypass traffic. Usually, acquiring and improving dedicated rights-of-way for transit operations is extremely expensive. Greenville, however, has a tremendous opportunity in an existing unused railroad corridor owned by the Greenville County Economic Development Corporation (GCEDC), which can be developed as a multimodal corridor in one of the most congested part of the region: the corridor between downtown Greenville and Mauldin and Simpsonville. The rail corridor parallels Laurens Road (US 276) and continues through downtown Mauldin and Simpsonville. **Figure 7.10** shows the location of this corridor. Developing this corridor as part of a regional transit system would improve transit travel times, establish a positive image for regional transit, and provide opportunities for the kind of transit-oriented development described above. A short section of abandoned right-of-way between Pleasantburg Drive and downtown Greenville would have to be acquired to complete this corridor.

Extensive discussions have occurred about the possibility of providing transit service in the discontinued rail corridor paralleling the Reedy River North of Greenville. This rail corridor has some significant limitations for transit development, because much of the corridor is in the floodplain — or worse, in the floodway — of the Reedy River. The railroad that previously operated in this corridor was nicknamed "The Swamp Rabbit" because it runs along the top of a narrow berm through wetlands, crisscrosses the river and creeks, and hugs the banks of the Reedy River for most of the distance between downtown and Furman University.

Among the most important reasons for developing high-performance transit service is the opportunity to generate higher-density, compact development within easy walking distance of transit stations. Where much of the land surrounding stations is environmentally unsuitable for development, one of the most important benefits of transit is undesirably constrained. Because the existing rail corridor is single-track, adding a second track to allow efficient two-way transit operations would have a substantial negative environmental impact and could worsen flooding problems in an already flood-prone river corridor. While some opportunities exist for short passing tracks to be added in the limited areas that are outside of the floodplain, the constraints to developing a high-capacity transit corridor on the Swamp Rabbit railroad are severe. The corridor generally seems more appropriate for development as a greenway trail, which would require very little environmentally-disruptive construction, and would not depend on nearby high-intensity development to be successful.

Figure 7.10 – Right-Of-Way Available for Dedicated Transitway



Traffic Signal Preemption

Where an exclusive transitway cannot be developed, traffic signal preemption also can be implemented at key intersections to improve transit operating speeds. Signal preemption would work by allowing a transit vehicle to gain priority when approaching a traffic control signal. As a bus or light rail vehicle approaches, traffic signals adjust slightly to provide the approaching transit vehicle with a green signal to clear the intersection.

Intelligent Transportation Systems (ITS)

In order to improve transit service quality, a number of passenger amenities can also be introduced. Intelligent transportation systems, using advanced computer software and Global Positioning System technology, can provide a real-time information display at bus stops and transit stations, providing waiting passengers with accurate information about vehicle arrival times based on bus location and traffic conditions. Pre-paid fare systems, which require passengers to purchase a ticket from a ticket machine prior to vehicle arrival, reduce passenger loading and unloading time at stations by eliminating the requirement for passengers to enter at the front door of the vehicle and pay a fare. Fare payment is enforced by fare inspectors who randomly board vehicles; this fare payment system is used almost universally in light rail systems.

Examples of Transit Stations (Charlotte, NC)

Concept Plans and Projected Expenses

GPATS staff has developed three transit concept plans, developed planning-level estimates of capital and operation costs, and provided illustrative examples of the revenue options available to finance a regional transit plan.

The first scenario is the Bus Rapid Transit alternative. This scenario would invest in a dedicated bus rapid transit (BRT) line between Greenville and Mauldin, fed by four regional on-road Bus Rapid Transit corridors serving the rest of the region. By 2030, the GPATS region would have a level of transit service comparable to other southeastern U.S. cities, and the densest, most congested corridor in the region would be served by a high-performance, high-capacity BRT line.

The second alternative is a lower-cost regional express bus alternative. This alternative would still provide a dedicated BRT line at the center of the region, but would provide slightly less transit service overall and would minimize capital investment outside of the BRT line.

The third scenario is the rail transit alternative, and was developed in response to expressed public desires for a rail alternative to be examined. This scenario assumes that a light rail transit (LRT) line is developed in the north-south corridor, from Travelers Rest to Fountain Inn, and that commuter rail service is developed between Clemson and Greer.

In developing the capital and operating cost estimates for these three alternative transit plans, many assumptions were required. Operating costs were based on data from the Federal Transit Administration's National Transit Database reports, and capital cost estimates were based on normal "rule of thumb" costs per mile. While extensive further analysis would be required to develop more accurate cost estimates, the planning-level estimates here will establish good approximate costs for each of the three alternatives.

Bus Rapid Transit Concept Plan

The bus rapid transit plan (shown in **Figure 7.11**) would operate 51 transit buses in peak hours, consisting of two regional routes, 19 local fixed routes, and 5 shuttles feeding the regional system. With a projected urbanized population of almost 700,000 persons in the GPATS region by 2030, this quantity of service is comparable to that currently provided in peer urban areas in the southeast, and would be a five-fold increase in the quality of public transit operated in the GPATS region.

System Description

For the base system, local fixed routes would generally operate with half-hour headways, as opposed to the one hour headways currently provided. Conceptually, this would allow most users to travel between transfer points in either direction every half-hour. Transfers would be timed at each of the transit centers in the system. Many suburban transit centers would have park-and-ride lots.

Two regional BRT lines would converge on a dedicated bus-only roadway between East Washington Street in Greenville and the ICAR campus. The east-west line would serve Clemson, Liberty, Easley, Greenville, Verdae, ICAR, and GSP Airport. The north-south line would serve Fountain Inn, Simpsonville, Mauldin, ICAR, Verdae, Greenville, Furman University, and Travelers Rest. A feeder route would connect downtown Pickens and the Pickens County government complex to the regional route at Liberty and at Easley. Other downtowns in the region would be served by feeder routes as well, and Greer would have connections to Greenville along Wade Hampton Boulevard and to GSP Airport.

Figure 7.12 is a map of the system envisioned in this alternative. The City of Greenville would be served by the timed-transfer network of transit routes described earlier, with transfer stations at major regional activity centers. The regional routes would serve the entire region, and the two regional routes would converge in the densest corridor in the region, between downtown Greenville and the I-85/I-385 interchange.

Source: Los Angeles Metro

Figure 7.11 – BRT Concept Plan

Figure 7.12 – Timed Transfer network

Transit Corridors and Feeder Routes

For the north/south corridor, bus rapid transit operating on an exclusive busway from East Washington Street to Mauldin was examined. Buses would operate in mixed traffic on Washington Street through downtown Greenville and on Poinsett Highway north to Travelers Rest. South of ICAR, buses would operate for a short distance to on shared right-of-way parallel with the active Carolina Piedmont freight rail line in Mauldin, and they would operate in mixed traffic on SC 417 and SC 14 through Simpsonville to Fountain Inn.

Along the dedicated transitway, stations would be located approximately at East Washington Street, Pleasantburg Drive, Airport Road, Haywood Road, Woodruff Road, Verdae Boulevard, and at Millennium Parkway in the ICAR Campus. The on-street segments of the route would have improved transit stations spaced at half-mile to one-mile intervals, with park-and-ride opportunities and good pedestrian and bicycle access. Traffic signal preemption technology would be used to improve operating speeds. Development along the line would be focused at transit stations. Extensive redevelopment opportunities exist in the Poinsett Highway corridor as well as in downtown Travelers Rest, Mauldin, Simpsonville, and Fountain Inn.

The east-west corridor would operate along the same path as the north-south corridor from downtown Greenville to ICAR, taking advantage of the exclusive busway and providing higher-frequency service along the busway. Due to the distance between activity centers and overall low-density of many parts of the corridor outside of Greenville, on-street BRT service would operate with a limited number of stops in key areas, such as downtown centers and remote parking lots. The stops to the west of Greenville could be located in Clemson, Liberty, and two or three key locations in Easley, as well as one or two park and ride locations on US 123 between Greenville and Easley.

The US 123 corridor between White Horse Road and downtown Greenville, which has declined along with Greenville's fading textile industry, offers significant redevelopment opportunities that could be spurred by improvements associated with regional BRT service. Starting at the ICAR campus, the east-west regional route would operate on Millennium Parkway through ICAR, to Woodruff Road, and non-stop on I-85 to GSP Airport. Predicted traffic congestion on I-85 would require an additional general-use lane on I-85 or a High Occupancy Vehicle (HOV) lane to maintain reliable service.

This east-west regional route would connect to local transit routes of Greenville Transit Authority (GTA) and Clemson Area Transit (CAT), providing local distribution of riders in the urban area as well as additional connections through Clemson Area Transit to the Cities of Anderson and Seneca, greatly improving transit connectivity in the region.

The north-south transitway would operate with 30 minute headways, while the east/west transitway would operate with 60 minute headways. An additional "transitway only" route would be operated to maintain 15-minute headways on the transitway.

Feeder routes would provide additional connectivity in Pickens, Travelers Rest, Mauldin, Simpsonville, and Fountain Inn. A shuttle would serve short trips among ICAR, Verdae, and the Woodruff Road/I-385 area.

Bus Rapid Transit Alternative, Operating Cost Estimate

Productivity estimates and cost recovery targets are displayed in **Table 7.5**. Operating cost per vehicle revenue hour was estimated at $63, slightly higher than GTA's current costs. Passenger trips per bus-hour were predicted to increase slightly as a result of improved service to match the 25 passengers per hour average of the Charlotte system. Total annual operating cost of the BRT alternative is estimated at almost $17 million, with a net operating cost slightly over $8.5 million. Specific headways, operating characteristics, and operating cost estimates per route are displayed in **Table 7.6**. Costs for paratransit services — the curb-to-curb wheelchair-accessible van service which ensures equal access for persons with disabilities — were assumed to add 14 percent to the cost of fixed route transit operating costs, based on analysis of average paratransit costs incurred by peer systems.

Table 7.5 – Productivity and Cost Recovery Targets for Base Scenario

Passengers per Vehicle Hour, Fixed Route	25
Passengers per Vehicle Hour, Paratransit	2.48
Annual Passenger Trips, Fixed Route	5,905,313
Annual Passenger Trips, Paratransit	130,422
Load Factor	8
Annual Passenger Miles	30,115,740
Average Trip Length (miles)	5.10
Operating Cost per Passenger Trip, Fixed Route	2.52
Operating Cost per Passenger Trip, Paratransit	15.97
Farebox Recovery Ratio	26.7%
Average Fare*	$0.75
Annual Farebox Revenue	$4,526,801
Net Operating Cost	$12,437,981

*Average fare includes transfers, elderly and disabled discounts

Table 7.6 – Preferred Concept Plan Transit System Operating Characteristics and Operating Cost Estimates

Route			Headways			Vehicles			Vehicles		Operating Cost
Route Type	Route Number	Notes	Weekday Headway (minutes)	Saturday Headway (minutes)	Sunday Headway (minutes)	Weekday Vehicles	Evening and Saturday Vehicles	Sunday Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Annual Operating Cost
Interlined Local Routes											
	2, 29, 6		30.0	50.0	75.0	5	3	2	23,468	330,986	1,478,453
	1, 5		30.0	60.0	60.0	4	2	2	18,186	249,512	1,145,718
	3, 7		30.0	45.0	45.0	3	2	2	14,999	172,383	944,906
	23, 34, 45, 56, 7	Beltline Clockwise	30.0	60.0	-	4	2	0	16,938	237,471	1,067,094
	23, 34, 45, 56, 7	Beltline Counterclockwise	30.0	60.0	-	4	2	0	16,938	237,471	1,067,094
	67, 8, 4		30.0	60.0	60.0	4	2	2	18,186	227,871	1,145,718
	9	Laurens Rd., Five Forks	30.0	45.0	90.0	3	2	1	14,375	240,342	905,594
	39	Haywood, Pelham, GSP	60.0	-	-	2	0	0	6,375	91,928	401,625
	300	Powdersville	30.0	-	-	2	0	0	6,375	118,575	401,625
Transitway and Regional Routes											
	100	Transitway	30.0	30.0	60.0	6	6	3	33,561	652,202	2,114,343
	200	(Clemson to GSP)	60.0	60.0	120.0	4	4	2	22,374	493,011	1,409,562
Feeder Routes											
	Pickens		60.0	60.0	-	2	2	0	10,563	227,105	665,469
	Travelers Rest/Furman		60.0	60.0	-	1	1	0	5,282	35,914	332,735
	Mauldin		30.0	60.0	-	2	1	0	8,469	140,585	533,547
	ICAR		15.0	30.0	-	2	1	0	8,469	101,628	533,547
	Simpsonville/Fountain Inn		30.0	90.0	-	3	1	0	11,657	207,486	734,360
	Total, Fixed Route					**51**	**31**	**14**	**236,213**	**3,764,468**	**$ 14,881,388**
	ADA Paratransit										**$ 2,083,394**
	Grand Total										**$ 16,964,782**

Capital Projects and Costs

Capital cost requirements include vehicles and infrastructure construction. The estimated amount of capital cost needed to fund the expanded concept plan is $285 million through the year 2030. This includes costs for vehicle fleet expansion and replacement, transitway construction, and other facility construction as described in **Table 7.7**. These costs are broken down by county based on the extent to which particular transit routes operate within each county, and the local share of capital costs is estimated using the assumption that transitway construction would receive 50 percent federal funding while all other items would receive 80 percent federal funding.

Table 7.7 – Capital Cost Estimates by County for BRT Alternative

Item	Greenville	Pickens	Anderson	Total
Buses	$22,750,138	$1,903,633	$220,328	$28,840,000
Fixed Guideway	$209,045,190	$5,102,273	$0	$219,249,735
Stations and Parking	$1,500,000	$200,000	$100,000	$1,800,000
Maintenance Facility	$23,010,355	$1,841,682	$147,963	$25,000,000
Greenville Center	$10,000,000	$0	$0	$10,000,000
Total	$266,305,682	$9,047,588	$468,291	$284,889,735
Local Share*	$115,974,693	$3,340,199	$93,658	$122,752,868
FTA Section 5307 Apportionment				$83,367,719
FTA Small Starts Funds				$78,769,148

Transitway Costs

Since a portion of the right-of-way for the transitway proposed here is owned by GCEDC and currently inactive, constructing a two-lane busway on this portion would be relatively inexpensive. Constructing a two-lane busway, new bridges and passenger stations from East Washington Street to Millennium Parkway on the ICAR campus is estimated to cost $26 million. This figure includes estimated right-of-way costs, a bridge at Laurel Creek, an overpass at Woodruff Road, and $5 million per mile construction costs for the two-lane busway.

Constructing a dedicated busway south of ICAR would be considerably more expensive, as the right-of-way is privately-owned and includes active but infrequent freight service. An estimate of $25 million per mile was used to estimate the construction costs per mile between ICAR and downtown Mauldin. Adding $200,000 per mile for on-street BRT improvements, the total cost of construction for the north-south transitway is estimated at $117 million.

For the east-west transitway, capital costs of construction for implementing the facilities needed for this transitway are relatively low, except for the expense of constructing an HOV lane on Interstate 85. In most of the corridor, such as between Clemson and Easley and between ICAR and Greenville-Spartanburg Airport, express buses can operate efficiently in mixed traffic without limited improvements due to the high-speed, limited-access roadways in most of the corridor. Improvements in these areas would include providing passenger stations, parking, and signage. In more urban areas, such as within Greenville and Easley, the bus service could benefit from strategic infrastructure improvements, such as signal preemption and by-pass lanes at congested intersections. The average, on-street costs for bus rapid transit improvements was estimated at $200,000 per mile. Fortunately, the capital cost of the dedicated busway in the Laurens Road corridor would be covered by the construction of the north/south transitway. Total estimated capital cost requirements are estimated at $62.6 million. Capital costs for the BRT alternative are shown in **Table 7.8**, while the network improvements needed to implement the preferred transitway alternatives are shown in **Figure 7.13**.

Table 7.8 – Capital Cost Estimates for Bus Rapid Transit Alternative

North-South Transitway	Cost/Mile	Miles	Total Capital Cost
Bus Rapid Transit			
On-Street	$200,000	20.7	$4,140,000
Exclusive Busway, north of ICAR	$6,306,829	4.1	$25,858,000
Exclusive Busway, south of ICAR	$25,000,000	3.5	$87,500,000
Total		28.3	$117,498,000
East-West Transitway	**Cost/Mile**	**Miles**	**Total Capital Cost**
Bus Rapid Transit			
On-Street w/ Bus Stops and Signal Preemption	$200,000	34.4	$6,887,689
Shared HOV lanes on I-85	$10,000,000	5.6	$55,767,045
Exclusive (shared with North South Transitway)	$0	4.4	$0
Total		44.4	$62,654,735

Figure 7.13 BRT Network Improvements

Regional Bus Concept Plan

The lowest cost regional transit alternative is the regional bus alternative. This alternative is generally similar to the BRT alternative, but provides less local bus service and minimizes capital costs. The operational reductions include scaled back service frequency on the beltline route in Greenville and elimination of all feeder routes for a transit system operating 37 vehicles in maximum service as compared to the 51 vehicles from the preferred concept plan.

A large reduction in capital expenses results from less transitway construction. The elimination of bus/HOV lanes on Interstate 85 and the elimination of the dedicated transitway south of ICAR to Fountain Inn eliminates $152 million in capital expenses, as detailed in **Table 7.9**. The need for a smaller bus fleet also created a savings of $7 million in rolling stock expenses (**Table 7.10**).

While the reductions in operating and capital expenses are significant, these reductions would decrease the attractiveness of transit service provided to the region. The regional routes would have lower overall operating speeds, while elimination of feeder routes would result in a less comprehensive coverage of the region. **Table 7.11** illustrates the financial effects of this option, while **Table 7.12** shows the operational characteristics and costs for the basic concept plan transit system.

In general, the regional bus alternative is presented as the least expensive way to develop a regional transit system that would begin to shape development patterns.

Table 7.9 – Transitway Capital Cost Estimate -- Regional Bus Alternative

North-South Transitway	Cost/Mile	Miles	Total Capital Cost
Bus Rapid Transit			
On-Street/Signal Preemption	$200,000	24.2	$4,840,000
Exclusive Busway, north of ICAR	$6,306,829	4.1	$25,858,000
Exclusive Busway, south of ICAR	$25,000,000	0.0	$0
Total		28.3	$30,698,000
East-West Transitway	**Cost/Mile**	**Miles**	**Total Capital Cost**
Bus Rapid Transit			
On-Street w/ Bus Stops	$20,000	24.7	$494,852
On-Street w/ Bus Stops and Signal Preemption	$200,000	15.2	$3,045,720
Exclusive (shared with North South Transitway)	$0	4.4	$0
Total		44.4	$3,540,572

Table 7.10 - Capital Cost Estimate by County – Regional Bus Alternative

	Greenville	Pickens	Anderson	Total
Rolling Stock	$20,279,093	$1,053,796	$227,111	$21,560,000
Fixed Guideway	$30,136,299	$4,102,273	$0	$34,238,572
Stations and Parking	$1,500,000	$200,000	$100,000	$1,800,000
Maintenance Facility	$25,000,000	$0	$0	$25,000,000
Greenville Multimodal Center	$10,000,000	$0	$0	$10,000,000
Total	$86,915,393	$5,356,068	$327,111	$92,598,572
Local Share*	$26,423,968	$2,301,895	$65,422	$28,791,286
FTA Section 5307 Apportionment				$70,545,523
FTA Small Starts Funds				$0

Table 7.11 – Productivity and Cost Recovery Targets for Basic Concept Plan

Passengers per Vehicle Hour, Fixed Route	25
Passengers per Vehicle Hour, Paratransit	2.48
Annual Passenger Trips, Fixed Route	4,475,588
Annual Passenger Trips, Paratransit	98,846
Load Factor	8
Annual Passenger Miles	22,983,958
Average Trip Length (miles)	5.14
Operating Cost per Passenger Trip, Fixed Route	2.52
Operating Cost per Passenger Trip, Paratransit	15.97
Farebox Recovery Ratio	26.7%
Average Fare*	$0.75
Annual Farebox Revenue	$3,430,825
Net Operating Cost	$9,426,643

*Average fare includes transfers, elderly and disabled discounts

Table 7.12 – Basic Concept Plan Transit System Operating Characteristics and Operating Cost Estimates

Route			Headways			Vehicles			Operations		Operating Cost
Route Type	Route Number	Notes	Weekday Headway (minutes)	Saturday Headway (minutes)	Sunday Headway (minutes)	Weekday Vehicles	Evening and Saturday Vehicles	Sunday Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Annual Operating Cost
Interlined Local Routes											
	2, 29, 6		30.0	50.0	75.0	5	3	2	23,468	330,986	1,478,453
	1, 5		30.0	60.0	60.0	4	2	2	18,186	249,512	1,145,718
	3, 7		30.0	45.0	45.0	3	2	2	14,999	172,383	944,906
	23, 34, 45, 56,	Beltline Clockwise	60.0	60.0	-	2	2	0	10,563	148,093	665,469
	23, 34, 45, 56,	Beltline Counterclockwise	60.0	60.0	-	2	2	0	10,563	148,093	665,469
	67, 8, 4		30.0	60.0	60.0	4	2	2	18,186	227,871	1,145,718
	9 Laurens Rd., Five Forks		30.0	45.0	90.0	3	2	1	14,375	240,342	905,594
	39 Haywood, Pelham, GSP		60.0	-	-	2	0	0	6,375	91,928	401,625
	300 Powdersville		30.0	-	-	2	0	0	6,375	118,575	401,625
Transitway and Regional Routes											
	100 Transitway		30.0	30.0	60.0	6	6	3	33,561	652,202	2,114,343
	200 (Clemson to GSP)		60.0	60.0	120.0	4	4	2	22,374	493,011	1,409,562
	Total					**37**	**25**	**14**	**179,024**	**2,872,995**	**$ 11,278,481**
	Paratransit										**$ 1,578,987**
	Grand Total										**$ 12,857,468**

Rail-Transit Concept Plan

In response to several public comments that rail transit options should be explored for the region, a third alternative was developed based on LRT in the north-south corridor and commuter rail in the east-west corridor. In all other respects, the rail transit alternative is identical to the BRT alternative.

It is important to remember when comparing between transit modes the different capital costs involved and the expected benefits from each mode. The densities of employment and population normally required to support rail transit do not exist currently within the GPATS region, and current development trends will not produce those densities. On the other hand, rail transit is generally credited with a stronger ability to create high-density transit corridors in the long term than the other transit modes.

The difference in cost required to implement the rail transit alternative compared to the BRT alternative is due to the capital and operating costs of rail transit service in the two transitway corridors. Capital costs would increase by $1.08 billion, based on the generalized cost estimates used here, while operating costs would remain comparable.

Several simplifying assumptions were made in order to develop approximate costs for rail transit construction and operations. In general, national and regional averages for rail construction per mile were used to forecast capital expenses, while operating expenses were assumed to average approximately 66 percent of the national average operating expenses per vehicle-hour. Commuter rail service is assumed to be operated by single diesel multiple unit (DMU) vehicles, which are assumed to have the same operating costs per vehicle hour as LRT vehicles. Since no operating data is available currently for DMUs in the U.S., no other method of estimating DMU operating cost was readily available.

It is important to note once again that the cost estimates here are intended to be illustrative; analysis and engineering studies far beyond the scope of this plan would be necessary to establish more precise cost estimates. Cost estimates are invariably controversial, as so many transit projects and other large public works projects have ultimately cost far more than initially estimated. The simplified approach here will simply provide residents and policy makers with reasonable "ballpark" indications of the costs and revenues necessary to develop different types of regional transit.

North-South Light Rail Line

Light rail service is assumed to be most likely in the north-south corridor due to the relatively short distances between major activity centers and the need for vehicles to operate on street in mixed traffic through downtown Greenville, where the former Greenville and Northern rail line was abandoned. Light rail would support higher density development in the corridor by providing a frequent, attractive, high-quality transit service connecting several of the regions largest activity centers.

The LRT line would follow the existing rail line from Fountain Inn to near Laurens Road, and would operate on surface streets through downtown Greenville. LRT, like all rail vehicles, has limited ability to climb steep grades, but those issues are not addressed by this analysis. North of downtown Greenville, the LRT line is assumed to be built along Poinsett Highway because of the environmental constraints associated with the Swamp Rabbit railroad line. While a scenario might exist where a light rail line could be developed on the Swamp Rabbit railroad, some combination of extensive filling of wetlands, construction in the floodway and floodplain of the Reedy River, and extensive bridges and structures to minimize environmental impacts would be necessary.

The north-south LRT line is estimated to cost approximately $810 million, based on an average capital cost of $30 million per mile, which is substantially lower than most recent light rail projects.

East/West Commuter Rail Line

The least expensive option for rail transit service in the east/west transit corridor would use the existing Norfolk-Southern rail line between Clemson and Greer. DMU vehicles would operate in mixed traffic with freight trains. Significant improvements would be needed to allow for more passenger service in this busy freight rail corridor.

The capital cost of commuter rail service on the existing Norfolk-Southern is highly uncertain, but an estimate of $7 million dollars per mile was used based on the experience of other systems, resulting in a total cost of almost $300 million. East of Greenville, service might operate on the old Piedmont and Northern rail line, currently owned by CSX Transportation and relatively lightly used. Assessment of the numerous operating issues that would have to be addressed with this commuter rail concept is beyond the scope of this plan.

Diesel Multiple Unit

Source: Colorado Railcar Manufacturing

Capital Cost Summary

Total capital costs for the rail transit alternative are estimated at $1.17 billion. The capital cost requirements were assessed based on the number of miles of route operated within each county. As shown in **Table 7.13**, the implementation of rail transit is capital intensive. The acquisition of new right-of-way, rail construction, and rolling stock purchase is expensive on the front-end. Rail rolling stock will last longer, however, with a life span of 25 years compared to the 12 years of urban buses. These life spans were taken into account in the rolling stock capital cost estimates.

Table 7.13 — Capital Cost Estimate by County -- Rail Concept Plan

Items	Greenville	Pickens	Anderson	Total
Rolling Stock	$17,942,624	$1,654,576	$221,200	$23,800,000
Transitway (LRT & CR)	$752,775,000	$178,579,545	$0	$1,109,934,091
Stations and Parking	$1,500,000	$200,000	$100,000	$1,800,000
Maintenance Facility	$22,645,599	$2,234,722	$119,679	$25,000,000
Greenville Multimodal Center	$10,000,000	$0	$0	$10,000,000
Total	$804,863,223	$182,668,843	$440,879	$1,170,534,091
Local Share*	$386,805,145	$90,107,632	$88,176	$567,087,045
FTA Section 5307 Apportionment				$83,367,719
Federal New Starts Funds				$520,079,326

For the purposes of this plan, federal funds from the discretionary FTA New Starts program are assumed to be available. The share of federal funding through the FTA New Start Program — which funds construction of new rail systems — has recently averaged about 50 percent of projects costs. There is currently a backlog of requests for funding, which has made future project funding highly competitive, with many cities with much more extensive transit systems competing for these funds. Proposed projects are evaluated based on the level of local financial commitment and cost effectiveness measures.

The transitway capital cost estimate for rail is also shown below, in **Table 7.14**. Rail transitway concept plans are illustrated in **Figure 7.14**.

Table 7.14 — Transitway Capital Cost Estimate -- Rail Concept Plan

North-South Transitway	Cost/Mile	Miles	Total Capital Cost
Light Rail Transit, Urban Environment			
Travelers Rest to Fountain Inn	$30,000,000	27.0	$810,000,000
East-West Transitway	**Cost/Mile**	**Miles**	**Total Capital Cost**
Commuter Rail			
Clemson to Greenville	$7,000,000	30.1	$210,611,174
Clemson to Greer	$7,000,000	42.8	$299,934,091

Operating Cost

Operating costs per passenger mile served are slightly lower for light rail systems than for bus systems as a result of several factors. New light rail investments are made in corridors where demand for transit service is highest. The investment in exclusive guideway increases average speeds, which improves labor productivity and thus reduces operating costs per mile. Much or all of the difference in operating costs between light rail and local bus operating costs is due to these factors.

The operating cost per hour estimate used for both rail lines was $140 per revenue hour. This figure is one-third lower than the national average operating cost for light rail systems. The figure used for bus operating costs, however, also is one-third lower than the national average. Several systems do report light rail operating expenses in this range. These same hourly operating costs are used to estimate commuter rail line costs as well, because no operating cost data exists for DMU-based commuter rail operations in the U.S.

Operating cost assumptions and operating characteristics are displayed in **Tables 7.15** and **7.16**. Total annual operating costs were estimated at just under $21 million.

Table 7.15 – Productivity and Cost Recovery Targets -- Rail Concept Plan

Passengers per Vehicle Hour, Fixed Route	25
Passengers per Vehicle Hour, Paratransit	2.48
Annual Passenger Trips, Fixed Route	5,905,313
Annual Passenger Trips, Paratransit	130,422
Load Factor	8
Annual Passenger Miles	30,115,740
Average Trip Length (miles)	5.10
Operating Cost per Passenger Trip, Fixed Route	2.52
Operating Cost per Passenger Trip, Paratransit	15.97
Farebox Recovery Ratio	26.7%
Average Fare*	$0.75
Annual Farebox Revenue	$4,526,801
Net Operating Cost	$12,437,981
*Average fare includes transfers, elderly and disabled discounts	

Table 7.16 – Rail Concept Plan Transit System Operating Characteristics and Operating Cost Estimates

Route		Headways			Vehicles			Total Service		Operating Cost
Route Type	Route Number	Weekday Headway (minutes)	Saturday Headway (minutes)	Sunday Headway (minutes)	Weekday Vehicles	Evening and Saturday Vehicles	Sunday Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Annual Operating Cost
Interlined Local Routes										
	2, 29, 6	30.0	50.0	75.0	5	3	2	23,468	330,986	1,478,453
	1, 5	30.0	60.0	60.0	4	2	2	18,186	249,512	1,145,718
	3, 7	30.0	45.0	45.0	3	2	2	14,999	172,383	944,906
	23, 34, 45, 56, 71, 12	30.0	60.0	-	4	2	0	16,938	237,471	1,067,094
	23, 34, 45, 56, 71, 13	30.0	60.0	-	4	2	0	16,938	237,471	1,067,094
	67, 8, 4	30.0	60.0	60.0	4	2	2	18,186	227,871	1,145,718
	9 Laurens Rd., Five Forks	30.0	45.0	90.0	3	2	1	14,375	240,342	905,594
	39 Haywood, Pelham, GSP	60.0	-	-	2	0	0	6,375	91,928	401,625
	300 Powdersville	30.0	-	-	2	0	0	6,375	118,575	401,625
Transitway and Regional Routes										
	100 Light Rail Line	30.0	30.0	60.0	6	6	3	33,561	-	4,664,979
	200 Commuter Rail Greer to Clemson	60.0	60.0	90.0	3	3	2	17,093	487,706	2,375,858
Feeder Routes										
	Pickens	60.0	60.0	-	2	2	0	10,563	227,105	665,469
	Travelers Rest/Furman	60.0	60.0	-	1	1	0	5,282	35,914	332,735
	Mauldin	30.0	60.0	-	2	1	0	8,469	140,585	533,547
	ICAR	15.0	30.0	-	2	1	0	8,469	101,628	533,547
	Simpsonville/Fountain Inn	30.0	90.0	-	3	1	0	11,657	207,486	734,360
	Total				**50**	**30**	**14**	**230,931**	**3,106,960**	**$ 18,398,319**
	ADA Paratransit									**$ 2,575,765**
	Grand Total									**$ 20,974,084**

Figure 7.14 – Rail Transitway Concept Plan

Funding Options

Identifying a stable local funding source for transit will be necessary to implement any of the three concepts presented in this chapter. Policy makers in multiple jurisdictions across the region may consider a variety of options, and will surely hold many different views on the merits of any additional funding for public transportation services.

For purposes of this plan, common funding sources for transit are evaluated to illustrate the potential sources of funding for each of the three transit concept plans described here, and the rates that would be necessary to fund each of the three alternatives.

Ultimately, a mixture of revenue sources may be explored if the region's leaders decide to pursue the significant improvements in public transportation evaluated in this plan. But for clarity and simplicity, each of these alternative revenue sources are evaluated as if only one revenue source would be used to provide all of the local funding necessary for transit.

The Greenville Transit Authority's five-year *Transit Development Plan* has identified the need for a local dedicated funding source to be secured in order to provide stability and predictable funding for public transit. The current system of dependence on yearly general revenue appropriations from the City of Greenville and Greenville County inhibits the ability to develop and implement long-range plans. Consideration of regional transit service makes the funding question more critical, since several units of government would have to collaborate to fund a multi-jurisdictional service.

A dedicated funding source will be essential to enable expansion of local transit services and development of the regional transit services presented here.

Four possible revenue sources are evaluated below: a local-option sales tax; property tax; vehicle registration fee; and a motor fuel tax. It is critical to note that each of these revenue sources is evaluated as if that source would provide all of the local funding necessary to implement one of the transit concept plans identified here. Anderson County's share of the transit services outlined here is very small, so the analysis of revenue options is limited to Greenville and Pickens Counties.

To estimate the revenues required for the three alternatives, it was assumed that revenue growth from each source would keep pace with inflation. Effects of population growth were not taken into account, but would tend to reduce the rates calculated here.

Local-Option Sales Tax

Local sales tax could be approved by referendum in the municipalities or counties receiving transit service. Three recent examples of this tax exist in South Carolina. In November 2004, 60 percent of Charleston County voters approved a half-cent sales tax dedicated to mass transit, road improvements, and greenways. Sixty-two percent of Horry County voters approved a one-cent sales tax in November 2006 to fund road improvements, while simultaneously approving a one-cent sales tax for schools. In November 2003, almost three-quarters of York County voters approved a renewal of a one-cent sales tax targeted at highway safety improvements. In North Carolina, Mecklenburg County is using the proceeds of a half-cent sales tax to fund bus system expansion, two light rail lines, two bus rapid transit lines, and a commuter rail line.

Vehicle Registration Fee

Vehicle registration fees are currently collected in Greenville and Pickens Counties, with the proceeds directed to road maintenance. Currently, Greenville assesses a $15 annual fee, and Pickens assesses a $20 fee per vehicle annually.

Property Tax

Many transit systems are funded through a dedicated portion of property taxes. While the property tax often is an unpopular tax, it is a major source of funding for transit in the GPATS region currently.

Motor Fuel Tax

For political and administrative reasons, local motor fuel taxes are unlikely; state law does not currently enable local governments to impose motor fuel taxes. However, one-quarter cent of the state motor fuel tax is dedicated to mass transit. A portion of any increase in state-level motor fuels taxes could be dedicated to transit, and redistributed to local jurisdictions to fund transit services. For this analysis, the GPATS Region was assumed to receive a 9.5 percent share of state fuel tax dedicated to transit. Each penny of motor fuel tax in South Carolina generates about $25 million annually.

Table 7.17 summarizes the tax rates that would be necessary to fund each of the three transit alternatives presented here. As mentioned above, while all four revenue options are summarized in the table, only one of the four revenue options would be necessary to provide the funding needed. Citizens on the GPATS Transportation Plan Advisory Committee found the local-option sales tax option to be the only probable source of funding for transit in the region. Other revenue options are presented in the table but are not discussed here.

Table 7.17 — Summary of Revenue Options to Fund Transit Alternatives

		Alternative		
County	Revenue Option	Regional Bus	Bus Rapid Transit	Rail Transit
Greenville County	Sales Tax (cents)	0.12	0.20	0.37
	Vehicle Registration Fee ($)	22.60	36.99	69.21
	Motor Fuel Tax (cents/gal)	3.2	4.9	14.2
	Property Tax (mils)	4.6	7.5	14.1
Pickens County	Sales Tax (cents)	0.03	0.06	0.30
	Vehicle Registration Fee ($)	4.64	9.31	46.52
	Motor Fuel Tax (cents/gal)	3.2	4.9	14.2
	Property Tax (mils)	1.0	2.1	10.5

A local-option sales tax of two-tenths of a cent in Greenville County would fund the BRT alternative, while six-one-hundredths of a cent on the sales tax in Pickens County would provide the Pickens County share of the funds needed. The regional bus alternative reduces the necessary sales tax rate by nearly half in both counties. Compared to the BRT alternative, the rail transit alternative nearly doubles the sales tax rate required in Greenville County, and would require a five times higher rate in Pickens County. The large increase in the cost of the rail transit alternative is related to the length of the rail line between Clemson and Greenville County; the BRT option minimizes capital investment in Pickens County, while the rail option would incur an estimated $7 million per mile to upgrade the Norfolk Southern rail line.

Conclusion

As the GPATS region grows, travel patterns, highway congestion, and other factors will make mass transit an increasingly important service to maintain regional mobility. While much smaller than Charlotte and Atlanta, the Upstate's growth and travel patterns are following very similar trends to those that created serious traffic and air pollution problems in those metro areas. Highway improvements alone do not adequately meet the mobility needs of large regions; this realization has led most large and growing metropolitan areas to begin making significant investments in mass transit.

Each of the alternatives examined here would provide the regional connectivity among universities, downtowns, and major regional destinations that helps build regional identity, mitigate traffic problems, and provide better employment and economic opportunities for everyone.

The high cost of light rail and commuter rail service, questions about feasibility of developing high-frequency passenger rail service in the region's available rail corridors, and availability of federal funding make the rail transit alternative presented here seem unlikely. The flexibility and lower costs of BRT appear to offer significant advantages, which make BRT a much more likely feasible option than rail for regional transit in the Upstate.

For any transit system to be effective, appropriate form and density of land uses must be encouraged in the transit corridors identified here. Pedestrian-friendly urban nodes centered around proposed transit stations will be an essential component of effective regional transit. The regions existing downtowns, which are all striving with varying degrees of success to restore the walkable environments necessary for downtown renewal, provide good models for the kind of urban form that works for mass transit.

Each of the alternatives examined here would provide the regional connectivity among universities, downtowns, and major regional destinations that helps build regional identity, mitigate traffic problems, and provide better employment and economic opportunities for all citizens.