To the Graduate Council:

I am submitting herewith a thesis written by Melany Strike Noltenius entitled "Transit Oriented Development, Park and Ride, and Transit Station Placement Along Bus Rapid Transit Corridors: A Study of the Sevier County, Tennessee Route." I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning, with a major in Planning.

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Acceptance for the Council:

Vice Chancellor and Dean of
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TRANSIT ORIENTED DEVELOPMENT, PARK AND RIDE, AND TRANSIT STATION PLACEMENT ALONG BUS RAPID TRANSIT CORRIDORS: A STUDY OF THE SEVIER COUNTY, TENNESSEE ROUTE

A Thesis
Presented for the
Master of Science in
Planning Degree
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Melany Strike Noltenius
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ABSTRACT

This study analyzes the current land use practices along the proposed Sevier County Bus Rapid Transit (BRT) route from Interstate 40 through Sevierville and Pigeon Forge to Gatlinburg, Tennessee. The study then provides direction in the possible placement of transit oriented developments (TOD), park and ride lots, and transit stations along the route based on population levels, commuter travel patterns, and employment nodes. The current zoning practices and regulations of each town along the proposed BRT are reviewed to see what changes need to be made in order to allow for TODs, park and ride, and transit stations.

PREFACE

The area of investigation is limited to the proposed Sevierville Bus Rapid Transit (BRT) route found in the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee*. The part of the route in the land use analysis begins at the I-40 and US 66 (Winfield Dunn Parkway) interchange in Sevier County (Exit 407) and continues along to US 441 (Forks of the River Parkway) in Sevierville, as well as to a second branch of US 441 called the Parkway, which leads through Pigeon Forge and Gatlinburg, Tennessee. The methods and procedures used in gathering the data for this study include a significant U.S. Census and Census Tract data review, and an examination of available literature regarding land use practices and public transit corridors. Additionally, a BRT listserv, hosted by the National Center for Transit Research located at the Center for Urban Transportation Research at the University of South Florida, provided valuable information regarding the functionality of BRT throughout the county. Furthermore, an appraisal of current zoning regulations and land use maps along the proposed BRT corridor in combination with population, commuter, and employment trends were used to find possible locations for TODs, Park and Ride lots, and BRT transit stations. The results of the study showed that with specific land use designs, density can increase, and so can subsequent BRT usage, but that the current land use and zoning by the three towns along the BRT corridor undermines BRT usage by both residents and tourists.

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INTRODUCTION

Background

Perhaps the crowded, dirty school bus has scarred our nation's psyche against bus transit or perhaps it is because the citizens of the United States, as a whole, do not need to ride public transit, but when buses are mentioned, ideas of unclean masses, and belching tailpipes come to mind (Carpenter, 2004). In fact, this negative stereotype has been used to sell cars. In 2003 General Motors ran an advertising campaign targeted toward bus riders. The destinations being served by the theoretical bus routes included "Hours of Hell" and "Bacterial Stew," while the patrons included "creeps and weirdoes" (Luba, 2003). Unfairly, Bus Rapid Transit (BRT) is also associated with typical busing, but BRT has some very significant characteristics that distinguish it from regular bus systems.

First of all, BRT integrates dependable high-quality service of rail-like transit via use of designated right-or-ways or High Occupancy Vehicle (HOV) lanes combined with intelligent transportation system (ITS) technology, which allows for traffic signal preemption. The result is a bus system that decreases travel times while increasing reliability. Second, BRT systems are designed to serve routes with excessive traffic congestion problems, and use well-designed park-and-ride lots to get commuters off the road. Rail-like transit stations that are spaced farther apart than ordinary urban bus stops are placed at significant employment or residential nodes, as well as attractions. Finally, "the definition of a good bus rapid transit system/model should be based on

improvements in conventional bus service and include . . . long-term benefits for land use that will decrease sprawl and protect open space" (EESI, 2003). Thus, land use issues begin and end with the placement of residential and employment developments that reduce the spread out of land uses, park-and-ride lots conveniently placed to serve as many commuters as possible, and transit stations that can serve a good majority of the people. The most significant element needed to increase ridership along BRT corridors is the concept of development that is transit-defined – transit oriented development (TOD). According to the February 2003 issue of *Bus Rapid Transit NewsLane*, Portland's public transportation system has been actively pursuing integration of TOD with BRT because:

> Well-planned bus routes and rail lines are the foundation of a successful transit system, but their customer research identified several elements that make public transportation a viable option, factors that relate to TOD . . . By changing the paradigm to include dialog of TOD and partner opportunities in BRT policy, a more balanced dialog of BRT service within the transit system may be achieved. Perhaps TOD should be included in the planning of BRT system service . . . Community decisions, extending the land uses and development patterns surrounding LRT stations to BRT stops and hubs, could both greatly enhance the rider's experience as well as support TOD (WestStart-CALSTART, 2003).

In this thesis, I will examine the placement of TODs, park-and-ride lots, and transit stops along the proposed BRT Sevier County corridor as outlined by the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* (Wilbur Smith and Associates, 2002). Current patterns of population and commercial density, as well as commuter habits will be the factors used to determine placement. Additionally, I will analyze existing zoning regulations in Sevierville, Pigeon Forge and Gatlinburg, Tennessee to see what changes need to be made to allow for TOD, park-and-ride, and transit stops. Finally, a set of recommendations is made as to how the town planners

along the proposed Sevier County BRT corridor may implement land use changes to better facilitate the use of the BRT system by residents of Sevier County.

Significance of Study

The research presented here can be used to assist planners along the Sevier County BRT corridor, which runs through the towns of Sevierville, Pigeon Forge, and Gatlinburg, Tennessee. Altering current land uses to provide for TOD, park and ride lots, and transit stops will provide the density to promote the use of the proposed BRT corridor (Burton, 2004). TODs will be placed along the BRT route in dense population areas that lack significant commercial establishments, but have enough acreage to implement mixed-use designs. The location of park and ride lots will be based on commuter traffic, and transit stops will be placed near dense commercial/residential areas or areas that are large tourist destinations. The results of this study can also be applied to other corridors to enhance the developments needed to increase the use of BRT. Additionally, zoning regulations are reviewed and changes are suggested in order to promote land use that supports BRT. The ultimate goal of the research presented here is to provide the missing land use elements needed for the Sevier County BRT corridor suggested by the *Regional Transportation Alternatives Plan (RTAP) For East Tennessee* to become successful – TOD, park and ride lot and transit stop placement.

Research Questions

Primary Question

Where should the Transit Oriented Developments, park and ride lots and transit stations be placed along the proposed Sevier County Bus Rapid Transit corridor based on residential, employment and commuter densities as outlined by the *Regional Transportation Alternatives Plan (RTAP) For East Tennessee?*

Secondary Question

What changes are needed to the zoning ordinances or Sevierville, Pigeon Forge and Gatlinburg, Tennessee in order to support the land use designs that will promote the Sevier County BRT?

Methodology

The research methodology in this thesis is to assess the current land use along the Sevier BRT corridor, and to evaluate parcels along the route that have potential for TOD, park-and-ride lots, and transit stations. Supporting evidence is provided by U.S. Census data, as well as a literature review. Additionally, current-zoning ordinances are evaluated to see what changes need to be made in order for zoning to not only permit, but also enhance use of the suggested BRT corridor. Existing TOD ordinances, park-and-ride and transit station regulations are applied to Sevierville, Pigeon Forge and Gatlinburg, Tennessee zoning ordinances.

Organization of Thesis

The thesis is organized into ten chapters. The first chapter is used to introduce the reader to the topic and provide background on BRT, as well as to clearly outline the purpose and content of this thesis. A literature and Internet information review is provided in the second chapter. Chapter Three presents a more detailed look at BRT, TOD, park and ride lots, and transit station purpose and elements. The fourth chapter looks at BRT in East Tennessee, and Chapter Five provides details about the proposed Sevier County BRT corridor. Chapters Six through Eight outline population densities, employment centers, commuter patterns, and visitor attractions in the three towns that are directly affected by the Sevier County BRT (Sevierville, Pigeon Forge and Gatlinburg, Tennessee). At this point, tables and maps are provided to show where TODs, park and ride lots, and transit stations should be placed. Additionally, a review of zoning ordinances and suggested changes are provided for each town in Chapter Nine. Finally, Chapter Ten provides an overview of the proposed Sevier County BRT corridor, and recommendations, based on the examination of population, commuter patterns, and employment centers, on ways to alter land use to better facilitate the use of the BRT corridor.

Chapter 2

LITERATURE REVIEW

Several articles and Internet resources are reviewed below to present an understanding of the importance between BRT routes and high-density land use, appropriate placement and designs of park-and-ride lots and transit stations, as well as examples of zoning ordinances conducive to the success of BRT corridors. A complete list of literature reviewed and resources used can be found in the Bibliography and is referenced in the research used to write this thesis.

The *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* is the basis for this thesis. The preliminary research determining the need for Bus Rapid Transit (BRT) routes in East Tennessee, and more specifically for the Sevier County BRT corridor, which travels through Sevierville, Pigeon Forge and Gatlinburg, Tennessee provides the background for determining the development of TOD, park and ride, and transit stations along the route.

The U.S. Department of Transportation (USDOT) has a BRT website (www.fta.dot.gov/brt) that provides a good overview of what issues are faced by BRT, and the status of completed and future BRT projects. This website was used to provide generalized background information about BRT, as well as to use the contained case studies to limit the application of land uses in the Sevier County BRT to three elements. The website was instrumental in providing a means by which the proposed Sevier BRT corridor could be evaluated.

The National BRT Institute's website (http://nbrti.cutr.usf.edu/) offers a plethora of valuable information resources. Most enlightening is the listserv that allows individuals to post queries and receive responses almost instantaneously from knowledgeable experts, who have background and experience in designing, implementing and altering land uses along BRT corridors. News about BRT systems are updated daily, and there is a number of online articles regarding BRT that can be accessed easily.

Reconnecting America (www.reconnectingamerica.org) is a website that explicitly demonstrates the reality of linking TOD designs and transit in a number of online articles. Among these are identifiers that true TODs must have to be distinguishable from simple transit-related designs, the challenges to integrating transit and mixed-use developments, and the step-by-step implementation of TOD in four large cities.

Building Livable Communities: A Policymaker's Guide To Infill Development by Nancy Bragado, Judy Corbett and Sharon Sprowls is an older book that looks at the specific needs of a community and the ways policymakers can alter zoning ordinances to make neighborhoods easier to live in. This book provides a good basis for looking critically at current zoning in towns along the proposed Sevier County BRT corridor.

Transit Oriented Development: Moving from Rhetoric to Reality, a discussion paper by Dena Belzer and Gerald Autler, brings to light the trends leading to revitalized downtowns and suburban centers that are forcing the issue of public transit to the political forefront. The result is a need for TOD. The article then reviews past mistakes in developments that were more transit adjacent as opposed to transit oriented, and defines

TOD and provides benchmarks to determine success. The article also lists six performance areas (location efficiency, value recapture, livability, financial return, choice, and efficient regional land use patterns) that can be used to this end. TOD design and function barriers are highlighted through case studies, and recommendations are provided in the text.

The Bus Rapid Transit Policy Center (www.gobrt.org/) has been an invaluable resource in discovering facts and figures about BRT around the United States, policies that affect BRT, presentations and many links to other institutes involved in BRT. The most important information found here are the Fact Sheets linking BRT to Smart Growth, and the online version of Volume I and II of the Transportation Research Board's BRT report.

Though geared toward the placement of park-and-ride lots for HOV lanes, the *Northern Virginia Park & Ride Lot Feasibility Study* could be easily applied to the placement of BRT park-and-ride lots. There are a number of similar elements needed to determine the call for and ultimate usage of park-and-ride lots. Lot placement is directly related to commuter travel patterns, and usage is dependent on proximity to amenities, so that errands can be run either before or after work.

A short article, *Transit Design Standards and Guidelines*, by the Grand Junction/Mesa County Metropolitan Planning Organization provided a great overview of the factors under consideration when placing a transit stop. Among these are population/employment densities, trip producers/attractions, sidewalk availability, and safe pedestrian walkways. General criteria for stop placement are also provided.

Overall, nearly forty books, articles and web sites were reviewed to find enough pertinent information to write this thesis. At this time, it is very difficult to find books specifically designed to address the issues of BRT and TOD; so many articles from the Internet were used. Much of the current literature addresses land use and light rail, and this information was modified to be applicable to the Sevier County BRT corridor.

Chapter 3

BRT AND LAND USE

Bus Rapid Transit

Bus Rapid Transit (BRT) is clearly *not* an inner city bus system. Primarily because the BRT transit system provides high quality public transit service similar to that of light rail. BRT uses either existing public roads when traffic congestion is limited or dedicated rights-of-way when traffic congestion is the norm. Thus, BRT reduces travel time and is able to provide a quicker alternative to car travel. Other attributes of a BRT system include safe, clean and well-designed rail-like stations, alternatively fueled vehicles, and professional service. BRT is designed to be quick, efficient and reliable through the use of Intelligent Transportation Systems (ITS) and signal preemption (Vincent, 2004). Finally, BRT allows for affordable, flexible service between medium-sized areas with a moderate level of density that would not be able to support a light rail system (Wilbur Smith and Associates, 2002).

BRT due to it's flexibility has been used successfully as an alternative to light rail throughout the world. Examples of cities that have successfully implemented BRT corridors instead of light rail include Ottawa's Transitway, Vancouver, British Columbia's B-Line, Honolulu's CityExpress, and Arizona's City of Phoenix BRT (Vincent, 2004). There are more than 13 cities in the United States stretching from Florida to Oregon that have implemented thriving BRT corridors (BRTPC, 2004). However, the public transit system of Curitiba, Brazil is the most well known example of a highly successful BRT system. Approximately 70% of the town's residents use the

system (USDOT, 2004). Most recently, in Virginia Beach, Virginia, the city council successfully developed an oceanfront BRT route instead of a traditional light rail initiative because BRT received both stronger political and voter support than light rail (Skog, 2004).

One of the reasons that BRT is gaining status is its ability to foster mixed-use development, such as TOD at transit stations; BRT supports integrated transit and land use planning via zoning and redevelopment. In Florida, the Miami–Dade County Joint Development Program has had many years of successfully using TOD designs around rail stations, and is now applying the same strategy toward BRT stations along the South Dade Busway to Florida City (Cura, 2003). In fact, according to the Minneapolis *Northwest Corridor Busway Study*:

> A successful bus rapid transit system requires supporting land use principles (often referred to as Transit-Oriented Development or TOD principles), in addition to the "rapid transit-like" features. Complementary land use principles may include such elements as increased density of development, a mixture of residential and employment-based development, as well as pedestrian-oriented urban design (IBI Group, 2002).

Transit Oriented Development

Clearly, an integral asset in the success of these BRT corridors is the land use that increases residential and employment densities, as well as provides for nearby stores and services. This involves combining residential areas with commercial and entertainment activities near BRT stations. Land use is intrinsically linked to the success of public transit. According to *Transit and Urban Form* "Public transportation services – rapid transit, commuter rail, light rail and bus – can and do provide extensive mobility and

access, given land use patterns that ensure sufficient ridership to make the service cost-effective" (Parsons, 1996).

TOD designs are specifically geared toward building compact, pedestrian friendly mixed-use developments around transit stations. TODs have also proven to be financially rewarding for governments that have encouraged development around stations (Dittmar, 2003). However, while transit provides accessibility and mobility, transit by itself is not sufficient to create TODs. Before implementation of TODs can begin, local zoning regulations must be in place to support mixed-use and densely populated designs, and local governments should actively engage in the promotion and use of these zoning regulations. Furthermore, for TODs to be successfully combined with BRT, there needs to be clearly outlined goals that can be used to evaluate the outcomes of each project, coupled with the active cooperation of the many actors involved in a BRT-TOD design (Reconnecting America, 2004). There are numerous factors that differentiate TOD from any other dense mixed-use development.

Locally, the *Regional Transportation Alternatives Plan (RTAP) For East Tennessee* has identified a strong need for a traffic-reducing BRT corridor through the tourist destinations of Sevierville-Pigeon Forge-Gatlinburg (Wilbur Smith and Associates, 2002). One of the elements missing in this transportation plan is a coordinating land use plan that utilizes mixed use principals, like TOD, to not only reduce congestion during the tourist season, but to provide a need for BRT service for residents in the communities along the Sevier County BRT corridor. TODs could provide centralized locations allowing for tourists and residents to walk to attraction and dining options, while reducing the need for car travel. However, mixed-use

developments that focus on public transit as the major form of transportation do not simply happen. According to the *Regional Transportation Alternatives Plan (RTAP) For East Tennessee*:

> One of the fundamental changes necessary to turn this plan into reality is a new way of growing. If the 200,000 additional residents anticipated in the five-county area in the next 30 years are housed in transit-supportive developments, then transit will be an even more viable alternative. Transit-oriented developments (TODs) do not just happen. There are policies that shape these developments such as zoning overlays, parking supply limits, and financial incentives for TODs (Wilbur Smith and Associates, 2002).

Though none of the towns along the Sevier County BRT corridor currently have zoning ordinances and subdivision regulations that permit the specifications called for in TOD designs, all three towns allow for Planned Unit Developments (PUD), which is a small start leading to the more detailed and efficient TOD regulations. Modifying land use policies to permit growth that is concentrated around transit nodes and corridors will help to maintain and increase transit's base of riders. Furthermore, policies that encourage in-fill development can lead to concentrated growth along the BRT, and this will also increase transit use. With regards to the Sevier County BRT corridor, there is one residential area in Sevierville that has the in-fill potential to be modified into a TOD. Finally, TOD designs are multi-modal. They allow for walkways that are easy-to-use by both pedestrians and bicyclists or skateboarders, as well as provide adequate, but shared parking spaces for motorcycles and cars.

Park-and-Ride Lots

Integral in any BRT design is the placement of park-and-ride lots. The locations are dependent on a number of factors; among them are commuter traffic predictions,

overall user demand, site access, proximity to major roads and highways, size and expansion potential, land and lease acquisition, land use and zoning, and community impacts (BMI, 2003). In the case of the Sevier County BRT corridor, the factors used to determine placement of park-and-ride lots include daily commuters from surrounding counties, site access, access to major roads, expansion potential and current zoning. Thus, there is one site with definite potential for a park-and-ride lot along the Sevier County BRT corridor that can be easily reached by I-40 and US 411 commuters.

As a minimum, amenities at park and ride lots should include safety features such as reliable lighting that illuminates the entire lot, and public phones, as well as, covered parking, with adjacent bus stops that contain real-time bus arrival information and informational kiosks. Other facilities that make riding public transit convenient to use include comfortable seating, and bicycle racks. However, in order to make the lots more enticing, other design characteristics need to be taken into account. These include connections to walking and bike trails and sidewalks, storage/bike lockers, and pleasant landscaping (BMI, 2003). New designs for park and ride lots are now integrating businesses, such as restaurants and other services within walking distance of the lot – basically sharing parking lots with established businesses. Furthermore, more and more TODs are being built to mix the commercial aspect of the area with park-and-ride facilities (King County DOT, 2004).

In the case of park-and-ride lots, urban design plays an important role, and municipal zoning should encourage mixed-use developments and shared parking around lots. A combination of residences, offices and stores would allow for greater convenience to the BRT system, thus making the park-and-ride lot attractive to people who have to run

errands before or after work. Furthermore, by providing a truly mixed-use design in park-and-ride lots, instead of a static eyesore during the weekday, these areas are vibrantly active throughout the week, thus creating employment opportunities and providing sales and property taxes for the municipality.

Transit Stops

Transit stops along the proposed Sevier BRT corridor should be located in areas that have significant population, employment and/or attraction densities, such as TODs, multi-family dwelling units, shopping malls, major entertainment sites, and clustered hotels. Currently, the corridor contains 12 areas that have the densities to support BRT transit stops. The transit stop locations, spaced at least 1/2 mile apart, depend on the configuration of the BRT corridor. Some stops will be located on the outside of the traffic lanes, whereas others will be located along the median of the road. BRT stops along the outside lanes of the road minimize the need for a pedestrian bridge, but calls for users on one side or the other to cross the street. BRT stops along the median call for pedestrian bridges to be built in order to ensure safety. Other needed elements in a BRT transit stop include shelters, and available real time schedules and route maps. Design considerations include safety lighting, and stop placement that allows easy egress and ingress without interfering with pedestrian or vehicular traffic. Because transit stops are the most visual element that reflects the BRT service, transit stop design is very significant in drawing users who might otherwise consider public transit unsafe and unreliable.

Chapter 4

BUS RAPID TRANSIT IN EAST TENNESSEE

In 1996 the Regional Transportation Alternatives Committee (RTAC) was created to look at various regional mass transit modes and systems for a 10-county region in East Tennessee in order to address future population growth and resulting road congestion. As a result of this committee, the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* was developed. This study looked at a wide variety of transportation modes, including trolley, bus rapid transit, light rail transit, and commuter rail routes. Eventually, due to the vast area under consideration, the study focused on potential public transit routes in a 5-county area, which included Anderson, Blount, Loudon, Knox, and Sevier counties.

After much scrutiny, the professionals of the RTAC, which included landscape architects, attorneys, national and local park administrators, city and regional transportation planners, and government leaders, decided that the "market potential indicates that there is not sufficient activity or development to warrant a rail-based concept," but that BRT was a legitimate alternative because it requires lower densities than light rail (Wilbur Smith and Associates, 2002). The study examined BRT corridors connecting Townsend and Cades Cove, Cocke and Sevier Counties, and Knoxville and Sevierville. In particular, the 24-mile Sevier County BRT corridor from the SR 66 (Winfield Dunn Parkway)/I-40 interchange to the US 441/US321 intersection in Gatlinburg seemed the most needed due to the traffic congestion caused by the approximately 11 million visits to the Great Smoky Mountains. Thus, the Sevier County

BRT route was considered as one of only two primary corridors primed for BRT in the RTAP study (Wilbur Smith and Associates, 2002).

Chapter 5

THE PROPOSED SEVIER COUNTY BRT CORRIDOR

BRT Configuration

The proposed Sevier County BRT corridor begins at the intersection of State Route 66 (Winfield Dunn Parkway) and I-40 at Exit 407, and ends in Gatlinburg at the intersection of US441 and US321, as shown in Figure 5.1. The route is designed specifically to alleviate the traffic problems caused by tourism - the persistent and chronic traffic delays and congestion during the summer and fall months. However, the corridor can also be used to transport Sevier County residents. The *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* divides the BRT route into seven sections – 1, 2, 3, 4, 5, 5A, and 6. Different BRT configurations are used for each section (Wilbur Smith and Associates, 2002).

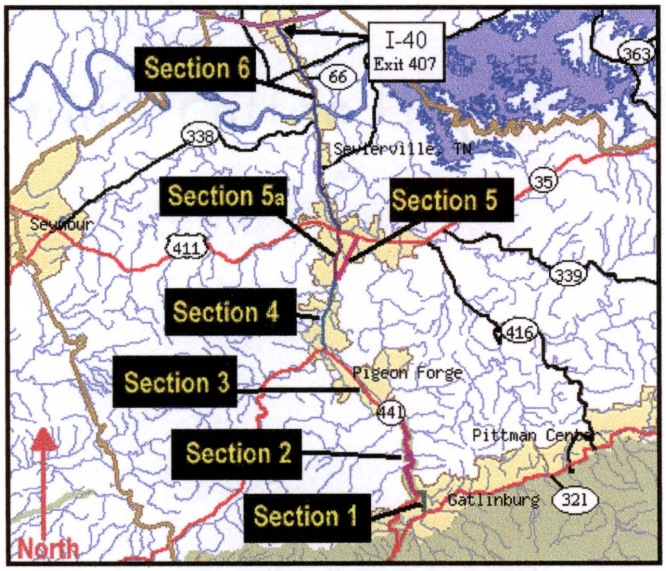

Figure 5.1 Map of Proposed Sevier County BRT Corridor
Source: U.S. Census Bureau. Used with permission (Appendix A).

Unfortunately, the proposed 24-mile long plan does not look at the BRT corridor in terms of stops or park-and-ride lots. In fact, "no specific locations for stations or park-and-ride lots have been chosen" (Wilbur Smith and Associates, 2002). Nor does the plan integrate the BRT route with the existing trolley system or take into account the existing public transit infrastructure. Most importantly, the plan does not try to halt the sprawl located along the corridor by increasing residential or commercial densities nor does it incorporate land use designs such as TODs along the route to enhance the use of the BRT or reduce the need to travel outright.

Population Trends

The definition of a transit-supportive area as described by the *Capacity and Quality of Service Manual* is an area that has "sufficient population or employment density (or an equivalent mix) to require service at least once per hour;" this means that for BRT, the minimum population densities to support transit are three households per acre or an average density of 5,750 residents per square mile, or four jobs per acre (Wilbur Smith and Associates, 2002). As shown in Table 5.1, Sevier County's population levels have increased approximately 4% per year, with Sevierville growing

Table 5.1: Sevier County Population Trends

	Year - 1990	Year - 2000	% Change/Year
Sevierville	7,718	11,757	+ 5.2%
Pigeon Forge	3,846	5,083	+ 3.2%
Gatlinburg	3,407	3,382	- 0.07%
Sevier County	51,043	71,170	+ 3.9%

Source: U.S. Census Bureau, 2000.

the fastest at 5%, and Gatlinburg remaining relatively stable (U.S. Census, 2000). With TOD zoning, this population increase could be centralized to allow for easy BRT access.

Unfortunately, at present there are only a few neighborhoods considered to be transit supportive. Although seven census tracts overlap the Sevier County BRT corridor, only four of these census tracts (Census Tract 801, 805, 806, 808) have existing population densities to support transit and are within 1/4 mile of the BRT corridor. There are four small-to-medium sized neighborhoods that have the density to support transit, but may not have the square acreage required or the consistent density to support BRT (Table 5.2). Ideally, TOD should be built near already established densities because it has the potential to revitalize existing areas with new development, while providing a base of transit users. Because of this lack of population densities in the Sevier County BRT corridor, TODs, park-and ride lots and most transit stops will be placed in areas when there is an existing combination of employment potential, residential and commuter use.

Employment Trends

Employment opportunities along the BRT corridor, in and around downtown Sevierville, and along the Pigeon Forge and Gatlinburg hotel corridor, are concentrated in and around shopping centers, and large entertainment venues. In Sevier County, 37.1% of employees are involved in the retail trade, which has nearly 700 establishments in the county (U.S. Census, 2000). This is the highest in Tennessee. The accommodation and food services industries, with almost 500 establishments, employ slightly less people at 32.4% than the retail trade; this is fourth highest in the state (U.S. Census, 2000).

Table 5.2: Census Tracts Overlapping the Sevier County BRT Corridor			
BRT Section	Census Tract	Location	Neighborhoods*
6	801	North of the French Broad River and south of I-40, bisected by SR 66 (Winfield Dunn Parkway)	1
6	806	South of the French Broad River, east along SR 66 (Winfield Dunn Parkway) and north of US 411	1
5 & 5a	808	South of US 411 and encompasses downtown Sevierville	1
4	805	South of the French Broad River, west along US 66 and the Forks of the River Parkway through Sevierville, north of Pigeon Forge	1
4 & 3	810	Bisected by US 441 through Pigeon Forge	0
2	809	Along US 441 south of Pigeon Forge and north of Gatlinburg	0
1	811	Along US 441 north of Gatlinburg and the intersection of US 321	0

Source: U.S. Census Bureau, 2000

* Neighborhoods within ¼ mile of the Sevier County BRT Corridor with population densities of approximately 5000+ persons per square mile

Transit stops will need to be placed in areas along the corridor where employment is concentrated. Entertainment venues that draw a significant number of visitors and employ numerous people are also studied for placement of transit stops. A number of businesses and shopping malls, as well as Dollywood, employ a significant number of people, and these businesses are located along the Sevier County BRT corridor or close to existing public transit routes, which can be used as feeder routes for the BRT system.

Commuting Patterns

A final determinant in the placement of TOD, park-and-ride lots, and transit stops involve commuting patterns in Sevier County. The Journey to Work data compiled by

the US Census Bureau is based on workers who are 16 years old and over, and is derived from the long form questionnaire, which is filled out by an average of one in six households. The most commuters originate from Cocke County, followed by Jefferson, Knox and Blount counties (Appendix B). This is a total of 6,545 commuters per workday, not counting the 25,388 intra-county commuters who both live and work in Sevier County. Approximately 700 additional commuters travel from 16 surrounding counties to Sevier County on a near- daily basis. Commuters from Cocke County tend to travel US 411 to Sevier County; most Jefferson County commuters travel I-40 to Sevier County; Knox County commuters have a propensity to travel I-40 or US 411 to Sevier County, and Blount County commuters are inclined to travel US 411 or US 321 (Wears Valley Road) to Sevier County. Figure 5.2 graphically represents the commute pattern to Sevier County.

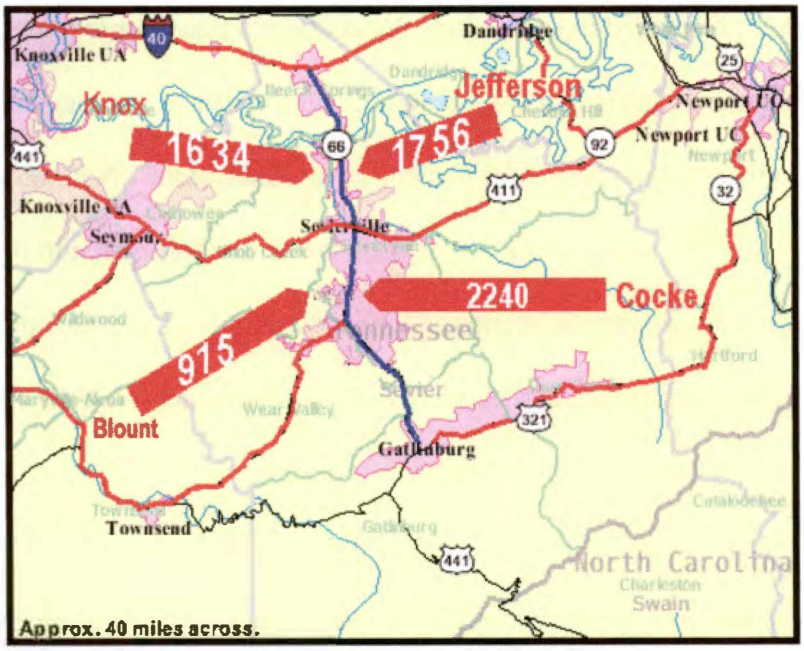

Figure 5.2 Commuter Patterns to Sevier County
Source: U.S. Census Bureau. Used with permission (Appendix A).

Chapter 6

SEVIERVILLE, TENNESSEE

History

Stretching from the SR 66 (Winfield Dunn Parkway)/I-40 intersection to the intersection of US 441 and Apple Valley Road, Sevierville is approximately 20 square miles and has a population of over 11,000 residents. Sevierville is Sevier County's most populated town (U.S. Census, 2000). Founded around 1800, and incorporated one hundred years later, Sevierville has slowly evolved from a tiny settlement with "one church, two mills, one tavern, one trading post, two lawyers and a stable for a courthouse" to a town that hosts more than 5 million visitors per year (Smoky Mountain Navigator, 2004). Nearly 6,000 city residents are employed either part or full time, which provides some employment density needed for transit stops along the Sevier County BRT corridor.

The BRT Route

Sections 6, 5, 5a and a portion of Section 4 of the Sevier County BRT corridor are found inside the city limits of Sevierville. This part of the BRT route is found within the four census tracts of 801, 805, 806, and 808. Section 6 of the BRT corridor is ten miles long and places the BRT lanes on the outside of an eight-lane roadway. Section 5, which is slightly shorter than a mile, and Section 5a (Forks of the River Parkway), which is a bit longer, are configured to allow for the BRT corridor to travel on the shoulders of a 5 Lane roadway. Section 4 begins when Sections 5 and 5a converge. Section 4 is almost

four miles long and made up of two interior bus lanes on a six-lane roadway with a raised median.

BRT Section 6

Along BRT Section 6 in Sevierville, there are only two areas currently dense enough to support public transit. Though Section 6 of the BRT touches on three census tracts, only two areas have enough residential population to be remotely considered transit supportive. The first densely populated neighborhood is found in Census Tract 805, and lies north of the French Broad River next to an arterial business district zone (C-4). The second transit-supportive neighborhood lies at the corner of SR 66 (Winfield Dunn Parkway) and US 411, just north of downtown Sevierville in Census Tract 806.

Leading up to these densely populated areas, Section 6 in Census Tract 801, along SR 66 (Winfield Dunn Parkway) passes acres of agricultural land that have been zoned C-4, yet have not been developed intensely. Pockets of isolated businesses, like a gas station, three businesses and a hotel lined together, before more acres of agricultural land, basically describe this part of the parkway. Other isolated businesses, like a bank, a car sales lot and a furniture store dot the agricultural landscape. Overall, the businesses are spaced very far apart. According to the *Sevierville Zoning Map*, approximately 4/5ths of this nearly 2 mile area north of Douglas Dam Road is zoned C-4, while the remaining 1/5th is zoned A-R (Agricultural-Residential).

Census Tract 801

Not surprisingly, as shown in Table 6.1, most of the residents in Census Tract 801 drive alone to work. Of the slightly more than 7,000 workers in this census tract, 4262 workers 16 years and over commuted to work, and this commute took approximately 30 minutes. Those who worked at home (184 or 4.3%) were not considered in this evaluation. Clearly, the current land use of separating residential from business and spacing businesses not in centralized nodes, but sprawled across the landscape, has an effect on traffic patterns. Furthermore, though the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* calls for a park-and-ride lot at the SR 66 (Winfield Dunn Parkway)/I-40 interchange, there simply is not enough population/residential or attraction density to warrant a park-and-ride lot in census tract 801 (Wilbur Smith and Associates, 2003). Nor are densities present that can support TODs or transit stops.

Appropriately, given the distance from the tourist attractions of Pigeon Forge and Gatlinburg, more than twice the people in Census Tract 801 work in sales and other office occupations than any other occupation. What is interesting to note is the fact that the number of sales and other office occupations spike significantly upward, all other occupations, with the exception of farming, fishing, and forestry, have approximately the

Table 6.1: Journey to Work Data for Census Tract 801

	Number of Commuters	Percentage
Drove Alone	3,605	84.6
Carpooled	334	7.8
Public transportation (including taxicab)	16	0.4
Walked	59	1.4
Other means	64	1.5

Source: U.S. Census Bureau, 2000

same number of workers. This distribution changes as the Sevier County BRT corridor heads toward Sevierville, Pigeon Forge and Gatlinburg, Tennessee. The closer the census tracts are to the towns along the Sevier County BRT corridor, the more people are working in retail trade, as well as the arts, entertainment, recreation, accommodation and food services industries (Appendix C). This remains fairly constant throughout all census tracts in this area. More importantly, these types of jobs have a definite impact on the level of service and hours of operation of the BRT corridor. According to the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* "service could be provided between Sevierville and Gatlinburg approximately every 15 minutes during the day . . . and less frequently to the [proposed] I-40 park-and-ride lot" (Wilbur Smith and Associates, 2002). Thus, higher commercial activity warrants more frequent BRT service.

Census Tract 805

Located in Census Tract 805, Section 6 of the BRT, south from Douglas Dam Road, but north of the French Broad River, is approximately 11/2 miles long. Like Section 6 in Census Tract 801, it is also predominantly agriculture with only one hotel, a car sales lot, and a cluster of two trailers dotting the landscape. The *Sevierville Zoning Map* has this entire area zoned C-4, even a narrow strip in front of an already established neighborhood of more than 700 residential lots, located right on the river as shown in Figure 6.1. Most of this neighborhood has a population density of at least 1000 people per square mile, with a smaller section reaching a density of more than 4500 people per square mile. With three short access roads, and the densest parts of the neighborhood

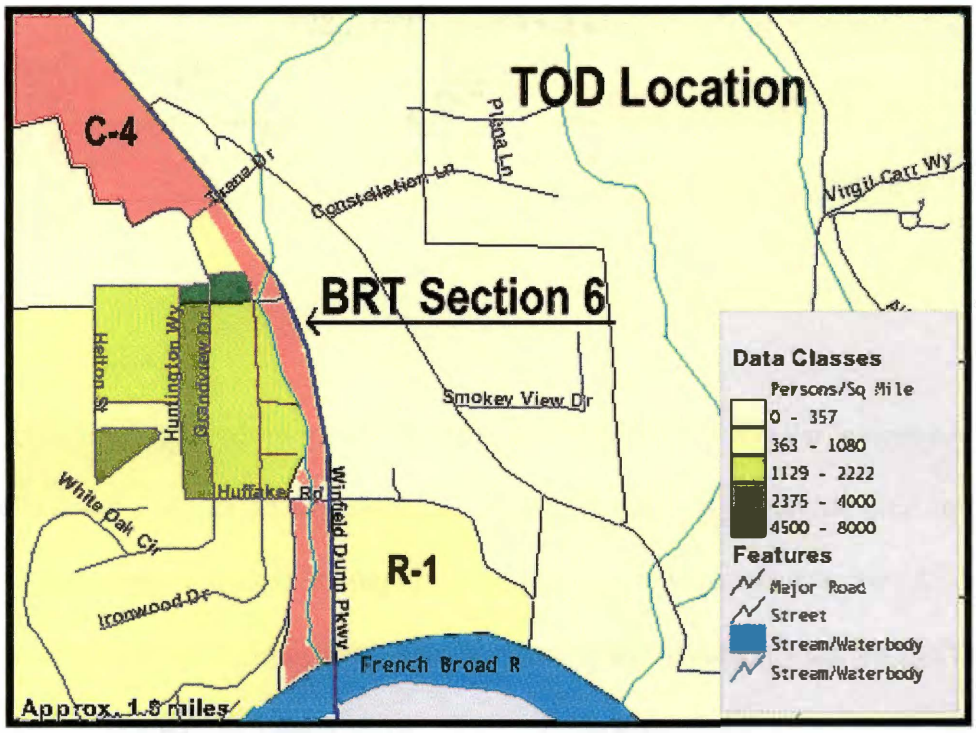

Figure 6.1 Map of Potential TOD Location in Sevierville
Source: U.S. Census Bureau. Used with permission (Appendix A).

located closer than ¼ mile to SR 66 (Winfield Dunn Parkway), this neighborhood could possibly already have a transit supportive density. Furthermore, the C-4 lot north of the neighborhood is still mostly undeveloped. This would allow room for a transit-oriented development (TOD) to be built and blend into the existing neighborhood. Since amenities are not located nearby, residents may provide demand for the businesses located in the TOD. Furthermore, though with only a density of 360 people or more per square mile, the neighborhood across the street could add activity to the TOD. Due to the location, available acreage, the number of nearby residents, and potential for future employment activities, this would be the best location for a TOD along the Sevier County BRT corridor.

Table 6.2: Journey to Work Data for Census Tract 805		
	Total Number of Commuters	Percentage
Drove Alone	1,623	79.2
Carpooled	314	15.3
Public transportation (including taxicab)	48	2.3
Walked	9	0.4
Other means	10	0.5

Source: U.S. Census Bureau, 2000

As shown in Table 6.2, slightly more than 2 percent of the total commuting population uses public transit, including taxis in Census Tract 805. This number is less than the 3.5 percent national average cited by the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* (Wilbur Smith and Associates, 2002), but is more than the census tract closest to downtown Sevierville. Additionally, in Tennessee, less than 1 percent (0.66%) of commuters use public transit to get to work, and in Sevier County, this percentage drops to 0.4 percent (U.S. Census, 2000). The residents in this census tract use public transit about as much as Nashville commuters, at almost 2 percent. Of the approximately 3,500 workers in this census tract, 2,050 workers 16 years and over commuted to work. Those who worked at home (46 or 2.2%) were not considered in this evaluation. The mean travel time to work is approximately 21.3 minutes (U.S Census, 2000). Already, the population in this census tract has some dependence on public transit that can be enhanced by the Sevier County BRT Corridor.

In contrast to Census Tract 801, more than 70% of all employees in this census tract work in two fields - either sales and office occupations or management, professional, and related occupations. The retail industry hires almost a quarter of all employees in this census tract, with arts, entertainment, recreation, accommodation and

food services representing nearly 20% of the industry (Appendix D). Thus, this census tract has both the population density and the type of industry employment conducive to the tourist trade locations, which can be serviced by the Sevier County BRT.

While traveling south of the French Broad River, but north of US 411, businesses become more frequent with small clusters of development; yet there are still gaps of undeveloped land that mingle with the various businesses and activity clusters, which are beginning to dot the landscape more frequently. After passing across the French Broad River, there is a group of businesses, including a Welcome Station, small shopping mall, bank, and other businesses. One mile later there is a collection of one gas station and three other businesses. Shortly afterward, there is a hotel-restaurant combination followed by more agricultural land. An abandoned mall area, and sparse residential housing, followed by a series of businesses, more thinly placed residences, and another restaurant follow. A large tract of agricultural land separates this sprawling array of land uses from another group of businesses consisting of stores, and another hotel-restaurant combination. A large undeveloped landmass with an unfinished bridge follows. This area is reportedly the future site of a proposed events center, which could be developed in combination with residences and other businesses to warrant a transit stop (Bishop, 2004).

However, currently, this nearly four mile long part of the Section 6 BRT route contains a few sparsely placed businesses, an abandoned strip mall, and an older struggling strip mall that are interspersed with undeveloped land or dotted will occasional homes. There are no residential or employment densities that would warrant a transit stop. Most of the land in this area is zoned C-3, C-4, and C-5 (intermediate, arterial and

floating tourist business districts) with an occasional splash of low-density residential zoning spotting the landscape.

By continuing south from the proposed mall location, but north of US 411 and downtown Sevierville, there is a tight cluster of businesses and residents along a one mile stretch of the corridor that have the employment concentration and residential density to warrant a transit stop. While the businesses are located in Census Tract 805, the residential section, which is zoned R-2 medium density, lies in Census Tract 806. Throughout this area businesses are built closer together – adding density and shopping/employment opportunities to the area. Zoned C-4, this node of activity has two hotels, the Comedy Barn, which has on the average two shows per day, restaurants, gas stations, two shopping malls, and in-fill construction. Additionally, there is still enough land in the area to continue with further in-fill development to create an even higher density area. Furthermore, the nearby 100-lot R-2 medium density neighborhood across the street provides population density to the area, which can only increase the BRT corridor use. Additionally, as seen in Figure 6.2, this area is easily accessible by traffic coming into Sevier County from both SR 66 and US 411.

Census Tract 806

Though only a small potion of Census Tract 806 lies along the Sevier County BRT Corridor, the commuting, occupational and industry data relay quite a bit of information. First of all, more people walk to work in this City of Sevierville census tract than any other, perhaps because businesses and residential areas are becoming denser. Yet in spite of the frequency and closeness of businesses in this census tract, more than

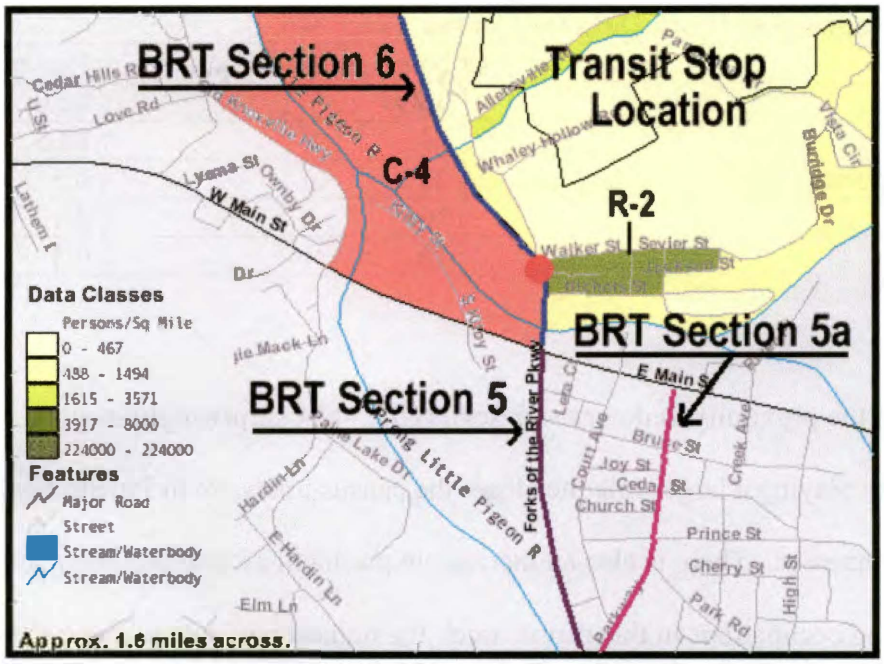

Figure 6.2 Map 1 of Potential Transit Stop Location in Sevierville
Source: U.S. Census Bureau. Used with permission (Appendix A).

80% of the people drove alone to work. This could be due to the lack of any "true public transit system" in Sevierville (Alexander, 2003). This trend could be negated by the construction of a nearby park-and-ride lot, which would allow commuters to travel short distances to the centralized lot before using the BRT system. As seen in Table 6.3, of the nearly 9,000 employees in this census tract, 4,754 workers 16 years and over commuted to work. Those who worked at home (78 or 1.6%) were not considered in this evaluation. The mean travel time to work is approximately 27.3 minutes, 7 minutes longer than the census tract located in downtown Sevierville.

Almost 30% of all employees in this area work in sales and office occupations; this is approximately 10% less than the census tracts along the northern portion of SR 66 (Winfield Dunn Parkway). This is surprising given the denser distribution of businesses

Table 6.3: Journey to Work Data for Census Tract 806		
	Number of Commuters	Percentage
Drove Alone	3,897	82.0
Carpooled	640	13.5
Public transportation (including taxicab)	22	0.5
Walked	101	2.1
Other means	16	0.3

Source: U.S. Census Bureau, 2000

in the area and the proximity to downtown Sevierville. Not surprisingly, service occupations are playing a larger role the closer the census tracts are to Pigeon Forge and Gatlinburg, Tennessee. There is also an increase in production, transportation and material moving occupations in this census tract, the highest percentage along the entire Sevier County BRT corridor, which can probably by accounted for due to the nearby location of Blalock Companies, one of the largest employers in the area, which has two locations in Sevierville. However, more than 20% of the people in this census tract are employed in the arts, entertainment, recreation, accommodation and food services industries with slightly less than 20% being employed in the retail trade (Appendix E). This is a switch from the other census tracts along Section 6 of the Sevier County BRT corridor that have most people employed in retail trade.

BRT Section 5a

As seen in Figure 6.3, on the corner of US 411 and the Forks of the River Parkway (US 441) along Section 5a of the Sevier County BRT route is a densely packed area of shopping, restaurants, and businesses located in Census Tract 805. Zoned C-3, there are approximately four restaurants, which front an immense parking lot filled with

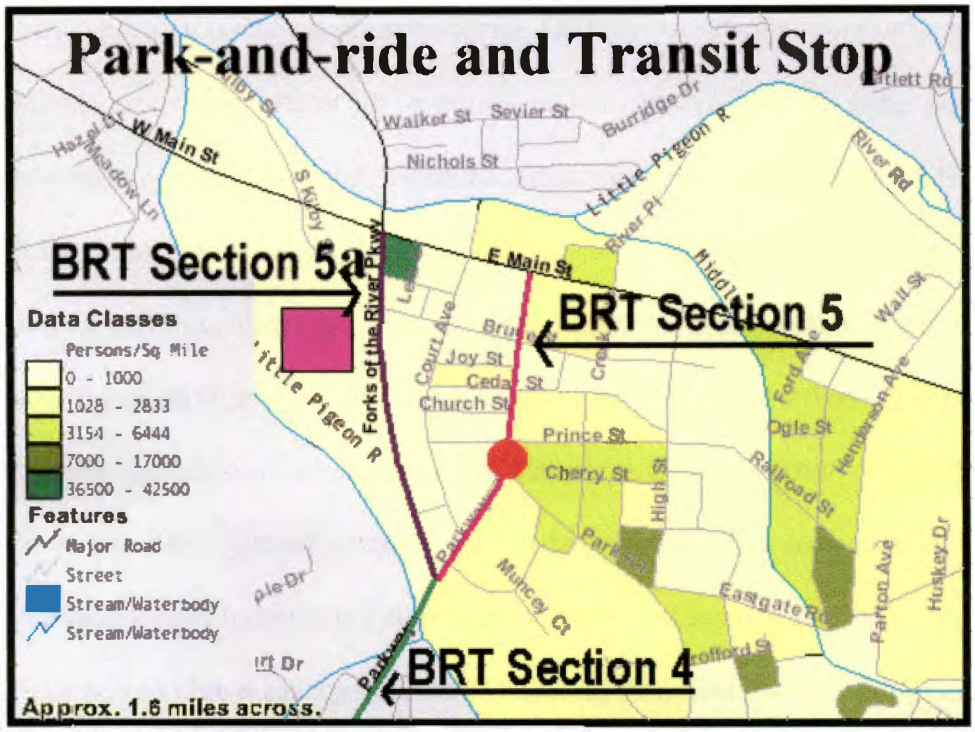

Figure 6.3 Placement of Park-and-Ride Lot and Transit Stop in Sevierville
Source: U.S. Census Bureau. Used with permission (Appendix A).

parking spaces for two large chain stores and several smaller establishments, like an ice cream parlor, mortgage and loan brokerage firms, a beauty salon, and bridal fashions. In this area, a shared parking lot for commuters, as opposed to a new parking garage, would provide space for commuters from the surrounding counties traveling south from the US 66/I-40 interchange or along US 411 toward Pigeon Forge and Gatlinburg. This area is out of the main traffic congestion found in Pigeon Forge, and is centrally located to the surrounding major roadways. Furthermore, because this is an already established commercial area, lighting and other safety concerns are already addressed.

Along the Forks of the River parkway are two adjacent hotels – Riverview Inn and Landmark Inn. Ideally a park-and-ride lot should be placed between the hotels and

businesses, but until demand for the BRT service increases, shared parking between commuters using the BRT system, and customers of the nearby businesses should be utilized. Unfortunately, this is easier said than done. According to *Institutional Aspects of Bus Rapid Transit*, one of the most difficult issues to resolve when creating a BRT system is "local and business community opposition to the removal of restrictions on parking spaces for BRT use" (Miller, 2002). Shared parking facilities at this location would allow commuters, as well as tourists staying at the two hotels, easy access to a transit stop associated with the park-and-ride lot. Approximately, 7,000 out-of-county commuters arrive every workday. If a very generous 2 percent of these commuters were able to use public transit, then only around 140 parking spaces would be required; this small number does not call for the building of a large park-and-ride lot or tiered building. The placement of a park-and-ride lot at this location allows for a near no-cost investment during the initial phases of the BRT corridor, yet undeveloped land between the businesses and the hotels would allow the size of the lot to enlarge should demand for the service increase. An additional benefit of placement at this location is the availability of businesses that would allow commuters to run errands easily either before or after work, and would also allow hotel visitors easy access to amenities.

BRT Section 5

Section 5 of the Sevier County BRT Corridor goes from Main Street (US 411) to the intersection of US 441 (Forks of the River Parkway) and Section 4 of the Sevier County BRT route. It is an extra finger of the corridor as opposed to being a continuation of a flowing pathway. This section is located in downtown Sevierville, and encompasses

a portion of Census Tract 808. The part of the route seems to have been developed to serve both the residential and business public transit needs in downtown Sevierville. A cursory glace at Figure 6.3 suggests that there is enough population density to support public transit. Zoned R-2 and R-3 (medium to high residential density) with an HRO (Historic Residential/Office) overlay in the center of downtown, this area is extremely dense in both residential and employment opportunities. In fact, there is one neighborhood that has more than 7,000 persons per square mile located approximately ¼ mile away from the BRT corridor. In addition to existing residential and commercial densities, this area is prime for a transit stop for one other reason - The Sevier County Government, located in the historic courthouse on Court Avenue, is one of the county's largest employers with approximately 470 employees. Though a number of county employees are not required to work in the courthouse – all Sevier County services for residents are found in the courthouse. The downside is that it would be inconvenient and unrealistic to assume that county residents needing services at the courthouse would park at the park-and-ride lot in Section 5a, and then take the bus to the stop in Section 5 because it would be easier to simply drive to the courthouse. However, residents located in TODs and others who have access to transit stops could use the BRT service to reach the county courthouse.

Census Tract 808

Only a portion of Census Tract 808 lies along the Sevier County BRT corridor, and the commuting to work information provided is similar to the other census tracts discussed. As seen in Table 6.4, of the 5,700 people in this census tract who work, 3,382

Table 6.4: Journey to Work Data for Census Tract 808		
	Number of Commuters	Percentage
Drove alone	2,715	80.3
Carpooled	426	12.6
Walked	61	1.8
Other means	42	1.2

Source: U.S. Census Bureau, 2000.

people 16 years or over commuted to work. No one used public transportation, including taxicabs to get to work in this census tract, which is not very surprising because there is no public transit in the town. However, there were more people working at home (138 people) in this census tract than in any other in Sevierville. Also, the mean travel time to work in this census tract is less than 20 minutes, which is the least time spent commuting along the BRT corridor. Perhaps this is due to the proximity and denseness of residences and businesses, in addition to the lack of traffic along this roadway.

Nearly 60% of all employees in Census Tract 808 work in sales/office occupations or management/professional jobs. Most of these people work in the arts, entertainment, recreation, accommodation and food services industries (nearly 30%) with half that number working in the retail trade or educational, health and social services (Appendix F). The employment and industry distribution is interesting in this census tract, as the other census tracts showed a concentration of work in the arts or retail with social services hiring a significantly smaller percentage of the workforce. As employment types begin to become specialized toward entertainment and retail venues, occupations become more concentrated and limited to service and sales occupations.

BRT Section 4

The clustering of businesses and employment opportunities is integral in establishing useful transit stop locations. BRT Section 4, bisecting Census Tracts 805 and 808, is 3.8 miles long and extends from the intersection of Sections 5a and 5 to Wears Valley Road in Pigeon Forge. The BRT configuration at this point consists of a 6-Lane raised median with 2 interior BRT lanes. In the part of Section 4 that is in the City of Sevierville, there are four potential transit stops that have the appropriate mixture of residents, employees and/or attractions. As seen in Figure 6.4, there is a solid area of residences on both sides of US 441 after the intersection of Sections 5 and 5a of the BRT route. This closely packed area is zoned predominantly R-3 and R-2 (High to moderate density residential) with three small neighborhood dots of R-1 (Low density residential) intermingled. The average density is more than 4,500 people per square mile. Because of this area's residential compactness, it would be a perfect location for a transit stop. A stop located in the median would permit access by both neighborhoods.

One of the largest employers in Sevierville, Blalock Lumber Company, has one of it's three divisions located along the Parkway and is accessible by Section 4 of the Sevier County BRT system, as seen in Figure 6.5. Though this company employees 600 people, only approximately 300 work at this concrete plant (ETEDA, 2002). Opened in the early 1960s, this plant has expanded greatly, and continues to supply more than 90% of the region's ready-mix concrete needs (Blalock, 2000). Thus, the plant is still hiring new people to work, so not only would a transit stop at this location serve current employees, it would furnish reliable public transportation for the future.

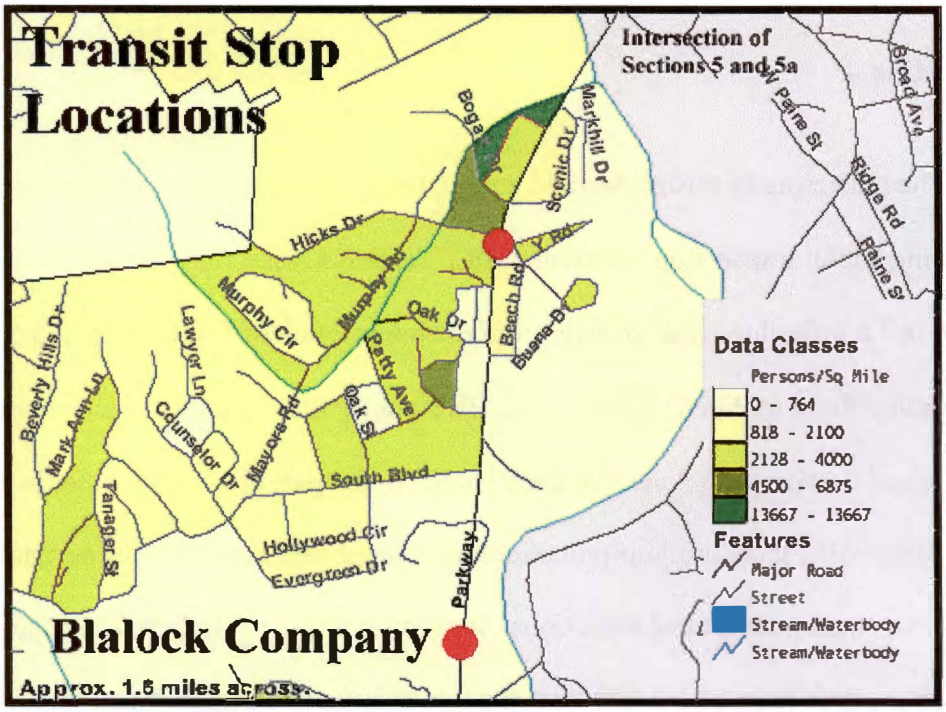

Figure 6.4 Map 2 of Potential Transit Stop Location in Sevierville
Source: U.S. Census Bureau. Used with permission (Appendix A).

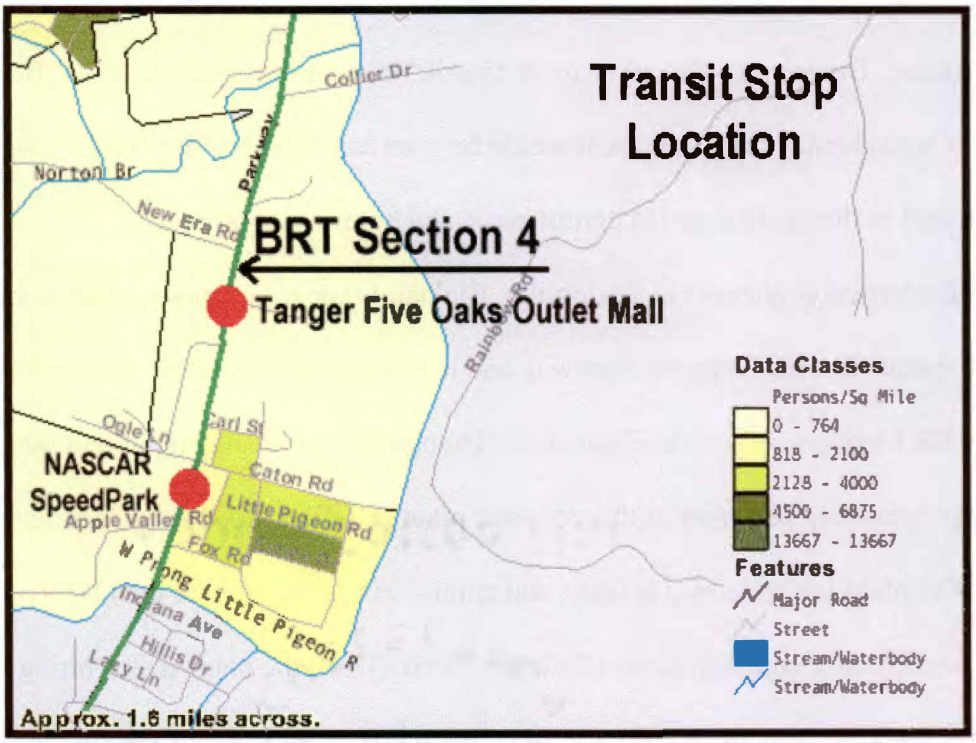

Figure 6.5 Map 3 of Potential Transit Stop Location in Sevierville
Source: U.S. Census Bureau. Used with permission (Appendix A).

Two more transit stops should be developed along Section 4 of the BRT route. As seen in Figure 6.5, one should make the Tanger Five Oaks Outlet Mall accessible, and another should be placed near the NASCAR SpeedPark. The Tanger Five Oaks Outlet Mall is a large strip mall shopping center with approximately 86 shops and restaurants; it is the largest mall in Sevier County. According to the U.S. Census there are approximately 8 paid employees per retail establishment in Sevier County. This means that the Tanger Five Oaks Outlet Mall could have nearly 700 employees. This warrants a transit stop. Another transit stop should be placed near the NASCAR SpeedPark. This entertainment venue, which has been in business for nearly five years, offers a variety of activity. Six NASCAR Motor Speedway simulators, 8 race tracks, 2 miniature golf courses, rides for small children, a rock-climbing wall, bumper boats, and an arcade can all be found in this one business. Additionally, behind the business is a small residential neighborhood that has at least one block of more than 4,500 people per square mile. Furthermore, across the street from the NASCAR SpeedPark there are a number of small retail businesses, two hotels, various restaurants and other businesses catering to tourism. The combination of popular attractions, businesses and residential area warrants a transit stop.

Overall, due to the centralized location and development patterns of Sevierville, the only TOD and park-and-ride sites along the Sevier Count BRT corridor are to be found within the city limits of Sevier County's largest town. In addition, one transit stop in the densely developed downtown Sevierville core could be supported. Four transit stops, which could possibly service as many people as the Pigeon Forge Fun Time Trolley, are called for south of the city along US 441 toward Pigeon Forge. Though land

uses are not spaced as closely as those in Pigeon Forge, Sevierville has great potential for in-fill development, which can only increase the usage and validity of the BRT system.

Chapter 7

PIGEON FORGE, TENNESSEE

History

Named after an iron forge established in 1810, and the flocks of pigeons that fed along the river's banks, Pigeon Forge was a relatively quiet gateway community until 1961 when the town incorporated. At this time, businesses catering to tourists began to slowly emerge, but the rush of construction and tourist traps along U.S. 441, better known as the Parkway, did not occur until the 1980s (Smoky Mountain Navigator, 2004). Only four miles south of Sevierville and six miles north of Gatlinburg, Pigeon Forge is ideally situated between the calm of the Great Smoky Mountains National Park and the retail trade of Sevier County's largest mall in Sevierville. Nearly 12 square miles in size, the Parkway in Pigeon Forge is crammed with approximately 100 restaurants, 80 hotels, 45 major attractions, and 4 outlet malls (Wilbur Smith and Associates, 2002). Thus, US 441 suffers from major traffic congestion during the summer months when some 75,000 vehicles try to use the road each day (Wilbur Smith and Associates, 2002). Though the Pigeon Forge Fun Time Trolley and the Gatlinburg Trolley systems try to alleviate the traffic problems by carrying on average approximately 650,000 passengers per year, the congestion persists (TDOT, 2004). The biggest detriment to using the trolley system is the fact that the trolley's themselves get entangled in the persistent summertime traffic congestion, so that time is not saved by using public transit. The Sevier County BRT corridor is designed to alleviate the congestion by providing an attractive alternative with a designated right-or-way that saves time and aggravation.

The BRT Route

Section 4 of the Sevier County BRT Corridor continues, and Section 3 begins and ends in the City of Pigeon Forge. This part of the BRT route is found within Census Tract 810. The remainder of Section 4 of the BRT corridor is less than one mile long; Section 3 is five miles long and bisects the city. The BRT lanes in Section 3 of the busway consists of two interior bus lanes on a six-lane roadway with a raised median, and extends from Wears Valley Road to Conner Heights Road.

BRT Section 4

As seen in Figure 7.1, along Section 4 of the BRT corridor in Pigeon Forge, there are no residential areas dense enough to support public transit located ¼ mile or closer to

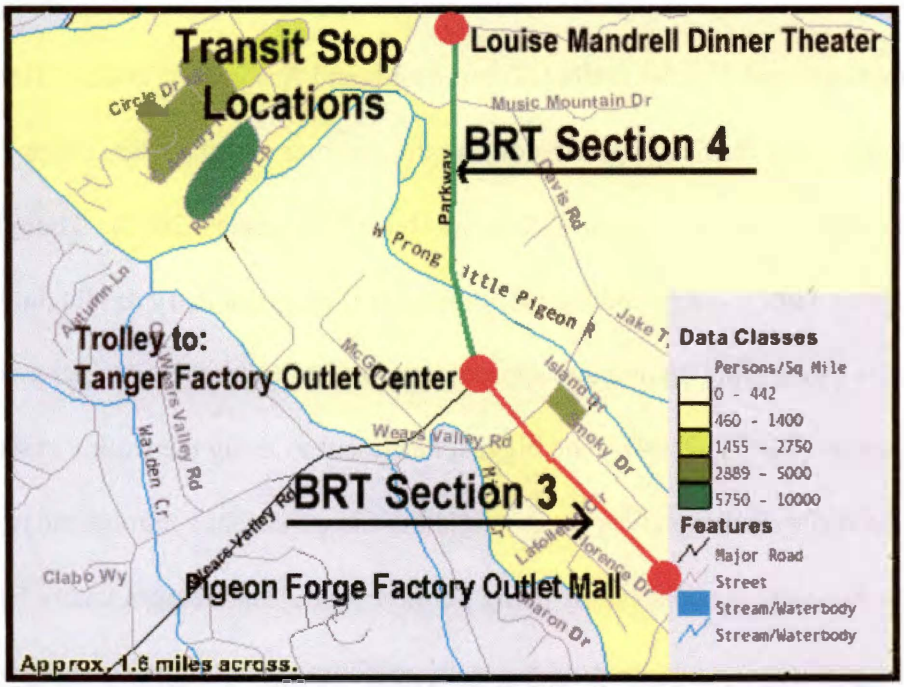

Figure 7.1 Map 1 of Potential Transit Stop Location in Pigeon Forge
Source: U.S. Census Bureau. Used with permission (Appendix A).

US 441; however, there are employment opportunities and tourist's attractions to warrant two transit stops. Transit stop locations are based on the number of tourists and employees attracted to a location. The first transit stop should be located at the Louise Mandrell Theater, which has 1400 seats, and is the largest theater in Sevier County. This business is found in large complex containing two other theaters. Additionally, next-door, on Music Mountain Drive, there are two medium-size theaters. Thus, five of Sevier County's 17 theaters are found in this one location. The second transit stop should be located at the intersection of US 441 and Wears Valley Road, which is also the junction of Sections 4 and 3 of the BRT Corridor. At this point, the Fun Time Trolley travels to the Tanger Factory Outlet Center on East Wears Valley Road. This shopping center has approximately 24 stores that employ approximately 200 people. All of the surrounding area is zoned for commercial activity, so near the proposed transit stop are numerous restaurants, hotels and shops. Right before the intersection of US 441 and Wears Valley Road, an approximate 14-acre site, which will host more stores and other businesses, is undergoing construction. From this point onward until Section 2 of the Sevier County corridor, Section 4 bisects a series of businesses fronted with parking lots on both sides of the Parkway.

BRT Section 3

The third transit station found in Figure 7.1 stops at the Pigeon Forge Factory Outlet Mall, which has over 35 stores, and employs approximately 300 people. For the entire length, both sides of the US 441 parkway are zoned for businesses for at least ¼ mile deep, though occasionally an older neighborhood has survived the

commercialization of surrounding parcels. Thus, other small businesses and restaurants, etc surround this outlet mall.

The fourth and final transit stop in Pigeon Forge, as seen in Figure 7.2 should be located near the Pigeon Forge Trolley stop leading to Dollywood and Dolly's Splash Country, outside the Dixie Stampede Dinner Show. Dollywood attracts more than two million visitors per year and employs more than 2,000 people to work the theme park during the summer months (ETEDA, 2003). During the winter season, when closed, Dollywood still employs 300 people. The employment figures alone, not to mention the tourist traffic, warrant a transit stop at this location.

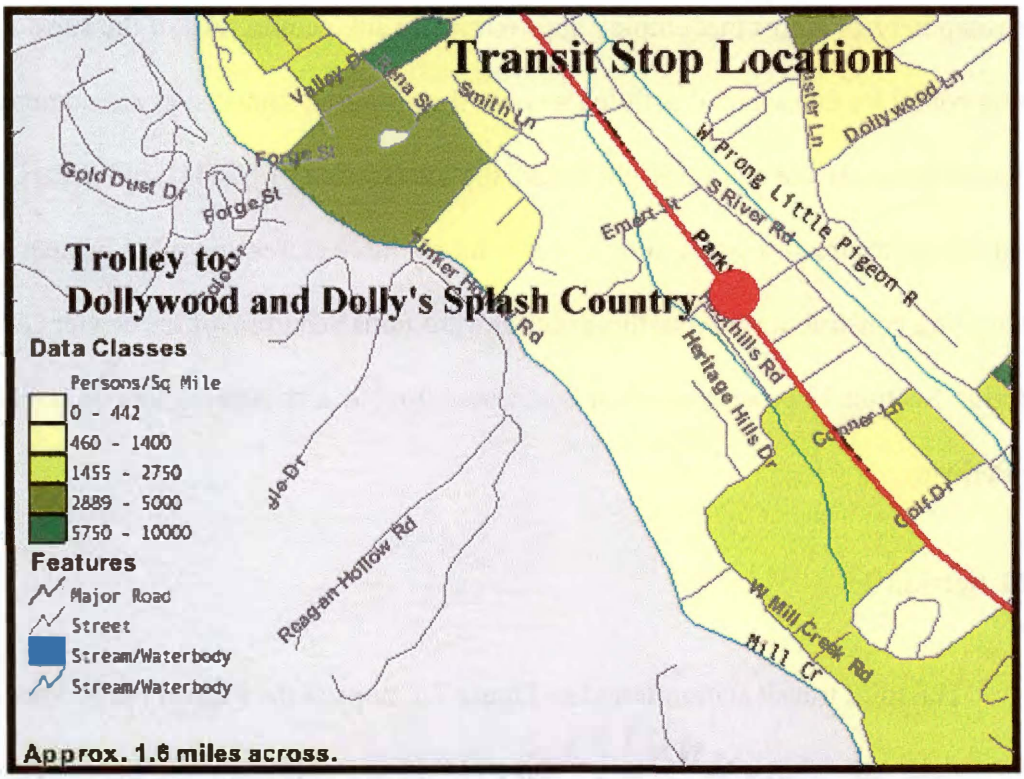

Figure 7.2 Map 2 of Potential Transit Stop Location in Pigeon Forge
Source: U.S. Census Bureau. Used with permission (Appendix A).

Census Tract 810

Census Tract 810 encompasses all of Section 3 of the Sevier County BRT corridor. Not surprisingly, as shown in Table 7.1, as the density of development increases, driving alone decreases and carpooling increases. Additionally, a higher percentage of people are walking to work. Of the approximately 4,300 workers in this census tract, slightly more than 2,500 workers 16 years and over commuted to work, and this commute took approximately 20 minutes. No one in this census tract used public transportation to get to work, which is surprising given the fact that the Pigeon Forge Fun Time Trolley has approximately 18 stops along the Parkway, and travels down Wears Valley, and to Dollywood, Dolly's Splash Country, and the Gatlinburg Welcome Center (TDOT, 2004). The available trolley infrastructure could possibly be used as a feeder service for the BRT stops.

Most of the individuals in this census tract work in service occupations – nearly 30%. This is a change from the census tracts in Sevierville where most employees were in sales and office occupations, though slightly more than 25% of all workers in this area work in sales and office occupations. Service occupations are now playing a larger occupational role, and this can be attributed to the intense tourist industry along this

Table 7.1: Journey to Work Data for Census Tract 810

	Number of Commuters	Percentage
Drove Alone	1,998	77.6
Carpooled	407	15.8
Walked	81	3.1
Other Means	33	1.3

Source: U.S. Census Bureau, 2000

portion of the Sevier County BRT corridor. Also, more employees are working in the arts, entertainment, recreation, accommodation and food services industries – approximately 36%, while less people are being employed in the retail trade – 12% (Appendix G). This in spite of the four shopping malls located in Pigeon Forge.

BRT Section 2

As seen in Figure 7.3, Section 2 of the BRT corridor in Pigeon Forge beings at the a large sign that says "Welcome to the Great Smoky Mountains National Park". Because this section of roadway is within the park, it would require "additional environmental review and compliance" (Wilbur Smith and Associates, 2002). This section has no residential areas dense enough to support public transit nor is there any employment

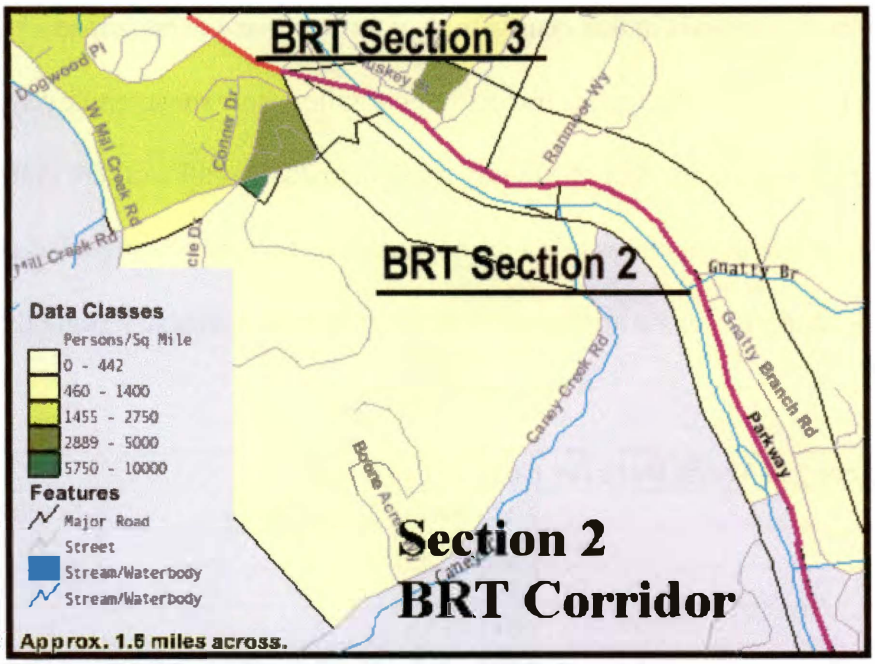

Figure 7.3 Map of Section 2 of the BRT Corridor
Source: U.S. Census Bureau. Used with permission (Appendix A).

opportunities or tourist attractions at all, since almost the entire area is zoned rural residential. The configuration of the BRT route at this place consists of a one-lane bi-directional route using the eastern lane of US 441, since the Pigeon River splits the road into a western and eastern side. The bus system will be regulated using ITS signaling since only one vehicle can pass through this part of the corridor at a time. Furthermore, the impacts of development of this area would harm the nearby national park, and the steep topography adds to the difficulty in building dense commercial and residential communities in the area. This 4-½ mile section of the Sevier County BRT corridor winds through the foothills of the mountains, rarely being disturbed by any obvious construction, so TODs and park-and-ride lots would be unnecessary, as would transit stops.

Chapter 8

GATLINBURG, TENNESSEE

History

Gatlinburg is surrounded on three sides by the Great Smoky Mountain National Park, which has allowed for a denser city than either Sevierville or Pigeon Forge. The downtown area is easy to walk with broad sidewalks, and contains a number of tourist attractions. The town covers approximately 10 square miles, but the main street or the Parkway contains most of the attractions, such as an aquarium, museums, miniature golf courses, shopping, and restaurants. With approximately 90 hotels in the area, Gatlinburg has approximately 6,500 motel rooms along the Parkway. Due to its separation from other towns by the mountains, Gatlinburg grew very slowly. In fact, regular mail service was not available until 1855 when a post office was finally opened (Smoky Mountain Navigator, 2004). However, all of this changed when Gatlinburg gained fame as a resort community when the Great Smoky Mountains National Park was dedicated in 1940, and numerous access roads were built. The residential population of the town grew during this time, but then began to level off around 3,000 people. In fact, the comparisons between the 1980, 1990 and 2000 census show that the population has only changed by about 150 people (U.S. Census, 2000). Unfortunately, the same stability cannot be said about the tourist population. Due to its proximity to the Great Smoky Mountains National Park, the single most visited national park in the country, Gatlinburg hosts nearly 10 million of these visitors per year.

The BRT Route – Section 1

As seen in Figure 8.1, Section 1 of the Sevier County BRT corridor ends in Gatlinburg. This part of the route begins at the Gatlinburg By-Pass and ends at the intersection of the Parkway and US 321, a distance of less than one mile. Section 1 consists of a 5-Lane Roadway with 2-BRT Lanes on the outside of the roadway. Since this portion of the BRT route is so short, the only stop needed is at the end. However, the Gatlinburg Trolley has approximately 20 stops throughout the city that can bring commuters to this end of the Sevier County BRT corridor.

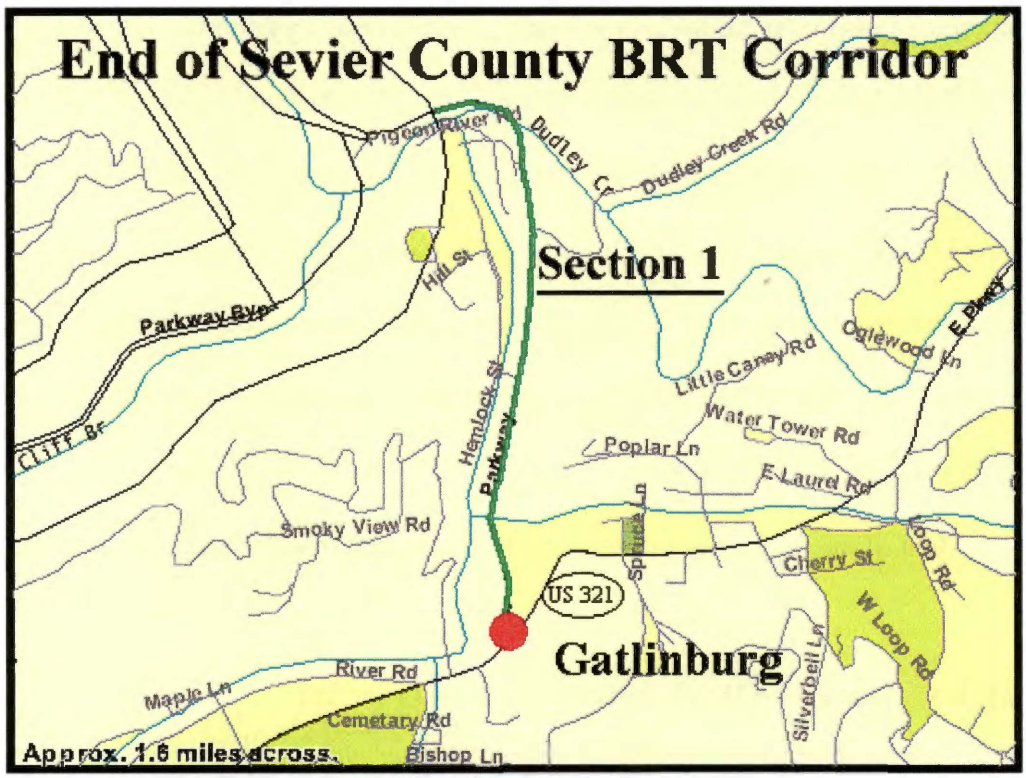

Figure 8.1 The End of the Sevier County BRT Corridor
Source: U.S. Census Bureau. Used with permission (Appendix A).

Census Tract 811

Census Tract 811 encompasses the short Section 1 of the Sevier County BRT corridor, but the census tract extends further south of the city. Gatlinburg is an extremely dense city – with nearly 100 restaurants, 180 shops, and more than 40 attractions, most within walking distance of the Parkway. As shown in Table 8.1, this denseness allows almost 10% of all residents either use public transit, walk or use other means to get to work. Furthermore, more people in this census tract work at home (163 or 7.0%), than in any other. Finally, of the 2,328 people 16 years and over who commuted, less than 70% drove alone. The average travel time to work took 21 minutes. Residential and commercial densities seem to have an impact on commuting patterns. The Gatlinburg Fun Time Trolley has approximately 20 stops along the Parkway, and travels to the Great Smoky Mountains National Park, the Arts and Crafts Community, Dollywood and Dolly's Splash Country, and the Gatlinburg Welcome Center. The Gatlinburg Fun Time Trolley system has been in service since 1980, and has been used by nearly 16 million people (TDOT, 2004). The available trolley infrastructure could definitely be used as a feeder service for the BRT stops.

Most of the individuals in this census tract work in sales and office occupations,

Table 8.1: Journey to Work Data for Census Tract 811

	Number of Commuters	Percentage
Drove Alone	1,563	67.1
Carpooled	373	16.0
Public transportation (including taxicab)	32	1.4
Walked	171	7.3
Other means	26	1.1

Source: U.S. Census Bureau, 2000.

as opposed to service occupations, which was the norm in Pigeon Forge, but constitutes only 24% in Gatlinburg. Not surprisingly, most employees are working in the arts, entertainment, recreation, accommodation and food services industries – approximately 36%, the same as in Pigeon Forge, while significantly less people are being employed in the retail trade – 12% (Appendix H). The BRT route has a very limited extension into the city of Gatlinburg, providing only one transit stop that is not near any specific entertainment attraction or residential node, but given the proximity and variation in businesses and residences, this may work here.

Chapter 9

ZONING ALONG THE BRT CORRIDOR

Introduction

Simply stated, the purpose of zoning is to control the uses of land in an area. Euclidian zoning allows local governments to separate land uses into small areas known as districts. This type zoning also isolates different residential neighborhoods based on density - single family from multi-family, as well as disconnects one type of commercial activity from another. This is the type of zoning used along the Sevier County BRT corridor. The purpose of Euclidian zoning is to allow property owners a reasonable use of their property without suffering from nuisances created by abutting properties. Each parcel of property or lot has a zoning classification that determines exactly how the property can be used.

Unfortunately, this type zoning is not without problems and critics. In fact, Euclidean zoning's disconnection of various uses makes traveling from one zone to another a necessity. Thus, the car or nearness to public transit is required in order to reach needed amenities. The problems with this neat and tidy zoning tradition are written about in Jane Jacob's *The Death and Life of Great American Cities.* In the early 1960s, Jacobs not only became the most vocal critique of Euclidean zoning, but also offered a movement toward mixed uses (Slusser, 2004).

> A rethinking of Euclidean zoning, consistent with Jacobs's principles, requires regulatory strategies that work at different scales. At the scale of the street, zoning should focus on how private buildings help create and activate the public space of the street. At the scale of the urban district, codes should offer strong incentives for mixtures of primary

> uses and reuse of older buildings. At the scale of the metropolitan region, state oversight of local and regional planning should favor the coordination of denser, compact developments with public investments in transit (Wickersham, 2004).

Mixed-use neighborhoods allow for people to live above ground-level businesses or nearby, and to base their everyday and social activities a short distance from their residences. Examples of combined uses can still be seen in European and Latin American cities. This form of development was dominant in the United States until the turn of the 20th century, when suburban sprawl began to emerge and clear lines were drawn separating business from residential areas. One of the most significant advantages of mixed-use development is that people living in areas containing a variety of land uses are less reliant on cars because amenities and work are within walking distances of home, and become more reliant on public transit (Dittmar, 2004). Mixing uses on a land parcel is now making a comeback, and a number of new zoning ordinances have supported this change. There are many types of zoning that mix neighborhood and commercial activity - Planned Unit Development (PUD), Traditional Neighborhood Development (TND), and Transit Oriented Development (TOD). However, the only mixed-use development pattern that is centered on transportation options is the TOD.

This portion of the thesis takes a look at the zoning ordinances of the towns along the Sevier County BRT corridor – Sevierville, Pigeon Forge and Gatlinburg - to examine the types of zoning changes that need to be made to allow and encourage TOD, park-and-ride and transit stops along the corridor. Also, an examination of current land uses will be reviewed and changes offered to make the corridor more conducive to a BRT system.

TOD Zoning

The TOD design differs from all other mixed-use developments in that it encourages people to live near public transit services, like BRT, in order to decrease their dependence on cars and driving. According to a 1997 ordinance in Portland, Oregon, an early proponent of transit oriented designs:

> "(TODs) are multiple-unit housing and mixed use projects that support the public investment in light rail and fixed route transit (bus) service because they preserve, enhance or contribute to creating active pedestrian districts within walking distance of transit. Mixed-use buildings, projects or areas with a mix of uses are active from early in the morning to late in the evening, making the environment safer for pedestrians and providing peak and off-peak customers for transit service (TOD Advocate, 2004)."

TODs are different from other mixed-use designs because they specifically address the issue of traffic controls while other land use designs, like TNDs and PUDs, that allow for simultaneous yet varied uses, do not (Miller, 2003). Additionally, TODs allow for development to occur around a business core so that access to public transit is easy. Unfortunately, none of the towns along the Sevier County BRT corridor have zoning ordinances that allow, much less promote, Transit Oriented Development (TOD). However, all towns do allow for Planned Unit Development (PUD). Thus, it would seem at first glance as though mixed use, transit centered developments could be possible. Unfortunately, there are a number of significant differences between the two developments that make TODs superior in a BRT corridor.

TODs reduce automobile traffic and subsequent congestion, which is what the Sevier County BRT route is attempting to do. TODs increases the mix and density of newly developed *or already existing areas* to make it both walkable, and accessible to

public transit (Olsen, 2004). Transit stations are built within ¼ to ½ mile from all residences and businesses, which creates a critical mass to use the transit system. Ultimately, the edges of the development are designed to blend into surrounding neighborhoods, allowing the city to steer high-density developments into the TOD.

One the other hand, PUDs do not relate directly to traffic patterns or congestion. The purpose of a PUD is to "is to permit the application of new ideas, new techniques, and greater freedom in land development than may be possible under strict interpretation of the provisions of this ordinance. The uses of these provisions are dependent upon the submission of an acceptable plan and the satisfactory assurance that it will be carried out in the time limits agreed to with a performance bond" (Baker City, 2004). PUDs are not necessarily designed to purposely restrict the amount of traffic entering or leaving the development. Whereas a PUD may be located within any residential, commercial or industrial district, a TOD is always located along transit routes. Finally, TODs as opposed to PUDs have parking restrictions and shared parking regulations that make driving a car more inconvenient than walking or using public transit (Vestavia Hills Comprehensive Plan, 2003).

Sevier County will experience a population increase of 40% in the next ten years. That is an increase of nearly 2,800 people per year. If the population and associated services can be concentrated in nodes along the Sevier County BRT corridor, instead of scattered throughout the county, then traffic congestion can be reduced as a result of creating development that combines services and residences within walking distance of one another. Currently, zoning along the corridor or countywide does nothing to limit

sprawl and associated traffic congestion, which is exasperated by the 30-week tourist season. This is a problem that can be directly mitigated through TOD zoning.

TOD Zoning Elements

The City of Phoenix, Arizona has two TOD overlay districts found in their comprehensive plan that can be used as a template of TOD districts along the Sevier County BRT corridor. These two overlay districts share many of the same elements; the only difference is that one overlay district has more prohibited uses than the other.

In both TOD districts, the specific purpose and intent outlined for the TOD is to "encourage an appropriate mixture and density of activity around transit stations to increase ridership . . . and promote alternative modes of transportation to the automobile . . . decrease auto dependency, and mitigate the effects of congestion . . .where streets have a high level of connectivity and the blocks are small, all within a comfortable walking and bicycling distance from stations. . . as either new developments or infill and reuse within areas of existing development." (City of Phoenix, 2004)

Development of TODs are limited to areas that do not have uses contrary to densely developed public transit services areas. Thus, TODs are not allowed on parcels of land already containing large-scale retail store areas of 40 acres or more, but can be built on areas where the entire reused acreage is to be redeveloped (Miller, 2003). Additionally, due to the need to support transit ridership, TOD districts prohibit uses that do not support transit ridership. Some of these uses include car dealerships, service stations, bulk retail and wholesalers, and car washes. All of which seem logical since these businesses simply add to traffic congestion in an area. Some of the more humorous

prohibited uses include cemeteries, funeral homes and mortuaries, golf courses, and RV parks. Conditional uses allowed with a special permit include grocery stores, fast food restaurants and liquor stores (Olsen, 2004).

TODs purposely limit parking spaces to encourage walking and transit ridership. Thus, limits on parking spaces and shared parking are required, but additional parking can be obtained via a conditional use permit. Parking requirements are a function of floor area, unit size or land use type and can vary. Limitations of placement of parking lots are also a part of the TOD. Any business in excess of 80,000 square feet shall not front a street with a parking lot, but must provide a linear building with parking behind it (Parsons, 1996). Bicycle parking is also a requirement, and is provided at one space per 2,000 square feet of business floor area.

TOD regulations also include a number of design elements used to make the development pedestrian friendly. Landscaping that breaks up the scale of buildings to make the area more pedestrian friendly, buildings that emphasize pedestrian access and are visually interesting, and placement of clear windows on half of the building's façade are required, in addition to the elimination of blank walls that encompass more than 30% of any non-residential or 50% of any residential building (TOD Advocate, 2004). Sidewalks are also required to be at least 8 feet deep in all areas, and 12 feet deep in areas where there is outdoor seating. While no exterior storage is allowed on the sidewalks, sidewalk displays and small retailers like flower, food and drink stands and small shops are allowed. Also, all businesses near a transit stop are required to offer ease of access and entrance for pedestrians.

All of these elements could be used to create TOD zones for the towns along the Sevier County BRT corridor. Special attention should be paid to the entertainment industries and their need for additional parking during show times. Finally, pedestrian paths from neighborhoods should not be ignored when concentrating on the commercial element of the TOD.

Park-and-Ride Zoning

Park-and-ride lots consist of either a parking building or surface lot that is used by people who plan to use a public transit system. The purpose of these lots is to provide a well-designed location for people occupying low-occupancy vehicles to transfer to public transit easily and without obstacles. Park-and-ride lots also offer amenities that make parking at the lot and using public transit preferable to driving. This encourages people to use public transit, which reduces traffic congestion in heavily traveled corridors.

Due to their size and their multi-functionality, park-and-ride lots require zoning that makes them compatible with surrounding uses. Most recently the concept of park-and-ride areas in conjunction with other uses, such as having housing and/or shops above the park and ride, have come to light (TALC, 2004). Additionally, since these parking facilities generally accommodate parked cars during working hours, 6:00 a.m. to 6:00 p.m., Monday through Friday, parking space sharing is possible with nearby businesses. Finally, park-and-ride lots are generally developed in accordance with both Parking and Access Requirements, and Landscape Requirements. All of these conditions require very specific zoning, such as freeway tourist (FT) zoning or public facilities and services

(PFS) zoning, none of which are considered along the Sevier County BRT corridor (TALC, 2004).

Currently, the zoning ordinances applicable to the BRT corridor have simplistic parking requirements – number of spaces per employee, resident or customer, per square footage of floor space, or per number of seats, rooms or beds. Landscaping requirements for parking areas are only referred to in the *Sevierville Zoning Ordinance*:

> All fixed objects within parking lots (utility poles, signs, fire hydrants, etc.) shall be located within islands to which access by vehicles is physically limited. These islands shall be appropriately landscaped with grass, shrubs or other appropriate plant material which shall not exceed 30 inches in height above the adjacent paved surface (Wagner, 1999).

The other two towns along the Sevier County BRT corridor do not address landscaping in parking areas at all. Additionally, out of the three zoning ordinances only Gatlinburg provides limitations as to the location of parking lots. However, none provide specific zoning regulations for park-and-ride lots.

Park-and-Ride Zoning Elements

There are a number of detailed park-and-ride zoning elements that need to be taken into consideration when creating regulations for parking facilities. Among these are identifying the different types of lots, the ownership and operation of the lots, restrictions in size, use and placement, spaces required, and design elements.

There are three types of park-and-ride lots. An Exclusive Use lot allows only park-and-ride customers to use the lot; a Joint Use lot allows both park-and-ride customers as well as parking for other purposes, and a Fringe Use lot allows for temporary overflow parking and is found near the main park-and-ride facility (BMI,

2003). The appropriate designation is vital in detailing how the park-and-ride lot can be used. Ownership of the lot can also determine possible uses. Private ownership limits the town's ability to mix or change uses, as well as to establish operating hours conducive to special events or high demand. The lot owner is able to decide which type of payment system to use - parking by permit only during certain hours and days or cash payment. Very rarely will private lot owners offer free parking in order to entice commuters to use the associated public transit system. Maintenance is also in issue with regards to lot ownership. A private owner does not have the obligation toward cleanliness and safety that a public owner does.

Park-and-ride lot restrictions may limit uses, but they also provide a framework that reduces interference to the rest of the community. Height restrictions on multi-tiered lots are a must so that the skyline is not destroyed, and nearby businesses are not overshadowed by parking facilities. Parking restrictions are used to keep driving lanes clear, and minimum requirements for handicapped parking spaces allow everyone access to the lot, public transit and nearby businesses. Restrictions also allow for controlled shared parking, a reduction in the number of car spaces needed, placement of bike racks, the types of businesses/housing types or amenities permitted in the park-and-ride facility and location of the lot itself (BMI, 2003). For example, in most cases, a park-and-ride lot cannot be located between a building and the front lot line nor is it placed to an adjacent parcel obtaining a large parking lot.

Finally, design elements create a safe, esthetically pleasing place to park, while simultaneously enhancing the public transit experience. One of these elements include required screening for lots that are visible from a public street via landscaping like trees

other vegetation or other buildings containing associative uses. Another element pertains to architectural detailing, like mosaics, murals, or masonry patterns, which add visual interest and excitement to a park-and-ride facility. Another design element is creation of comfortable car circulation patterns, which is combined with safe and convenient pedestrian walkways and bike paths (BMI, 2003). Direct entrance and egress access to a main street by lot users coupled with a separated bus stop are also design elements that need consideration. Also, landscaping elements are used to define entrances and pedestrian walkways from public rights-of-way, as well as to define the ends of parking aisles and highlight the pattern of circulation. Other design elements include lighting, integration of the lot with residences or businesses, the types of bicycle facilities available, or the visual clues separating shared parking spaces with designated park-and-ride spaces. All of these design elements highlight and enhance the commuter's use of public transit and should be used in any zoning regulation the towns of Sevierville, Pigeon Forge and Gatlinburg enact to allow for park-and-ride lots.

Transit Stop Overlay

Integral in the Sevier County BRT corridor are the placement of various transit stops. These stops are placed in areas of high commercial or residential density, and are located at least ½ mile apart (EESI, 2003). Another feature of BRT corridor transit stops are the amenities and connectivity between the stops and the surrounding areas. By making the transit stops a vibrant focal point of each community, more people will be encouraged to take the bus. Transit Stop Overlays provide a framework for accomplishing these goals. None of the zoning ordinances along the Sevier County BRT

corridor have any codes addressing transit stops nor do any have overlays addressing this fundamental part of public transit, though benches are used as stops for the Pigeon Forge and Gatlinburg Fun Time Trolley systems.

Transit Stop Overlay Elements

The goal of a transit stop overlay is to increase transit ridership by making public transit more convenient than personal automobile use. Overlays provide the link between conventional zoning, and pro-transit designs. The overlays provide guidance on the types of nearby businesses, create a framework to maintain physical transit-related structures, provide for convenient pedestrian access and bike accommodations, and also enhance the use of public transit. In a nutshell, this means no more exposed benches on the sidewalk, but a comfortable place to wait for the bus. Transit Stop Overlays also address issues of safety, comfort, convenience, amenities, design elements, and land use. Overlays also ensure new managed growth, such as retail, office and institutional buildings, at or near major transit stops (WCOPD, 2002).

One of the biggest concerns relating to public transit is safety while reaching the bus station or waiting for the bus. Overlays address safety concerns such as station visibility and lighting, ease of accessibility for those who use public transit, impediments used to dissuade those who simply want to loiter, and hotline telephone and security camera placements in and near stations. Overlays also address pedestrian safety issues, such as lighted road crossings leading to the transit stop, and large easy-to-read crossing signs and visible crossing lights.

Another element in a transit stop overlay is the need to ensure passenger comfort and convenience. Comfort items deal with seat design and placement, and protection from the elements via shelter design. Shelters can be planned to provide an overhang so that passengers entering or exiting a bus are protected from the wind, rain or snow (WCOPD, 2002). Furthermore, enclosed heated or air-conditioned waiting areas for add even more comfort and protection to public transit passengers. Convenience, on the other hand, creates a transit system that is more efficient than driving a car. Real-time bus arrival signage, detailed system maps and schedule information, and the introduction of modern fare collection systems can work together to provide efficiency to the public transit experience. The goal of convenience is to take up as little of a passenger's time as necessary.

Design guidelines not only dictate the general appearance of the transit stops, which can help to alleviate negative images about public transit, but also can act as a promoter for public transit. The addition of distinguishing decor and artwork can be used to make the public spaces more comfortable and inviting. Providing appealing bus shelters that contain artistic themes that highlight local talent can also attract riders. Amenities, such as telephones, restrooms, and drinking fountains, as well as, more modern day services like wireless Internet connections, can be used to bring more people into the public transit frame of mind.

Transit stops are an integral part of the community landscape and attention to these facilities can enhance ridership and opinions on bus transit (WCOPD, 2002). Integrated or nearby facilities of a transit stop that includes features not directly related to passenger transfer make public transit more enticing. Some of these features include

shopping, cafes, dry cleaners, childcare, and even senior centers. A newer idea is that of an adjacent pedestrian plaza, which is a small semi-enclosed area that provides a place for pedestrians to run errands or rest. The plazas usually provide a sense of scale through low walls, planters, or landscaping that separates the plaza from the adjoining parking lots or commercial district while making the plaza a part of the transit experience (Cura, 2003). This type mixed use development can create convenient areas that help reduce the distance that residents and employees have to drive. A transit stop overlay helps to direct land uses around stations so that these combinable services can be provided. Future land use decisions are also lead by an overlay, which details ways in which transit stops can strengthen existing businesses while generating demand for more business space, support the building of new homes near the stop, and increase the existence of nearby open space and parks. However, all of these land uses require the rezoning of some parcels of land already used for businesses. The transit stop overlay provides guidance for the future by predicting which parcels will be rezoned in the future to better promote public transit.

The towns along the Sevier County BRT corridor will benefit by the use of a transit stop overlay. The overlay can strengthen the connection between the BRT route and land use along the corridor. The overlay recognizes that land surrounding a major bus stop may need to shift to accommodate for new development, and that safe, attractive stops are a significant factor in building up ridership for public transit.

Conclusion

Only by integrating the Sevier County BRT corridor with land use conducive to public transit will the proposed BRT route gain enough ridership to be feasible. Changes

from Euclidian to mixed use zoning and the introduction of overlays will provide impetus for a mixture of development types to occur in centralized nodes that promote the use of and public investments in public transit. Furthermore, the flexible patterns of development allowed by mixed-use zonings will create an atmosphere that can connect the resident of the corridor with the visitor.

TOD zoning allows residents to live above businesses, and to combine walkable areas with employment and recreational opportunities. Zoning changes involve outlining prohibited uses while encouraging uses that are favorable toward transit riders, limiting available parking while encouraging pedestrian and bicycle traffic, and adding design elements to create an open pedestrian friendly development. The biggest challenges that TOD place on the towns along the BRT corridor are finding buildable areas that already have dense enough employment/residential populations to support a BRT system while waiting for developers to use the new mixed use zoning regulations to their advantage, and providing special attention to the entertainment industries and their need for additional parking during show times.

Park-and-ride lot zoning entails more than just surface parking. The purpose of the lot is to provide commuters with a place to park and use the more convenient public transit system while still be able to run errands if need be. Because of their size, visual impact and varied uses, special park-and-ride zoning ordinances need to be passed that cover the broad spectrum of the specific type of park-and-ride facility needed. Park-and-ride lots can bring a cohesive element to already existing business areas and can promote transit ridership through specific allowable designs and amenities, like pedestrian friendly garages, and adjacent residential/commercial uses. The biggest challenge in creating

park-and-ride zoning ordinances deals with finding a centralized location that is easily accessible by all commuters entering the BRT corridor by the various roadways leading from Knox, Blount, Jefferson and Cocke counties.

Transit stop overlays provide the link between the transit stop and the surrounding land use. While addressing issues such as safety, comfort, convenience, amenities, and design elements, they also address the very central issue of current and future land use surrounding the stops. There are two challenges with regards to the overlay. One problem is dichotomy between providing services to the population and land use. Land uses surrounding the stops are already ingrained and spread out through the BRT corridor; this brings in tourists or customers, who can be provided with a transit stop. So in order to service the most populated areas with stops, there has to exist current land use. However, in order to create an overlay that specifically promotes transit use, rezoning has to happen, and there is great reluctance of businessmen to change current zoning to a less prosperous one in order to promote a service that is generally not considered in the financial bottom line. Another problem with regards to transit stop overlays is the spacing of stops. Currently there are very few areas along the Sevier County BRT corridor with barely enough density to support public transit. This is because sprawl has eliminated any natural condensation of activity. An overlay would be difficult to place in an area that does not have the employment/resident mixture to support transit, and while the corridor has a spot or two of transit supportive employment or residential density, there are no areas with both.

Overall, for the Sevier County BRT corridor to work effectively and efficiently, the towns along the corridor need to revise and update their zoning ordinances to allow

for mixed uses that make using public transit more convenient than using a personal automobile. This involves specifically writing the ordinances to promote public transit, and then selling the ideas to city councils, mayors and the public at large. This is no easy endeavor and may take years to complete, much less implement and witness the results.

Chapter 10

CONCLUSION AND RECOMMENDATIONS

Summary

The purpose of the Proposed Sevier County BRT system is to alleviate traffic congestion, especially during the summer months when more than 70,000 vehicles per day use US 441 between Pigeon Forge and Gatlinburg while providing service for the residents of the county. Unfortunately, inherent in any bus system, including BRT, there exists a negative stereotype that must be overcome by providing service comparable to that of light rail. Land use zonings and overlays to promote density conducive to the use of the BRT service is a positive step in this direction. This thesis has attempted to answer the questions left unanswered in the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee* regarding these land use issues – the use of transit-oriented developments, placement of park-and-ride and transit stops along the BRT route. Census tract data were used to review residential/employment densities and commuter patterns to identify potential locations for the TOD, lots and stops. Changes of current zoning practices are also outlined to provide planners in the towns of Sevierville, Pigeon Forge, and Gatlinburg, Tennessee with elements of successful zoning practices that promote public transit and the BRT corridor. Altering current land use to provide for TOD, park and ride lots, and transit stops in conjunction with a land use plan that coordinates efforts between the three towns along the route and Sevier County will provide the residential, employment and commuter densities to promote the use of the proposed BRT corridor. Census data show that for all tracts lying next to the proposed

BRT corridor, most workers are employed in the industries related to tourism, and do not use public transit to get to work.

Conclusion

Traditional zoning has left a legacy of separate land uses along the Sevier County BRT corridor, which has limited the use of the existing trolley system for residents, and will limit the effectiveness of a BRT system. This coupled with a lack of cooperation and consistent regulation between Sevierville, Pigeon Forge, Gatlinburg and Sevier county has exasperated the disconnect between where people live and where people work. There are currently only 13 areas with enough activity or density to support the use of BRT. Even with land use modifications only 5 or these areas could be considered productions of transit riders – 3 residential areas, 1 residential area with TOD capability, and 1 potential park-and-ride lot; the rest are attractions for transit riders – 1 manufacturing business, 3 outlet malls, 3 entertainment attractions, and the end of the BRT system. The critical mass lacking to make the BRT service successful are the productions. There are not enough dense pockets of residents along the 24-mile route to supply a significant number of BRT using patrons. Unfortunately, even with zoning changes and overlays, there are no guarantees that the densities required by public transit will emerge any time soon. In fact, according to the *Transit Cooperative Research Program Report 74*:

> Unfortunately, experience indicates that this tactic [changes in land use] suffers from two major flaws. First, local residents in communities serviced by transit stops often oppose increasing densities around those stops . . . Second, even where high-density residential and commercial development has taken place near transit stops, a majority of people living or working within walking distance nevertheless drive instead of using transit. . ." (Burchell, 2000).

Tourism is theoretically supposed to provide at least temporary density during the summer months. Unfortunately, this concept is flawed in that there are no compact cores of hotels to provide transit stop locations that can be frequently and thus efficiently used. Though there are some attractions that can support transit stops (places to go are available), there are almost no dense areas from which a large number of visitors can leave – no centralized location for densely packed accommodations. Additionally, tourists would be more likely to travel to their hotels, and then use public transit, than they would be to travel to a park-and-ride to take public transit to a hotel. Thus, the proposed placement of a park-and-ride facility at the interchange of I-40/SR 66, as outlined in the *Regional Transportation Alternatives Plan (RTAP) for East Tennessee*, would not be used given that the majority of hotels are in Pigeon Forge and Gatlinburg, and only four widely spaced hotels are found along SR 66.

One clear conclusion drawn from the thesis is that zoning plays an integral part in developing growth patterns over a long time that can ultimately support densities needed by public transit. The towns along the Sevier County BRT route, as well as Sevier County can change zoning to alter land use, but this transformation will take many years before it can fully support public transit. Furthermore, zoning and overlays are only one element in the development of residential, employment and commuter densities that would encourage the use of public transit. The other most difficult element is to change the mindset of public transit users from reluctant user to enthusiastic supporter.

Recommendations

The proposed Sevier County BRT corridor is expected to cost approximately $45 million dollars to modify the current road system to allow for a BRT designated right-of-way that would allow the buses to travel unencumbered by traffic congestion. This amount does not take into account the cost of transit stops, signal modifications, fleet costs or traffic control software and engineering studies, which can cost an additional $53 million dollars. This one hundred million dollar project can provide the backbone for a public transit system; however, cooperation between governmental agencies, land use changes, and the integration and expansion of the currently public transit system need to take place in conjunction with the building of the Sevier County BRT corridor.

Sevierville, Pigeon Forge and Gatlinburg need to coordinate growth plans with Sevier County to direct residential and commercial growth into nodes that can be serviced by the BRT system. As it stands now, Sevier County only has subdivision regulations to control land use, and does not have a plan that encompasses the towns along the BRT route, much less encourage dense and mixed-use development. Furthermore, the towns along the corridor do not control the sprawling uncoordinated land uses along the parkway. The first step in creating a BRT route that can be used by a majority of people is to change the seemingly isolated governmental land use decisions into a coordinated master plan that can encourage public transit use.

With cooperation between county and town government, the current Euclidian pattern of land use can be altered to encourage public transit supportive development; however, public support of land use changes need to be gained first. Without public

enthusiasm for more concentrated land uses, developers would be hesitant to invest in mixed-use and dense residential and commercial areas. The second step in creating a BRT system that is effective is to educate the public and developers about the benefits of land use changes that encourage public transit use, such as TOD regulations, park-and-ride lot zoning, and transit stop overlays.

In order to create a BRT system that is well used, the local bus/trolley structures need to be synchronized with the BRT service. The area along the proposed corridor already has two trolley systems, the Pigeon Forge and Gatlinburg Fun Time Trolleys, and Sevierville has recently received 1.1 million dollars in funding to initiate a town bus system. Though the trolleys serve more than ½ million visitors per year, census data shows that the residents along the trolley routes do not use public transit. The very flexible trolley systems currently have a web of stops not only along the Parkway, but also along side streets; however, the trolley routes should be expanded to reach more town residents and visitors, thus providing a feeder service to the 24-mile Sevier County BRT corridor. Unfortunately, the biggest detriment to using the existing trolley system is the use of the same right-of-ways as visitor traffic. This prohibits timely and reliable trolley service. However, if the shoulders of the existing roads were to be widened or if lanes were to be designated for the exclusive use of the trolley service in conjunction with the construction of the BRT system, then the problems of congestion and slow service would be eliminated. Thus, the final steps needed to enhance the use of the proposed Sevier County BRT corridor is to use the existing town bus/trolley systems as a feeder service, expand the routes traveled by the bus/trolley to reach more passengers for

the BRT system, and provide exclusive or nearly exclusive rights-or-way for the BRT feeder bus/trolley system.

The proposed Sevier County BRT corridor cannot be built in isolation. Without cooperation between the various governmental agencies involved, and a coordinated land use plan, the BRT system cannot attract ridership and critical mass needed to support the BRT system. The coordinated land use plan should integrate mixed-use and transit oriented regulations, zonings and overlays to create dense activity nodes that can be served by public transit. Finally, incorporating the local bus/trolley systems with transit supportive development would also provide density for the BRT corridor, as well as provide a transportation alternative to the automobile. The achievable result would be a reduction in traffic along the Sevier County BRT corridor.

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APPENDICES

Appendix A

Permission to Use U.S. Census Maps

- **Public Domain Maps**

The Census TIGER data base is the source for maps generated by the TIGER Map Service. The data used to create the maps comes from the Census Bureau, an agency of the U.S. Government, and is in the public domain. Thus **the maps** you can download from this site **are in the public domain** and you are free to use them as you choose. They are created on the fly and displayed on the screen in a raster (or bit map) format. They aren't meant to be imported into other mapping or GIS packages. They can be imported into many graphics or paint packages where they can be further manipulated to a limited extent. If you want the base data for use in your GIS or other mapping package visit our TIGER® Page for information on the TIGER/Line® product. We also have some **cartographic boundary files** accessible from this page.

Permission to use and manipulate U.S. Census TIGER data base maps. Found at www.census.gov/geo/www/tiger/tigermap.html

Appendix B

Journey to Work Data - Commuting to Sevier County

From	Number of Commuters - 2000
Anderson	48
Blount	915
Campbell	40
Carter	5
Claiborne	19
Cocke	2240
Grainger	57
Greene	17
Hamblen	228
Hamilton	35
Hawkins	12
Jefferson	1756
Knox	1634
Loudon	26
McMinn	21
Meigs	6
Monroe	17
Morgan	14
Sevier	25388
Sullivan	25
Union	52
Washington	47

Source: U.S. Census Bureau, 2000

Appendix C

Occupational and Industry Data for Census Tract 801

Occupation Data for Census Tract 801		
	Number of Employees	Percentage
Management, professional, and related occupations	806	18.5
Service occupations	670	15.4
Sales and office occupations	1518	34.9
Farming, fishing, and forestry occupations	12	0.3
Construction, extraction, and maintenance occupations	622	14.3
Production, transportation, and material moving occupations	725	16.7

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 801		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	87	2.0
Construction	508	11.7
Manufacturing	556	12.8
Wholesale trade	140	3.2
Retail trade	850	19.5
Transportation and warehousing, and utilities	215	4.9
Information	67	1.5
Finance, insurance, real estate, and rental and leasing	186	4.3
Professional, scientific, management, administrative, and waste management services	245	5.6
Educational, health and social services	484	11.1
Arts, entertainment, recreation, accommodation and food services	662	15.2
Other services (except public administration)	204	4.7
Public administration	149	3.4

Source: U.S. Census Bureau, 2000

Appendix D

Occupational and Industry Data for Census Tract 805

Occupation Data for Census Tract 805		
	Number of Employees	Percentage
Management, professional, and related occupations	543	25.7
Service occupations	360	17.0
Sales and office occupations	798	37.7
Farming, fishing, and forestry occupations	0	0.0
Construction, extraction, and maintenance occupations	150	7.1
Production, transportation, and material moving occupations	263	12.4

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 805		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	8	0.4
Construction	156	7.4
Manufacturing	202	9.6
Wholesale trade	37	1.8
Retail trade	482	22.8
Transportation and warehousing, and utilities	70	3.3
Information	85	4.0
Finance, insurance, real estate, and rental and leasing	126	6.0
Professional, scientific, management, administrative, and waste management services	88	4.2
Educational, health and social services	301	14.2
Arts, entertainment, recreation, accommodation and food services	384	18.2
Other services (except public administration)	75	3.5
Public administration	100	4.7

Source: U.S. Census Bureau, 2000

Appendix E

Occupational and Industry Data for Census Tract 806

Occupation Data for Census Tract 806		
	Number of Employees	Percentage
Management, professional, and related occupations	979	19.9
Service occupations	900	18.3
Sales and office occupations	1438	29.3
Farming, fishing, and forestry occupations	7	0.1
Construction, extraction, and maintenance occupations	659	13.4
Production, transportation, and material moving occupations	928	18.9

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 806		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	22	0.4
Construction	459	9.3
Manufacturing	777	15.8
Wholesale trade	86	1.8
Retail trade	908	18.5
Transportation and warehousing, and utilities	160	3.3
Information	59	1.2
Finance, insurance, real estate, and rental and leasing	365	7.4
Professional, scientific, management, administrative, and waste management services	186	3.8
Educational, health and social services	395	8.0
Arts, entertainment, recreation, accommodation and food services	1113	22.7
Other services (except public administration)	271	5.5
Public administration	110	2.2

Source: U.S. Census Bureau, 2000

Appendix F

Occupational and Industry Data for Census Tract 808

Occupation Data for Census Tract 808		
	Number of Employees	Percentage
Management, professional, and related occupations	1,016	29.0
Service occupations	534	15.2
Sales and office occupations	1,106	31.5
Farming, fishing, and forestry occupations	9	0.3
Construction, extraction, and maintenance occupations	316	9.0
Production, transportation, and material moving occupations	528	15.0

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 808		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	33	0.9
Construction	356	10.1
Manufacturing	356	10.1
Wholesale trade	66	1.9
Retail trade	549	15.6
Transportation and warehousing, and utilities	79	2.3
Information	52	1.5
Finance, insurance, real estate, and rental and leasing	217	6.2
Professional, scientific, management, administrative, and waste management services	158	4.5
Educational, health and social services	431	12.3
Arts, entertainment, recreation, accommodation and food services	972	27.7
Other services (except public administration)	142	4.0
Public administration	98	2.8

Source: U.S. Census Bureau, 2000

Appendix G

Occupational and Industry Data for Census Tract 810

Occupation Data for Census Tract 810		
	Number of Employees	Percentage
Management, professional, and related occupations	484	18.4
Service occupations	752	28.6
Sales and office occupations	673	25.6
Farming, fishing, and forestry occupations	23	0.9
Construction, extraction, and maintenance occupations	396	15.1
Production, transportation, and material moving occupations	298	11.3

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 810		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	25	1.0
Construction	343	13.1
Manufacturing	197	7.5
Wholesale trade	14	0.5
Retail trade	313	11.9
Transportation and warehousing, and utilities	62	2.4
Information	50	1.9
Finance, insurance, real estate, and rental and leasing	215	8.2
Professional, scientific, management, administrative, and waste management services	174	6.6
Educational, health and social services	142	5.4
Arts, entertainment, recreation, accommodation and food services	942	35.9
Other services (except public administration)	99	3.8
Public administration	50	1.9

Source: U.S. Census Bureau, 2000

Appendix H

Occupational and Industry Data for Census Tract 811

Occupation Data for Census Tract 811		
	Number of Employees	Percentage
Management, professional, and related occupations	521	22.4
Service occupations	545	23.4
Sales and office occupations	676	29.1
Farming, fishing, and forestry occupations	7	0.3
Construction, extraction, and maintenance occupations	389	16.7
Production, transportation, and material moving occupations	188	8.1

Source: U.S. Census Bureau, 2000

Industry Data for Census Tract 811		
	Number of Employees	Percentage
Agriculture, forestry, fishing and hunting, and mining	0	0.0
Construction	239	10.3
Manufacturing	131	5.6
Wholesale trade	22	0.9
Retail trade	282	12.1
Transportation and warehousing, and utilities	66	2.8
Information	49	2.1
Finance, insurance, real estate, and rental and leasing	184	7.9
Professional, scientific, management, administrative, and waste management services	133	5.7
Educational, health and social services	108	4.6
Arts, entertainment, recreation, accommodation and food services	844	36.3
Other services (except public administration)	188	8.1
Public administration	80	3.4

Source: U.S. Census Bureau, 2000

VITA

Melany Strike Noltenius is a beautiful older woman, who courageously returned to school after a near 20-year hiatus. At 5' 2'' tall and 114 pounds, she can compete with girls half her age, but compete in what is the question. Though having lived nearly four decades, she still is only 27-years-old. Her secret passions include meeting Winnie-the-Pooh at Disney World, and actually being hired at an exorbitant salary to do exactly as she pleases, to get her Ph.D., to travel and become princess of the world.

Humble and shy, Melany speaks seventeen thousand languages, and writes ancient Greek and modern Chinese simultaneously. Melany is an asset wherever she goes, but prefers to go where chocolate is in abundant supply.